

18.

Eastern Pacific Expeditions of the
New York Zoological Society. XVI.Holothurians from the Western Coasts of Lower California and
Central America, and from the Galápagos Islands.¹

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(Text-figures 1-15).

[This is the *Sixteenth* of a series of papers dealing with the collections of the Eastern Pacific Expeditions of the New York Zoological Society made under the direction of William Beebe. The present paper is concerned with specimens taken on the Eastern Pacific *Zaca* (1937-1938) and the *Arcturus* Oceanographic (1925) Expeditions. For data on localities, dates, dredges, etc., of these expeditions, refer to *Zoologica*, Vol. VIII, No. 1, pp. 1-45 (*Arcturus*) and *Zoologica*, Vol. XXIII, No. 14, pp. 287-298 (Eastern Pacific *Zaca*).]

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INTRODUCTION.

The holothurians brought back by the Eastern Pacific *Zaca* Expedition of 1937-1938 are of even greater interest than those secured in 1936.² Twenty different species were collected and only five are identical with those brought back in 1936 (two of these were then described as new). Of the remaining fifteen species four are new, while three are reported for the first time since the types were described. Only eight may be designated as common and even here the material in hand has in two cases given very valuable additional information and helped to straighten out some moot questions.

A few shore species from the Galápagos Islands (secured by the *Arcturus* Oceanographic Expedition in 1925) have been included, thereby bringing the total number of species discussed up to twenty-three. Some of the species in the *Arcturus* collection were also taken by the *Zaca*.

I beg Dr. William Beebe to accept my sincere thanks for the opportunity of studying this interesting collection.

ORDER ASPIDOCHEIROTA.

Family Stichopodidae.

Genus *Parastichopus* H. L. Clark, 1922.*Parastichopus californicus* (Stimpson).

For diagnosis, synonyms, etc., see Deichmann, 1937, p. 163.

Local Range: Two large specimens from Cedros Island, 40 fathoms, (Station 126 D-17).

Parastichopus parvimensis (H. L. Clark).

Stichopus parvimensis H. L. Clark, 1913, p. 234; 1922, p. 70, pl. 1, figs. 13-14; G. H. Parker, 1921, p. 205.

Parastichopus parvimensis, Deichmann, 1937, p. 163 (*passim*).

Diagnosis: Resembles *P. californicus* but is normally dark brown with black tips to the papillae. Spicules minute tables (disk up to 0.05 mm.) and small buttons (length 0.08 mm.). Shallow water form.

Type: U.S.N.M.

Type Locality: Cedros Island, west coast of Lower California, 3.5 feet.

General Distribution: From San Pedro to Cedros Island, in shallow water.

² See Deichmann, 1937.

Local Range: One much contracted specimen from Cedros Island, 20 fathoms, (Station 126 D-18).

Remarks: The specimen agrees in every respect with various individuals from Corona del Mar, California.

Genus ***Stichopus*** Brandt, 1835.

Stichopus fuscus Ludwig.

For diagnosis, synonyms, etc., see Deichmann, 1937, p. 163.

Local Range: Two large, well expanded specimens from Hood Island, Galápagos, 15 feet depth (*Arcturus* Oceanographic Expedition).

Remarks: The first record of this characteristic form from the Galápagos. Previously it had been reported from Ecuador (Ludwig).

Family Holothuriidae.

Genus ***Labidodemas*** Selenka, 1867.

Labidodemas Selenka, 1867, p. 309; Sluiter, 1901, p. 21; Fisher, 1907, p. 674.

Diagnosis: Medium sized forms with 20 small tentacles, terminally placed; anus subterminal. Feet few, arranged in three double rows ventrally and in two single to double rows on the dorsal side; either all the feet are cylindrical or the dorsal ones are more papilliform. Skin thin, soft. Inner anatomy as in a typical *Holothuria*. Spicules form a more or less scattered layer of tables with spire of various degrees of development; besides also a few plates or buttons with large holes; C-shaped spicules said to be present in some cases. In one species the spicules seem to be completely reduced. Shallow water.

Type Species: *Labidodemas semperianum* Selenka.

Remarks: Three or four species were hitherto described, ranging from the East Indies to Hawaii; [the latter locality represents supposedly the type locality for *L. semperianum*, but the label in the M.C.Z. says Society Islands.] According to Sluiter (1901, p. 21) three of the species are identical (see Fisher, 1907, p. 675), while the fourth species lacks spicules.

The species described below differs so markedly from the other species known that it cannot be considered a variety of any of these.

Labidodemas americanum sp. nov.

Diagnosis: Ventral feet cylindrical, in double rows; dorsal feet papilliform, in two scattered rows. Spicules delicate tables with four central holes and a circle of marginal holes. Spire low, mostly incomplete or reduced to four knobs. Ventral feet with large end plate and plates with four to five holes, possibly reduced tables. Dorsal papillae with no end plate but the same kind of plates as the ventral feet. Skin soft, golden brown in color to greenish, appendages mostly dark brown.

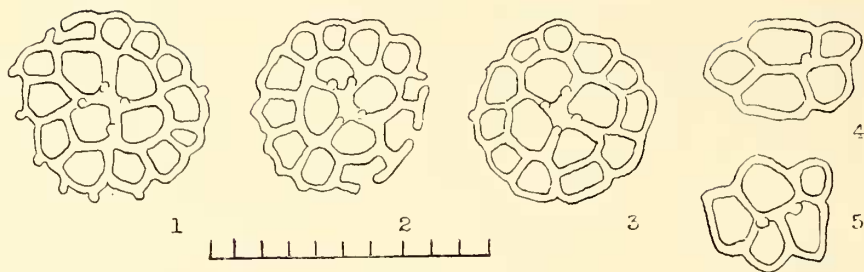
Type: M.C.Z.

Type Locality: Jasper Island, Costa Rica.

General Distribution: Probably widespread in the Panamic region.

Local Range: Two contracted specimens from Jasper Island, Gulf of Nicoya, Costa Rica.

Remarks: The material has been compared with the type material of *L. semperianum* from Hawaii, (or Society Islands) in the M.C.Z. The latter



Text-figure 1.

Labidodemas americanum sp. nov. 1-3, Tables with reduced spire from skin. 4-5, Buttons in wall of feet, probably derived from tables. Scale 1/100 mm.

species has much stouter spicules with long spines on the top of the spire, so it is out of question that the present species is identical with Selenka's species as one would be inclined to expect.

The specimens are small (5-6 cm. long) and not well suited for anatomical studies. The radials are large squarish while the interradials are low; both are thin and delicate in structure. The Polian vesicle is small and ventrally placed; the single stone canal is embedded in the dorsal mesentery, its flattened head projecting free to the right. The intestine is partly torn and filled with coarse coral débris. No traces of gonads are present in the types.

Genus *Holothuria* Linnaeus.

Holothuria arenicola Semper.

Holothuria arenicola Semper, 1868, p. 81, pl. 20, pl. 30, fig. 13, pl. 35, fig. 4; Théel, 1886a, p. 7; Fisher, 1907, p. 662; Deichmann, 1930, p. 66, pl. 4, figs. 1-9; 1937, p. 165 (*passim*); Panning, 1935, IV, p. 88, text-figure 73.

Holothuria maculata Ludwig, 1887, p. 2.

Nec Holothuria maculata Ludwig, 1894, p. 1 (= *H. inhabilis* Selenka; see Deichmann, 1937, p. 165).

Diagnosis: Slender tapering form (up to 20 cm. long); mouth almost terminal with 20 small tentacles; anus terminal. Feet cylindrical, in scattered bands almost equally numerous ventrally and dorsally and only very slightly smaller on the dorsum. Calcareous ring low; ring canal unusually far behind the calcareous ring (1-2 cm.); normally one small stone canal attached to the mesentery; one or two Polian vesicles. Cuvierian organs present but seem normally to be small; gonads numerous tubes in a tuft behind the vascular ring.

Spicule tables with 4-8 marginal holes and a low four-pillared spire with 8-12 spines on top. Buttons smooth, regular, usually with 6 holes often decreasing in size with advancing age; few buttons present in young individuals. Feet with end plate and straight supporting rods with perforated ends and often holes along the middle sometimes developed as regular large buttons with numerous holes.

Color mottled gray, with either two rows of dark spots on the dorsum or irregularly spotted.

Type: Possibly in Germany.

Type Locality: Bohol, Philippines.

General Distribution: Almost circumtropical. Common in the West Indies and Hawaii, in shallow water often buried in sand.

Local Range: Two small specimens from Tangola-Tangola Bay, Mexico, in coral (Station 196 D-15); one small specimen from Ballena Bay, Costa Rica (Zaca 1938); one from Gardner Bay, Hood Island, Galápagos (*Arcturus*, 1925).

Remarks: This widespread species was recorded from the Galápagos by Théel, 1886a, and from Panama by Ludwig in 1887³. Later Ludwig mistook *H. inhabilis* from off Cocos Island, 66 fathoms, for this common species. It has been reported by most collectors working in the Panamic waters.

***Holothuria impatiens* (Forskål).**

Fistularia impatiens Forskål, 1775, p. 121, pl. 39, fig. B.

Holothuria impatiens Théel, 1886a, p. 7; Fisher, 1907, p. 667; Panning 1935, IV, p. 86, text-fig. 72 (complete list of references); Deichmann, 1930, p. 64, pl. 3, figs. 17-18.

Diagnosis: Medium sized form (10-15 cm. long), slender, often distinctly bottle-shaped with long narrow "neck." Tentacles 20, small, mouth and anus both terminal. Feet cylindrical, slightly more papilliform on the dorsal side, scattered over the entire body without any apparent order, often placed distinctly on warts. Calcareous ring low; stone canal free; Polian vesicles usually 2-4; Cuvierian organs unusually thick tubes; gonads placed in anterior part of body.

Spicules regular tables with 8 large marginal holes; spire with one or two cross beams and numerous short spines on the top. Buttons smooth oval with 6 large holes. Feet with end plate, often reduced in the dorsal appendages and numerous slightly curved supporting rods, heavy, with few holes in the ends and on each side of the middle, occasionally developed as complete buttons. Color mottled, gray, skin decidedly sandy to the touch.

Type: Lost.

Type Locality: Red Sea.

General Distribution: Almost circumtropical. Common in the West Indies and in Hawaii; shallow water to few fathoms depth.

Local Range: Five small individuals from Situatanejo, Mexico; 6 from Station 195 D-15; two fragments from Galápagos (*Arcturus* 1925).

Remarks: This common species was reported from the Galápagos in 1886, by Théel; from Lower California in 1913 by H. L. Clark.

***Holothuria inhabilis* Selenka.**

For diagnosis, etc., see Deichmann, 1937, p. 164.

Local Distribution: Three large specimens from Corinto, Nicaragua, 2 and 1 fathoms (Station 200 D-5 and D-15).

Remarks: The specimens agree with those previously reported from Lower California, Cocos Island and Clarion Island. The depth is exceptionally low but very likely the larger individuals migrate shorewards as is known to be the case in other species.

***Holothuria inornata* Semper.**

Holothuria inornata Semper, 1868, p. 252, pl. 40, fig. 1; Panning, 1934, II, p. 33, text-fig. 28 (reproduction of Semper's figure).

Diagnosis: Large form (20 cm. or more) with thick skin; 20 large tentacles; mouth ventrally directed; anus terminal; ventral feet numerous,

³ Deichmann (1937) erroneously writes "1875" instead of "1887."

cylindrical, forming a crowded sole; dorsal appendages mostly papillae, many arranged on more or less distinct warts. Inner anatomy not remarkable except for a cluster of 5-6 free stone canals; Cuvieran organs present.

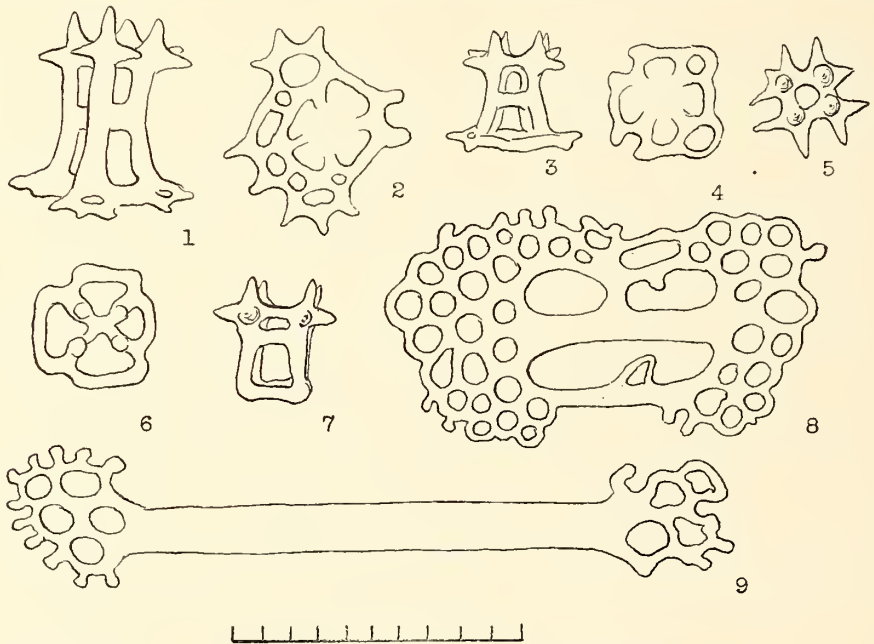
Spicules a thinly scattered layer of tables; dorsally they are large with mostly complete disk consisting of four central holes and four marginal ones and with about 12 marginal spines; ventrally most of the tables are smaller with disk completely reduced; spire with four pillars, usually one cross beam and ending in four upright and 8 vertical spines. Feet with end plate and no supporting rods or plates except a number of perforated plates close to the end plate; dorsal appendages with a vestigial end plate and numerous supporting rods, straight or curved, smooth with perforated ends. Color almost black with a reddish tinge.

Type: Hamburg.

Type Locality: Mazatlan, Mexico.

General Range: Probably the entire Panamic region. Shallow water.

Local Range: Two small specimens from Ballena Bay, Costa Rica, shore; one small from Corinto, Nicaragua; two large from Galápagos (*Arcturus*, 1925).



Text-figure 2.

Holothuria inornata Semper. 1-5, Tables of various development from skin and dorsal appendages. 6-7, Typically reduced tables from ventral appendages. 8, Supporting plate from near end plate in ventral appendages. 9, Straight supporting rod from dorsal appendage. Scale 1/100 mm.

Remarks: The species has not been reported since the original type specimens were secured. The general exterior of the animal is slightly suggestive of *H. grisea* Selenka from the West Indies, and the coasts of Brazil and West Africa, but it is much larger and more darkly colored and has numerous stone canals.

Although it is not impossible that *H. atra* occurs in the Galápagos

Islands and Clipperton Island (see Panning, chart, p. 29) it is very likely that the two records actually refer to this species.

Holothuria languens Selenka.

Holothuria languens Selenka, 1867, p. 335, pl. 19, figs. 80-81; H. L. Clark, 1920, p. 149; Panning, 1934, II, p. 45, text-fig. 37.

Holothuria imitans Théel, 1886a, p. 7.

Diagnosis: Slender form (rarely more than 10 cm. long); tentacles small, mouth and anus terminal; feet ventrally cylindrical, dorsally papilliform, in indistinct longitudinal rows, scattered. Inner anatomy not remarkable. Cuvierian organs apparently lacking.

Spicules a crowded layer of tables with reduced disk, except in very young individuals (3 cm. long) where it is circular with smooth edge; spire tall with normally one cross beam and ending in a Maltese cross of 8 flat spines; in the juvenile tables the spire is more tapering, often with two cross beams and insignificant teeth. Feet with end plate and curved supporting rods, either smooth with perforated ends or with lateral projections which ultimately may become united so they form a series of holes along the sides. Dorsal papillae lack end plate but are filled with curved supporting rods with spinous or perforated ends.

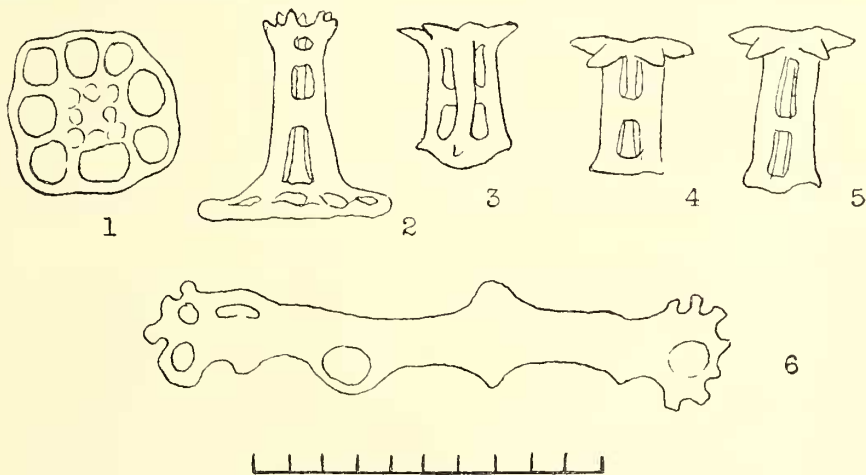
Color mottled reddish-brown, lighter below; tentacles yellow. Skin slightly sandy to the touch.

Type: In Germany; paratype in M.C.Z.

Type Locality: Panama.

General Distribution: Probably the entire Panamic region, including Galápagos. Shallow water.

Local Range: One specimen from Santa Cruz Bay, Mexico, 4 and 15 fathoms (Station 195 D-14 and D-15); one from Jasper Island, Gulf of Nicoya, Costa Rica (Station 213 L-3); two from Galápagos (*Arcturus*, 1925).



Text-figure 3.

Holothuria languens Selenka. 1-2, Juvenile table, disk and lateral view, from small specimen from the Galápagos Islands. 3-5, Normal reduced tables, lateral view from adult specimens. 6, Straight supporting rod from dorsal appendage. Scale 1/100 mm.

Remarks: The species differs from the common West Indian form, *H. surinamensis* Ludwig, in its smaller size, its total lack of large flat rods scattered in the skin, and in the flat undivided spines on the top of the spire.⁴ It differs from the Indo-Pacific form, *H. imitans* Ludwig from the Navigator Islands, in the more delicate tables with smooth margin to the disk, which is preserved only in very young individuals, while *H. imitans* apparently retains the disk on most of its tables.

H. languens was described from Panama, and as far as known it is restricted to that region. Semper referred (1868, p. 87) an incomplete specimen from British Guiana to *H. languens*, as it seemed to resemble Selenka's species. Undoubtedly he was dealing with Ludwig's *H. surinamensis*, described a few years later from Dutch Guiana (Surinam)—a species which never has been reported from outside of the West Indies. Sluiter's record (1910, p. 331) of *H. languens*, from St. Thomas, W. I., also undoubtedly refers to *H. surinamensis*.⁵

Ludwig withdrew, but as I consider incorrectly, *H. surinamensis*, making it a synonym of *H. imitans* which he, in the same paper (1887), reported from Panama and Galápagos. He did not mention Selenka's species at all, being probably misled by Selenka's very untypical figure. It is not clear whether he refers to his original material from the Navigator Islands or to his Panamic-Galápagos material when he speaks of the presence of tables with spinous margin. As far as the present material shows, the disk is smooth in *H. languens*. H. L. Clark (1920, p. 148) describes an *H. imitans* from somewhere in the Pacific Ocean—*Albatross* cruise, locality label lacking—and emphasizes the spinous disk and the tapering spire with 12-20 teeth, different from *H. languens* which he records from the Gulf of Panama.

Holothuria lubrica Selenka.

Holothuria lubrica Selenka, 1867, p. 329, pl. 18, fig. 59; Panning, 1934, p. 45, text-fig. 38 (copied from Lampert, 1896, fig. 2).

Holothuria kapiolaniae Bell, 1887, p. 533; Fisher, 1907, p. 653.

For diagnosis, etc., see Deichmann, 1937, p. 165.

Local Range: Four specimens from Ballena Bay, Costa Rica, shore; 1 from Corinto, Nicaragua, shore.

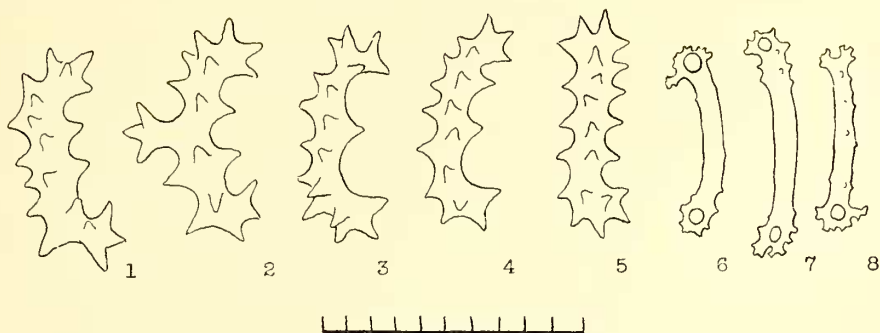
Remarks: The typical form seems to be restricted to Panamic waters and possibly Hawaii (*H. kapiolaniae* Bell). The records from the Malay Archipelago, given by Sluiter (1901, p. 8), need re-investigation. Sluiter gives no measurements of the spicules and it is possible that he was dealing with the other species with similar but shorter spicules before him, viz., *H. parva* Lampert, type locality east coast of Africa, or possibly *H. moebii* Ludwig.

Théel's record of *H. lubrica* from St. Bartholomew, W. I., has unfortunately been repeated uncritically by various writers. Actually Théel says about his West Indian material: "either *lubrica* or the foregoing species," (= *H. glaberrima*), and the description is decidedly of *H. glaberrima*.

Ludwig maintains (1898, p. 434) that he has found spicules of the *glaberrima* type in specimens from Mazatlan, Mexico, but he has not

⁴ Deichmann (1926, pl. 1, fig. 1) selected the most reduced table she could find in *H. surinamensis*, as well as the most complete type. Unfortunately this figure was selected by Panning (1934, 11, text-fig. 34) instead of the more typical tables figured in 1930, pl. 3, figs. 12-15, 19. Normally *H. surinamensis* has heavy double spines on the top of the spire.

⁵ The records of *H. imitans* from Bermuda are due to Panning who refers Clark's material of *H. surinamensis* (1898, p. 412, and 1899, p. 118) to Ludwig's Indo-Pacific species. His reasons are that Clark states that flat bars apparently are lacking in the Bermuda specimens (but may have been overlooked) and that he sometimes has found spines on the edge of the tables in specimens from Bermuda as well as from Jamaica, adding that these tables may have more spines (18-20) on the top of the spire. Presumably this is merely an untypical variation, and *H. imitans* must be removed from the list of West Indian species until a careful comparison has been made.



Text-figure 4.

Holothuria lubrica Selenka. 1-5, Typical spinous rods from integument.

Holothuria glaberrima Selenka. 6-8, Typical rods from integument. Scale 1/100 mm.

compared them with spicules of the true *glaberrima*. Although the spicules vary somewhat in development and are of approximately the same size, I have always found that they cannot be confused. Moreover, the two species are rather different in exterior. *H. glaberrima* is dark brown and robust, while *H. lubrica* is smaller and grayish in color, often with yellow feet and two rows of dark spots on the dorsum.

***Holothuria marenzelleri* Ludwig var. *théeli* var. nov.**

Holothuria marenzelleri var. ? Théel, 1886a, p. 7.

Holothuria marenzelleri Ludwig, 1887, p. 2, pl. 2, fig. 12; Panning, 1934, II, p. 47, fig. 41 (copy of Ludwig's figure).

Diagnosis: Large robust form (up to 20 cm. long) with 20 large bushy tentacles; ventral side covered by numerous cylindrical feet; dorsal side with numerous small papillae. Single free stone canal.

Spicules in young individuals short spectacle-shaped rods, often developed as asymmetrical or symmetrical plates; surface smooth; margin scalloped. In larger individuals the spicules change into larger rods with more or less rough surface and numerous holes in the ends and along the margins. Color dark brown.

Type: M. C. Z. cat. no. 665. Ludwig's types of the typical form from the Nicobars are probably in Germany.

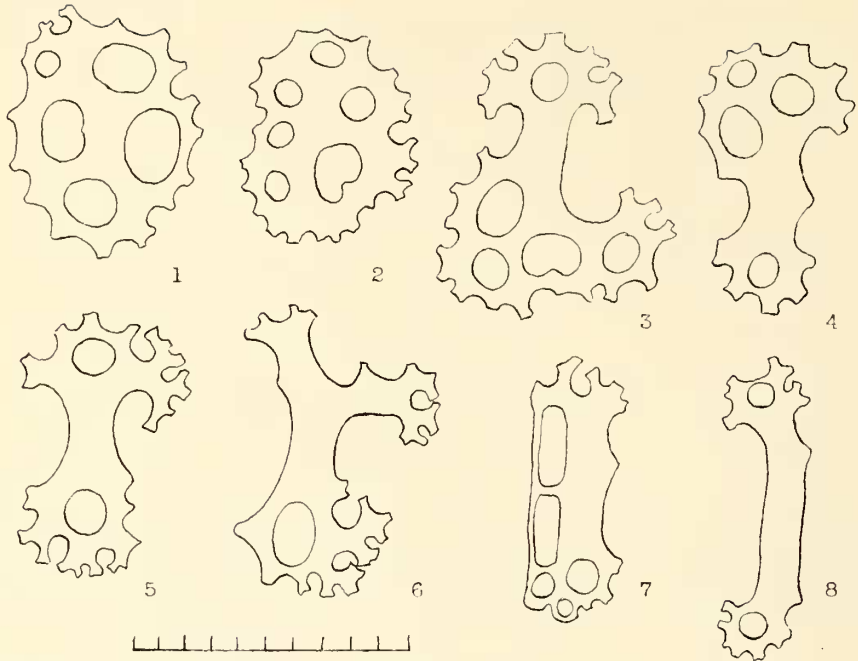
Type Locality: Galápagos Islands.

General Distribution: According to Panning (chart, p. 44) taken only in the Galápagos Islands.

Local Range: Nine specimens ranging from small to large, from Tower Island and Hood Island, Galápagos (*Arcturus*).

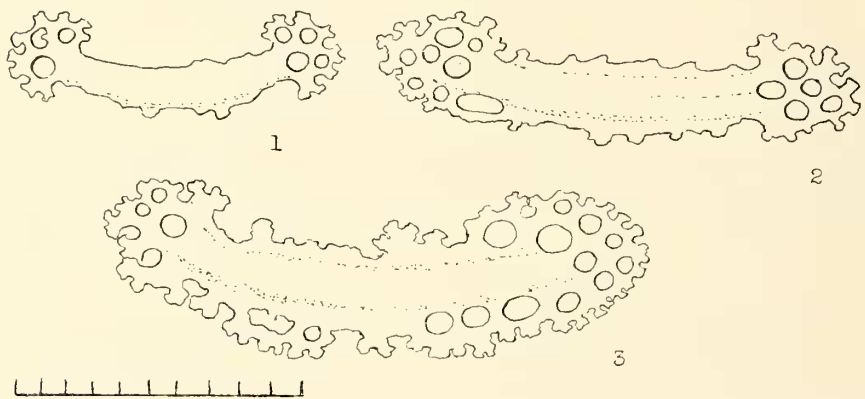
Remarks: Ludwig gives no figures of the spicules in his species from the Nicobars and his description may equally well refer to *H. erinaceus* Semper—a widespread form in the East Indies. Théel was the first to express his doubt whether the Galápagos specimens were identical with the typical *H. marenzelleri*.

Only examination of the types of *H. marenzelleri*, or of specimens from Nankauri, Nicobars, can decide whether two species are concealed under one name or not. Apparently there are no records of *H. marenzelleri* occurring between the Galápagos Islands and the Malay Archipelago.



Text-figure 5.

Holothuria marenzelleri Ludwig var. *thélii* var. nov. 1-8, Typical smooth plates and rods from young individuals from Galápagos. Scale 1/100 mm.



Text-figure 6.

Holothuria marenzelleri Ludwig var. *thélii* var. nov. 1-3, Typical rods with numerous holes and rough surface from large individuals from same locality as the small individuals figured above. Scale 1/100 mm.

It is with great hesitation that the large individuals with rather different spicules are referred to *H. marenzelleri* var. *thélii*. But it is quite possible that the small smooth spicules are completely reduced and the spicules in the older individuals become large and rough.

***Holothuria gyrifer* (Selenka).**

Stichopus gyrifer Selenka, 1867, p. 319.

Holothuria monacaria, Fisher, 1907, p. 659; H. L. Clark, 1923, p. 163; 1938, pl. 16, fig. 7 (colored figure); Panning, 1934, III, p. 69, text-fig. (complete list of references).

Holothuria ? *patagonica* R. Perrier, 1904, p. 13.

Stichopus (*Holothuria* ?) *patagonicus* R. Perrier, 1905, pp. 11-17, pl. 1, figs. 1-3.

Nec Psolus monacarius Lesson, 1830, p. 225, pl. 76.

Diagnosis: Slender form, of medium length (10-5 cm.), slightly bottle-shaped, with pronounced "neck" when normally expanded. Tentacles 20, cylindrical feet small; mouth and anus terminal. Feet few, in indistinct rows; ventrally cylindrical feet, dorsally papillae. Inner anatomy rather similar to that of *H. impatiens*.

Spicules a crowded layer of tables and buttons. Tables with round disk with a complete circle of marginal holes, edge smooth, spire moderately high with four pillars and mostly one cross beam and few teeth on the top. Buttons smooth with six large holes. Ventral feet with large end plate but no special supporting rods, except for a few reticulated plates next to the end plate or the typical buttons may be slightly larger. Dorsal appendages with no end plate and besides the typical buttons a number of long curved rods with short transverse projections which often unite so they form a row of lateral holes on each side.

Color bright brown, ventrally paler; appendages white, base surrounded by a circular white area.

Types: M. C. Z. and Göttingen, Germany.

Type Locality: Hawaii.

General Distribution: Indo-West Pacific to Hawaii, and Gulf of California (Clark, 1923). A specimen without spicules, tentatively described as a new species, reported from Chile by R. Perrier, 1904.

Local Range: Two large specimens from Jasper Island, Gulf of Nicoya, Costa Rica, shore.

Remarks: It has been deemed advisable to change the name *monacaria* Lesson to *gyrifer* Selenka, since it is absolutely certain that the species usually called *monacaria* has nothing to do with the species which Lesson described and figured from Tahiti, while the type of *gyrifer* has been examined. It is a mystery how the present species with few appendages has been confused with Lesson's species which has numerous conical appendages on the dorsal side while the ventrum is covered by numerous cylindrical feet. What Lesson's species actually is cannot be said offhand—possibly it is a well known form and the name *monacaria* may be placed among the synonyms.

H. gyrifer is a most strikingly colored species (see Clark's colored figure, 1938) and it can hardly be confused with any other form. It resembles *H. impatiens* in general shape but it is more brightly colored and the skin is less rough to the touch. The spicules resemble those found in *H. arenicola*, but differ in the presence of a complete circle of holes in the margin of the disk, and the holes are often rectangular, while in *H. arenicola* the holes are more circular and frequently the marginal holes are reduced to four. Also the buttons in *gyrifer* are large while in *arenicola* they tend to become very small.

Stichopus patagonicus R. Perrier, from Sta. Cruz, Patagonia, is unquestionably this species. The single individual measured 5.3 cm. (strongly contracted) and the spicules were dissolved and the calcareous ring slightly corroded. Possibly it was wrongly labelled, as it is most unlikely that this tropical form should occur so far south.

Holothuria pardalis Selenka.

Holothuria pardalis Selenka, 1867, p. 336, pl. 19; fig. 85; Fisher, 1907, p. 664, pl. 69, figs. 1, 1a-g; Panning, 1935, V, p. 3, text-fig. 106.

Diagnosis: Small to medium-sized form (10-12 cm.) slender, with 20 small tentacles; mouth and anus terminal; feet cylindrical, in indistinct bands, not crowded, rarely retracted into warts.

Spicules tables with reduced or low spire and small disks often composed of four holes, margin spinous. Buttons with 6-8 holes, often incomplete and frequently twisted. Feet with end plate, slightly smaller in the dorsal appendages and supported by curved supporting rods with perforated ends.

Color mottled gray, extremely variable, reminiscent of *H. arenicola* Semper.

Type: M. C. Z. and Göttingen, Germany.

Type Locality: Hawaii.

General Distribution: Indo-West Pacific and Galápagos Islands.

Local Range: Three specimens from Darwin Bay, Galápagos Islands (*Arcturus*).

Remarks: The specimens were kept in formalin but the spicules are well preserved and agree with those figured by Fisher.

ORDER DENDROCHIROTA.

Family Cucumariidae.

Genus **Cucumaria** Blainville, 1834.

For definition and diagnostic characters, see Deichmann, 1938, p. 103.

Cucumaria californica Semper.

Cucumaria californica Semper, 1868, p. 235, pl. 39, fig. 16, pl. 40, fig. 10; Théel, 1886a, p. 9.

Nec Cucumaria californica, Edwards, 1910, p. 601. (= *Cucumaria fallax* Ludwig).

Diagnosis: Medium sized forms (about 10 cm.) with ten bushy tentacles of equal size. Skin soft, smooth; feet large, soft, completely retractile, arranged in five bands, not scattered in the interambulacra. Calcareous ring simple, single stone canal and one or two Polian vesicles.

Spicules four-holed buttons or longer oblong plates with holes mostly in two rows; surface knobbed or smooth. Feet with no end plate or a vestige and a few three-armed supporting rods. Tentacles with few plates or rods or no spicules at all. In older individuals the spicules may be almost completely lacking.

Color varying from almost black to slate-colored or almost white with dark tentacles and anterior end which always seems to be blackish.

Type: Possibly in Germany.

Type Locality: Mazatlan, Mexico.

General Distribution: Probably widespread in the Panamic region.

Local Range: Eighteen specimens from Situatanejo Bay, Mexico, shore.

Remarks: A well marked species which can hardly be confused with any other species described from the Panamic region.

The name *C. californica* Semper has by a curious error been applied to

a large *frondosa*-like form, *C. fallax* Ludwig, which is common in the Bering Sea. A large individual of the latter species, from the *Albatross* cruises, received in one way or another the label Galápagos. Edwards, who identified the material, assumed that the label was correct and that this species was identical with Semper's *C. californica*. He referred several of the specimens from the Bering Sea to Semper's species while other, mostly smaller, individuals from the same area, were correctly named *C. fallax* Ludwig.

Genus **Pentamera** Ayres, 1852.

Pentamera Ayres, 1852, p. 207; Deichmann, 1938, p. 105.

Diagnosis: Small to medium sized forms (rarely more than 10 cm.); ventral tentacles small; feet long, non retractile, arranged in five bands but never scattered in the interambulacra. Calcareous ring with long posterior prolongations on the radials. Spicules two-pillared tables, or reduced derivatives of these or developed as acorn-like bodies. Feet with large end plate and numerous supporting tables usually with well developed spire, in some cases completely reduced. Tentacles with rods or plates, in some forms no spicules, at least in older individuals. Spicules usually numerous, but in some species scarce and reduced with advancing age.

Type Species: *Pentamera pulcherrima* Ayres.

Remarks: The diagnosis is here modified to include also *Pentamera chierchia* (Ludwig) and *P. zacae* sp. nov., the former with few and mostly reduced spicules, the latter with peculiar acorn-shaped bodies, as it seems unwise for the present to segregate these two forms which otherwise conform well with the typical members of the genus.

The type species seems to represent the only form in the tropical western Atlantic, while *P. calcigera* (Stimpson) is a typical form in the northern waters, of both Atlantic and Pacific, and a series of seven related species are known from the west coast of North America (see Deichmann, 1938).

From the Panamic region (and Chile) four species are known.

KEY TO THE SPECIES OF *Pentamera* KNOWN FROM THE PANAMIC REGION AND CHILE.

- 1. Spicules in skin acorn-shaped bodies, possibly derived from tables. Feet with large end plate and numerous curved supporting tables with well developed spire composed of two rods with flattened top with blunt lobes or teeth. Color white.....*Pentamera zacae* sp. nov.
- 1. Spicules in skin two pillared tables or derivatives of these with spire reduced2.
- 2. Spicules scarce; disk with normally four holes and spinous edge; spire low with few teeth or reduced to two knobs. Feet with large end plate and a varying number of spectacle-shaped rods with or without two knobs representing the spire. Color dark brown or black
Pentamera chierchia (Ludwig).
- 2. Spicules numerous with well developed spire, disk with smooth edge. Feet with large end plate and well developed supporting tables with curved disk and tall or even excessively tall spire.....3.
- 3. Supporting tables in feet often excessively tall. Tables small with tuft of slender spines on top.....*Pentamera beebei* sp. nov.
- 3. Supporting tables in feet not excessively tall. Tables large with fairly stout short spines on top.....*Pentamera chiloensis* Ludwig, 1887.
(*Syn. Cucumaria tabulata* Perrier, 1904). *Type Locality:* Chiloe Island, Patagonia.

***Pentamera beebei* sp. nov.**

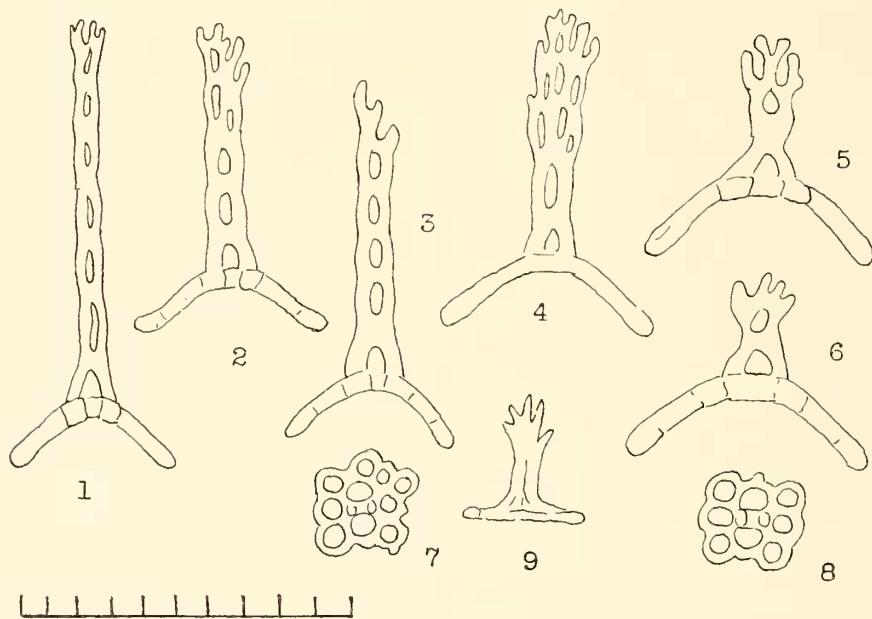
Diagnosis: Small form (few cm. long), externally and internally typical of the genus. Spicules minute tables with mostly four larger holes and four marginal ones; spire two pillared, ending in a tuft of slender spines. Feet with large end plate and curved supporting tables with from 2-7 cross beams in the spire which ends in a few flattened lobes or teeth. Color white.

Type: M. C. Z.

Type Locality: Ballena Bay, Gulf of Nicoya, Costa Rica, 40 fathoms.

General Distribution: Known from the type locality. Costa Rica.

Local Range: One small specimen from Ballena Bay, Gulf of Nicoya, Costa Rica, 40 fathoms (Station 213 D-15).



Text-figure 7.

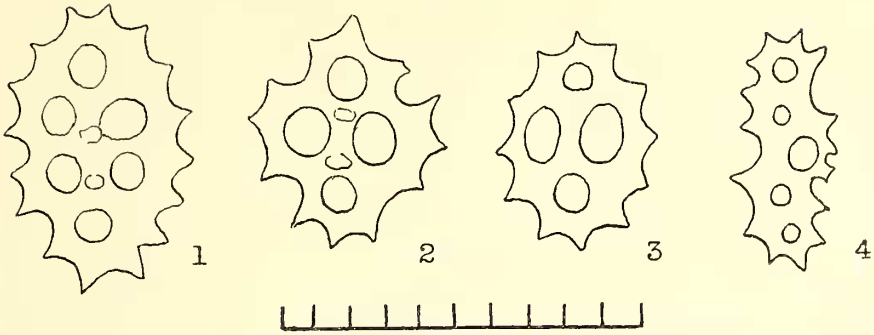
Pentamera beebei sp. nov. 1-6, Supporting tables of various degree of development. 7-9, Tables from integument. Scale 1/100 mm.

Remarks: Superficially the species resembles others of the smaller pentamerids, but the peculiar spicules set it apart from any other species known. The very tall spires may possibly disappear completely but the excessively small tables will be sufficient to distinguish it from other related forms.

***Pentamera chierchia* (Ludwig).**

Cucumaria chierchia Ludwig, 1887, p. 13, pl. 1, fig. 5.

Diagnosis: Small form (3-6 cm.), soft skinned with numerous cylindrical feet in five bands; ventral tentacles small. Calcareous ring with long posterior prolongations. Spicules present in varying number but not crowded. Tables with mostly four central holes and dentate margin; spire low, two-pillared, often completely lacking; feet with large end plate and few short spectacle-shaped rods, rarely with a trace of a spire. Tentacles with curved perforated plates and rods. Color dark brown, almost black.



Text-figure 8.

Pentamera chierchia (Ludwig). 1-3, Tables with reduced disk from integument. 4, Supporting rod from appendage. Scale 1/100 mm.

Type: Possibly in Germany.

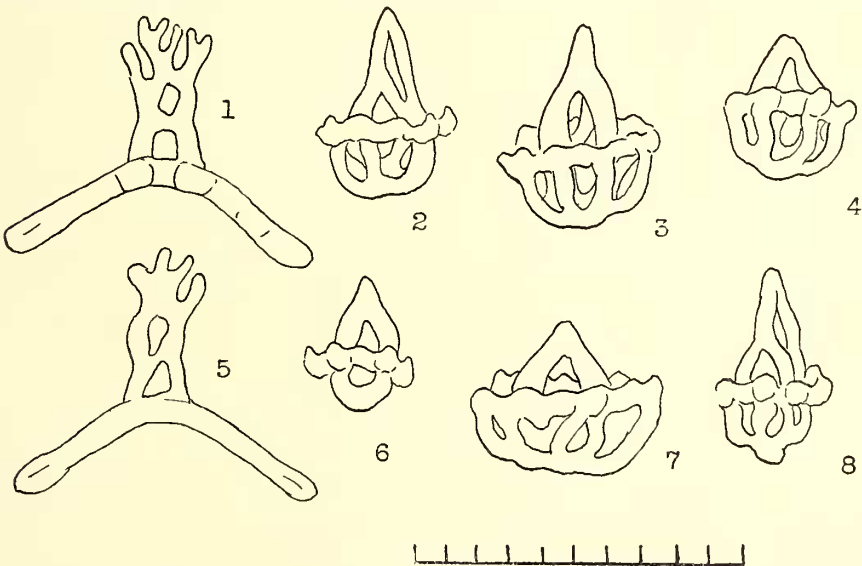
Type Locality: Coast of an island in the Gulf of Panama (shore; one single specimen secured).

General Distribution: Probably widespread in the Panamic region, in shallow water.

Local Range: Five from Situatanejo Bay, Mexico, shore; one from Jasper Island, Gulf of Nicoya, Costa Rica, shore; one from Port Parker, Costa Rica, 1.5-4 fathoms (Station 203 D-9).

***Pentamera zacae* sp. nov.**

Diagnosis: Small form (few cm. long) with body strongly curved, tapering toward both ends. Feet cylindrical, nonretractile, in five bands,



Text-figure 9.

Pentamera zacae sp. nov. 1 & 5, Supporting tables from appendages. 2-4 & 6-8, Acorn-shaped spicules from integument. Scale 1/100 mm.

most numerous on the ventrum, more sparingly on the dorsum and toward the oral and anal ends. Spicules form a crowded layer of peculiar small bodies resembling acorns, with a tapering spire, mostly composed of two rods and basal cup-shaped part. Feet with large end plate and numerous supporting tables with curved disk with four holes and a small hole in each end; spire with two pillars ending in few flattened lobes or blunt teeth. Color dirty white.

Type: M. C. Z.

Type Locality: Tangola-Tangola Bay, Mexico, 23 fathoms.

General Distribution: Known only from the type locality.

Local Range: Tangola-Tangola Bay, Mexico, 23 fathoms (Station 196 D-17).

Remarks: The tentacles and calcareous ring are lacking, but nevertheless it can hardly be doubted that the species belongs in the genus *Pentamera*.

Genus *Thyone* Oken, 1815.

Remarks: The genus is extremely heterogenous and needs a revision, but the time is hardly yet ripe for undertaking the task. The type species is *Thyone fusus* (O. F. Müller), a well known form from the northeastern Atlantic with a closely related representative in the West Indies. The two species listed below undoubtedly deserve separate genera.

Thyone benti Deichmann var. *zacae* var. nov.

Thyone benti Deichmann, 1937, p. 170, text-figs. 2, 1-11 (*partim*).

Diagnosis: Like the typical form, from Puget Sound, but the disk of the tables seems to become more quickly reduced and large heavy rods are totally lacking in the tentacles whereas rosettes are numerous.

Type: M. C. Z.

Type Locality: East of Cedros Island, Lower California; 40 fathoms.

General Distribution: The variety is apparently restricted to the waters of southern California and as far south as Cedros Island. The typical form is known from Puget Sound and may be expected as far south as Point Conception, California.

Local Range: East of Cedros Island, Lower California; 40 fathoms (Station 126 D-17).

Remarks: The specimen in hand measures about 3 cm. and has its tentacle crown and calcareous ring. It resembles otherwise the larger individual which had lost these organs, from the same locality (*Zaca* 1936), except that the feet have just barely begun to spread out into the interambulacra. No gonads were developed in this small individual.

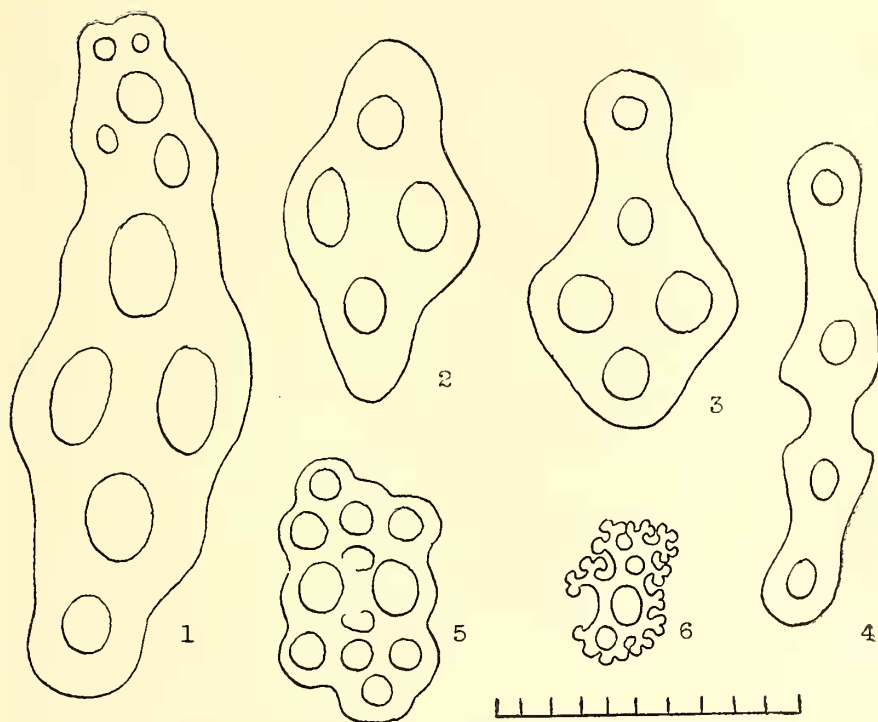
Thyone gibber (Selenka).

Stolus gibber Selenka, 1867, p. 356.

Thyone gibber Deichmann, 1921, p. 205, text-fig. 4; 1936, p. 64 (*passim*).

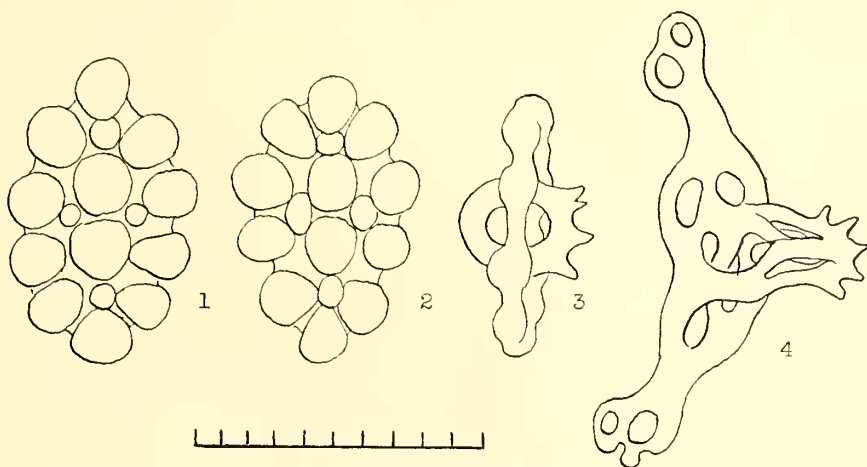
Thyone similis Ludwig, 1887, p. 23, pl. 2, fig. 7; Deichmann, 1936, p. 64 (*passim*).

Diagnosis: Medium sized form (5-10 cm.), robust, with thick skin packed with spicules and numerous feet covering the entire surface of the body; tentacles large, bushy, the two ventral smaller. Calcareous ring with long posterior prolongations on the radials. Spicules regular four-holed knobbed buttons, often with the central knobs united into a handle which



Text-figure 10.

Thyone bentii Deichmann var. *zucacae* var. nov. 1-3, Tables with spire completely reduced. 4, Supporting rod with no trace of spire. 5, Table from introvert. 6, Rosette from tentacles. Scale 1/100 mm.



Text-figure 11.

Thyone gibber (Selenka). 1-2, Knobbed buttons from integument. 3, Knobbed button with spinous handle, from external layer of buttons. 4, Supporting tale from appendages. Scale 1/100 mm.

on the external side of the surface spicules may carry spines. Feet with large end plate and large supporting tables with a low spire composed of several twisted rods. Introvert with two-pillared tables and disk perforated by numerous holes, almost lace-like, forming transition to rosettes. Tentacles with heavy rods or oblong plates and numerous rosettes. Color black or purplish-brown or white with tentacles and anterior part more or less black.

Type: M. C. Z.

Type Locality: Panama.

General Distribution: Widespread in the Panamic region, in shallow water.

Local Range: Four from Situatanejo Bay, Mexico, shore, (Station 186 L-1); one from Jasper Island, Gulf of Nicoya, Costa Rica.

Remarks: From the Panamic region only one other species is known with similar spicules, viz., *T. panamensis* Ludwig (1887, p. 22). The latter seems to lack the spines on the handles of the buttons and has no heavy rods in the tentacles. From Californian waters a smaller species, *Thyone rubra* H. L. Clark, is known. It has knobbed buttons but the entire surface of the external side of the superficial buttons is covered by a reticulum and the supporting tables have mostly large reticulated spires.

Family Phyllophoridae.

Diagnosis: Dendrochirotes with 12-30 tentacles, either definitely arranged in an external circle with 10 large tentacles and an inner with 5 or 10 much smaller ones, or the two circles more or less confluent and the size and number of the tentacles variable. Feet either restricted to the ambulacra or scattered over the entire surface. They are mostly cylindrical; in some forms the dorsal appendages are conical, more papilliform. Calcareous ring simple or with posterior prolongations. Third mesentery attached in left interambulacrum.

Remarks: The family is at present in a state of upheaval, as are the other Dendrochirotes and it is therefore necessary briefly to summarize the history to understand the viewpoint adopted here. In this connection there are no grounds for discussing the genera in which the feet are restricted to the ambulacra as these forms are not known from the Panamic region. (For these species, see Ohshima, 1912, and Engel, 1933). Moreover they seem to form well defined genera which have given little cause for trouble.

Two genera, viz., *Thyonidium* Düben & Koren, 1844, and *Phyllophorus* Grube, 1840, have for a long time constantly been confused and most authors have in despair chosen to unite all the species in the oldest genus *Phyllophorus*. The reason for this state of affairs has been that the tentacles in the common northern species, *T. pellucidum* Düben & Koren, have either been counted as 15 or 20—never any number between these (except occasionally 16 which has been considered an abnormality). The species showed therefore apparently almost as wide a variation as in *Phyllophorus* in which the number ranged from 12 to 20, so there seemed no valid grounds for separating the two genera on account of the tentacles. The differences in the type of calcareous ring seems to have been completely ignored.

Recent studies of Heding (1936, pp. 19-26) have revealed that the five inner pairs of small tentacles in *T. pellucidum* are merely five tentacles which usually are so deeply cleft that they simulate five pairs, and were described and figured as such by Düben & Koren (1844, p. 217, pl. 11, fig. 57), and also that the full number is reached very quickly in this species (Heding, p. 22). The same has been found by the writer to be true of *T. commune* Forbes where specimens 1 cm. long exhibit the full number of tentacles (in this species five small inner pairs of tentacles). In *Phyllophorus*, on the other hand, the tentacle number remains low for a long

period. Sars describes (1857, p. 137) how specimens of *P. urna* which measure 3-4 cm. in length have only 17 tentacles, (12 external of unequal size and 5 small inner ones), and gradually more are added. The same irregularity in the appearance of the last tentacles is also noticed by Engel, 1933, so it seems to be a characteristic feature of the genus *Phyllophorus*.

In the following an attempt is made to draw the line between the genera belonging to the Phyllophoridae with feet scattered in the interambulacra. Three new genera are proposed, one to take in *Phyllophorus granulatus* Grube, one to accommodate the *Thyonidium*-like forms known from the tropical areas, and one to include the forms which have 20 tentacles in two well defined circles, as *Thyonidium*, but a calcareous ring with long posterior prolongations, as *Phyllophorus*. Furthermore Selenka's old genus *Pattalus* is re-established.

KEY TO THE GENERA OF PHYLLOPHORIDAE WITH INTERAMBULACRAL FEET.

1. Tentacles arranged in an external circle of five pairs of large tentacles and an inner circle of much smaller tentacles, five deeply divided or five pairs2.
1. Tentacles arranged in two indistinct circles, of unequal size although those in the inner circle are small, as are also some of those in the outer circle. Number of tentacles varying from 12-20, frequently 16.....4.
2. Calcareous ring tall, tubular with long deeply divided posterior prolongations and long narrow interradians.....*Neothyonidium* gen. nov.
Type Species: N. hawaiiense (Fisher), 1907.
2. Calcareous ring low, with long anterior teeth but no distinct posterior tails, at most low protuberances.....?
3. Spicules four-pillared tables which rapidly disappear with age; tentacles with perforated rods or plates, but no rosettes. Arctic and boreal forms.....*Thyonidium* Düben & Koren, 1844.
Type Species: T. pellucidum Düben & Koren, 1844.
3. Spicules four pillared tables with spire often reduced to knobs or spines. Spicules sometimes reduced with advancing age. Tentacles with rosettes. Tropical forms.....*Eothyonidium* gen. nov.
Type Species: E. seguroensis (Deichmann), 1930.
4. Calcareous ring low, simple. Spicules apparently plates, which are quickly reduced: Large forms, 20 cm.....*Pattalus* Selenka, 1867.
Type Species: P. mollis Selenka, 1867.
4. Calcareous ring tall, with posterior prolongations.....5.
5. Feet tubular, spicules tables with two to four pillars in spire and apparently not reduced with advancing age.⁶.....*Phyllophorus* Grube, 1840.
Type Species: P. urna Grube, 1840.
5. Feet partly conical, papilliform on the dorsal side.
Euphyllophorus gen. nov.
Type Species: E. granulatus Grube, 1840.

⁶ Heding's proposal (1936, p. 23) to transfer *T. commune* (Forbes) to *Phyllophorus* cannot possibly be accepted. Aside from the difference in the number of inner tentacles (which may be a variable character in *T. pellucidum*), the two species differ very slightly from each other in general features, early appearance of the full number of tentacles, etc. It is a regrettable slip when Heding also states (p. 23) that the genus *Thyonidium* "usually" has many spicules, in contrast to "*Phyllophorus*" in which they disappear. Both *T. pellucidum* and *T. commune* lose their spicules very rapidly—hence the difficulty in distinguishing between the two forms (see among others Mortensen, 1927, pp. 411 and 413). But in no case is it known that the spicules disappear completely in any member of *Phyllophorus*. Sars says that the tables often are scarce in the adult individuals of *P. urna* (1857, p. 138); Théel, 1886, p. 150, mentions the presence of end plate and supporting rods in the largest individuals while tables are practically lacking. Usually careful examination of fragments of the integument reveals the presence of some tables. More important, however, is the entirely different type of calcareous ring which is characteristic of the members of the genus *Phyllophorus*.

Euthyonidium gen. nov.

Diagnosis: Medium sized forms (10 cm. long) with fairly robust feet scattered over the entire body, rarely with trace of being arranged in bands. Tentacles five large pairs in an external circle and five small pairs in an inner circle, often contracted so they are difficult to observe. Calcareous ring simple or with insignificant posterior protuberances. Spicules tables or derivatives of tables with spire reduced, often scarce in older individuals. Feet with large end plate and a few supporting rods. Tentacles with delicate rods and rosettes.

Type Species: *Euthyonidium seguroensis* (Deichmann).

Remarks: The genus represents the tropical counterpart of the northern genus, *Thyonidium* Düben & Koren, 1844. Two species are known from the West Indies, viz., the type species and *E. occidentalis* (Ludwig). Re-examination of Selenka's *Thyone ovulum* from Acapulco, Mexico, showed a complete circle of five pairs of small inner tentacles, while a microscopical examination of the skin revealed the presence of a few tables with reduced spire—of exactly the same shape as those found in an *Euthyonidium* brought home by the *Zaca*.

Euthyonidium ovulum (Selenka).

Stolus ovulum Selenka, 1867, p. 365, pl. 20, fig. 117.

Thyone ovulum, Deichmann, 1936, p. 64.

Diagnosis: Agrees in exterior with diagnosis given for the genus. Calcareous ring with radials posteriorly deeply incised, and with long anterior tooth; interradials heart-shaped with posterior margin slightly incised. Numerous free stone canals and Polian vesicles. Spicules a scattered layer of tables with cross-shaped disk with spinous or branching edge and spire in most cases reduced to 1-4 spines. Feet with large end plate and apparently few supporting rods; tentacles with few rosettes and delicate rods. Spicules more or less completely reduced with advancing age and except for the large end plate, easily overlooked. Color reddish-brown.

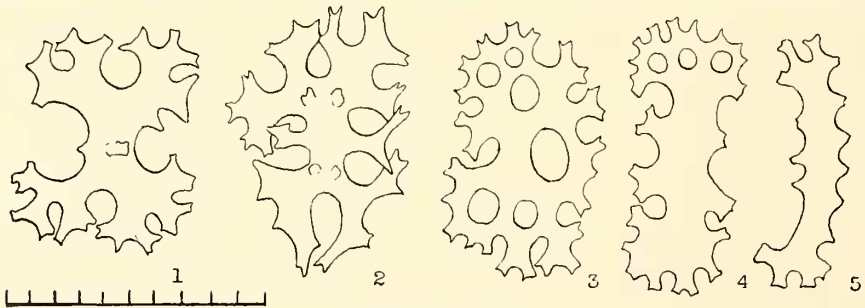
Type: M.C.Z.

Type Locality: Acapulco, Mexico.

General Distribution: Probably widespread in the Panamic region.

Local Range: One specimen from Port Parker, Costa Rica, 1.5-4 fathoms (Station 203 D-9).

Remarks: The *Zaca* specimen, which decidedly is a polychirote form, showed so remarkable a similarity with *Thyone ovulum* that a re-examina-



Text-figure 12.

Euthyonidium ovulum (Selenka). 1-3, Plates with reduced spire from integument. 4-5, Supporting rods from appendages. (From Selenka's type, M. C. Z.) Scale 1/100 mm.

tion of Selenka's material was undertaken and the presence of five pairs of small tentacles demonstrated as well as the presence of a few tables with reduced disks of the same type as those found in the *Zaca* specimen. "*Thyone ovulum*" must therefore be transferred to *Euthyonidium*. The *Zaca* material represents the first record since the types were described.

Genus *Phyllophorus* Grube, 1840.

Diagnosis: Medium sized forms (rarely more than 10 cm. long) with robust cylindrical feet distributed over the entire surface and with 12-20 tentacles of different size in two indistinct circles; the last tentacles appear at intervals after the animal has reached a considerable size. Calcareous ring with distinct long posterior prolongations on the radials; interradials shorter or longer and often overlapping the radials. Spicules delicate tables; feet with end plate and sometimes a few oblong, curved supporting tables; tentacles with few delicate rods and rosettes. Spicules apparently preserved throughout the animal's entire life.

Type Species: *Phyllophorus urna* Grube.

Remarks: Defined this way the genus comprises the Mediterranean *P. urna* Grube and five of the seven species known from the tropical western Atlantic, some species from the Indo-Pacific (see Engel, 1933) and two species from the Panamic region, including the species described below. From the west coast of North America no Phyllophoridae are known (except *Thyonidium commune* Forbes; unpublished record, material in U.S.N.M.) nor has any been reported so far from the coast of Chile (except *Pattalus*). Two Phyllophoridae were described in 1907 from Hawaii by Fisher.

Not included is *P. granulatus* Grube from the Mediterranean which seems to differ in so many respects (papillae on the dorsal side and reticulated plates, etc. [see Koehler, 1927, p. 199]), that it unquestionably deserves its own genus for which the name *Euphyllophorus* is proposed.

KEY TO THE SPECIES OF *Phyllophorus* KNOWN FROM THE PANAMIC REGION.

1. Spicules tables with oval disk with smooth edge and 8-12 small marginal holes; spire with four pillars and ending in wreath of 8-12 spines. Feet with end plate and supporting tables with an enormous four-pillared spire ending in a long conical tooth which perforates the skin.
Phyllophorus aculeatus Ludwig.
(Panama, shallow water. Only the type specimen known, U.S.N.M.; Ludwig, 1894, p. 128, pl. 13, figs. 6-11).
1. Spicules tables with oval disk with four large and four smaller marginal holes, the latter more or less wedge shaped. Spire with two pillars and ending in four tufts of few spines. Feet with large end plate and few supporting tables with oval curved disk and low two-pillared spire ending mostly in two diverging spines.....*Phyllophorus zaca* sp. nov.

Phyllophorus zaca sp. nov.

Diagnosis: Medium sized form with 15 (probably up to 20) tentacles of unequal size, in confluent circles. Feet stout, distributed over the entire body, not crowded. Calcareous ring with well developed posterior prolongations on the radials; anteriorly the radials have a long rectangular tooth with a constriction at its base; interradials with broad base and short anterior tooth, and overlapping the radials. Spicules delicate tables with oval disk with four large and four smaller marginal holes, often wedge shaped, spire with two pillars, ending in four tufts of few spines. Feet with large end plate and with few oblong supporting tables with mostly oval disk

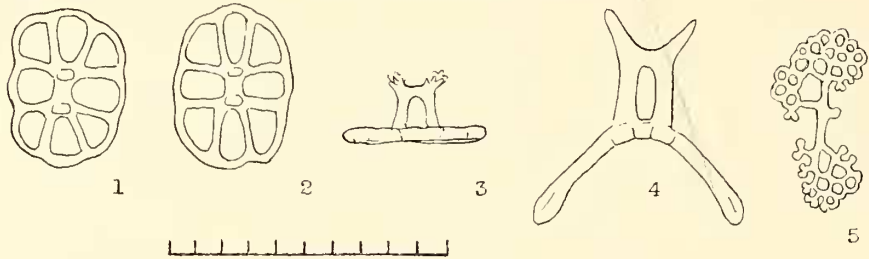
with numerous holes and a two-pillared spire ending mostly in two diverging horns or teeth. Tentacles with few delicate rods and rosettes. Color reddish.

Type: M.C.Z.

Type Locality: Tangola-Tangola Bay, Mexico, 10 fathoms.

General Distribution: Known only from the type locality.

Local Range: One contorted specimen from Tangola-Tangola Bay, Mexico, 10 fathoms (Station 196 D-13).



Text-figure 13.

Phyllophorus zacae sp. nov. 1-3, Tables from integument. 4, Supporting table from appendages. 5, Rosette from tentacles. Scale 1/100 mm.

Remarks: The species is closely related to *Phyllophorus destichadus* Deichmann (1930, p. 146, pl. 18, fig. 3) from the West Indies. It differs in the presence of supporting tables in the feet and in minor details of the calcareous ring and the spicules.

From Hawaii Fisher (1907, p. 712, pl. 79, figs. 2, 2a-c) has described a species with similar spicules but with the tentacles arranged in two distinct circles and of pronouncedly different size and with a very different calcareous ring—with long narrow interradials. For that species the genus *Neothyonidium* has been proposed.

Family Psolidae.

Genus *Thyonepsolus* H. L. Clark, 1901.

Thyonepsolus beebei Deichmann.

For diagnosis, etc., see Deichmann, 1937, p. 172, text-fig. 3.

Local Range: Two specimens from Situatanejo Bay, Mexico, shore; one from Jasper Island, Gulf of Nicoya, Costa Rica, shore.

Remarks: The specimens are larger and more robust than the single type specimen secured in 1936 from Arena Bank, Gulf of California. The present records indicate that the species occurs widespread in the Panamic region, as was to be expected.

ORDER MOLPADONIA.

Family Caudinidae.

Genus *Paracaudina* Heding, 1931.

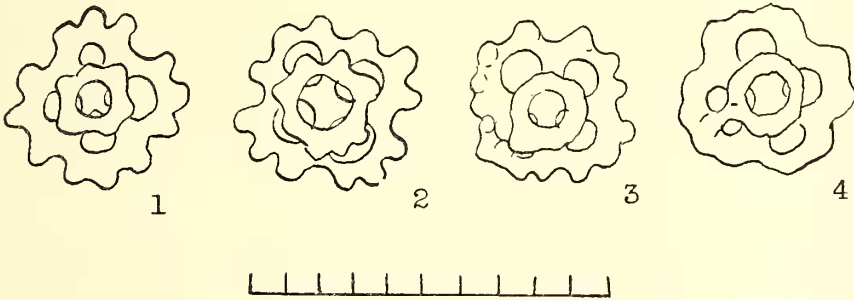
Caudina Auctores.

Pseudocaudina Heding, 1931, p. 283.

Paracaudina Heding, 1931, p. 455; Clark, 1935, p. 267.

Diagnosis: Caudinids of medium size or large (up to 20 cm.) with 15 tentacles with two pairs of digits but no unpaired terminal digit. Calcareous ring with short undivided posterior prolongation on the radials. Third loop of intestine supported by powerful pseudomesenteries attached to the lateral body walls while the normal ventral mesentery is reduced or lacking. Spicules small cross-cups or four-holed plates with spinous to lobate margin, with age degenerating into irregular deformed plates. No phosphatic bodies present but older individuals may have certain spicules surrounded by a reddish substance. Color white. Shallow water forms.

Type Species: *Paracaudina chilensis* (J. Müller).



Text-figure 14.

Paracaudina chilensis (J. Müller). 1-4, Cross-cups from *Zaca* specimen, from 35 fathoms depth.

Remarks: The number of species belonging to this genus has been the subject of much discussion. Clark (1935) holds that there are two Australian species with fairly simple spicules while the type species can be divided into a number of varieties which differ merely in the development of the spicules. One argument against uniting the widespread forms under one name has been the discontinued distribution of the species. It was first in 1938 that some specimens were taken between Chile, the type locality, and California, viz., off Guatemala and Mexico, (Deichmann, 1938, p. 23, text-figure) and the zoögeographic gap thereby closed. The *Zaca* expedition has furthermore secured two specimens from off Costa Rica, an indication that *P. chilensis* is by no means uncommon in the Panamic region.

Paracaudina chilensis (J. Müller).

Molpadia chilensis, J. Müller, 1850, p. 139; 1854, pl. 4, fig. 14, pl. 9, fig. 1.

Caudina chilensis, H. L. Clark, 1908, p. 175.

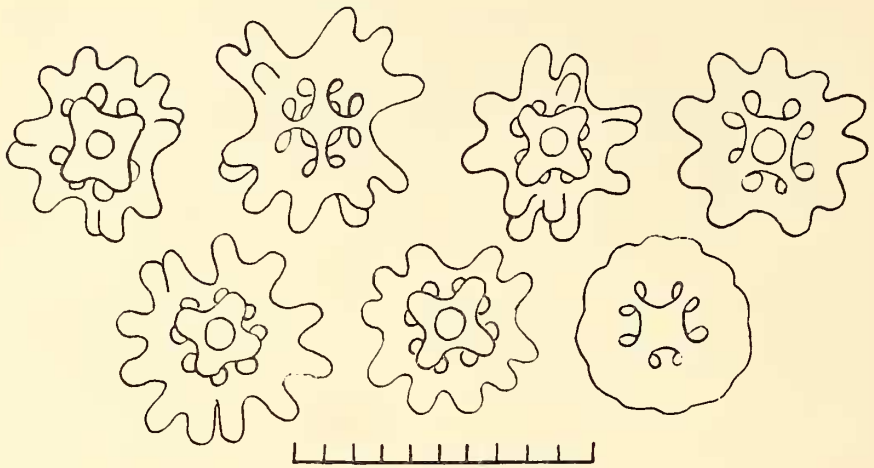
Paracaudina chilensis, H. L. Clark, 1935, pp. 267-284. (discussion of the species problem). Deichmann, 1938, p. 23, text-fig.

Diagnosis: As for the genus. Spicules numerous cross-cups with marginal projections, shorter or longer, often as rounded lobes; reduced to simple plates in older individuals.

Type: Museum of Berlin.

Type Locality: Coast of Chile.

General Distribution: From the Strait of Magellan, along the west coast of South, Central and North America to Japan, Coasts of China and North Australia—varieties chiefly with long marginal projections on the cross-cups; from New Zealand and West Indies—varieties chiefly with



Text-figure 15.

Paracaudina chilensis (J. Müller). Spicules from specimens from off Guatemala, 10 fathoms (upper row) and from off Mexico, 7 fathoms (lower row). Reproduced from Deichmann, 1938.

reduced marginal projections (this type may also occur in numbers in specimens from the west coast of Central America). Shallow water to about 40 fathoms.

Local Range: Two specimens, 4 and 5 cm., from Ballena Bay, Gulf of Nicoya, Costa Rica, 35 and 40 fathoms (Station 213 D-12 and D-15).

Remarks: The spicules selected at random from the *Zaca* material shows the extreme variability of the calcareous spicules in this species when contrasted with the figures of spicules from the specimens from Guatemala and Mexico, from respectively 10 and 7 fathoms depth.⁷ Possibly the greater depth from which the *Zaca* material came may account for the variation of the spicules.

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⁷ Record of depth omitted in the original report (Deichmann, 1938).

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