

TASMANIAN SEA-CUCUMBERS (HOLOTHUROIDEA)

By

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(With two plates and 186 figures in the text.)

ABSTRACT

Over five hundred and forty specimens of sea-cucumbers collected on the northern, eastern and southern coasts of Tasmania have been examined in the course of the present study. Seven families, 12 genera and 14 species are represented in the collection. One genus *Necomphicyclus*, is regarded as new. Four species are also described as new, namely, *Psolidiella adhaerens*, *Neomphicyclus lividus*, *Psolidium ravum* and *Paracaudina luticola*. Three other species have not been recorded previously from Tasmania but are known from the coast of Victoria. They are *Cucumella mutans* (Joshua), *Staurothyone inconspicua* (Bell) and *Trochodota roebucki* (Joshua). The total number of species now known to occur on the coast of Tasmania is 15. A description of each species is given.

INTRODUCTION

The sea-cucumbers of Tasmania have received little attention from zoologists. The earliest reference to the occurrence of this group of marine animals in Tasmanian waters appears to be due to W. Saville-Kent, who exhibited some specimens from the Derwent Estuary at a meeting of this Society held on the 14th July, 1885. The specimens were dredged between Kangaroo Point and Ralphs Bay. At that time they were regarded as belonging to the genera *Synapta* and *Chirodota*. However, from the descriptions given by Saville-Kent, there is little doubt that the species exhibited were those now known as *Leptosynapta dolabrifera* (Stimpson) and *Trochodota allani* (Joshua), both of which are still frequently dredged in the locality mentioned.

No further reference to Tasmanian holothurians appears in the literature for over fifty years, in fact not until 1938, when H. L. Clark published a list of Tasmanian echinoderms. The list, which included seven holothurians, was based on specimens given to him by Professor T. T. Flynn, and on others collected during a dredging expedition in the Derwent Estuary on 15th November, 1929. The seven species listed by Clark (1938, p. 573) are the following:—

Pentacta australis
Pseudocucumis thomsoni
Lipotrachea vestiens
Stichopus mollis
Leptosynapta dolabrifera
Chirodota gigas
Trochodota allani

Eight years later, when Clark (1946) published his comprehensive work on the echinoderm fauna of Australia, no further species were added to the list. However, he transferred *Pseudocucumis thomsoni* to a new genus *Mensamaria* and renamed it *Mensamaria thomsoni*.

In 1954 Heding and Panning, after examining some specimens dredged by Dr. Th. Mortensen in the eastern end of Bass Strait, stated that they agreed extremely well with Clark's examples of *Mensamaria thomsoni* from Tasmania. Moreover, Heding and Panning considered that *Mensamaria thomsoni* really belonged to the genus *Amphicyclus* Bell, and that it was a new species, which they therefore named *Amphicyclus mortenseni*.

In a table showing the distribution in Tasmania of animals, which he regarded as important intertidal species, E. R. Guiler (1954, p. 114) lists three of the seven holothurians recorded by Clark (1938) and adds *Paracaudina australis* (Semper).

The collection which forms the basis of the present study contains over 540 specimens taken on the northern, eastern and southern coasts of Tasmania. Most of them were found under stones at low tide, but some were taken by dredging. The specimens include representatives of all but one of the previously recorded species found in this State. One genus and four species appear to be new, whilst three other forms have not hitherto been found in Tasmanian waters, but are known from the coast of Victoria. The additions to the list of known Tasmanian species brings the number to 15 as follows:—

Psolidiella adhaerens sp. n.
Staurothyone inconspicua (Bell)
Pentacta australis (Ludwig)
Cucumella mutans (Joshua)
Amphicyclus mortenseni Heding and Panning
Neomphicyclus lividus gen. et sp. n.
Lipotrachea vestiens (Joshua)
Psolidium ravum sp. n.
Stichopus mollis (Hutton)
Paracaudina australis (Semper)
Paracaudina luticola sp. n.
Leptosynapta dolabrifera (Stimpson)
Chirodota gigas Dendy and Hindle
Trochodota allani (Joshua)
Trochodota roebucki Joshua

Since some of the previous records are founded on single specimens or on immature forms, it seemed desirable that, wherever possible, descriptions based on the new material available should

be given. In the case of *Amphicyclius mortenseni*, which is not represented in the collection, the description is based on accounts given by other authors.

Unless otherwise stated the specimens have been collected by the writer.

KEY TO SPECIES OF TASMANIAN HOLOTHUROIDEA

- | | |
|--|---|
| 1. Pedicels present | 2 |
| Pedicels absent | 10 |
| 2. Tentacles peltate | <i>Stichopus mollis</i> (Hutton) |
| Tentacles dendritic | 3 |
| 3. Ten tentacles present | 4 |
| More than ten tentacles present | 7 |
| 4. Body with a distinct creeping sole | 5 |
| Body without a distinct creeping sole | 6 |
| 5. Dorsal skin with crosses and scale-like plates | |
| <i>Psolidium ravum</i> sp. n. | |
| Dorsal skin without crosses and scale-like plates | |
| <i>Psolidiella adhaerens</i> sp. n. | |
| 6. Skin with small rods and large cruciform plates | |
| <i>Staurothyone inconspicua</i> (Bell) | |
| Skin with baskets and large buttons | |
| <i>Pentacta australis</i> (Ludwig) | |
| 7. Pedicels over whole body | <i>Lipotrachea vestiens</i> (Joshua) |
| Pedicels not over whole body | 8 |
| 8. Introvert with pedicels | 9 |
| Introvert without pedicels | |
| <i>Amphicyclius mortenseni</i> Heding and Panning | |
| 9. Perforated plates with towers in skin | |
| <i>Cucumella mutans</i> (Joshua) | |
| Perforated plates without towers in skin | |
| <i>Neoamphicyclius lividus</i> gen. et sp. n. | |
| 10. Tentacles 15; body stout but tapering posteriorly .. | 11 |
| Tentacles 10-12; body slender and cylindrical | 12 |
| 11. Skin with numerous crossed cups | |
| <i>Paracandina luticola</i> sp. n. | |
| Skin with perforated irregular plates | |
| <i>Paracandina australis</i> (Semper) | |
| 12. Skin with anchors | <i>Leptosynapta dolabrifera</i> (Stimson) |
| Skin with wheels | 13 |
| 13. Wheels grouped in papillae | |
| <i>Chiridota gigas</i> Dendy and Hindle | |
| Wheels not grouped in papillae | 14 |
| 14. Tentacles with four digits | <i>Trochodota roebucki</i> Joshua |
| Tentacles with eight to ten digits | |
| <i>Trochodota allani</i> (Joshua) | |

Order: DENDROCHIROTA

Family: CUCUMARIIDAE

Genus: *PSOLIDIELLA* Mortensen, 1925

Psolidiella adhaerens sp. n.

(Pl. I, fig. 1 and text-figs. 1-16)

The living animal is usually light fawn in colour, some specimens being almost white. The tentacles are white or yellowish brown and marked with golden brown spots. Foreign particles such as shell grit, sponge spicules, sand grains and pieces of seaweed often adhere to the dorsal surface and sides of the holothurian tending to conceal it.

When fully extended the largest specimens measure about 37.0 mm. in length and 9.0 mm. in greatest width. The anterior and posterior ends of the body are directed upwards. The dorsal surface and sides generally exhibit a number of longitudinal ridges. The ventral surface forms a distinct sole by means of which the animal is firmly attached to the stone or shell on which it is resting.

The tentacles are ten in number. They are dendritic and the ventral pair smaller than the others. The mouth aperture is surrounded by papillae. The introvert is short.

The pedicels are well developed round the margin of the sole, where they are arranged in three rows. They are also present in two or three rows on the mid ventral radius within the sole. The region between the margin of the sole and the mid ventral radius is devoid of pedicels. Beyond the margin of the sole, on the sides and dorsal surface of the body, are numerous pedicels, which are scattered irregularly. They are generally longer and more slender than those round the margin of the sole. They are completely retractile and their main function seems to be the attaching of the numerous foreign particles with which the holothurian is often covered. Pedicels are absent from the introvert.

Calcareous particles or spicules are present in the skin of the body wall, the introvert, and tentacles. They are absent from the peristome and oral papillae.

The spicules of the body wall are largest and most numerous in the soft interradii skin of the sole. Here they have the form of perforated plates (text-figs. 1-5), the larger ones measuring 160-210 μ in greatest diameter and possessing from 11-18 holes. On the sides and dorsal surface spicules are much less numerous and smaller, the larger ones being 135-153 μ in maximum diameter and perforated by 5-7 holes (text-figs. 6-9).

In the skin of the introvert the spicules are very small, 27-33 μ in length and have the form of branched rods with nodular projections (text-figs. 10-13).

In the tentacles the spicules are very large. They have the form of irregular perforated rods and bars measuring 210-405 μ in length. They are disposed transversely to the long axis of the stem or branch of the tentacle (text-figs. 14-15).

The pedicels are devoid of spicules except for the perforated disk in the sucker. The disk is large and strongly developed in the pedicels of the sole but smaller and somewhat degenerate in those of the rest of the body.

The calcareous ring surrounding the oesophagus is composed of five radial and five interradii

ossicles. They are devoid of posterior prolongations (text-fig. 16). Both the radials and inter-radials are somewhat pointed anteriorly, but the narrow end of the radials is notched.

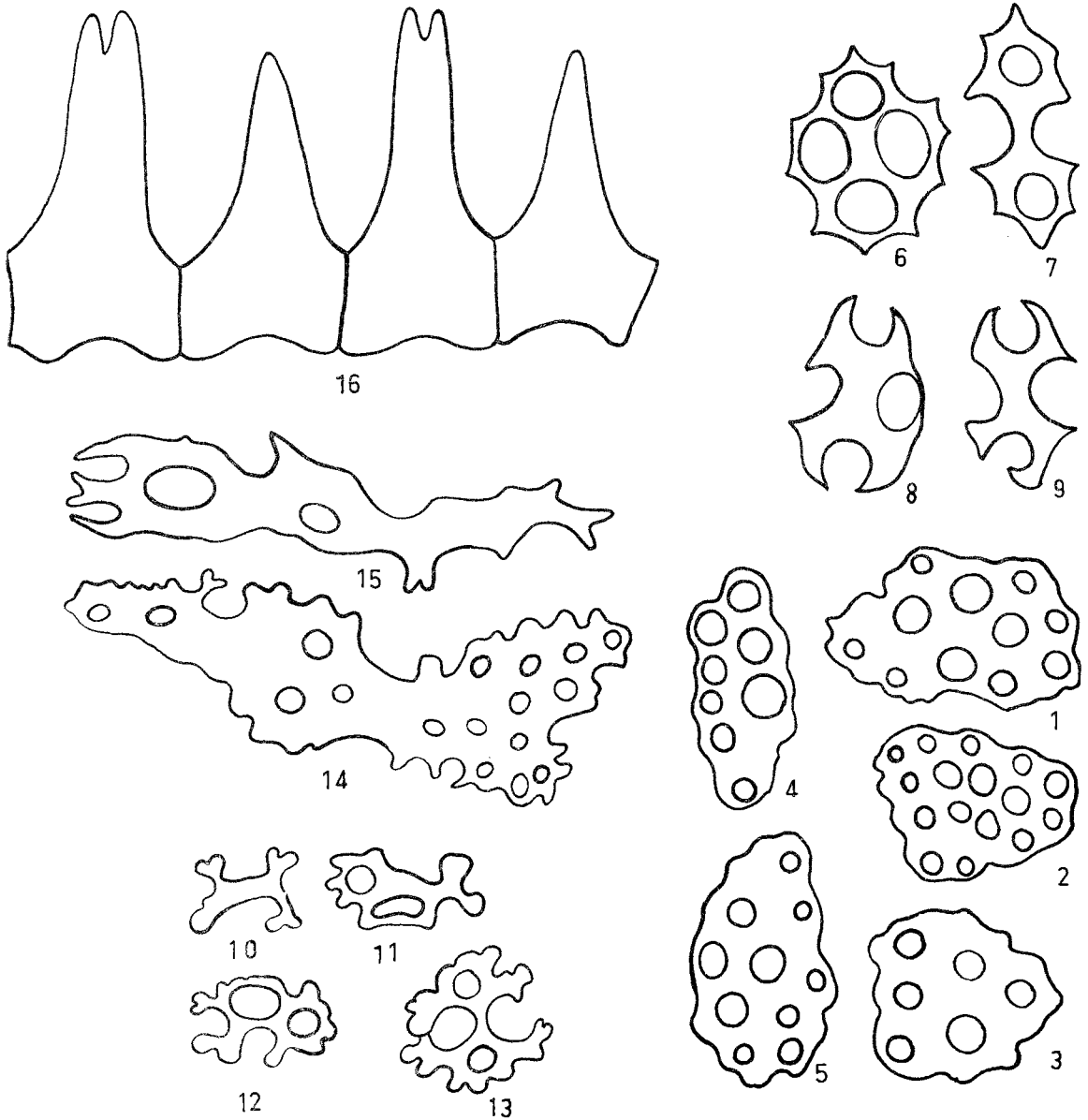
The anal aperture is surrounded by five anal teeth.

The oesophagus is short and relatively narrow without any bulbous enlargement. The intestine

has the usual S-like curvature and the mesentery supporting its posterior end lies in the left ventral interradius. The cloaca is moderately large.

The respiratory trees or water lungs on each side extend from the cloaca as far forward as the vascular ring and are well branched.

The five radial muscles of the body are well developed as also are the five retractor muscles.



Psolidiclla adhaerens sp. n.

FIGS. 1-5.—Perforated plates from sole. FIGS. 6-9.—Perforated plates from sides and dorsum. FIGS. 10-13.—Spicules from introvert. FIGS. 14-15.—Perforated bars from tentacles. FIG. 16.—Four ossicles from calcareous ring.

The latter are long being attached posteriorly slightly behind the middle of the body.

The vascular ring gives rise ventrally to a single large Polian vesicle. From the dorsal side of the ring a coiled stone canal ending in a madreporite is given off and lies in the dorsal mesentery.

The gonads are situated dorsally near the middle of the body. The genital duct runs forward in the dorsal mesentery and opens between the bases of the two dorsal tentacles. In the male the testis has the form of about 80 pale yellow slender tubules arranged in a group of 40 on each side of the mesentery. Only a few of the tubules are branched. In the female the ovary is composed of about 36 finger-like lobes, 18 on each side of the mesentery. Mature ova are large, measuring 548μ long and 493μ wide. They have a bluish-grey colour.

Locality: Pirates Bay, Eaglehawk Neck, Tasmania. Two specimens were collected on 19th March, 1954, seventy-five on 13th May, 1954, and four on 9th March, 1960.

All the specimens were found under stones near low tide level. The holothurian seems to favour stones that are cemented together by encrusting sponges and other organisms. When once established in a suitable position it adheres very firmly and does not readily move from its position. A specimen kept in an aquarium in the laboratory remained fixed in the one place for more than seven days, although the conditions under which it was living were by no means normal.

Affinities: *Psolidiella adhaerens* is close to the New Zealand species, *Psolidiella nigra* Mortensen (1925), but differs in colour, in possessing anal teeth and in lacking spicules in the walls of the pedicels. Panning (1949) has transferred *Thyone spectabilis* Ludwig and *Pseudocolochirus mollis* Ludwig & Heding to the genus *Psolidiella*. The former has an almost globular body with rod-like spicules in the skin and the latter exhibits atrophy of the calcareous particles. In these and other characters they differ from the Tasmanian species.

Genus: **STAUROTHYONE** H. L. Clark, 1938.

Staurothyone inconspicua (Bell).

(Pl. I, fig. 2 and text-figs. 17-23.)

Cucumaria inconspicua Bell, 1887.

" " Joshua, 1914.

Staurothyone inconspicua Clark, 1938.

" " Clark, 1946.

" " Panning, 1949.

This species has not been previously recorded from Tasmania, but it has been found on the coast of Victoria and South Australia. Both Clark (1938) and Panning (1949) think that the species may be the same as *Staurothyone rosacea* (Semper) from Aden.

The Tasmanian species have been preserved in alcohol without previous narcotization and nearly all of them are strongly contracted. The largest measures 25.0 mm. long and 12.0 mm. wide in the contracted condition. A single specimen with the tentacles extended is 38.0 mm. long and 8.00 mm.

wide. The body is somewhat narrowed posteriorly and in preserved specimens is curved upwards at the anterior and posterior ends.

The colour of the body, tentacles and pedicels varies from dark-brown to greyish-brown.

There are ten tentacles. They are dendritic and the ventral pair slightly smaller than the others. The mouth aperture is not surrounded by papillae and the introvert is short.

Pedicels occur on all five radii. On the two dorsal radii they are small and arranged in about two rows. On the three ventral radii they are larger and more numerous, forming three or four rows near the middle of the body but decreasing to two rows anteriorly and posteriorly. A few pedicels extend onto the introvert. Some scattered pedicels are also present on all interradii but are more numerous dorsally than ventrally.

Calcareous particles or spicules are present in the skin of the body-wall, tentacles, peristome, introvert and pedicels.

The spicules of the body-wall have the form of small rods bluntly forked at each end and often with one or more lateral projections (text-figs. 17-20). These small rods are usually $45-54\mu$ in length. In addition to these small rods there is a slightly deeper layer of large crosses which measure $170-204\mu$ in length and $96-138\mu$ in width. The arms of the cross are usually forked twice and end in bluntly rounded projections (text-fig. 21).

In the tentacles the spicules are slender rods, $39-93\mu$ in length and having bluntly forked ends (text-fig. 22). In the peristome, introvert and sides of the pedicels the spicules have the form of short rods similar to those in the body-wall but much smaller, being only $18-36\mu$ in length.

The calcareous ring is composed of five radial and five interradial ossicles, which are fused together. There are no posterior projections or tails. The ossicles are short and each is excavated on the posterior margin. Anteriorly each is produced into a narrow point, which is notched in the case of the radials but not notched in the interradials (text-fig. 23).

Surrounding the anal aperture are five anal teeth, which are radial in position.

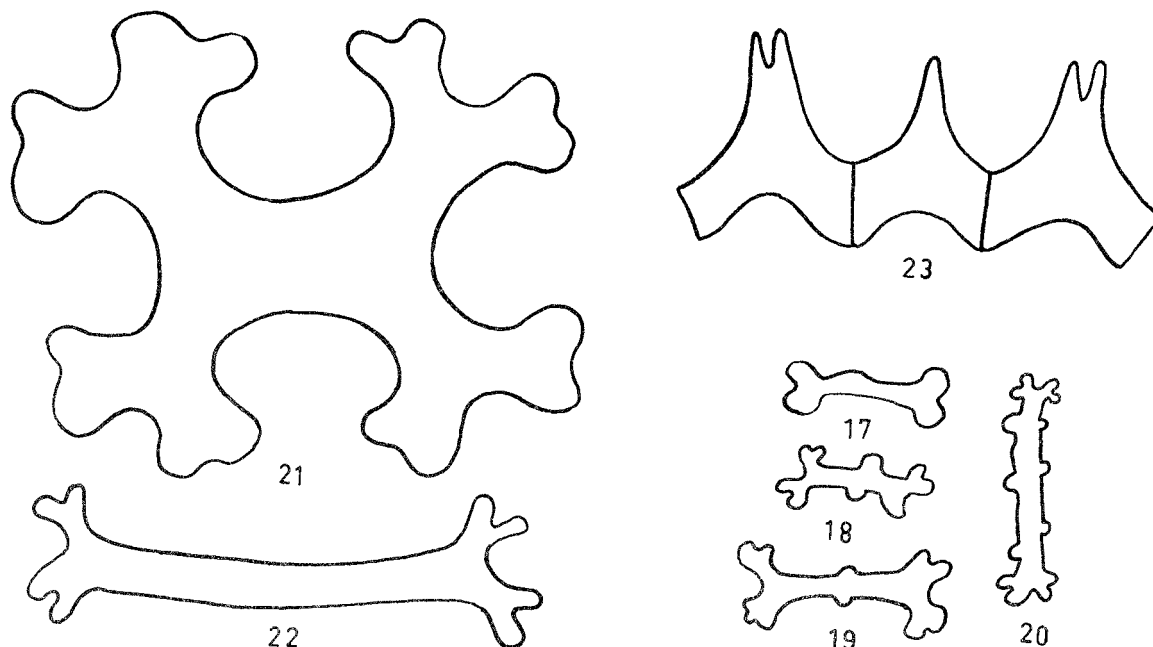
The oesophagus is short and narrow without any enlargement.

The respiratory trees are well developed and strongly branched.

Of the five radial muscles of the body-wall, the three ventral bands are larger than the two dorsal bands. The posterior ends of the retractor muscles are inserted slightly in front of the middle of the body.

The vascular ring is connected dorsally with a single stone canal and madreporite, and ventrally with two Polian vesicles.

Localities: Four specimens were collected by A. M. Olsen at East Devonport in January, 1940, and six specimens by J. L. Hickman near First Lookout Point, Cockle Creek, 3rd December, 1952. All the specimens were found under stones near low tide mark.



Staurothyone inconspicua (Bell).

FIGS. 17-20.—Rods from outer layer of body-wall. FIG. 21.—Large cross from deeper layer of body-wall. FIG. 22.—Spicule from a tentacle. FIG. 23.—Three ossicles from the calcareous ring.

Genus: **PENTACTA** G. A. Goldfuss, 1820.

Pentacta australis (Ludwig).

(Pl. I, fig. 3 and text-figs. 24-37.)

Colochirus australis Ludwig, 1874.

Colochirus doliohum Erwe, 1913.

Ekman, 1918.

Pentacta australis Clark, 1932.

" " Clark, 1938.

" " Clark, 1946.

Colochirus australis Panning, 1949.

The recorded occurrence of this species in Tasmanian waters is based on a single very young specimen dredged from D'Entrecasteaux Channel by T. T. Flynn and identified by H. L. Clark (1938). The specimen was bright brown with large yellow brown pedicels and Clark remarks "No other specimen of this colour or with such large pedicels has been seen, but there is no evident reason for doubting the identification". The species occurs at many places on the Australian coast from Western Australia to Queensland.

In the present collection there are eight specimens from the Derwent Estuary. With tentacles extended they vary in length from 10.0 - 27.0 mm. and in width from 3.0 - 5.0 mm.

The general body colour in life is orange and white. The pedicels are orange with darker orange patches around their bases. The tentacles have dark-stems with pale-brown translucent pinnae. The ventral surface is mainly white with a few small patches of orange. In alcohol speci-

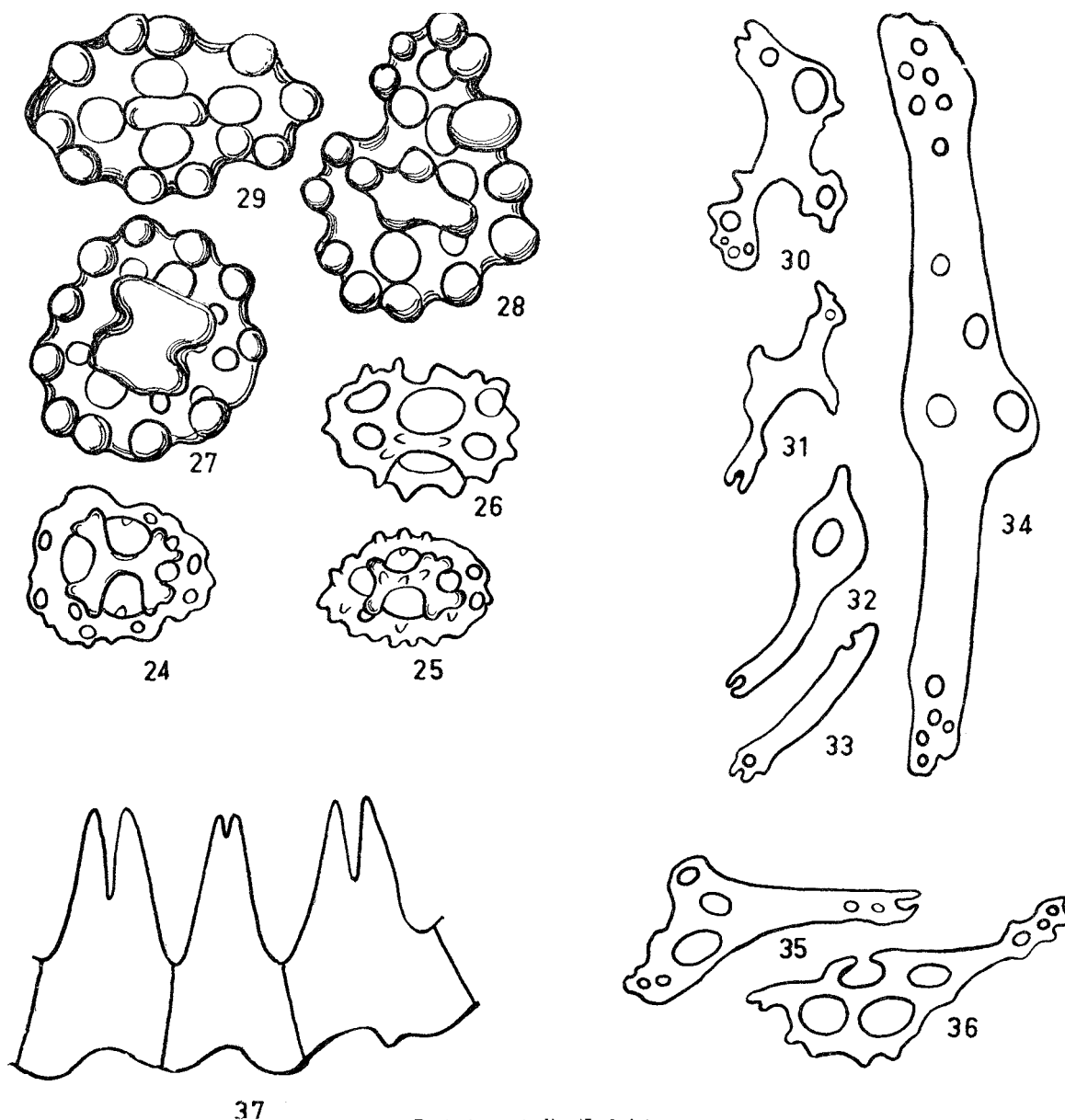
mens are bleached white except for the tentacles, which retain their brown colouration.

In extended specimens the body is somewhat quadrangular in transverse section and tapers slightly towards the posterior end. Ten tentacles are present, the ventral pair being smaller than the others. The mouth aperture is surrounded by papillae. Between the bases of the tentacles are large calcareous bodies, which appear as ten conspicuous white patches around the outer margin of the peristome.

The body-wall is more or less rigid due to the abundant calcareous particles present. Each radius tends to form a ridge along which the pedicels project. The base of each pedicel is surrounded by a tubercle and at the anterior end of each radius a peg-like process projects forward over the introvert. The pedicels are arranged in two loose rows on each radius and are more numerous on the three ventral radii than on the two dorsal radii.

Calcareous particles or spicules are very numerous and are present in the skin of the body-wall, tentacles and pedicels.

In the body-wall the spicules form two more or less distinct layers. The spicules of the outer layer are in the form of small oval "baskets" about 42-70 μ in length (text-figs. 24-26). They are furnished with a well-developed primary cross, which surmounts a perforated plate having a number of projections. Below the "baskets" is an inner layer of large buttons, more or less oval in shape and composed of many reticulate strata.



Pentacta australis (Ludwig).

FIGS. 24-26.—Baskets form outer layer of body-wall. FIGS. 27-29.—Knobbed perforated plates from body-wall. FIGS. 30-34.—Perforated rods and plates from tentacles. FIGS. 35-36.—Perforated plates from pedicels. FIG. 37.—Three ossicles from the calcareous ring.

Most of the buttons are about 420μ in length but some of the largest are 840μ . Intermingled with the large buttons are smaller perforated plates. $70-84\mu$ in length and furnished above and below with rounded knobs or nodules (text-figs. 27-29).

The tentacles are supported by slightly curved perforated rods and plates of irregular form (text-figs. 30-34). The rods are arranged transversely. Those towards the bases of the tentacles are

larger than the others and measure about 420μ in length.

The pedicels possess numerous "baskets" and irregular perforated plates and rods (text-figs. 35-36). The "baskets" are similar to those in the body-wall and measure $21-60\mu$ in length.

The calcareous ring is simple and without posterior forked tails (text-fig. 37). The radials are narrow and pointed anteriorly, the point being

cleft. The interradials are similar but somewhat smaller and the point not so deeply cleft. The posterior margin of the ring is undulating.

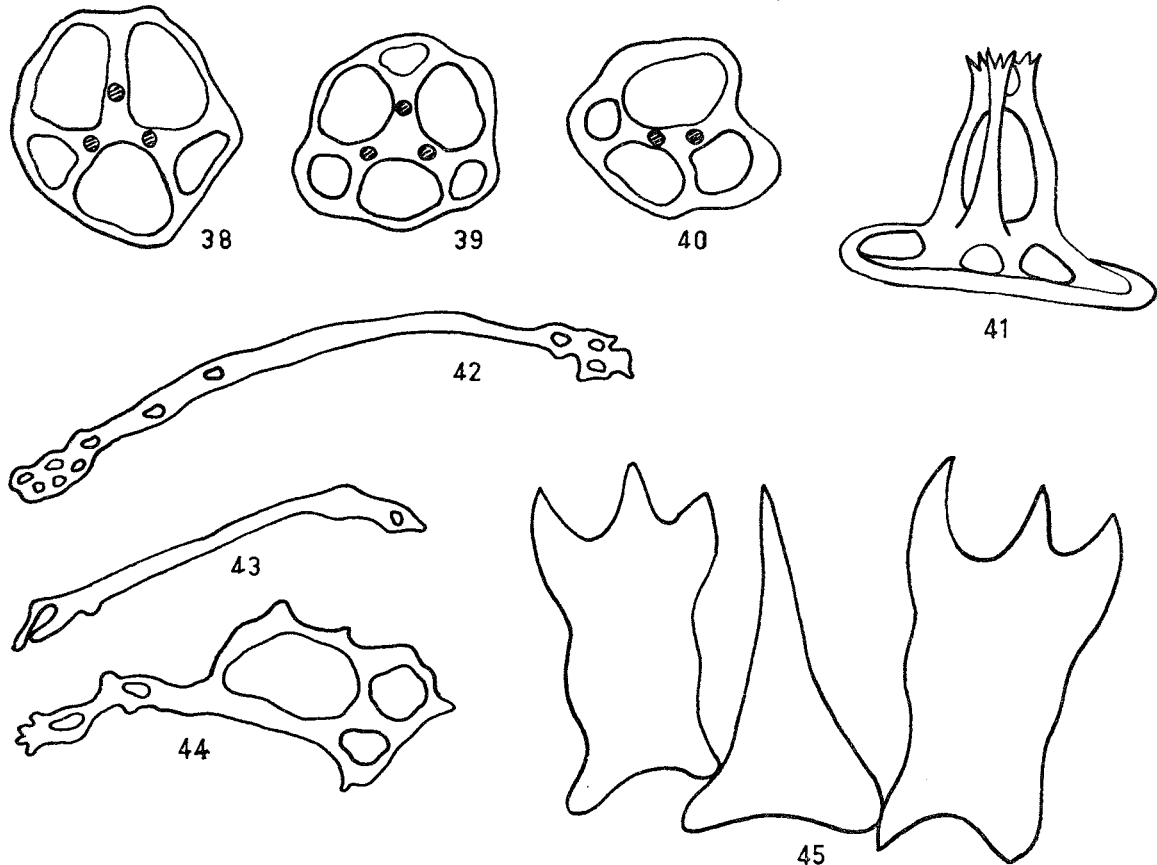
The respiratory trees extend forward from the cloaca for about half the length of the body and have about eight branches.

The five retractor muscles have their posterior ends inserted near the mid length of the body.

A single large Polian vesicle is connected with the ventral side of the vascular ring and a single madreporic canal with the dorsal side.

The gonad is situated dorsally in the anterior third of the body. In a female specimen it consists of 28 short finger-like caeca, about 14 on each side of the dorsal mesentery. Some of the caeca contain large eggs measuring 0.47 mm. long and 0.42 mm. wide.

Localities: One specimen was taken in the Derwent Estuary off Sandy Bay, 23rd September, 1955; and seven at Ralphs Bay, 30th June, 1959. All were dredged at a depth of 4-6 fathoms on a bottom of mud, sand and shells.



Cucumella mutans (Joshua).

FIGS. 38-40.—Perforated basal plates of tables. FIG. 41.—Table with tower of three columns in side view. FIGS. 42-44.—Perforated rods from tentacles. FIG. 45.—Three ossicles from the calcareous ring.

Family: PHYLLOPORIDAE.

Genus: **CUCUMELLA** Ludwig & Heding, 1935.

Cucumella mutans (Joshua).

(Pl. I, fig. 4 and text-figs. 38-45.)

Cucumaria mutans Joshua, 1914.

" " Joshua & Creed, 1915.

" " Clark, 1938.

Cucumella mutans Heding & Panning, 1954.

This species has not been recorded from Tasmania hitherto, but is known from the coasts of

Victoria, South Australia and Western Australia. The present collection contains specimens from the Derwent Estuary.

A well extended specimen measures 50.0 mm. long and 10.0 mm. in greatest width. It has the form shown in Pl. I, fig. 4.

The general colour of the body is brownish with the tentacles darker and pedicels lighter. Small specimens have a bluish tinge, especially on the introvert.

In Victorian specimens Joshua (1914) gives the number of tentacles as 10, but Heding and Panning (1954) state that "judging from his excellent figure

of the calcareous ring it could be 20". In Tasmanian specimens the number is 25. They are arranged in one circle and there is a tendency for 2 large tentacles to be situated in each inter-radius and 3 smaller ones in each radius.

The pedicels are confined to the radii and do not extend into the interradii. Anteriorly and posteriorly in each radius they are arranged in two rows, but near the middle of the body they are in more than two rows, especially in the ventral radius where four or five rows may be present. Towards the front the pedicels extend onto the introvert and here they are longer and more slender than elsewhere.

Calcareous particles or spicules are numerous and are present in the skin of the body-wall, introvert, peristome, tentacles and pedicels.

The spicules of the body-wall, introvert and pedicels are in the form of tables with a short spire or tower. The diameter of the tables measures up to 105μ and the height of the spire is from one half to three quarters the diameter of the table. Most of the spires have three columns but some only two. The apex of the spire is provided with six or seven sharp spines. The tables have from four to twenty-one perforations (text-figs. 38-41).

In the skin of the peristome, tentacles and the slender pedicels of the introvert some of the spicules have the form of curved bars or rods with flat perforated ends. They measure up to 186μ in length. Many of the rods are branched in an irregular manner (text-figs. 42-44).

All the pedicels have the usual perforated plate in the suctorial end.

The calcareous ring is composed of five radial and five interradii ossicles. The radials are wide distally and furnished with three points as shown in text-fig. 45. The interradials are slender and pointed at the apex but expanded towards the base. Posterior forked tails are absent.

The oesophagus is expanded into a bulb at its posterior end.

The respiratory trees are well developed and extend from the cloaca almost to the vascular ring.

The retractor muscles are long and their posterior ends attached near the mid length of the body.

Four or five Polian vesicles open into the vascular ring, the largest being ventral and almost as long as the oesophagus.

Two large coiled madreporic canals open into the dorsal part of the vascular ring.

In a male specimen, which was dissected, the testes are situated dorsally near the middle of the body. They are made up of about 75 primary tubules on each side of the dorsal mesentery. Most of the tubules are unbranched but a few are branched. They occupy a large part of the body cavity.

Localities: Two specimens taken in the Derwent Estuary off Sandy Bay, 23rd September, 1955. One at Ralphs Bay, 29th August, 1955, and four at the same locality, 28th August, 1959. All were dredged in about 5-7 fathoms by J. L. Hickman.

Genus: **AMPHICYCLUS** Bell, 1884.

Amphicyclus mortenseni Heding & Panning.

(Text-figs. 46-52.)

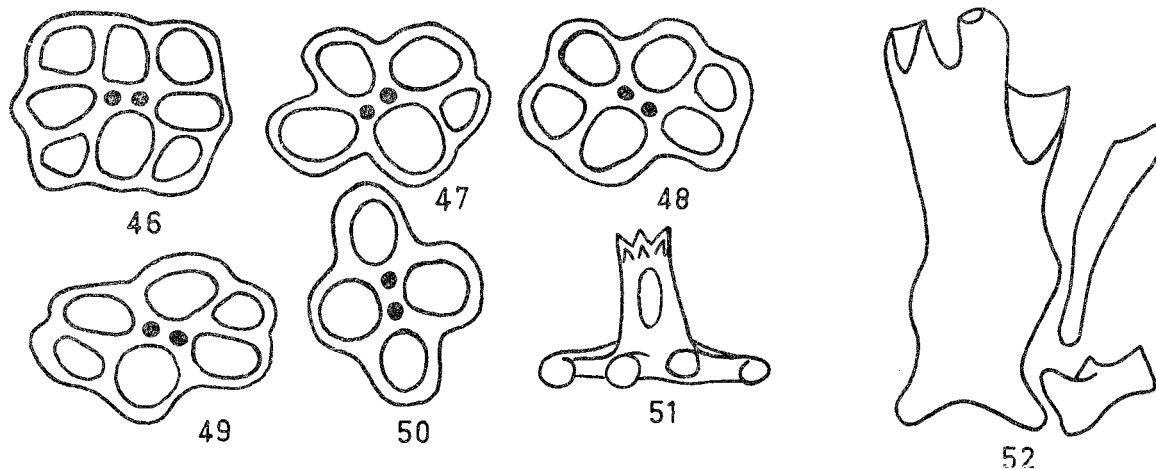
Pseudocucumis thomsoni Clark, 1938.

Mensamaria thomsoni Clark, 1946.

Amphicyclus mortenseni Heding & Panning, 1954.

This species, first recorded from Tasmania by Clark (1938), does not appear to be represented in the present collection. The following description is therefore based on the accounts given by Clark (1938) and Heding & Panning (1954).

The slender, nearly cylindrical body is pale-grey or pale-yellow in colour. It measures up to 90.0 mm. long and 10.0 mm. wide.



Amphicyclus mortenseni Heding & Panning.

(Figures after Heding & Panning, 1954.)

FIGS. 46-50.—Perforated basal plates of tables from introvert. FIG. 51.—Table with tower of two columns in side view. FIG. 52.—Two ossicles from calcareous ring.

According to Clark three of his specimens had 24, 23 and 20 tentacles respectively. Heding & Panning describe the number of tentacles as 25, arranged in an outer circle of 15 and an inner circle of 10.

The pedicels are usually in two rows, occasionally in three, on the radii. The introvert is white and without pedicels.

Calcareous particles or spicules are absent from the skin of the body-wall and from the wall of the pedicels, but present in the introvert and tentacles.

In the introvert the spicules have a basal plate perforated with 4-6 holes and surmounted by a two-columned tower with a strongly spined apex (text-figs. 46-51).

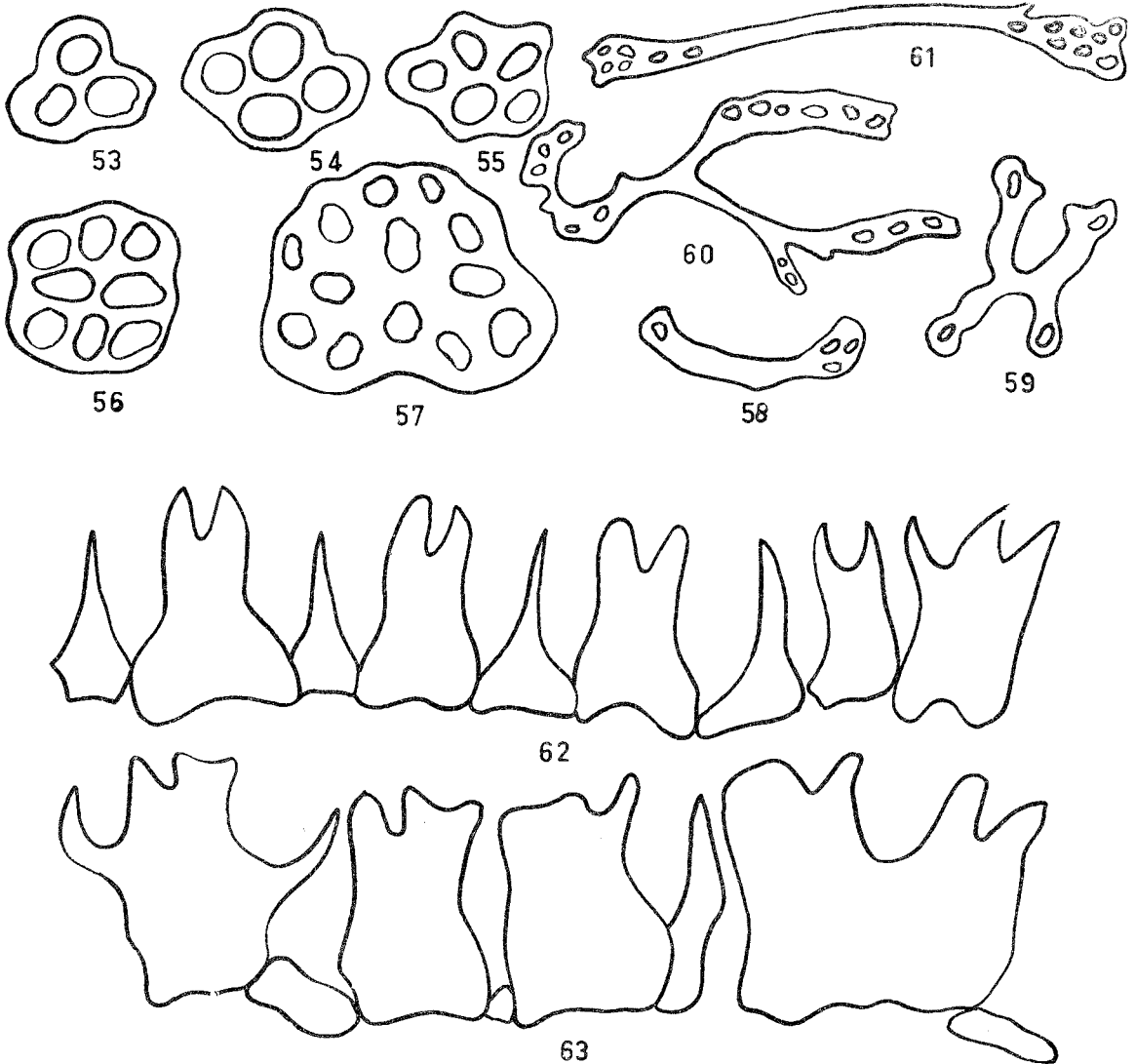
The spicules of the tentacles are in the form of rods.

The calcareous ring is simple and devoid of forked tails. The radials have two small and one large insertion point for the radial tentacles. The vascular notch is large. The interradians have a narrow anterior part, which is not fused with the broader base (text-fig. 52).

The respiratory trees are well developed but have few branches.

The retractor muscles are very long. Two Polian vesicles and a single stone canal are present. The gonads are slightly branched and lie far back in the body.

Locality: D'Entrecasteaux Channel at five fathoms, two specimens collected by T. T. Flynn (*vide*



Neomphicyclus lividus sp. n.

FIGS. 53-57.—Perforated plates from body-wall. FIGS. 58-59.—Rods from tentacles. FIGS. 60-61.—Rods from papillae of peristome. FIG. 62.—Calcareous ring (opened out) showing fusion of one of the radials with an interradii. FIG. 63.—A markedly abnormal calcareous ring (opened out) showing extensive fusion of parts.

Clark, 1938). Eastern end of Bass Strait at 70-260 fathoms, twenty-two specimens collected by T. Mortensen (*vide* Heding & Panning, 1954).

Genus: **NEOAMPHICYCLUS** gen. nov.

Diagnosis: Dendrochirote holothurians with 25 tentacles arranged in two circles. Pedicels on radii but lacking on interradii. The pedicels extend onto the introvert. Calcareous ring simple without posterior bipartite prolongations. The interradialia somewhat reduced. In adults the calcareous bodies or spicules are few and widely scattered in the body-wall, where they have the form of perforated plates without towers or spires. Spicules are absent from the pedicels, except for the end plate.

Genotype: *Neoamphicyclus lividus* sp. n.

This genus appears to be closely related to *Amphicyclus* Bell, but differs in having pedicels on the introvert and in lacking spires or towers on the calcareous bodies.

Neoamphicyclus lividus sp. n.

(Pl. I, fig. 5 and text-figs. 53-63.)

This species is one of the most common Tasmanian holothurians and the present collection contains more than 150 specimens. Nearly all of them are slaty-blue in colour with the tentacles and introvert usually darker. In some the tentacles and posterior end of the body are dark-blue.

The largest specimen when extended measures 110 mm. long and 10 mm. wide. Most specimens, however, do not exceed 80-90 mm. in length.

The 25 tentacles are dendritic. They are arranged in two circles, an outer circle of 15 large tentacles and an inner of 10 smaller ones. The outer tentacles occur three in each interradius and the inner ones two in each radius.

The pedicels are on the radii but not on the interradii. They are usually in two rows, but on the ventral radii in some specimens three rows are present. Long slender pedicels are present on the introvert.

Calcareous particles or spicules are present in the skin of the body-wall, the tentacles, the papillae surrounding the mouth and, in the case of young specimens, in the skin of the introvert. Apart from the end plate they are absent from the pedicels. In most cases the spicules of the body-wall are few and well scattered. They are more numerous near the middle of the body than they are anteriorly or posteriorly. In three large specimens they are absent from the skin of the introvert. In other cases, however, a few scattered spicules are present.

The particles from the body-wall have the form of perforated plates up to 54μ in diameter. The number of perforations varies from three to eight, but is usually four or five (text-figs. 53-57). In small specimens, about 8.0 mm. long, the plates are more numerous and larger, some of the larger plates measuring 96μ in diameter and having eleven perforations. In no specimen, either young or adult, is there any evidence of the presence of a spire or tower on the plates.

In the tentacles the spicules have the form of curved rods up to 195μ in length. The rods have perforated ends and are sometimes branched (text-figs. 58-59).

In the papillae of the peristome there are curved rods similar to those of the tentacles and in addition many rods with perforated branches (text-figs. 60-61).

The calcareous ring usually has five radial and five interradiial ossicles. The radials are wide with a deep notch and three points of insertion for the tentacles in front. Posteriorly they are deeply excavated. The interradials are very slender and slightly constricted, so that they form a narrow union with the wider posterior part, which is excavated on its hinder margin (text-fig. 62). In a number of cases abnormal conditions occur in which the radials become partly or wholly fused with the interradials, so that the ring appears to have a reduced number of segments (text-fig. 63).

The oesophagus is about one-eighth the length of the extended body. It has a bulbous muscular region near the middle of its length. The intestine exhibits the usual contortion. In the living animal the stomach or mid-gut region is brown. The cloaca is darkly pigmented. The posterior end of the intestine is supported by the mesentery in the left ventral interradius.

The respiratory trees are well developed and extend forward almost to the vascular ring.

The retractor muscles are long and attached posteriorly slightly behind the middle of the body.

The ring vessel is provided with from two to five Pollan vesicles. A single coiled madreporic canal opens into the dorsal part of the ring vessel.

The gonads are situated dorsally near the middle of the body. In the male the testes are pale cream in colour and made up of about 100 slender tubules, 50 on each side of the dorsal mesentery. A few of the tubes branch. In the female the ovary is small and has about 15 finger-like lobes on each side of the dorsal mesentery. The mature ovum measures 350μ in diameter.

Localities: Coal Point, Bruny Island; January, 1937, 5 specimens. East Devonport; January, 1940, 13 specimens collected by A. M. Olsen. Recherche Bay, Catamaran; 3rd December, 1952, 18 specimens. Pirates Bay, Eaglehawk Neck; 19th March, 1954, 70 specimens; 13th May, 1954, 40 specimens; 22nd May, 1959, 4 specimens; and 7th March, 1960, 17 specimens collected by J. L. Hickman and the author. All the specimens were found under stones near low tide mark.

I formerly regarded *Neoamphicyclus lividus* sp. n. as being *Mensamaria thomsoni* Clark (1946) and gave it this name in designating it as the host of the turbellarian, *Notothrix inquilina*, which is frequently present in its gut (Hickman, 1955).

Genus: **LIPOTRAPEZA** H. L. Clark, 1938.

Lipotrapeza vestiens (Joshua).
(Pl. I, fig. 6 and text-figs. 64-74.)

Phyllophorus vestiens Joshua, 1914.

Lipotrapeza vestiens Clark 1938.

" " Clark, 1946.

" " Heding & Panning, 1954.

A single specimen of this holothurian was found at low tide at Wynyard by Professor T. T. Flynn

and recorded by H. L. Clark (1938). The species has also been found on the coasts of Western Australia and Victoria.

The present collection contains two specimens taken near Burnie. Both are strongly contracted and have the tentacles withdrawn. One measures 84 mm. long and 23 mm. wide, the other 52 mm. long and 19 mm. wide. They are fusiform in shape and exhibit a distinct dorsal curvature. Joshua (1914) has pointed out that this flexure occurs in preserved specimens but not in the living holothurian.

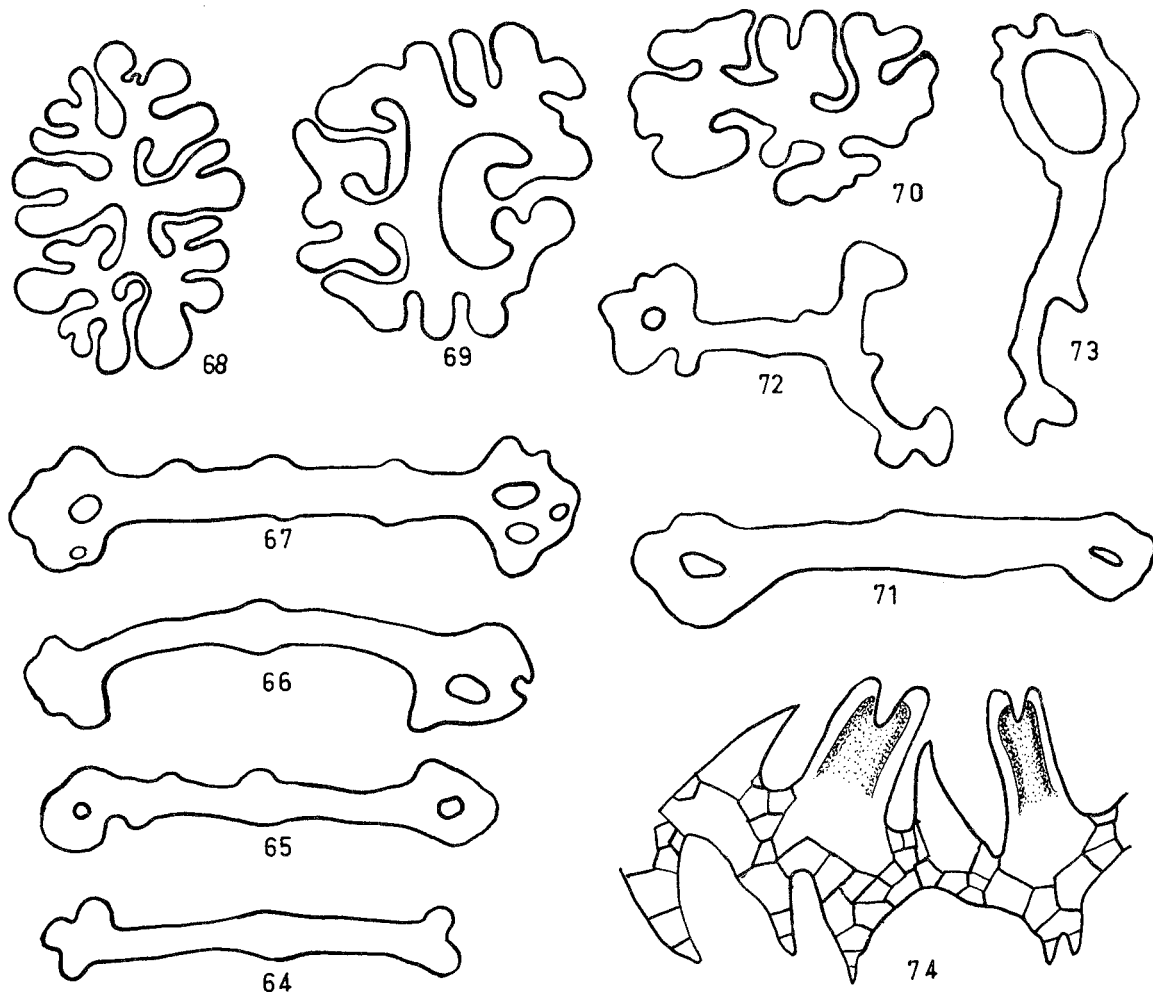
The general body colour is light-brown with the pedicels white and the tentacles black.

Twenty tentacles are present. They are ranged in an outer circle of ten and an inner circle of ten. Those of the inner circle are smaller than the others and are disposed in five pairs.

The body-wall is thick and very muscular. The pedicels are numerous, not arranged in rows, but scattered thickly over the whole surface of the body.

Calcareous particles or spicules are absent from the body-wall but are present in the tentacles, peristome, introvert and the anal region. The pedicels have the usual perforated end plate but no other calcareous bodies.

In the parts of the body where they occur the spicules have the form of rods and rosettes (foliaceous spicules). In the tentacles the rods measure up to 114μ in length and often have expanded perforated ends (text-figs. 64-67). The rosettes vary in form (text-figs. 68-70). In the main stems of the tentacles and also in the peristome they are frequently grouped together in large numbers forming heaped-up masses, which may also include a few rods.



Lipotrapeza vestiens (Joshua).

FIGS. 64-67.—Rods from tentacles. FIGS. 68-70.—Rosettes from main stem of tentacle. FIGS. 71-73.—Rods from introvert. FIG. 74.—Four ossicles from calcareous ring.

In the introvert rods are more numerous than rosettes. They measure up to 69μ in length and are sometimes branched (text-figs. 71-73).

The skin around the anal aperture is furnished with a few small rosettes. Tables, which Clark (1938) found in the anal region of one of his small specimens, do not appear to be present.

The calcareous ring has five radial and five interradial ossicles. The radials are wide, deeply notched in front, and strongly concave on the outer surface. The base of each is divided into a number of angular pieces and forms a pair of short posterior projections of variable length. The interradials are narrow and pointed in front. Like the radials they have a base made up of a number of angular pieces, but without posterior projections, the posterior margin being concave (text-fig. 74).

The intestine has the usual S-shaped curvature and its final loop is supported by the mesentery attached to the midventral radial muscle band. The respiratory trees are extensive and well branched.

The five retractor muscles are short, their posterior ends being inserted anterior to the gonad.

One Polian vesicle is present in the smaller specimen and two in the larger. They arise from the ventral part of the vascular ring.

The gonads are situated dorsally near the middle of the body. They have the form of numerous unbranched tubules which open separately into the gonoduct and are disposed on each side of the dorsal mesentery. In the smaller specimen, a male, the testis is composed of 275 such tubules. In the larger specimen, a female, the ovary is formed of 290 tubules. Mature ova measure about 0.53×0.49 mm. In both sexes the gonad is pale-yellow in colour.

Locality: Cooee, Burnie, North West Tasmania; two specimens collected by Mr. D. J. Cullen of the Burnie High School. The specimens were taken at low tide level and were buried in sediments of mud, sand and small pebbles, occurring between groups of quartzite rock in the infra-littoral zone.

Family: PSOLIDAE.

The family Psolidae contains a small number of holothurians characterised chiefly by the possession of a distinct thin-walled sole on the ventral surface and by having the dorsal side more or less completely covered by scales. Another feature to which some importance has been given is the position of the third mesentery, that attaches the last loop of the intestine to the body-wall. However, statements in reference to this feature appear contradictory. Deichmann (1941, p. 73) says "The Cucumariidae seem typically to have the third mesentery attached on the right side of the midventral muscle band, the Phyllophoridae seem to have it attached to the left, and the Psolidae have it either way". Mortensen (1925, p. 359), however, states that the Cucumariidae have the hind part of the intestine attached in the left ventral interradius and the Psolidae have it in the right. Moreover, Mortensen examined the type of the genus *Psolidium*, namely *Psolidium dorsipes* Ludwig, and found that "beyond doubt the posterior part of the intestine really lies in the right ventral interradius". Deichmann (1941, p. 135), on the other

hand, states that in the genus *Psolidium*, the third loop of the intestine is attached in the left ventral interradius.

In the species described in the present paper the posterior loop of the intestine is attached in the right ventral interradius.

Genus: *PSOLIDIUM* Ludwig 1886.

Psolidium ravum sp. n.

(Pl. II, fig. 7 and text-figs. 75-86.)

The body measures 30 mm. long and 10 mm. wide. The anterior end is narrow and cylindrical; the posterior end short and conical. In the living animal both ends are directed upwards. The dorsal surface is wrinkled longitudinally. The ventral surface has a well delimited sole, which measures about 25 mm. long and occupies a large part of the under side.

The colour in alcohol is grey, the sole being lighter with a brownish tinge. The introvert and tentacles are dark-grey. The ends of the tentacles and pedicels are white.

The body-wall is thick and tough except on the sole, where it is thin. Scales are evident externally only around the conical posterior end and anal aperture. Elsewhere they are sunk below the surface.

Ten tentacles are present, the ventral pair being much smaller than the others. The mouth aperture is surrounded by papillae.

Pedicels are scattered irregularly on the dorsal surface but are not present on the introvert. On the ventral side they are large and arranged in three or four rows around the margin of the sole and in two rows on the midventral radius bisecting the sole. They are not present on the ventral interradial.

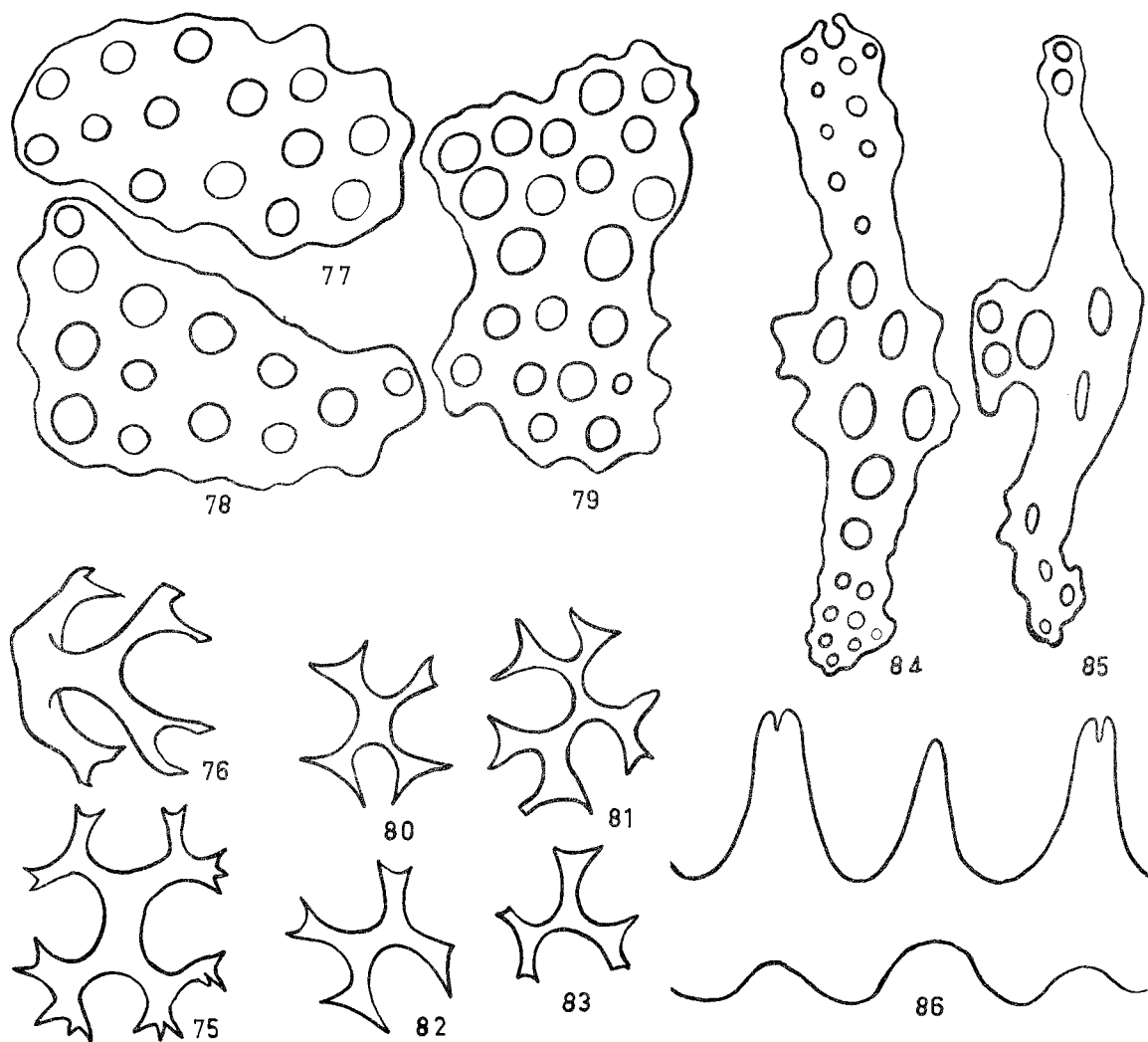
Calcareous bodies or spicules are present in the skin of the body-wall, introvert, tentacles and pedicels, but are absent from the peristome.

In the superficial skin of the body-wall the spicules are in the form of numerous small crosses measuring $48-81\mu$ long and $45-66\mu$ wide. The arms of the crosses are generally curved towards the surface and forked twice, the ends of the forks being provided with short spines (text-figs 75-76). In a deeper layer of the dorsal epidermis are very large thick scales, made up of reticulate strata and measuring up to 1.5 mm. long and 1.2 mm. wide. Around the posterior end of the body the scales are imbricated and visible externally.

The skin of the sole is supported by numerous perforated plates, which often overlap. They measure up to 238μ long and 140μ wide. They generally have about 12 holes but up to 16 may be present (text-figs. 77-79). In a more superficial layer there are branched particles with the ends of the branches forked (text-figs. 80-83). Crosses similar to those of the dorsal surface are also present but less numerous.

The skin of the introvert is supported by crosses, small perforated plates and small scales.

The pedicels and tentacles have spicules in the form of curved perforated bars (text-figs. 84-85).



Psolidium ravum sp. n.

FIGS. 75-76.—Crosses from outer layer of body-wall. FIGS. 77-79.—Perforated plates from sole. FIGS. 80-83.—Branched particles from sole. FIGS. 84-85.—Perforated bars from tentacles. FIG. 86.—Three ossicles from the calcareous ring.

In the pedicels a few crosses are also present. The end plate is large in the ventral pedicels but somewhat reduced in those of the dorsal surface.

The calcareous ring consists of five radial and five interradial ossicles of similar form. The ossicles are pointed in front and excavated on the posterior margin (text-fig. 86).

The intestine exhibits the usual contortion, the third loop being attached to the mesentery in the right ventral interradius. The respiratory trees are large and strongly branched.

The retractor muscles of the dorsal side are long and attached posteriorly near the middle of the

body; those of the ventral side are much shorter and attached further forward.

The gonad is situated dorsally near the middle of the body. In the female it consists of numerous pale-yellow tubules, which occupy most of the body cavity. Mature ova measure about 0.25 mm. in diameter.

Locality: The Derwent Estuary; Blackman's Bay, 27th January, 1956; one specimen collected under a stone at low tide. Ralph's Bay, 28th August, 1959; one specimen dredged at a depth of about seven fathoms.

Order: ASPIDOCHIROTA.

Family: STICHOPODIDAE.

Genus: **STICHOPUS** J. F. Brandt, 1835.

Stichopus mollis (Hutton).

(Pl. II, fig. 8 and text-figs. 87-105.)

Holothuria mollis Hutton, 1872.

Stichopus mollis Dendy, 1897.

" " Erwe, 1913.

" " Joshua, 1914.

" " Mortensen, 1925.

" " Clark, 1938.

" " Clark, 1946.

Stichopus simulans Dendy & Hindle, 1907.

Stichopus simultans Erwe, 1913.

(For further synonymy *vide* Mortensen, 1925.)

This species was originally described from New Zealand and has since been recorded from Victoria, Western Australia and Tasmania.

Clark (1938) mentions having dredged a number of specimens of this large holothurian in 2-3 fathoms on the west side of the estuary at Hobart on 15th November, 1929. His specimens measured 160-250 mm. long and varied in colour from grey to brown. He remarks that they were "apparently the largest yet recorded".

Specimens in the present collection vary in length from 20-280 mm. and in width from 5-35 mm. Most of them are dark purple-brown in colour, one is orange-brown and another, taken on a sandy bottom, is yellowish above and brown below, with the papillae, pedicels and tentacles brown. Small specimens found near the shore at low tide level are usually of a uniform dark-brown colour.

The body is almost cylindrical and on the dorsal side at the anterior end is produced into an irregular brim overhanging the pale-coloured peristomial region and tentacles. Around the margin of the peristome is a set of twenty peltate tentacles, which are partly retractible. When the holothurian is contracted the brim closes over the oral region concealing the mouth and the retracted tentacles.

The body-wall is tough and thick. The dorsal surface is furnished with large and small conical papillae but is devoid of pedicels. The ventral surface, which is slightly flattened, has numerous pedicels, which are situated on the three ventral radii and the two ventral interradial.

Calcareous spicules occur in large numbers in the body-wall. The stems of the tentacles, the peristome, pedicels, introvert, walls of the radial vessels, wall of the mid-gut and cloaca, but not in the wall of the intestine.

Spicules from the skin in the mid-body region have the form of tables with a short spire or tower. The basal plate is more or less circular, about 60 μ in diameter and perforated with four large and four small holes. The tower is composed of four columns linked together by cross bars at the top and near the middle. In some spicules the tower is wide and short, its height being equal to about half the diameter of the basal plate (text-figs. 87-88). In other spicules the tower is narrower and its height equal to about three-quarters of the diameter of the basal plate (text-figs. 89-90).

This second type of tower is similar to that observed by Mortensen (1925) in a young *Stichopus* from Paterson Inlet, Stewart Island. As he had not seen this type of spicule in adult specimens of *Stichopus mollis*, he thought the young specimen might perhaps belong to a different species. Since the tall as well as the short towered spicules occur in adult specimens of *Stichopus mollis* in Tasmania, there is little doubt that the juvenile form examined by Mortensen was a young specimen of that species. In both spicules the tower is provided with a crown of small spines. Stages in the development of a spicule from a primary cross are shown in text-figs. 91-94.

In the introvert the spicules are not as numerous or as large as in the body wall of the mid-body region. They have a large basal plate, about 42 μ in diameter, perforated with four holes and provided with a tower of four columns. The columns are joined together by cross bars at the top but not near the middle. The height of the tower is about half the diameter of the basal plate. The crown has four short spines (text-figs. 95-96).

The spicules supporting the walls of the pedicels are similar to those of the body-wall. A large cribriform plate is present in the end of the pedicel.

The stems of the tentacles are provided with spicules in the form of curved rods covered with small projections (text-figs. 97-98). Similar but smaller rods occur in the peristome, walls of the radial vessels, wall of the mid-gut and wall of the cloaca (text-figs. 99-101). Around the anal aperture the skin often has rosettes (text-figs. 102-104) in addition to the ordinary spicules of the body-wall.

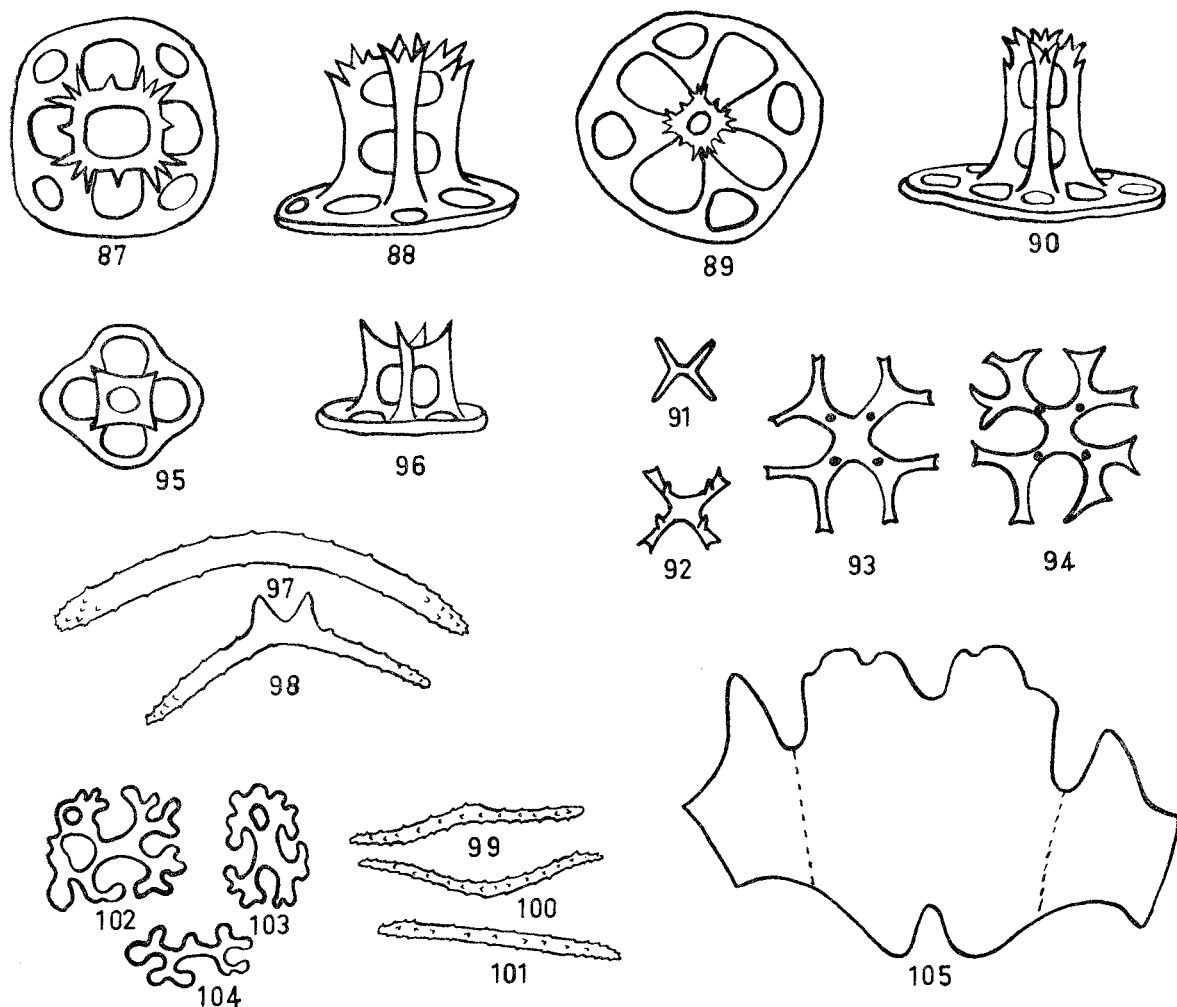
The calcareous ring has five radial and five interradial ossicles. The radials are wide and deeply notched in front and behind. The interradials are narrow, pointed in front and concave on the posterior margin (text-fig. 105).

The respiratory trees are large and well branched. Cuvierian organs are not present.

The vascular ring is connected dorsally with a single stone canal, which lies in the dorsal mesentery and ends in an ovoid madreporite. A single large Polian vesicle opens into the ventral side of the ring. Each tentacle is provided with a large ampulla.

The gonad is situated dorsally in the anterior quarter. In a female specimen, measuring 120 mm. long, the gonad consists of about eight primary tubules on each side of the dorsal mesentery. They open into the expanded end of the common genital duct. Distally they form numerous branches extending into the body cavity. Mature ova are small, measuring about 135 μ in diameter.

Localities: Frederick Henry Bay: one collected on beach at Carlton, 3rd April, 1948; one dredged by D. Kurth at Lewisham, 8th November, 1952; one found under a stone on the shore at low tide at Lewisham, 14th November, 1952; and one collected on Seven Mile Beach, 25th April, 1960. Derwent Estuary: one found under a stone at low tide, Blackman's Bay, 1st November, 1952; fourteen dredged in 6-7 fathoms in Ralphs Bay by J. L. Hickman, 14th April, 1955; two on 29th August, 1955; and one on 28th August, 1959. D'Entrecasteaux Channel: three collected at low tide at Oyster Cove by E. R. Guiler, 18th November, 1952.

*Stichopus mollis* (Hutton).

FIGS. 87-88.—Table with wide tower viewed from above and side respectively. FIGS. 89-90.—Table with narrow tower viewed from above and side respectively. FIGS. 91-94.—Stages in the development of a table from a primary cross. FIGS. 95-96.—Table from introvert viewed from above and side respectively. FIGS. 97-98.—Rods from tentacles. FIGS. 99-101.—Rods from wall of mid-gut. FIGS. 102-104.—Rosettes from skin near anal aperture. FIG. 105.—Three ossicles from the calcareous ring.

Order: MOLPADONIA.

Family: MOLPADIIDAE.

Genus: *PARACAUDINA* Heding, 1932.*Paracaudina australis* (Semper).

(Pl. II, fig. 9 and text-figs. 106-130.)

Molpadia australis Semper, 1868.*Caudina chilensis* Clark, 1908.

" " Joshua, 1914.

" " Joshua & Creed, 1915.

Caudina australis Mortensen, 1925.*Pseudocaudina australis* Heding, 1931.*Paracaudina australis* Heding, 1932.

" " Heding, 1933.

" " Clark, 1935.

" " Clark, 1946.

After stormy weather this large holothurian is sometimes washed up on Seven Mile Beach in considerable numbers. Its normal colour is brown, but many specimens appear partly white due to the superficial skin having been eroded by the action of the sand and waves.

The body is fusiform in shape and may reach a length of 220 mm. and a width of 50 mm. It tapers posteriorly but there is little evidence of a tail. This is not due to the specimens being damaged or strongly contracted. The presence of the anal papillae indicates that the posterior end has not been lost. Moreover, living specimens placed in sea water extend but show no signs of a distinct tail.

The mouth is surrounded by fifteen short tentacles, each of which ends in four short lobes. Internally each tentacle possesses a large ampulla. The anal aperture is encircled by five groups of papillae, each group being radial in position. Pedicels are absent.

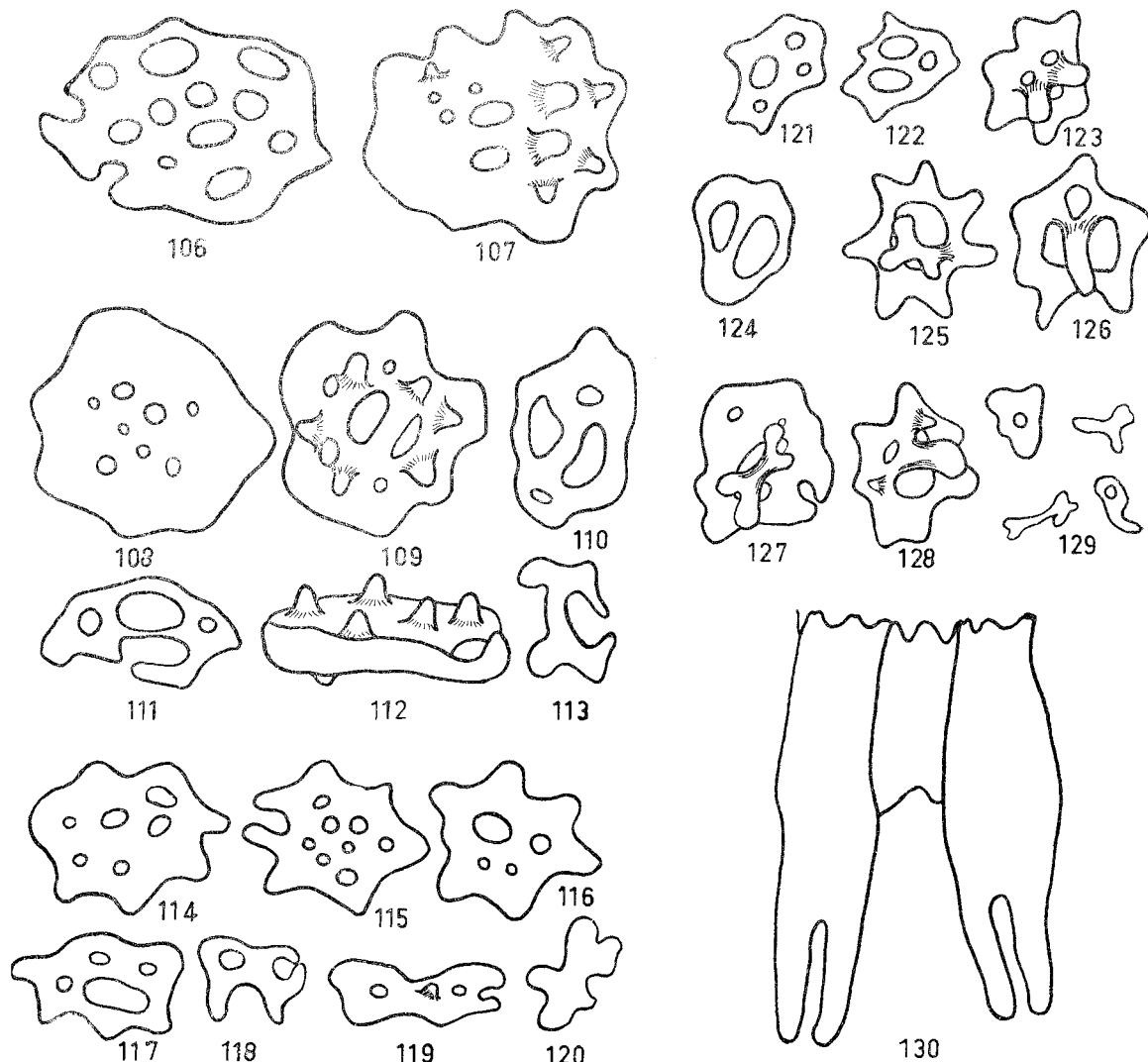
Calcareous particles or spicules are not present in the tentacles and peristome but occur in large numbers in the skin of the introvert, body-wall and anal papillae.

In the body-wall the most characteristic spicules have the form of rounded perforated plates about 63μ in diameter. The plates usually have six to eight holes of unequal size. Short conical knobs

also frequently occur on both inner and outer surfaces of the plates. In addition to the rounded plates there are others which may have a few projections around the margin. Small plates with only three or four perforations and larger plates with up to eleven holes are present in smaller numbers (text-figs. 106-113).

In the skin of the introvert the spicules are similar to those of the body wall but smaller and with fewer holes. The rounded forms are less numerous than those with marginal projections and not many of the spicules are furnished with knobs (text-figs. 114-120).

The skin of the posterior end of the body and of the anal papillae is provided with numerous



Paracaudina australis (Semper).

FIGS. 106-113.—Perforated plates from body-wall. FIGS. 114-120.—Plates from introvert. FIGS. 121-128.—Small plates from posterior end of body. FIG. 129.—Four irregular particles from posterior end of body. FIG. 130.—Three ossicles from the calcareous ring.

small spicules having marginal projections, two or three holes and one or two knobs (text-figs. 121-128). In addition large numbers of small irregular particles are present (text-fig. 129).

The calcareous ring consists of five radial and five interradiat ossicles. The radials are long and narrow with a deep cleft posteriorly (text-fig. 130). The interradiatals, which are intimately fused with the radials, are slightly less than half their length. They have almost parallel sides and an excavated posterior margin.

The respiratory trees are extensive and have numerous branches. Cuvierian organs are not present.

The radial muscles bands are wide and double. The retractor muscles are short having their posterior ends attached only a short distance behind the ring vessel.

A single madreporite is present and is situated in the dorsal mesentery. It communicates with the dorsal side of the ring vessel. A large Polian vesicle opens into the ventral side of the vessel.

The gonad consists of a large number of branched tubules disposed in two tufts, which arise one on each side of the dorsal mesentery in the anterior quarter of the body cavity.

Localities: Bridport, one washed up on beach, January, 1928. Derwent Estuary: Blackman's Bay,

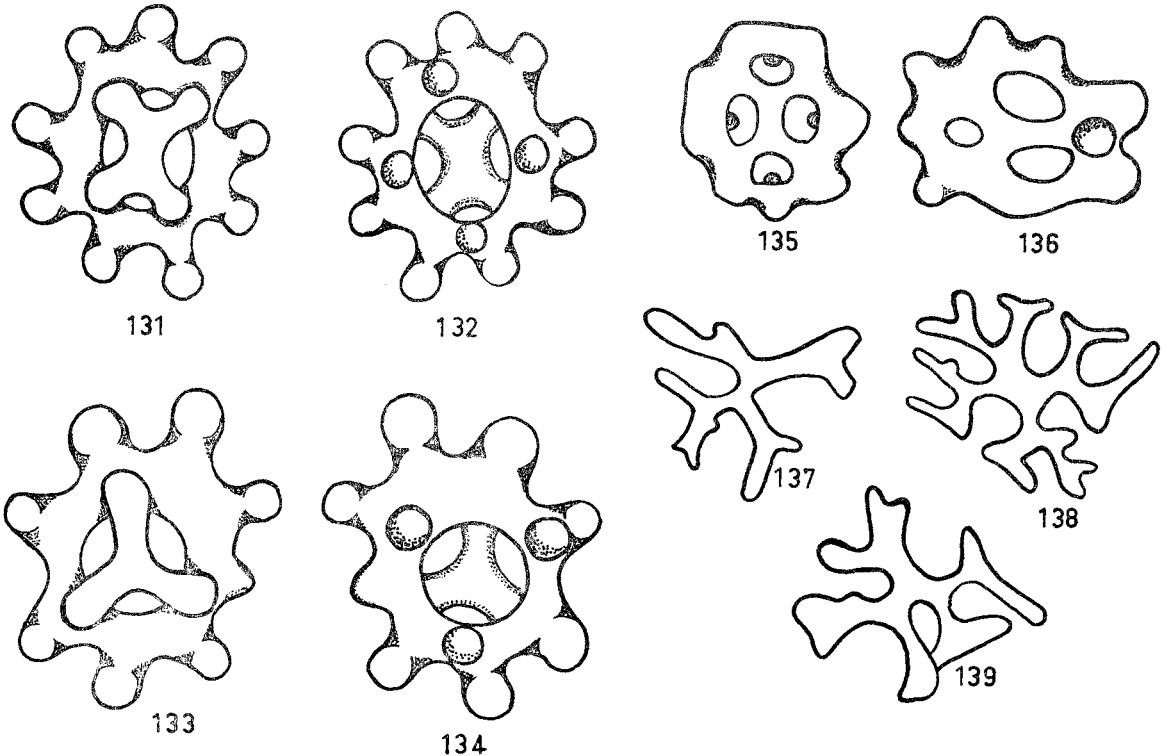
two, 18th October, 1951. Kingston Beach, two, 13th October, 1952. Frederick Henry Bay: Seven Mile Beach, thirteen collected by E. R. Guiler and A. G. Lyne, 14th October, 1952; eleven by J. L. Hickman, 13th August, 1956; twenty-eight by J. L. Hickman and the writer, 20th October, 1956; fifty-four by J. L. Hickman, 6th September, 1957. In all cases the specimens were found washed up on the shore usually after rough weather.

Paracaudina luticola sp. n.

(Text-figs. 131-139.)

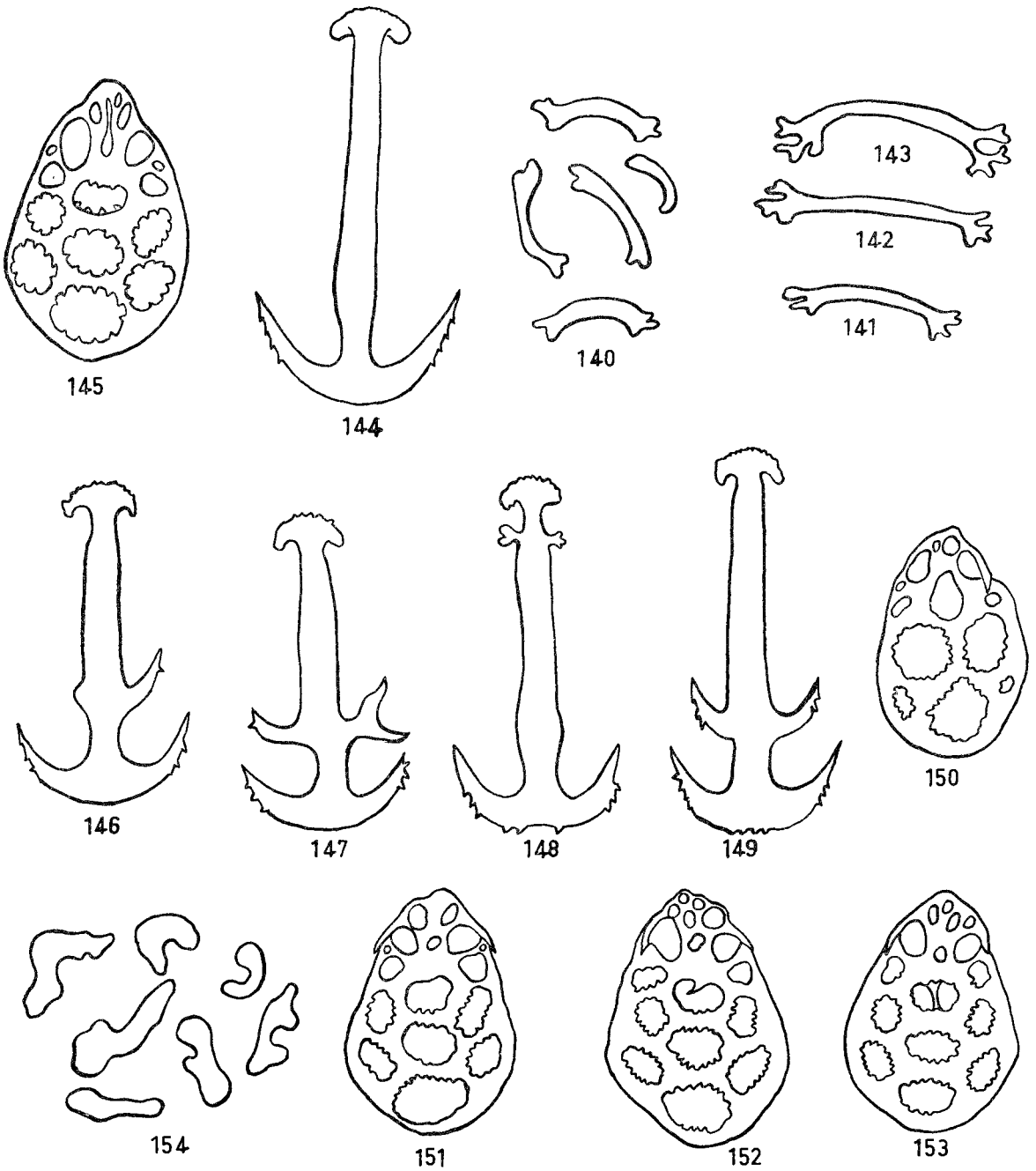
During dredging in Ralphs Bay, 30th June, 1959, seven caudal appendages were obtained. The form of the calcareous particles in the skin of the appendages indicates that they belong to holothurians of the genus *Paracaudina* and apparently to a new species. The animals seem to be buried in the sandy mud at the bottom of the bay with only their caudal extremities reaching the surface of the mud and thus being cut off by the blade of the dredge. Mortensen (1925) obtained only caudal appendages of *Paracaudina coriacea* (Hutton), when dredging in Colville Channel and Tiri-Tiri, New Zealand, in 1914.

Unfortunately further dredging in Ralphs Bay has failed so far to yield a complete specimen of *Paracaudina luticola* sp. n. and it is therefore



Paracaudina luticola sp. n.

FIGS. 131-132.—Crossed cups showing outer and inner surfaces respectively. FIGS. 133-134.—Crossed cups with three arms to the cross showing outer and inner surfaces respectively. FIGS. 135-136.—Small perforated plates from integument. FIGS. 137-139.—Spicules from anal papillae.



Leptosynapta dolabrifera (Stimpson).

FIG. 140.—Rods from main stem of tentacle. FIGS. 141-143.—Rods from digits. FIGS. 144-145.—Anchor and anchor-plate from body-wall. FIGS. 146-153.—Abnormal anchors and anchor-plates. FIG. 154.—Miliary granules from integument above radial muscle bands.

possible to describe only the caudal appendages obtained. They are pale-yellow almost white in colour and measure 16-27 mm. long and 4 mm. wide. Owing to marked contraction the surface is strongly corrugated. The body-wall is thick and tough. The skin is furnished with numerous calcareous particles. At the posterior end the anal aperture is surrounded by 22-32 papillae, which are narrow and finger-like.

The calcareous particles consist very largely of crossed cups (text-figs. 131-132). The margin of the cup is produced into 7-10 rounded knob-like processes. On the outer surface of the particle is an X-shaped cross, which partly covers a large central hole, which is the only perforation. On the inner surface of the particle and opposite the angles of the cross are four rounded knobs. Most of the spicules measure 45-51 μ in diameter. In some cases only three arms of the cross on the outer surface and three knobs on the inner surface are developed (text-figs. 133-134).

Some spicules have the form of small plates with three or four perforations and without well rounded marginal knobs (text-figs. 135-136).

The anal papillae are supported by branched spicules of irregular form (text-figs. 137-139).

Locality: Derwent Estuary: Ralphs Bay. Seven caudal appendages dredged in about 7 fathoms by J. L. Hickman, 30th June, 1959.

Affinities: The typical crossed-cup spicules of *Paracaudina laticola* sp. n. differ from those of *P. chilensis* (Müller) and its varieties *coriacea*, *obesacauda* and *ransonnetii* in the basal plate lacking marginal perforations, and also in the large central hole of the plate not being barred on the inner side by a square plate with a large perforation in its centre. The presence of crossed-cup spicules in large numbers clearly distinguishes the new species from *P. australis* (Semper) and *P. tetrapora* (Clark), in both of which crossed-cups are lacking or reduced.

Order: APODA.

Family: SYNAPTIDAE.

Genus: **LEPTOSYNAPTA** Verrill, 1867.

Leptosynapta dolabrifera (Stimpson).

(Pl. II, fig. 10 and text-figs. 140-154.)

Synapta dolabrifera Stimpson, 1855.

Leptosynapta dolabrifera Clark, 1908.

" " Clark, 1924.

" " Heding, 1928.

Leptosynapta variopatina Heding, 1928.

Leptosynapta jacksonia Heding, 1928.

Leptosynapta dolabrifera Clerk, 1938.

Leptosynapta dolabrifera Clark, 1946.

This common synaptid was first recorded from Tasmania by H. L. Clark (1938), who examined and identified nine specimens dredged by T. T. Flynn in Ralphs Bay and the Derwent River.

The present collection contains 45 specimens. The largest, when alive and extended, measured 220 mm. in length. The living holothurian has a translucent appearance and is usually pale-yellow

or white. Some examples are almost colourless. Specimens which have been narcotised with menthol and preserved in alcohol measure up to about 150 mm. in length and 6 mm. in width.

The mouth is surrounded by twelve tentacles, each of which has six or eight pairs of finger-like lobes. The inner surface of the main stem of each tentacle is provided with sensory papillae, which vary in number from about six in specimens 35 mm. long to about twenty-seven in the largest specimens. The number and arrangement of the papillae differ on the several tentacles of the one animal.

Calcareous particles or spicules are present in the tentacles and the body-wall. In the tentacles the spicules have the form of slightly curved rods with several knobs at each end (text-figs. 140-143). They measure 36-81 μ in length. Those in the main stem of the tentacle are stouter, more curved and not so strongly knobbed as compared with those in the digits.

In the body-wall the spicules have the characteristic form of anchors and anchor-plates. The anchors vary in length from 178-288 μ and in width from 96-164 μ . The arms have four to six serrations (text-fig. 144). The anchor-plates have the form shown in text-fig. 145. They measure 137-192 μ in length and 103-137 μ in width.

A specimen collected at Beauty Point in the Tamar Estuary exhibited strongly abnormal anchors and plates. Some of the abnormalities are shown in text-figs. 146-153. Many of the anchors showed a tendency to form a second pair of arms or projections on the main stem.

In the integument overlying the radial muscle bands there are numerous miliary granules, 27-42 μ in length (text-fig. 154).

The calcareous ring consists of five radial and seven interradial ossicles, there being two interradial ossicles situated in both the right and the left dorsal interradius. Each radial ossicle is perforated by a foramen.

Two to four Polian vesicles are present. The madreporic canal is single, unbranched and attached to the dorsal mesentery. Ciliated funnels are situated in the left dorsal interradius. They are numerous and are distributed almost the full length of the body.

The sexes are separate and in both the male and the female the gonads are long, tubular and branched. The genital aperture is situated on a small papilla in the mid-dorsal line close behind the tentacles.

Localities: Eaglehawk Neck, May, 1942, one specimen. Beauty Point, River Tamar, February, 1950, twenty-six. Margate, 22nd October, 1952, four. Oyster Cove, 18th November, 1952, one. Wyn. rd., 24th August, 1954, one immature example. At all the above-mentioned localities the specimens were found more or less embedded in sandy mud under stones near low tide mark. Ralphs Bay, 14th April, 1955, one specimen; 18th August, 1955, two; 19th August, 1955, two; and 30th June, 1959, three. All were obtained by dredging in about seven fathoms. Seven Mile Beach, 29th December, 1955, four collected from kelp holdfasts washed up on the beach.

Family: CHIRIDOTIDAE.

Genus: **CHIRIDOTA** Eschscholtz, 1829.

Chiridota gigas Dendy & Hindle.

(Pl. II, fig. 11 and text-figs. 155-166.)

Chiridota gigas Dendy & Hindle, 1907.

" " Joshua, 1914.

" " Mortensen, 1925.

" " Clark, 1938.

" " Clark, 1946.

The generic name *Chiridota* is spelt *Chirodota* by Dendy & Hindle in their description of the original specimen, which came from the Chatham Islands near New Zealand. The recorded occurrence of the species in Tasmanian waters is based on three small specimens collected at Wynyard by T. T. Flynn in 1927 and identified by H. L. Clark (1938). The largest of the specimens measured only 100 mm. in length.

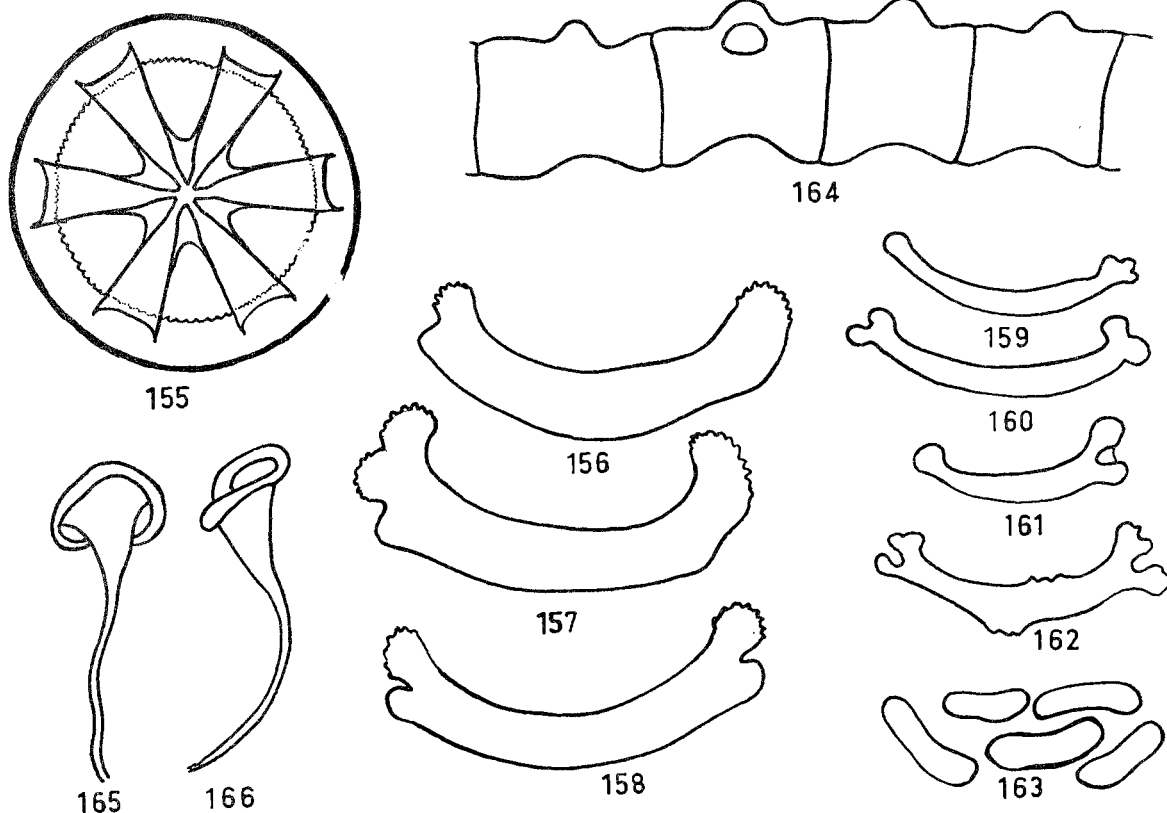
In the present collection there are 31 specimens of the holothurian. A well extended example measures 248 mm. long and 15 mm. wide. Preserved adult specimens usually measure about 120-160 mm. in length. In life the body is yellowish-pink anteriorly but the colour merges into

dark-red posteriorly. The tubercles or papillae distributed over the surface are white and give the body a speckled appearance. In preserved specimens the body colour is generally bleached.

Twelve tentacles are present, the ventral pair being slightly smaller than the others. Each tentacle has seven pairs of digits, which increase in length distally.

The calcareous particles in the tentacles and body-wall agree closely with those found in the specimen examined by Dendy & Hindle. Six-rayed wheels (text-fig. 155) measuring 78-135 μ in diameter are numerous in the white papillae of the body surface. In most cases the number of wheels in a single papilla is over 100. The wheels are superimposed on one another forming a heaped mass. Intermingled with the six-rayed wheels are some which have only four rays and measure about 60 μ in diameter.

Short curved rods (text-figs. 156-158) occur in five radial bands outside the radial muscles. The rods measure 72-129 μ in length and 15-24 μ in width. In some cases the ends are slightly bifurcate and furnished with short spines or tubercles. Short thick miliary granules up to 39 μ long and 9 μ wide are present together with the short curved rods.



Chiridota gigas Dendy & Hindle.

FIG. 155.—Wheel from a papilla of the body-wall. FIGS. 156-158.—Curved rods from integument above radial muscle bands. FIGS. 159-162.—Curved rods from main stem of a tentacle. FIG. 164.—Four ossicles from the calcareous ring. FIGS. 165-166.—Ciliate funnels.

The digits of the tentacles are supported by numerous slender curved rods arranged in two rows, one on each side of the digit. The rods measure 57-78 μ in length and usually have knobbed ends (text-figs. 159-162). The main stem of each tentacle has numerous short thick rods with rounded ends. Near the base of the tentacle they are densely arranged and more or less straight. They measure 27-51 μ in length (text-fig. 163).

The calcareous ring consists of five radial and seven interradial ossicles. Each radial is perforated by a well-developed foramen, a feature not mentioned by Dendy & Hindle in the case of their specimen. Moreover, in the Tasmanian specimens each of the twelve ossicles forming the ring has a distinct projection from the middle of the anterior margin (text-fig. 164).

In reference to the radial muscle bands Dendy & Hindle (1907) state that in their specimen "The two ventral muscle-bands are much closer together than the other three bands". There seems to be some error in the statement since in the organization of the holothurian there are three ventral bands. In the Tasmanian specimens the five radial bands are evenly spaced. However, the three ventral bands are somewhat stouter than the two dorsal ones.

The ring vessel is furnished with a large number of Polian vesicles, all of which are given off from the ventral half of the ring. In the largest specimen 25 Polian vesicles are present. In two smaller examples there are 19 and 21 vesicles respectively. The madreporic canal is single, coiled and situated in the dorsal mesentery in front of the gonads.

Neither Dendy & Hindle (1907) nor Joshua (1914) refer to the presence of ciliated funnels in the specimens they examined. Mortensen (1925), however, mentioned ciliated funnels as occurring in the left dorsolateral interradius of a specimen from Dusky Sound, New Zealand. Ciliated funnels occur in a similar situation in Tasmanian specimens. The funnels are numerous forming a band which extends almost the full length of the interradius. They have the form shown in text-figs. 165 and 166.

The gonads are in the form of branched tubular caeca. They are arranged in two groups, one on each side of the dorsal mesentery in the anterior quarter of the body. The caeca unite near the genital aperture, which opens in a mid-dorsal position close behind the tentacles. In a large female there are six caeca on each side of the mesentery. In life the gonads of the female are bright orange, those of the male pale yellow.

Localities: Coal Point, Bruny Island, January, 1937, one specimen. Pirates Bay, Eaglehawk Neck, 31st October, 1955, two; 13th February, 1960, six; 12th-15th March, 1960, twenty-two. All specimens were found more or less embedded in sand and shell-grit under stones at low tide mark.

Genus: **TROCHODOTA** Ludwig, 1892.

Trochodota allani (Joshua).

(Pl. II, fig. 12 and text-figs. 167-176.)

Taeniogyrus allani Joshua, 1912.

Trochodota allani Joshua, 1914.

" " Clark, 1938.

" " Clark, 1946.

This little holothurian was first recorded from Victoria, where it occurs abundantly in the mud of Port Phillip Bay. The record of its occurrence in Tasmania is based on a single small specimen from the estuary of the Derwent. The specimen was dredged near Hobart, 15th November, 1929, and identified by Clark (1938).

The present collection contains twenty-three examples, the largest being 82 mm. long and 5 mm. in diameter. In life the holothurian is usually dark-purple in colour but becomes grey when preserved in alcohol.

The mouth is surrounded by ten tentacles, the three ventral ones being slightly smaller than the others. Each tentacle is provided with four or five pairs of digits.

Calcareous particles are of three kinds, namely wheels, sigmoid bodies and curved rods with knob-like projections. The wheels and sigmoid bodies occur chiefly in the skin of the trunk, and are scattered in both the radii and interradii. The wheels (text-fig. 167) have the form of rounded hexagons, the largest being about 216 μ in diameter. Each is provided with six spokes. The sigmoid bodies (text-figs. 168-169) measure 132-150 μ in length. The curved rods with knob-like projections (text-figs. 170-173) occur in the tentacles. They measure 72-81 μ in length.

The calcareous ring consists of five radial and five interradial ossicles. They have the form shown in text-fig. 174. The radials are not perforated by a foramen.

A single Polian vesicle is given off from the ventral side of the ring vessel. Joshua (1912) states that a stone canal is "apparently absent". This however is not the case in the Tasmanian specimens. The canal, though small, is definitely present, being situated in the dorsal mesentery immediately in front of the gonad. It measures about 490 μ in length. The madreporite is circular and 112 μ in diameter.

Ciliate funnels occur in the left laterodorsal, the dorsal and the right ventral interradius. They have the form shown in text-figs. 175-176 and measure 180-285 μ in height.

In both sexes the gonad consists of two long unbranched tubular caeca, one on each side of the dorsal mesentery. The two caeca unite in a common gonoduct slightly behind the vascular ring. The gonoduct passes forward in the dorsal mesentery and opens at the genital aperture, which is situated in a mid-dorsal position at the base of the tentacles. In a female specimen well advanced ova measured 164 μ in diameter.

Locality: Ralph's Bay, April, 1955, seventeen specimens; August, 1955, nineteen; all dredged at about 7 fathoms on a muddy bottom.

Trochodota roebucki Joshua.

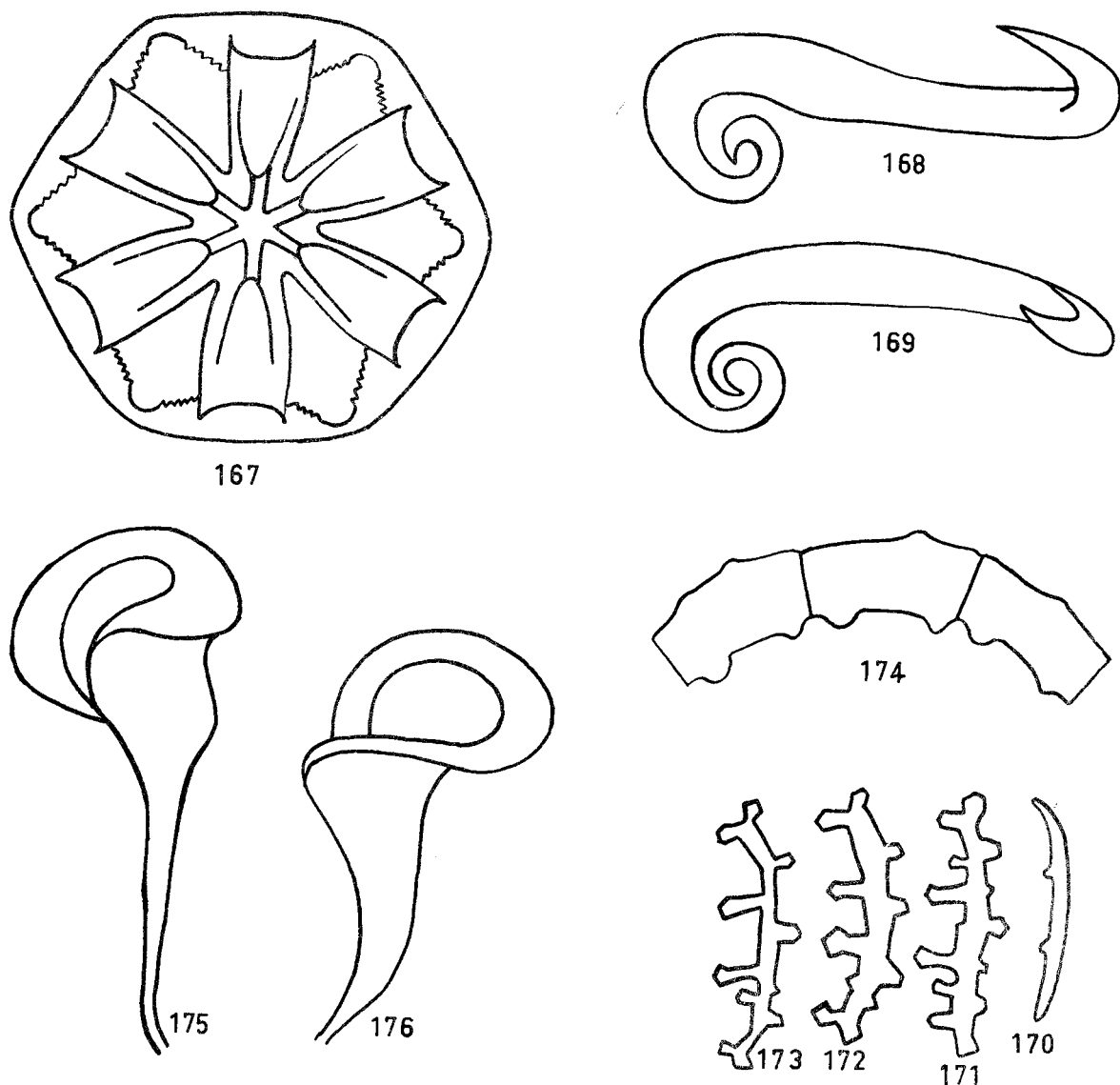
(Pl. II, fig. 13 and text-figs. 177-186.)

Trochodota roebucki Joshua, 1914.

" " Clark, 1938.

" " Clark, 1946.

This small chiridotid has been recorded from Torquay in Victoria (Joshua, 1914) and from Geraldton and Rottnest Island in Western Aus-



Trochodota allani (Joshua).

FIG. 167.—A wheel from the body-wall. FIGS. 168-169.—Sigmoid particles from body-wall. FIGS. 170-173.—Knobbed rods from tentacles. FIG. 174.—Three ossicles from the calcareous ring. FIGS. 175-176.—Ciliated funnels.

tralia (Clark, 1946), but hitherto has not been recorded from Tasmania.

In the present collection there are ten specimens from the estuary of the Tamar. When alive the holothurian is almost colourless and translucent. When preserved in alcohol it becomes yellowish and opaque.

After being narcotised with menthol and preserved in spirit, the largest specimen measures only 35.0 mm. long and 2.00 mm. wide.

Ten tentacles are present, the ventral ones being smaller than the others. Each has two pairs of digits, the distal pair being longer than the proximal pair (text-fig. 177).

Calcareous particles are present in the tentacles and the body-wall. In the tentacles they have the form of slightly curved rods with projections at each end and along the sides (text-figs. 178-180). The rods measure about 90 μ in length.

In the wall of the trunk the spicules have the form of wheels and sigmoid bodies. The wheels

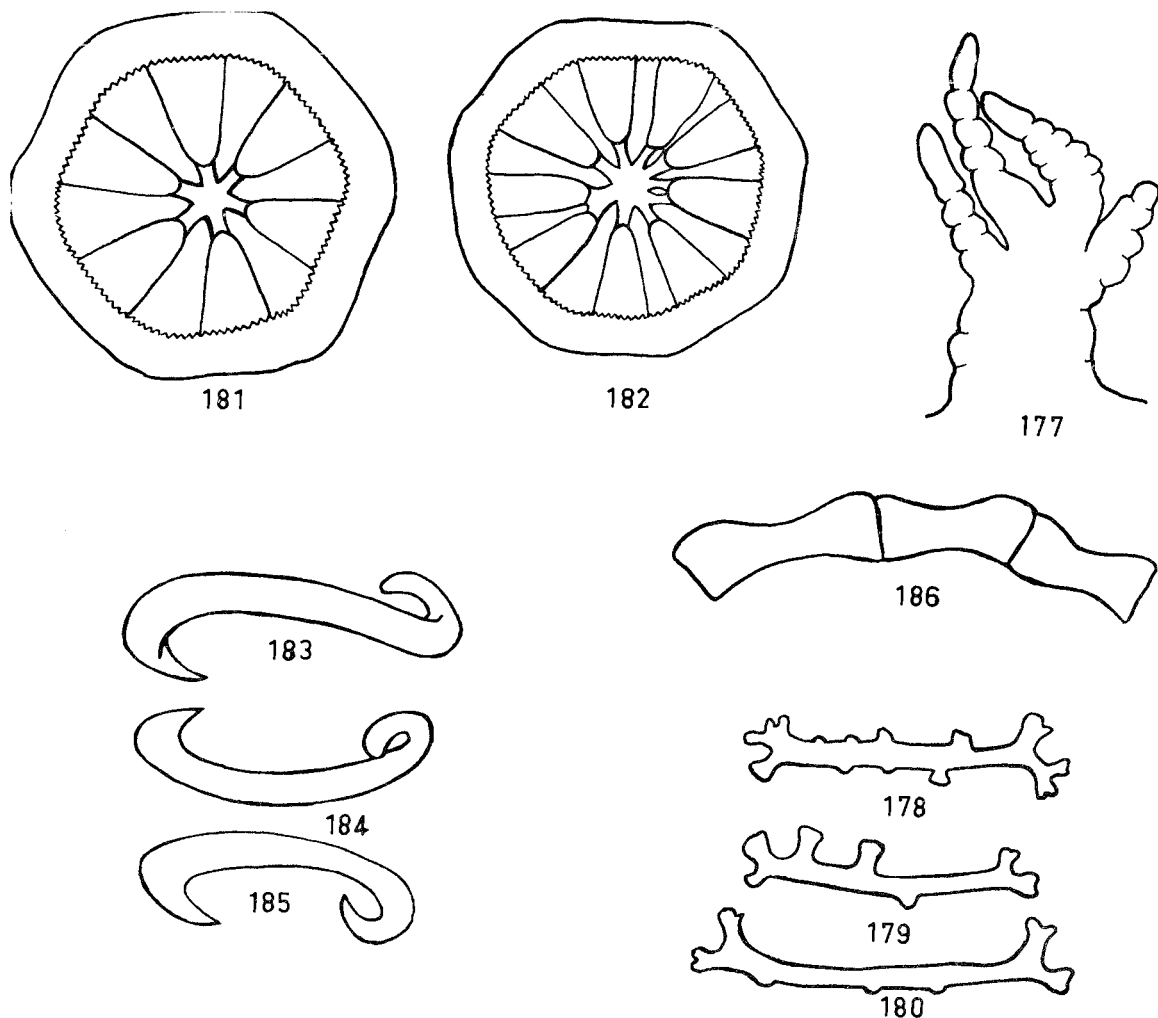
*Trochodota roebucki* Jeshua.

FIG. 177.—A tentacle showing the four digits. FIGS. 178-180.—Knobbed rods from tentacles. FIGS. 181-182.—Wheels from body-wall. FIGS. 183-185.—Sigmoid particles from body-wall. FIG. 186.—Three ossicles from the calcareous ring.

occur interradially. They are scattered but are found in greater numbers near the radial muscles than in the middle of the interradiial areas. They are somewhat hexagonal in outline and measure up to 105μ in diameter. Most of them have six rays, but some have seven or eight and a few ten. The inner margin of the rim of the wheel is uniformly toothed (text-figs. 181-182). Sigmoid bodies occur both radially and interradially. They measure up to 144μ in length and have the usual form (text-figs. 183-185). Those which occur radially are arranged in a row on each side of the radial muscle bands and have their long axes disposed transversely. Those which are interradiial in position are scattered.

The calcareous ring has five radial and five interradiial ossicles of similar form. They are somewhat constricted in the middle and expanded at each end (text-fig. 186). The radials are not perforated by a foramen.

A single Polian vesicle opens into the ventral side of the ring vessel and a single short madreporic canal is connected with the dorsal side of the vessel.

Ciliated funnels occur along the line of attachment of the mesentery in the mid-dorsal inter-radius.

As in the previous species the gonads have the form of a pair of long thin tubular caeca. They extend the full length of the body and unite anteriorly immediately behind the ring vessel. The gonoduct opens dorsally near the base of the tentacles.

Locality: River Tamar near Beauty Point. Ten specimens were collected during February, 1950. They were found embedded in sand and mud under stones near low water mark.

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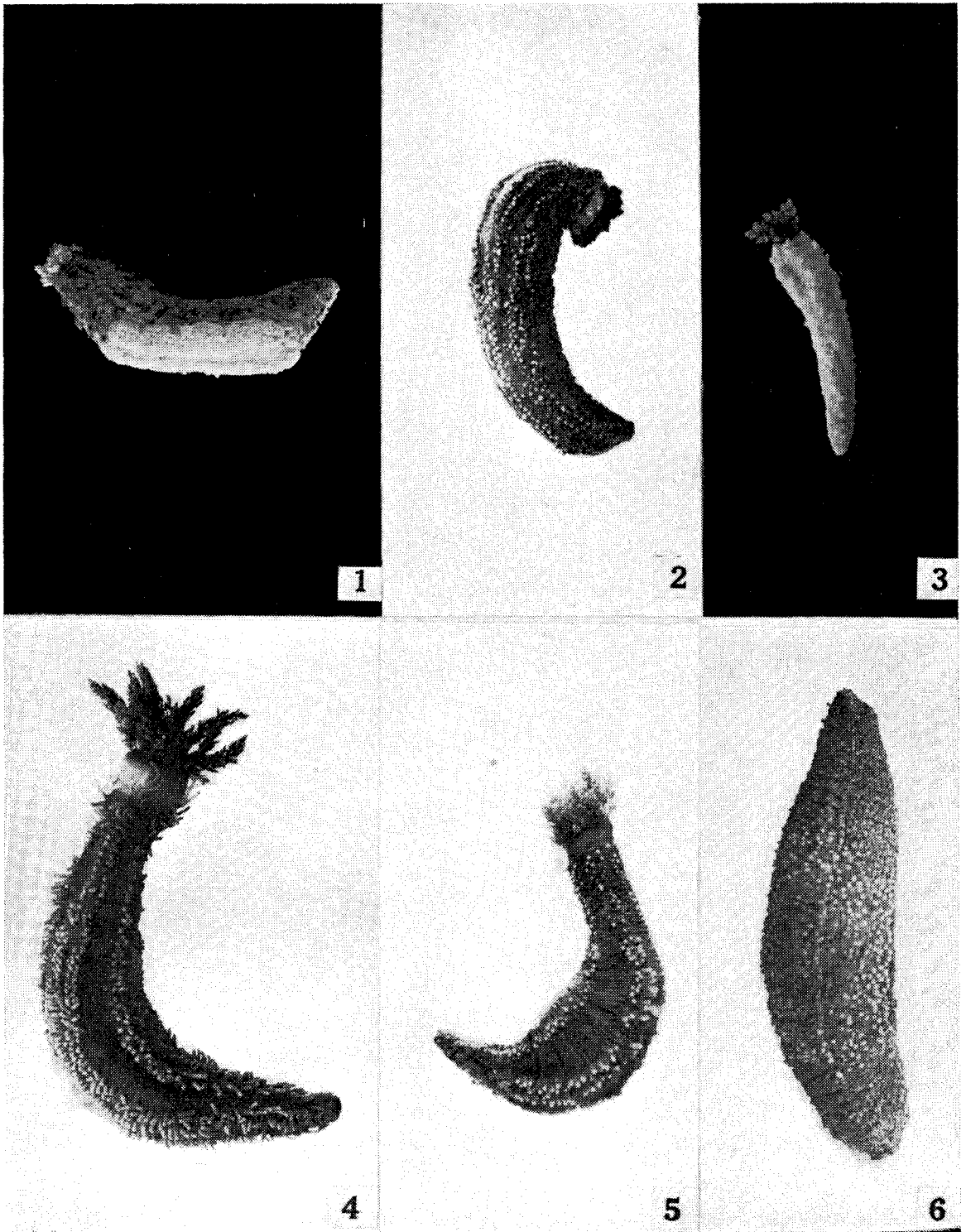


PLATE I.

FIG. 1.—*Psolidiella adhaerens* sp. n. FIG. 2.—*Staurothyone inconspicua* (Bell). FIG. 3.—*Pentacta australis* (Ludwig). FIG. 4.—*Cucumella mutans* (Joshua). FIG. 5.—*Neoamphicyclus lividus* sp. n. FIG. 6.—*Lipotrachea vestiens* (Joshua).

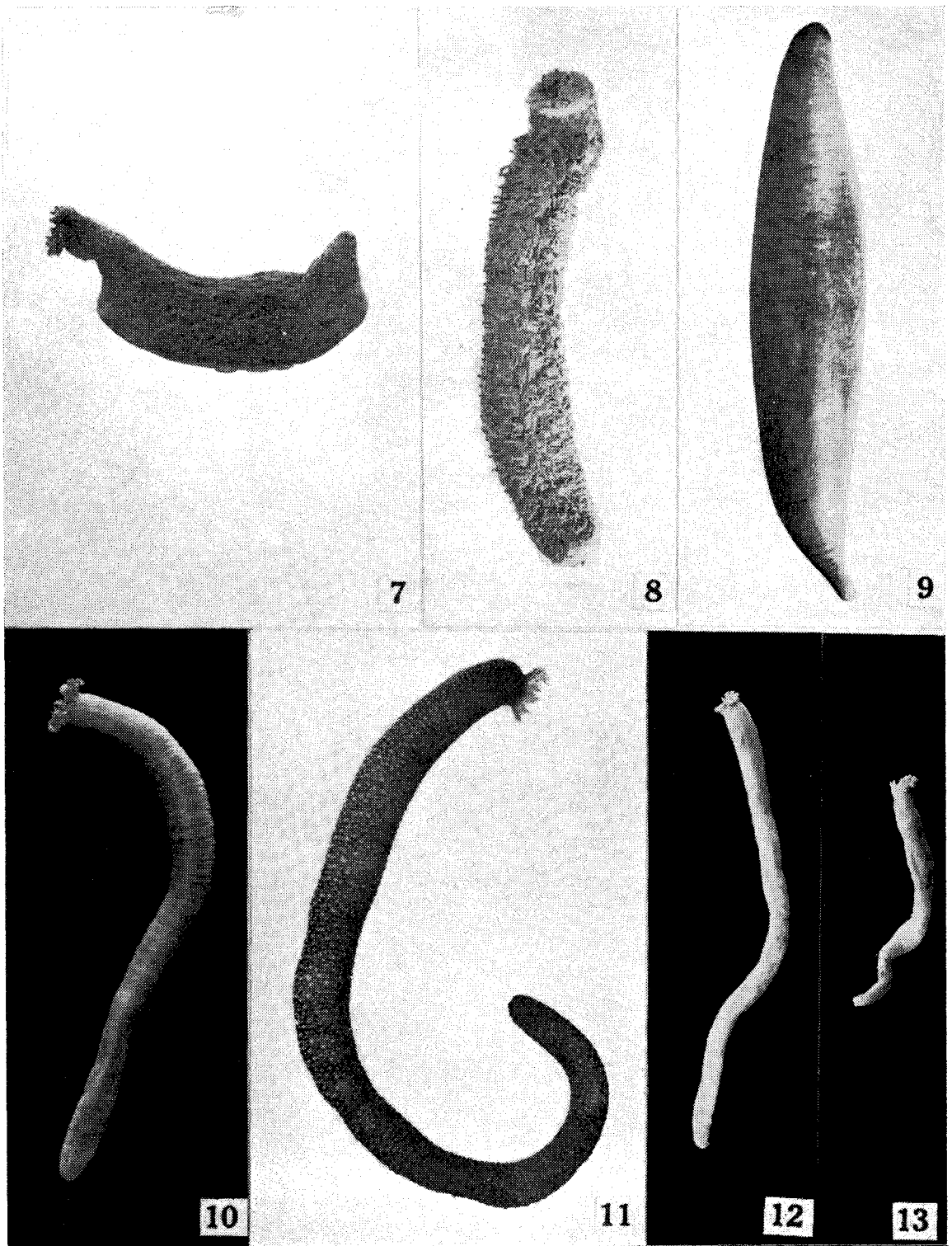


PLATE II.

FIG. 7.—*Psolidium ravum* sp. n. FIG. 8.—*Stichopus mollis* (Hutton). FIG. 9.—*Paracaudina australis* (Semper). FIG. 10.—*Leptosynapta dolabrifera* (Stimpson). FIG. 11.—*Chiridota gigas* Dendy & Hindle. FIG. 12.—*Trochodota allani* (Joshua). FIG. 13.—*Trochodota roebucki* Joshua.