

Ascidiens from the tropical western Pacific

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ABSTRACT

A large collection of 187 identified ascidian species is added to the records published in 1996 from the same tropical western Pacific islands. Most of the specimens were collected by the US Coral Reef Research Foundation (CRRF). They come from depths accessible by SCUBA diving. Most of the collection's species are described and figured, their color in life is illustrated by 112 underwater photographs; among them 48 are new species representing a fourth of the material collected. This demonstrates how incomplete the knowledge of the ascidian diversity in this part of the world remains. Moreover, very small or inconspicuous species were seldom collected, as compared to the highly coloured and large forms. Many other immature specimens were also collected but their precise identification was not possible. Almost all littoral families are represented with the exception of the Molgulidae which are more characteristic of soft sediments, a biotope which was not investigated. Among the very diversified genera, the colonial forms largely dominate, including not only all the Aplousobranchia genera but also some Phlebobranchia and Stolidobranchia. Very often only one specimen was available, so a detailed biogeographical distribution cannot be given, and no island endemism can be defined.

KEY WORDS

Tunicata,
western Pacific Ocean.

RÉSUMÉ

Ascidies tropicales de l'Ouest Pacifique.

Une grande collection de 187 espèces d'ascidies identifiées s'ajoute aux résultats déjà publiés en 1996 pour les mêmes îles de l'ouest Pacifique tropical. La majorité des échantillons provient de l'US Coral Reef Research Foundation (CRRF) pour des profondeurs accessibles en plongée. Une grande partie des espèces est décrite et figurée, parmi elles 48 sont nouvelles. La couleur des animaux vivants est illustrée par 112 photos sous-marines. Elles représentent un quart du matériel récolté. Cela montre à quel point nos connaissances de la diversité des ascidies sont insuffisantes dans cette partie du monde. De plus, les très petites formes ont été rarement récoltées, les formes plus grandes et brillamment colorées étant plus accessibles. Beaucoup d'autres espèces immatures ont aussi été récoltées, mais leur identification n'est pas possible. Presque toutes les familles littorales sont représentées à l'exception des Molgulidae, plus caractéristiques des sédiments meubles, un biotope non échantillonné. Parmi les genres très diversifiés, les formes coloniales dominent largement avec toutes les aplousobranches mais aussi des phlébobranches et des Stolidobranches. Comme bien souvent un seul spécimen était disponible, il n'est pas possible de donner une répartition géographique détaillée ni de définir un endémisme insulaire.

MOTS CLÉS

Tunicata,
océan Pacifique Ouest.

INTRODUCTION

The stations where the material was collected are distributed in a wide geographical area of the tropical western Pacific Ocean. It comprises Micronesia, Malaysia, Papua New Guinea, the Philippines Islands, Palau, Fiji, and Tonga. The present collection complements a first series of samplings made in the same large region, which was the subject of a previous publication (Monniot F. & Monniot C. 1996). The previous study noted one third of new species among a hundred identified. In addition we describe here 48 species among 187 identified species. This indicates how considerable the species diversity in that part of the world is and how our knowledge remains largely insufficient. The coastline sites that have been explored are few and dispersed, and limited to very shallow depths accessible by SCUBA diving.

Some very old data were cited in the previous study (Monniot F. & Monniot C. 1996). They originate from large oceanographic expeditions

such as the *Siboga* (Sluiter's work 1904-1909), the *Challenger* (Herdman 1882, 1886), and the *Albatross* (Van Name 1918). The ascidians of those studies were collected by dredging. Other more occasional samplings were due to navigators at the end of the 19th century; they have been entrusted to different natural history museums, and were studied especially between the years 1950 and 1975, by some excellent taxonomists, especially Tokioka (1967) and Millar (1975). But all the records accumulated during the 20th century in the wide area of the tropical western Pacific Ocean, from northern stations to Australia represent only about 350 species, certainly just part of the entire ascidian fauna.

Farther north still, successive collections were made in Japan from 1943 by Tokioka and, after him, Nishikawa, and have elucidated the Japanese ascidian fauna. Part of the most southern ascidian fauna of that country has close relationships with the truly tropical ascidians identified from more southern islands.

Many taxonomic papers by Kott describe material collected around Australia during the last 50 years. These were completed in a synthesis published in three parts in Kott (1985, 1990, and 1992 [didemnids excluded]). Many of the northern Australian species are recorded again here.

We also sampled tropical Pacific ascidians in French Polynesia (Monniot C. & Monniot F. 1987) and in the South of New Caledonia (Monniot C. or Monniot F., several publications). Some of the concerned species are also recorded here.

The environment in which the specimens described here were taken is the same as that of the previous collection studied in 1996, but sampling has been in different stations. Habitats include coral reefs, coastal rocky bottoms, caves, seagrass beds, marine lakes, and harbours. Soft sediments were not explored, as SCUBA diving is poorly adapted to sampling that habitat. Most of the specimens were collected from the shore to 40 m depth, only occasionally deeper.

Not all previously described species have been found again, either because they were collected by different means or because the number of specimens was too low or the stations incompletely sampled. Most of the material studied here (as in 1996) came from the Coral Reef Research Foundation programs funded by the US National Cancer Institute. One of the purposes of these programs has been to find natural products for pharmacology. So most of the material "worth taking" needed to be abundant and large enough to ensure future collecting of it if it proved promising. Often just a single voucher was preserved in formalin for zoological study, making the identification difficult, or even impossible when the specimen was not sexually mature.

No very extraordinary kind of anatomical organisation was found in these collections, in contrast to collections of abyssal material, and all the species were easily placed in well-known genera. As in all warm waters worldwide, colonial species largely dominate and represent about 80% of the collections' ascidian fauna. This is a little more

than the proportion we found in the Caribbean Islands (Monniot C. & Monniot F. 1985) and in Polynesia (Monniot C. & Monniot F. 1987). This corresponds to the proportions obtained by Kott (1981) for the Fiji Islands.

In temperate waters the results are very different, with 52% of solitary species in the American fauna according to Van Name (1945). Our own listing for European waters indicates more than 75% of solitary species, but this includes abyssal forms, all of which are solitary.

Taking into account the dispersion of the collecting stations and considering the large number of new species, it does not seem possible to establish a pattern of biogeographical distribution, and no endemism can be ascertained. A large part of already known species are common either to Australia, New Caledonia, New Zealand, Japan, or to several of these countries. In our present knowledge, with so few specimens, it seems wiser to only consider the fauna as a whole as one of a large tropical western Pacific Province.

The region's relationships with the Indian Ocean are confirmed, as they are for taxa other than ascidians. We evaluate about 20% of species to be common to both oceans, but we lack much information about the ascidian fauna along the eastern coast of Africa or around India.

The Atlantic fauna seems very different, with very few species in common with the tropical western Pacific, most of them being cosmopolitan, or else anthropogenic ascidians mainly collected in harbours.

During the present work, we have examined numerous type specimens stored in diverse museums (in Great Britain, Netherlands, Germany, USA, Japan, Australia, etc.) that we thank for the helpfulness of their loans. Nevertheless, for some identifications, we harbour some doubt. Intraspecific variability was impossible to evaluate with so few individuals per species. The specimens described here are deposited in the Muséum national d'Histoire naturelle, Paris (MNHN). The samples studied here were collected and photographed by the Coral Reef Research Foundation (CRRF).

SYSTEMATICS

Order APLOUSOBRANCHIA
 Family POLYCLINIDAE Milne-Edwards, 1841
 Genus *Aplidium* Savigny, 1816

Aplidium breviventer n. sp.
 (Figs 1A, B; 112A)

TYPE MATERIAL. — Federated States of Micronesia. Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm growing on nylon line, 6°57.68'N, 158°17.85'E, 8 m, 15.X.1996 (MNHN A1 APL.B 389).

ETYMOLOGY. — From the Latin *brevis*: short, and *venter*: abdomen.

DESCRIPTION

The peach-coloured colonies are soft, lobed, very inflated underwater (Fig. 112A). The common cloacal apertures protrude in chimneys at the cloacal channel crossings. These channels are visible from the colony surface, as the tunic above them is transparent. The zooids are irregularly lined up along these channels.

The zooids have a wide thorax, a short abdomen that is narrower than the thorax, and a short post-abdomen separated by a narrow section below the bottom of the gut loop. The oral siphon has six small lobes. The cloacal aperture is wide, opening the branchial sac from the second to the fourth stigmata row (Fig. 1A). The languet is large and clearly planted above the rim of the cloacal siphon. There are 12 short and stout tentacles in two orders. The branchial sac has nine to ten rows of stigmata, which are not interrupted on the dorsal line. There are at least 25 stigmata in a row on each side. The most posterior rapheal languets are much displaced on the left side. The thoracic muscles are thinly spaced bundles, of a sinuous design and often anastomosed.

The thorax narrows abruptly behind the branchial sac and the oesophagus opening projects inside the branchial cavity. The oesophagus is extremely short. The spherical stomach has an irregularly folded wall, in some zooids with almost entire longitudinal ridges (Fig. 1A), while in others the folds are so cut in pieces that the stomach seems areolated (Fig. 1A). A transverse

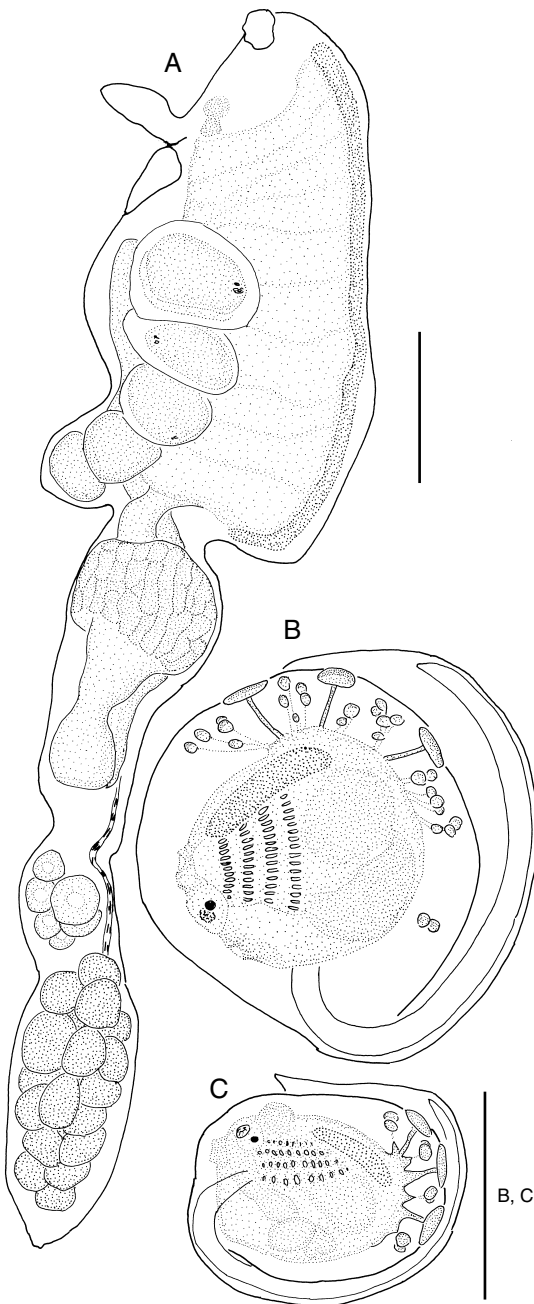


FIG. 1. — A, B, *Aplidium breviventer* n. sp.; A, zooid; B, larva; C, *Aplidium altarium* (Sluiter, 1909), larva. Scale bars: A, 1 mm; B, C, 0.5 mm.

section shows 20 to 24 folds. The post-stomach and mid-intestine are very short. The anus opens at the level of the fifth or sixth stigmata row.

The post-abdomen (Fig. 1A) is no longer than the thorax when the gonads are fully developed. It begins with a short and narrow segment and progressively widens. The testis follicles number about 50 in a cluster placed against and behind the ovary. The gonads leave only restricted space for the terminal heart (not shown).

Five to six larvae are incubated inside the wide cloacal cavity. The most advanced ones have already an uncoiled tail and a thick tunic. The spherical trunk measures 0.9 mm in diameter; four rows of numerous stigmata are clearly visible (Fig. 1B). The three adhesive papillae are well-spaced on long, thin stems. Round ampullae are distributed in four anterior median groups alternating with the adhesive papillae. There are also two or three of these ampullae on the posterior ventral side of the larvae (Fig. 1B). The tail does not exceed half a turn around the trunk.

REMARKS

This species is very similar to *A. altarium* (Sluiter, 1909), the type of which we examined (ZMA TU 176) (Fig. 1C). Sluiter's specimen is a small pedunculate colony. The post-abdomen of the zooids in that species is identical to ours but its cloacal aperture is more anterior than ours, with a languet prolonging the siphon's rim. Its larvae are smaller; they have three adhesive vesicles lying well apart from each other, but these are separated in *A. altarium* by only four pairs of ampullae (Fig. 1C). Its stomach folds are numerous and entire. Millar's (1956) description of *A. altarium* is not precise but corresponds fairly closely to Sluiter's type.

The description that Kott (1992a) gave for *A. altarium* may correspond to several species of different colours. Kott also noted larval incubation either in the cloacal cavity or in a pedunculate pouch. Her figure of the larva shows more vesicles than Sluiter's specimen.

A. breviventer n. sp. differs from *A. sacciferum* n. sp. in the mode of incubation, the folds of the

stomach, and the number of ampullae between the larval adhesive papillae.

Aplidium cerebrum n. sp.

(Figs 2; 112B)

Aplidium sp. A Monniot F. & Monniot C. 1996: 140, fig. 3A, B, pl. 1E. Type locality: Papua New Guinea.

TYPE MATERIAL. — Papua New Guinea. Coral Sea, eastern Fields, overhang, 10°09.35'S, 145°33.92'E, 27 m, 15.VI.1998 (MNHN A1 APL.B 412).

ETYMOLOGY. — From the Latin *cerebrum*: brain.

OTHER MATERIAL EXAMINED. — Philippines. Sulu Sea, Pasig Shoal, on rock, 9°57.16'N, 119°21.30'E, 11 m, 23.IV.1995 (MNHN A1 APL.B 387).

Papua New Guinea. Coral Sea, eastern Fields, overhang, 10°02.22'S, 145°33.01'E, 23 m, 14.VI.1998 (MNHN A1 APL.B 413).

DESCRIPTION

The colonies are soft, low cushions with zooids arranged in double rows around irregular bulges of tunic (Fig. 112B). There are just a few common cloacal apertures on short, transparent chimneys. The colour in life is highly variable from light blue to orange and brown. The formalin preserved colonies are brown. There is some surface sand at the level of the cloacal channels or else no incrustation at all. The thoraces are perpendicular to the colony surface but the post-abdomens extend in all directions. The zooids are up to 8 mm long and very thin. The oral siphon has six lobes. The narrow cloacal siphon is a simple hole at the third or fourth row of stigmata. The cloacal languet is either simple or ends in two lobes. It arises distinctly anterior to the cloacal opening (Fig. 2A).

The branchial sac has 12 to 15 rows of stigmata, which do not reach the endostyle. The abdomen (Fig. 2A) forms a long loop with an elongated stomach cut in five deep folds, without an annular post-stomach but with a narrow segment giving way to a slightly enlarged mid-intestine. Caeca are at the posterior pole of the gut loop (Fig. 2A).

The gonads are far from the gut in the second half of the post-abdomen (Fig. 2B, C) or farther, close to the heart. The ovary is immediately followed by tightly packed testis follicles.

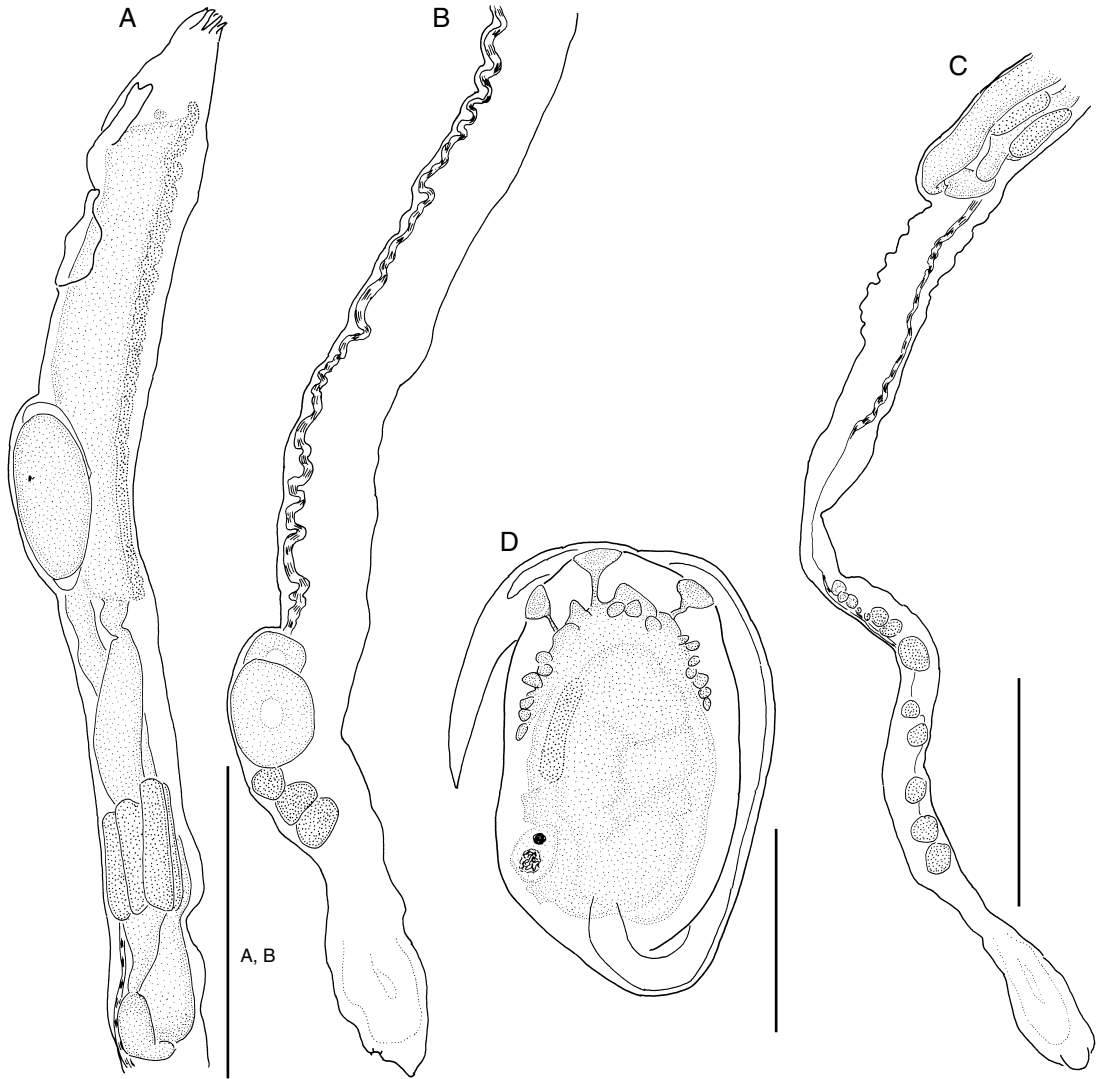


FIG. 2. — *Aplidium cerebrum* n. sp.; **A, B**, two parts of a zooid; **C**, post-abdomen; **D**, larva. Scale bars: A-C, 1 mm; D, 0.25 mm.

One or two larvae (Fig. 2D) are incubated in the cloacal cavity. The trunk measures 0.5 mm. There are three adhesive papillae on thin stems with intermediate odd, short protrusions and an anterior crown of not very well-individualised ampullae on each side (Fig. 2D).

REMARKS

The appearance of colonies, as well as the zooid distribution in them, the location of the cloacal

languet at some distance from the cloacal aperture, and the stomach with five folds all recall *Aplidium lenticulum* Kott, 1992. The species differs in the small amount of adhering sand, when present at all, in the smaller size of its zooids, and in the absence of granular inclusions in the tunic. *Aplidium cellis* Monniot F., 1987 has a similar general structure but in that species the cloacal languet emerges from the very rim of the cloacal aperture.

This species corresponds to the species described as *Aplidium* sp. A by Monniot F. & Monniot C. (1996) from Papua New Guinea. The species name refers to the brain-like structure of the colony.

Aplidium controversum

Monniot F. & Monniot C., 1996

Aplidium controversum Monniot F. & Monniot C., 1996: 135, fig. 1, pl. 1A. Type locality: Indonesia, and synonymy.

MATERIAL EXAMINED. — **Palau.** Koror, Ngeteklou Island (Kaibakku Island), tunnel into marine lake, 7°19.47'N, 134°29.42'E, 10 m, 1.XI.1995 (MNHN A1 APL.B 381).

Papua New Guinea. Louisiade Archipelago, Tagula Island, Yuma Pass, 11°20.79'S, 153°22.46'E, 12 m; South coast, barrier reef channel south of Cape Rodney, 10°15.74'S, 148°23.07'E, 19 m (Samples: CRRF).

Aplidium crateriferum (Sluiter, 1909)

Amaroucium crateriferum Sluiter, 1909: 103. Type locality: Philippines. Synonymy: see Kott 1992a: 536, fig. 71.

MATERIAL EXAMINED. — **Philippines.** SW Bohol, Panglao Island, 23 m, 20.IV.1997 (MNHN A1 APL.B 390).

DESCRIPTION

The colonies were attached to gorgonians, as smooth dark grey cushions with orange zooids inside. The tunic is up to 3 cm thick with large furrows between swellings. The zooids are arranged in lines. Some sand is incrustated along the lines of the oral siphons; it is sparse inside the tunic, more abundant in the base of the colony.

The oral siphon is long with short lobes and an apical stout sphincter making a protruding ring. The cloacal aperture is far apart at the level of the fourth stigmata row, in a short tube. A simple languet is inserted distinctly anterior to the aperture. There is a large unperforated area at the anterior part of the branchial sac. The thorax is elongated, with 18 to 20 rows of stigmata. The abdomen contains a long cylindrical stomach with five deep longitudinal folds.

The post-abdomen is particularly long. The ovary lies far from the gut, followed by a double row of testis follicles.

Only immature larvae were found in the cloacal cavity. They are particularly large, 1.9 mm for the trunk. They have three adhesive papillae and an anterior crown of dense ampullae.

REMARKS

The general structure very well corresponds to the type specimen that we examined (ZMA-TU 1278). The oral siphon with a strong sphincter, the cloacal aperture on a short tube, strong muscles in the transverse vessels, numerous rows of stigmata and a long stomach are common characters.

The species distribution comprises the Philippines, Queensland and western Australia.

Aplidium cyclophorum n. sp.

(Fig. 3)

TYPE MATERIAL. — **Papua New Guinea.** Southern Louisiade Archipelago, Long Reef, 11°11.10'S, 151°51.57'E, 12 m, 5.VI.1998 (MNHN A1 APL.B 418).

ETYMOLOGY. — From the Greek *kuklos*: circle and *phor*:- wearing.

DESCRIPTION

The single colony is a large pad 8 × 4.5 cm and 1.5 cm thick. The colour in life is unknown, but it is dark brown in formalin. The surface is smooth without sand or any epibiont. There are well-separated depressed systems made of a circular groove into which the oral siphons open. In the centre of each system is a cloacal aperture at the top of a short chimney. The zooids are perpendicular to the colony surface and much retracted.

The oral siphon has six petal-like lobes. In some cases the three ventral lobes are much longer than the three dorsal ones (Fig. 3A).

The cloacal aperture is narrow with a stout single languet on its anterior rim (Fig. 3A, B). When the aperture is expanded five teeth appear on its posterior margin.

The thoracic musculature is strong with numerous regularly criss-crossed transverse and longitu-

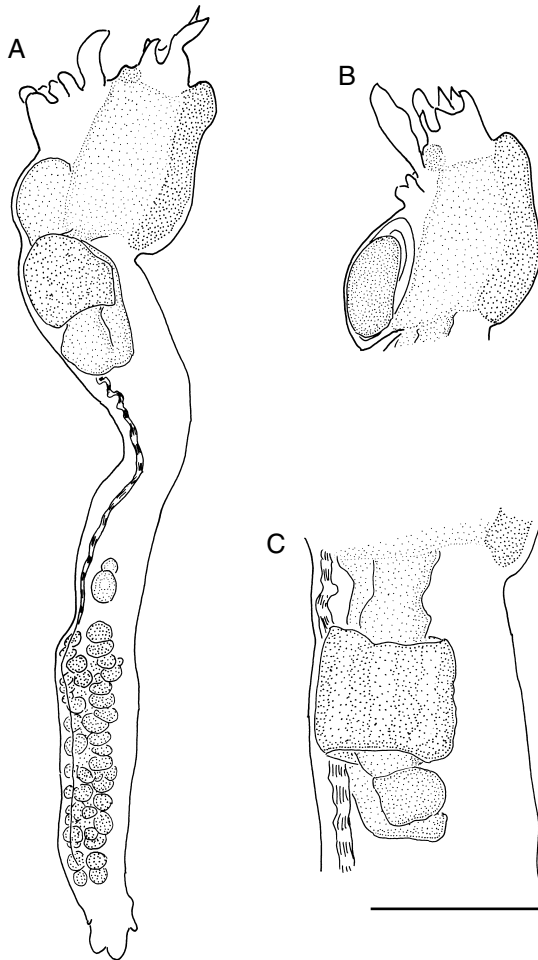


FIG. 3. — *Aplidium cyclophorum* n. sp.; **A**, zooid; **B**, thorax of another zooid; **C**, abdomen. Scale bar: A, B, 1 mm; C, 0.5 mm.

dinal fibres. We counted 20 longitudinal fibres on each side in one zooid.

The branchial sac contains 18 to 20 rows of numerous stigmata. There are no parastigmatic vessels. The dorsal languets are short.

The gut forms a rather short loop. The stomach has a neat typhlosole with a fold on each side, but other plications are not pronounced (Fig. 3A). In some specimens the stomach wall has five obscure longitudinal folds (Fig. 3C). The gut was too contracted to see intestinal compartments. There is no narrowing between the abdomen and post-abdomen. The ovary lies at some distance

from the gut, followed by numerous testis follicles in two rows filling the whole post-abdomen (Fig. 3A).

Only poorly advanced larvae are incubated in the cloacal cavity of some zooids (Fig. 3B). The oldest found has sensory organs and a trunk 0.3 mm long encircled by the tail.

REMARKS

This species is much like *A. longithorax* Monniot F., 1987. The shape of the colony is about the same, but in that species the colour is always yellow in formalin (Monniot F. 1987: 525; Monniot F. & Monniot C. 1996: 139, pl. 1c). *A. longithorax* differs in having eight lobes at the oral siphon, an elongated stomach with five deep folds, a different musculature, and an unperforated space between the stigmata and the endostyle. *Aplidium crateriferum* (Sluiter, 1909) and *A. clivosum* Kott, 1992 have systems of different shape, some sand embedded in the tunic, and a cloacal lip inserted clearly anterior to the cloacal aperture.

Aplidium grisiatum Kott, 1998
(Fig. 4)

Aplidium griseum Kott, 1992a: 551, fig. 80, preoccupied by *Aplidium griseum* Lahille, 1890, Mediterranean Sea. Replacement name. Type locality: Great Barrier Reef.

Aplidium grisiatum Kott, 1998: 119. Replacement name.

MATERIAL EXAMINED. — Palau. Koror, “White Face” sand slope S of Lighthouse Reef, 7°15.84’N, 134°27.68’E, 62 m, 22.VIII.1997 (Sample: CRRF). — Lighthouse Reef Basin, 7°16.72’N, 134°28.35’E, 47 m (MNHN A1 APL.B 416).

DESCRIPTION

The largest colony measures 7 × 3 × 5 cm, but it surrounds a sponge and its thickness actually does not exceed 1 cm. Its surface has a clear design of meandriform systems, well-isolated from each other. There is not any zooid external to the systems. Each system has one central common cloacal opening. Each system is externally and superficially fringed by an accumulation of

fine sand grains in a convoluted line. The centre of each system is perfectly transparent, devoid of sand, and reveals the upper part of the zooids. The remainder of the tunic contains sparse sediment, except that on the sides of the colonies it is abundant. The colour in life is unknown; in formalin it is brown with light brown zooids, which may have been red. The thin zooids reach 1 cm in length (Fig. 4A, B). The thorax as long as the abdomen. Zooids have six oral lobes. The narrow cloacal siphon lies at the level of the second stigmata row (Fig. 4A, C). The cloacal languet is pointed, inserted well ahead of the cloacal aperture (Fig. 4A, C).

There are 13 to 14 rows of stigmata, but their number in any row could not be counted.

The abdomen has the usual gut compartments. The stomach has eight deep longitudinal folds (Fig. 4A).

The post-abdomen is long (Fig. 4A, B). We have found only an ovary in the posterior part, far from the gut, but no testis follicles. The post-abdomen shortens when the ovary is mature.

One or two embryos are incubated in the cloacal cavity (Fig. 4A). The elongated trunks of mature larvae are 0.8 mm long with three well-spaced adhesive papillae and two short, pointed median ampullae. On each side of the trunk is an anterior crown of dense small vesicles (Fig. 4D).

REMARKS

This species exactly corresponds to the description of *Aplidium griseum* by Kott (1992a) but the name she chose was preoccupied by *Aplidium griseum* Lahille, 1890 for a Mediterranean species and so Kott (1998) created the replacement name *A. grisiatum*.

The superficial design of the colony is characteristic.

Aplidium intextum n. sp.
(Figs 5; 112C)

TYPE MATERIAL. — **Philippines**. Mindanao, Davao, Pakiputan Strait, rubble, 7°06.81'N, 125°39.99'E, 33 m, 30.IV.1996 (MNHN A1 APL.B 383).

ETYMOLOGY. — From the Latin *intextus*: embroidered.

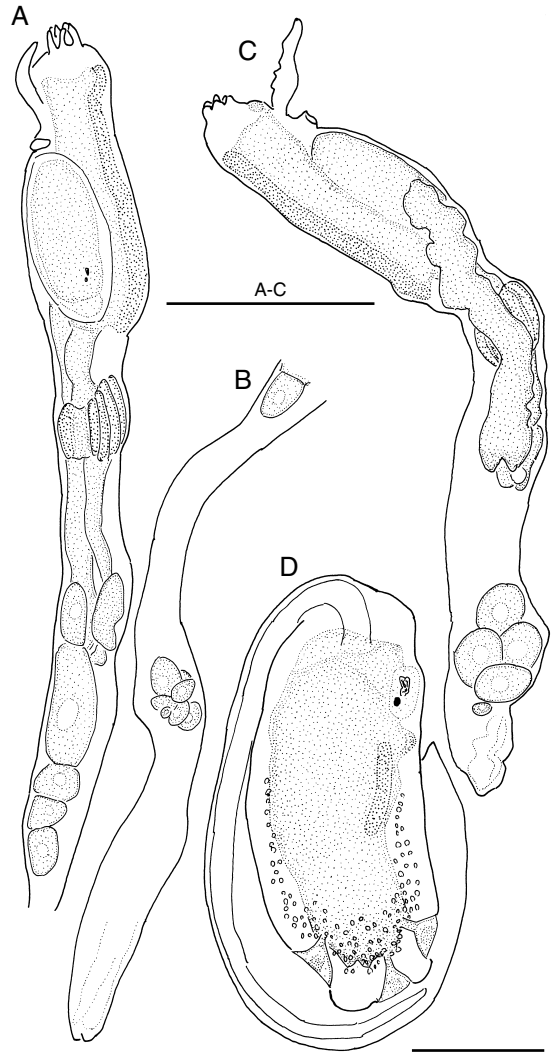


FIG. 4. — *Aplidium grisiatum* Kott, 1998; **A, B**, two parts of a zooid; **C**, another zooid; **D**, larva. Scale bars: A-C, 1 mm; D, 0.25 mm.

DESCRIPTION

The colonies are white and firm, encrusting, up to 3 cm thick, in flat cushions superficially ornamented with swellings separated by transparent and colourless furrows on which the oral apertures open. This suggests a work of embroidery (Fig. 112C) (thus the species name). The common cloacal apertures are not located at the groove crossings. The tunic is rubbery hard and translucent interiorly.

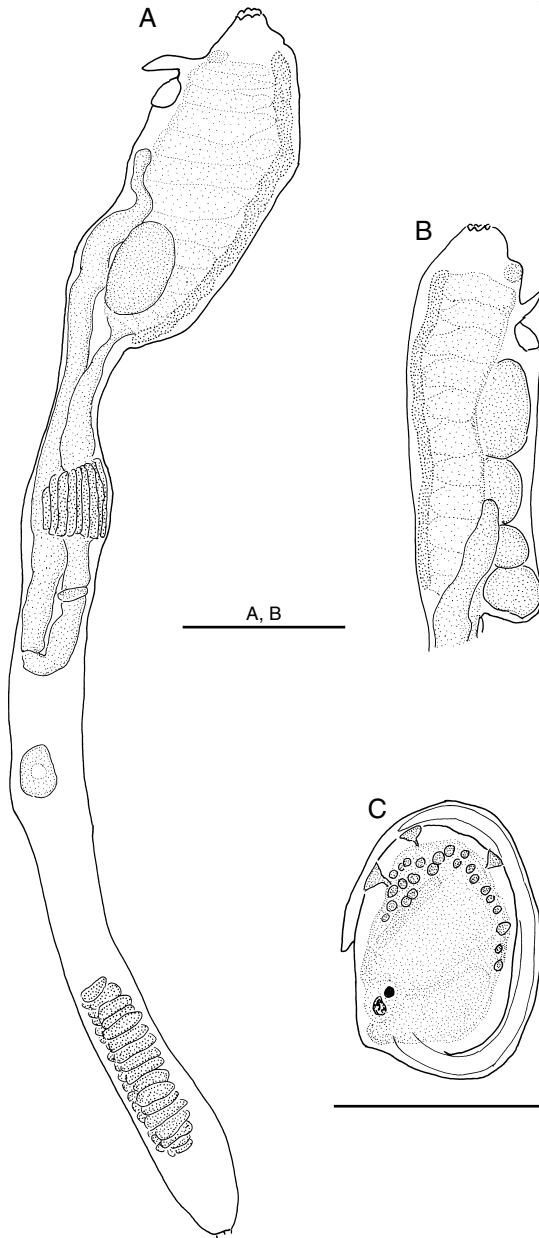


FIG. 5. — *Aplidium intextum* n. sp.: **A**, zooid; **B**, thorax of another zooid; **C**, larva. Scale bars: A, B, 1 mm; C, 0.5 mm.

The oral siphon has six short lobes above a strong sphincter. The cloacal aperture, which also has circular muscle fibres, faces the second row of stigmata. Even in one colony, its rim may be prolonged by a simple lip-like languet (Fig. 5B) in

some zooids, while in others the languet lies immediately anterior to the cloacal aperture (Fig. 5A). The long thorax has 11 to 12 rows of about 20 stigmata apiece. There are about 15 longitudinal thoracic muscles on each side.

The abdomen is as long as the thorax (Fig. 5A). The oesophagus is long. The cylindrical stomach has 15 to 16 deep longitudinal folds that are never interrupted. The ovary lies at some distance from the gut loop and is followed at some distance by two densely packed lines of testis follicles occupying the posterior half of the abdomen, down to the heart (Fig. 5A).

The larvae (Fig. 5C) are incubated in a distended cloacal cavity (Fig. 5B), protruding into the posterior part. We usually found four of them at different stages. The trunk measures 0.5 mm. The three adhesive papillae are not equidistant. They are not separated by ampullar protrusions but are rather lined on each side by an irregular row of clear round vesicles (Fig. 5C).

REMARKS

This species closely resembles *Aplidium lineatum* Monniot F. & Monniot C., 1996 in its colony structure, the branchial sac, and the arrangement of the testis into densely packed rows in the posterior post-abdomen. It differs in its narrow cloacal siphon with an undivided languet, and in having fewer and more regular stomach folds.

This species also differs from *A. controversum* Monniot F. & Monniot C., 1996 in having fewer stomach folds, in the testis follicles densely gathered in two compact lines very far down the post-abdomen, and in the different design of its colony surface.

Aplidium lineatum

Monniot F. & Monniot C., 1996

Aplidium lineatum Monniot F. & Monniot C., 1996: 137, fig. 2, pl. 1B. Type locality: Indonesia.

MATERIAL EXAMINED. — Papua New Guinea. Milne Bay Province, East Cape, Taodovu reef, 10°21.21'S, 150°56.27'E, 7 m, 6.VI.1998 (MNHN A1 APL.B 411). — Louisiade Archipelago, Tagula Island, Yuma Pass, 11°22.14'S, 153°20.99'E, 12 m (Sample: CRRF).

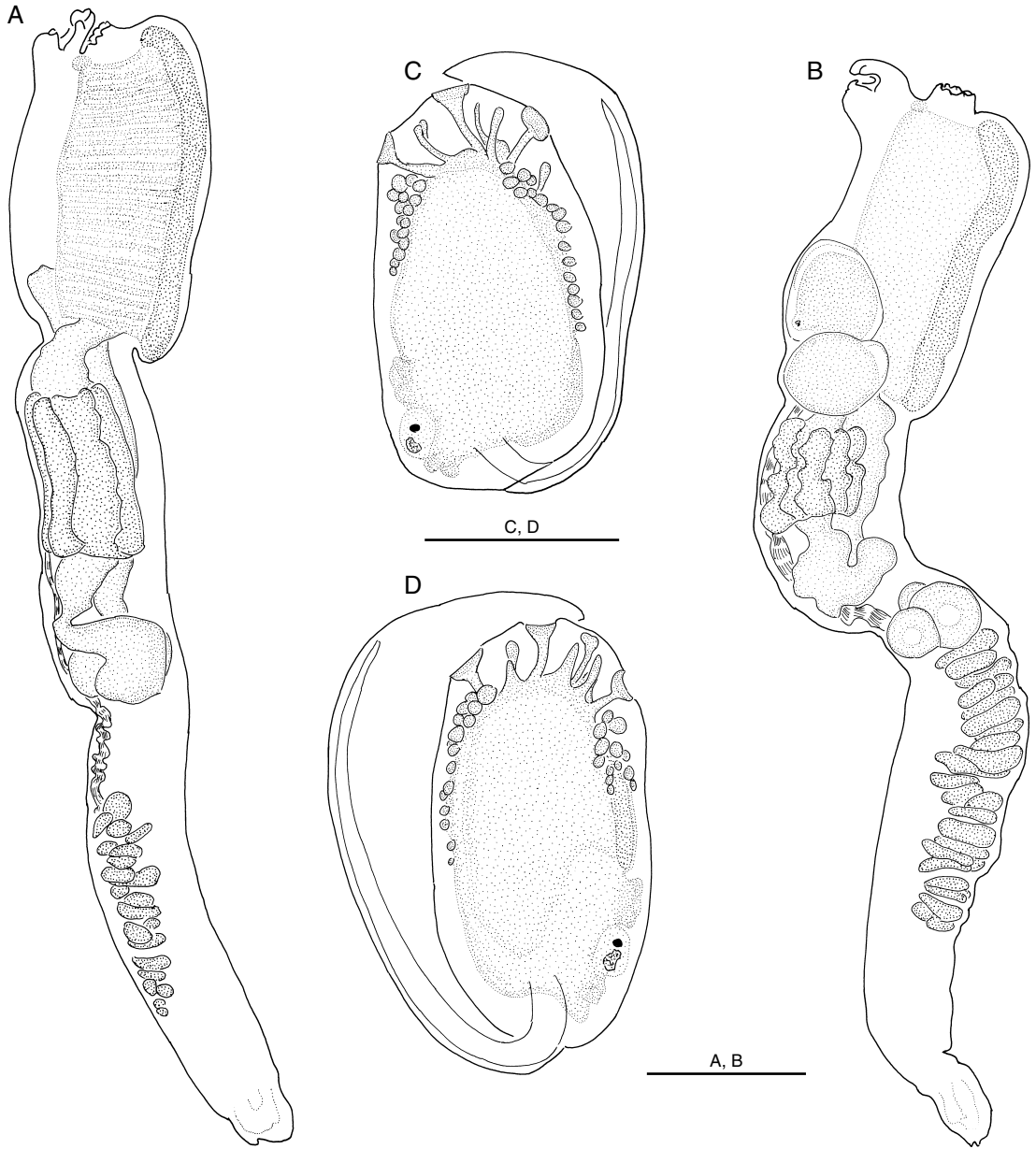


FIG. 6. — *Aplidium longithorax* Monniot F., 1987; **A, B**, two zooids; **C, D**, larvae of the same colony. Scale bars: A, B, 1 mm; C, D, 0.5 mm.

Aplidium longithorax Monniot F., 1987
(Figs 6; 112D)

Aplidium longithorax Monniot F., 1987: 525, fig. 11c-g, pl. 11F. Type locality: New Caledonia. — Monniot F. & Monniot C. 1996: 139, pl. 1C, Palau.

Aplidium protectans — Kott 1963: 102; 1992a: 579, Australia.

MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, Calvados Island Chain, Brooker Channel, cave, 11°03.09'S, 152°28.62'E, 20 m, 1.VI.1998 (MNHN A1 APL.B 417). — Milne

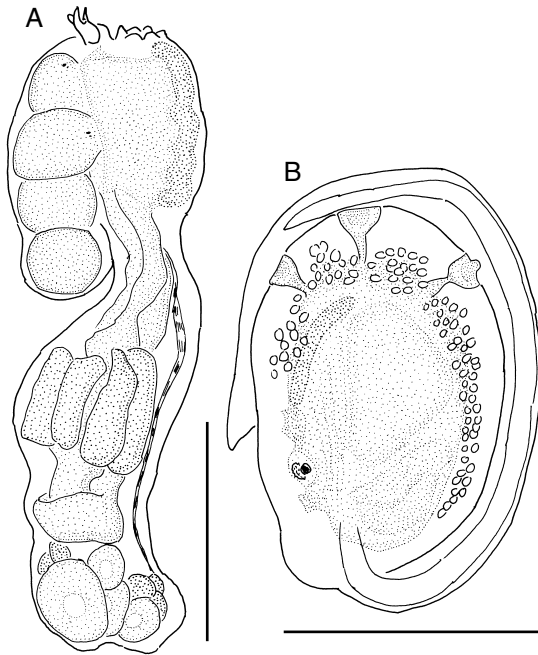


FIG. 7. — *Aplidium macrolobatum* Kott, 1992; **A**, zooid; **B**, larva. Scale bars: A, 1 mm; B, 0.5 mm.

Bay Province, East Cape, Boia Boia Waga Island, 10°12.26'S, 150°44.75'E, 22 m, 27.V.1998 (Sample: CRRF).

DESCRIPTION

The colonies are large, yellow or pink cushions or spheres with circular systems; in the centre of each system opens a common cloacal aperture (Fig. 112D). All characters agree with the previous descriptions of the species. The oral siphon is short with six lobes. The cloacal aperture has a three-toothed languet on its anterior rim (Fig. 6A, B). The branchial sac comprises 20 to 22 rows of stigmata (Fig. 6A). The stomach is particularly elongated with five longitudinal folds (Fig. 6A). The larvae are large; their trunks reach 1 mm (Fig. 6C, D). The three adhesive papillae are held on long, thin peduncles. There are numerous circular vesicles dorsally and ventrally and four long digitiform ampullae between the adhesive papillae. In one larva there was an additional adhesive papilla (Fig. 6D).

REMARKS

This species is widely distributed in the western Pacific Ocean: New Caledonia, eastern Australia, Papua New Guinea, and Palau.

Aplidium macrolobatum Kott, 1992
(Figs 7; 112E)

Aplidium macrolobatum Kott, 1992a: 561, fig. 87. Type locality: Queensland.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Balicasag Island SW of Bohol, 9°31.02'N, 123°40.83'E, 8 m, 15.IV.1997 (MNHN A1 APL.B 391).

DESCRIPTION

The colonies make flat cushions of irregular outline with swellings on the top of which large common cloacal siphons open. The colour in life is red (Fig. 112E). The tunic is glassy with some fine sand embedded. The red zooids are arranged in double rows converging toward the common cloacal openings. Zooids have six oral lobes. The cloacal languet, deeply divided into three lobes (Fig. 7A), is inserted on the anterior rim of the cloacal aperture. The thorax is wide, with 10 rows of stigmata. The stomach has five deep folds, followed by an annular post-stomach (Fig. 7A). The rectum begins with caeca.

The short post-abdomen (Fig. 7A) contains either an anterior ovary against the gut loop or a cluster of male follicles that disappears when the ovary matures.

The larvae are incubated in the cloacal cavity (Fig. 7A). They are very characteristic, with three adhesive papillae, no median ampullae but rather on each side a crescent of numerous small ampullae grouped in small bushes on filiform short stems (Fig. 7B).

REMARKS

The characters of this species correspond in all points to Kott's description (1992a) except that the post-abdomen, when its contains a mature ovary, is as short as the post-abdomen is in the male phase. All stages were found in a same colony.

The distribution of this species in Queensland is now extended to the Philippines.

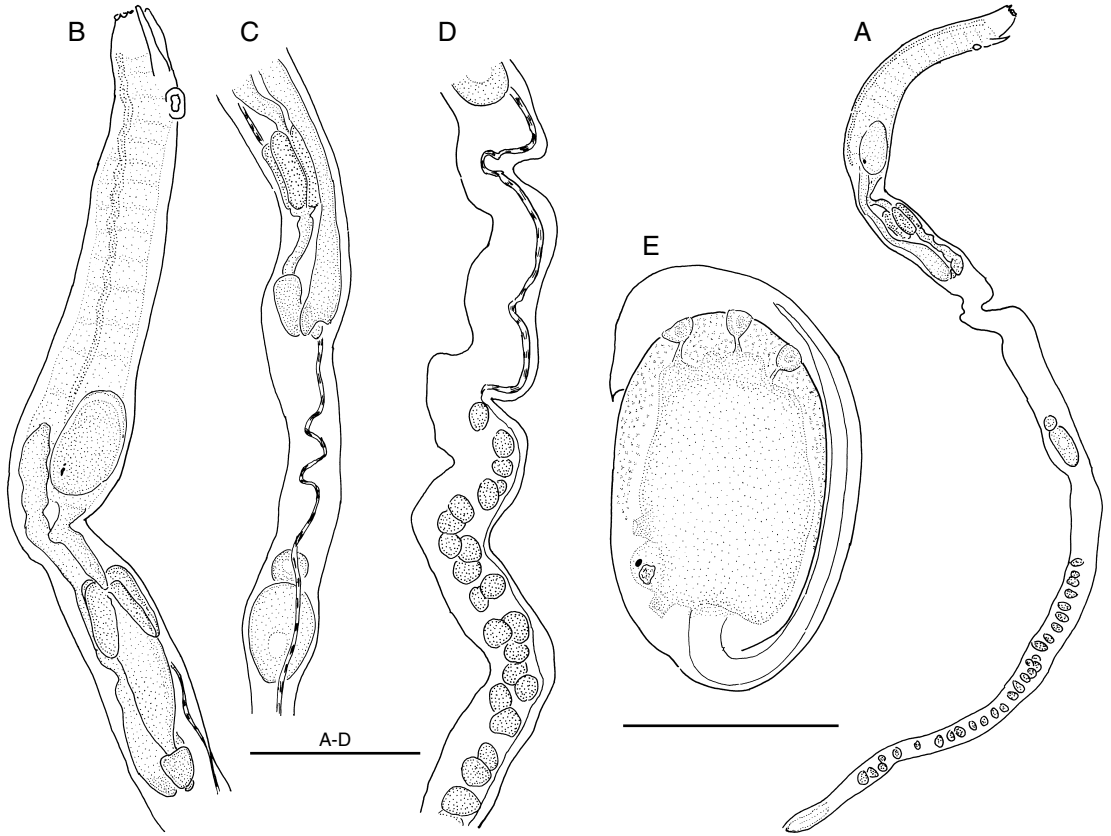


FIG. 8. — *Aplidium nadaense* (Nishikawa, 1980); A, zooid; B-D, several parts of a zooid; E, larva. Scale bars: A, 2 mm; B-D, 1 mm; E, 0.5 mm.

Aplidium nadaense (Nishikawa, 1980)
(Figs 8; 112F)

Amaroucium nadaense Nishikawa, 1980: 104. Type locality: Japan.

Aplidium nadaense – Monniot C. & Monniot F. 1987: 77, Polynesia. — Monniot F. 1987: 530, New Caledonia.

MATERIAL EXAMINED. — **Papua New Guinea.** Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 7 m, 1.VI.1998 (MNHN A1 APL.B 407). — Louisiade Archipelago, N side Tagula Island, Ima Channel, 11°25.92'S, 153°26.78'E, 7 m, 1.VI.1998 (MNHN A1 APL.B 408). — Louisiade Archipelago, Tagula Island, Yuma Pass, 11°22.14'S, 153°20.99'E, 16 m, 3.VI.1998 (Sample: CRRF).

DESCRIPTION

The colonies are filled with sand. The oral openings draw a surface design of polygonal systems, each with a central common cloacal hole (Fig. 112F). The zooids have a red thorax, but the remainder of the body is colourless. The zooids are long and thin (Fig. 8A-D), the post-abdomens crossing each other in all directions in a vitreous but densely sand-impregnated tunic. The cloacal languet is simple (Fig. 8A, B) or ends in two teeth, inserted clearly ahead of the cloacal aperture. The thorax is long and narrow with 16 rows of stigmata. The anus opens at the third stigmata row from the base of the branchial sac. The stomach has five folds. The post-abdomen is very long (Fig. 8A). The ovary lies far behind the gut (Fig. 8C), followed by the testis lobes

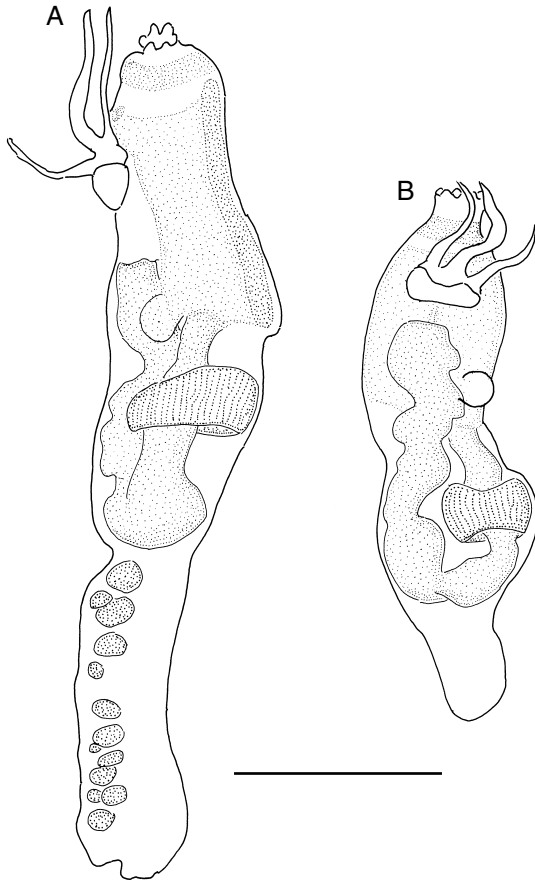


Fig. 9. — *Aplidium pictum* n. sp., two zooids. Scale bar: 1 mm.

(Fig. 8D), which do not reach the cardiac extremity. The larvae are poorly developed and only three adhesive papillae can be seen (Fig. 8E).

REMARKS

This species differs from Nishikawa's descriptions only in a larger size and 16 rows of stigmata instead of 13 to 15. The others characters correspond well to his original description and also to the specimens from Polynesia and New Caledonia.

Aplidium pictum n. sp.
(Figs 9; 113A)

TYPE MATERIAL. — Papua New Guinea. South coast, Coutance Island on barrier reef, 10°13.80'S,

148°06.87'E, 9 m, 12.VI.1998 (MNHN A1 APL.B 414).

ETYMOLOGY. — From the Latin *pictus*: painted.

DESCRIPTION

The round cushions of this species, inflated in life (Fig. 113A), become very flat when fixed. In each system there is a central common cloacal aperture toward which channels in which the zooids open in double rows converge. The test is colourless. The zooids have a black ring around the oral siphons and black pigment on the cloacal languets (hence the species name). The strongly contracted zooids are very short, only 4-5 mm long (Fig. 9). The oral siphon has six lobes. The cloacal aperture is rather large. Its anterior border has a languet dominated by three long prolongations with dark pigment (Fig. 9). The remainder of the body is colourless except for a darker tinge in the stomach folds.

There are 10 rows of stigmata in the branchial sac. The abdomen is short. The gut compartments are not well-separated. The stomach, wider than it is long has 20 to 30 longitudinal folds (Fig. 9A). There is no annular post-stomach in the contracted animals.

The post-abdomen is short. The ovary lies immediately behind the gut, followed by a series of testis follicles in a line. The zooids were not fully mature. There is a brood pouch on the right side of the rectum, at the junction of the thorax and the abdomen. This pouch is empty but present in all zooids, even those with no trace of gonads (Fig. 9).

No larvae were found.

REMARKS

This species is closely similar to *Aplidium sacciferum* n. sp. and *Aplidium altarium* (Sluiter, 1909) as described by Kott (1992a). The cushion-like colonies, the small size of the zooids, the 10 rows of stigmata, and the numerous stomach folds are the same in these species; but the other two lack the black ring around the oral aperture and the large cloacal languet so deeply cleft into three long lobes. The presence of an incubatory pouch in the new species is also distinctive.

Aplidium rosaceum n. sp.
(Figs 10; 113B)

TYPE MATERIAL. — Papua New Guinea. Louisiade Archipelago, Deboyne Lagoon, 10°47.46'S, 152°23.08'E, 12 m, 30.V.1998 (MNHN A1 APL.B 415).

ETYMOLOGY. — From the Latin *rosaceus*: rosaceous.

DESCRIPTION

One or several lobes arise from a common base. They are 3 to 3.5 cm high, cylindrical, and about 2.5 cm in diameter with a flat top. The tunic is an opaque pink (Fig. 113B). No sand adheres to the surface. Each head has a single system or a group of just a few systems. The tunic is raised around each system, which has a central common cloacal opening encircled by a groove where the oral siphons open.

The zooids are very large, averaging 25 mm long (Fig. 10A, B). The oral siphon (Fig. 10C) has six petal-like lobes and a red spot between each lobe. The cloacal aperture is a narrow hole, its anterior rim prolonged by a wide languet deeply cut into three pointed lobes (Fig. 10C). There is a median dorsal protrusion posterior to the base of the cloacal siphon (Fig. 10A).

The large branchial sac has 22 rows of about 40 stigmata on each side.

The thoracic musculature that issues from each siphon is dense, with numerous longitudinal fibres especially on the dorsal side. This gives the thorax a distorted aspect with its dorsal side shorter than its endostylar region (Fig. 10A). In contracted animals, there is a constriction between the thorax and abdomen.

The abdomen is about half the size of the thorax (Fig. 10A). The stomach is mid-way down the descending gut loop. Its wall has oblique, irregular, and branched folds, emphasized by a brown pigment. In transverse section we counted 10 to 12 ridges. There is an annular post-stomach and an oval mid-intestine. The rectum opens three rows above the base of the branchial sac with an anus that has two large lobes.

The post-abdomen is as long as the thorax plus abdomen. The ovary lies at mid-length, followed by a loose cluster of testis follicles (Fig. 10B). The

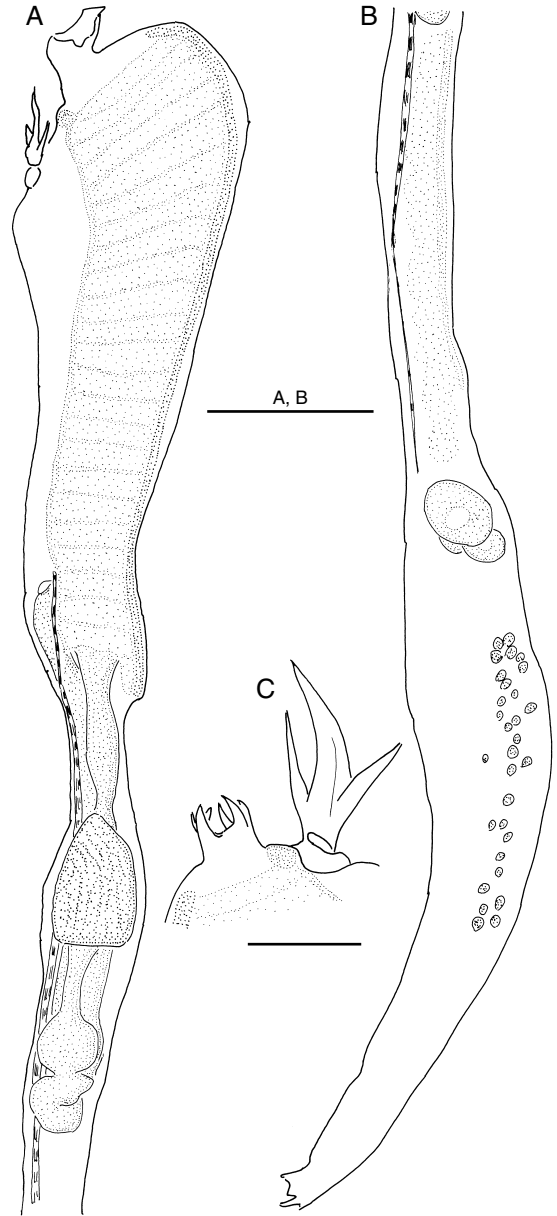


FIG. 10. — *Aplidium rosaceum* n. sp.; **A, B**, zooid in two parts; **C**, siphons. Scale bars: A, B, 2 mm; C, 1 mm.

gonads are included in an abundant reserve tissue. In addition, above the gonads and up to the base of the gut loop, the post-abdomen is filled by a mass of white tissue of unknown origin. No larvae were present in the colonies observed.

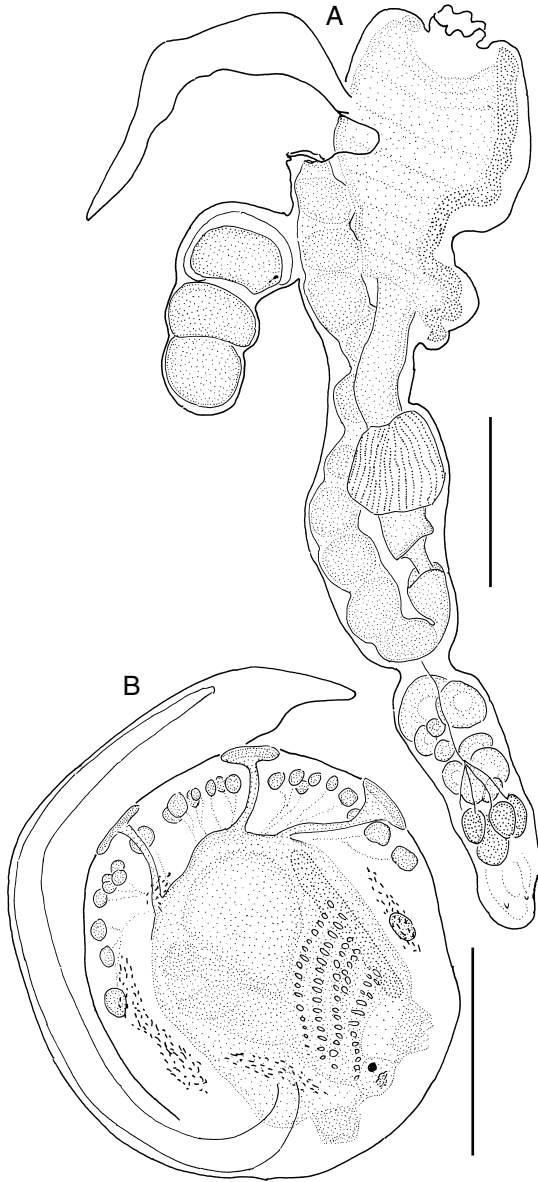


FIG. 11. — *Aplidium sacciferum* n. sp.; **A**, zooid; **B**, larva. Scale bars: A, 1 mm; B, 0.5 mm.

REMARKS

This species has several original characters: large zooids with a particularly large branchial sac, a stomach reticulated with low irregular plications, and a long post-abdomen but with clustered testis follicles. The colony shape reminds one of

Aplidium clivosum Kott, 1992 but the zooids are distinctly different.

Aplidium sacciferum n. sp.
(Figs 11; 113C)

Aplidium altarium – Kott 1992a: 519 part, fig. 62, pl. 10c-d.

TYPE MATERIAL. — Palau. Babeldaob, SE Airai, Ngerdwais, 7°20.82'N, 134°34.35'E, 5 m, 9.IV.1997 (MNHN A1 APL.B 402).

ETYMOLOGY. — From the Latin *saccus*: bag.

DESCRIPTION

The colonies are made of several joined cushions of 3 cm in maximum diameter and 1 cm in thickness. The colour is dark purple (Fig. 113C) but the pigment is localised in the tunic only, while the zooids are colourless. The cloacal channels converge at one or two common cloacal apertures in each colony. The systems are clearly apparent because each oral aperture is circled by a dark purple ring. The tunic is very soft, translucent, without sand, and contains long filiform pigment cells. The oral siphon has six pointed lobes. The long and undivided cloacal languet is inserted close to the cloacal aperture (Fig. 11A). The cloacal aperture is of variable diameter due to a strong sphincter.

The oral tentacles are very numerous. The branchial sac is wide with nine rows of 22 stigmata on each side. The stigmata are interrupted on the dorsal line, and the rapheal languets are slightly displaced to the left side.

The stomach is shorter dorsally than ventrally: its wall is marked with numerous narrow longitudinal folds (Fig. 11A). There is an annular post-stomach. The post-abdomen is short, with an anterior ovary and a cluster of testis follicles (Fig. 11A).

Two or three larvae are incubated in a brood pouch appended to the cloacal cavity (Fig. 11A). The larvae are large, 1 mm for the trunk. They have three adhesive papillae with narrow stalks, and a line of pedunculate ampullae on each side (Fig. 11B). A branchial sac is already developed with four rows of numerous stigmata. On each side there are two pigment flecks, one at the base of the tail and one along the ventral side.

REMARKS

These characters correspond well to the description given by Kott (1992a), for specimens having such a brood pouch, but we have not observed a bilabiate cloacal aperture in the zooids.

This species is not *Aplidium altarium*, whose type has been examined. In Sluiter's species the larva has only four pairs of ampullae between the adhesive papillae (Fig. 1C) and the incubation takes place inside the cloacal cavity. This same situation corresponds to what Millar described in 1956 for *A. altarium* for Mozambique specimens. The species described by Kott (1966) under the name *A. altarium* has numerous ampullae between the larval adhesive papillae, but the incubation is not in an appended brood pouch; this probably corresponds to a part of the description of *A. altarium* by Kott (1992a).

The description of *A. altarium* given by Michaelsen (1919a) for specimens from Zanzibar does not mention the larvae, so its status cannot be assessed.

The distribution of *Aplidium sacciferum* n. sp. is probably wide in the western Pacific Ocean, as it is now recorded from Palau and Australia.

Aplidium solidum (Herdman, 1891)
(Figs 12; 113D)

Psammaplidium solidum Herdman, 1891: 620. Type locality: Australia. Synonymy and distribution: see Kott 1992a: 586, Australia. — Monniot F. & Monniot C. 1999: 14, fig. 10, pl. 2B, Tanzania.

MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 7 m, 1.VI.1998 (MNHN A1 APL.B 409). — Milne Bay Province, East Cape, Boia Boia Waga Island, 10°12.26'S, 150°44.75'E, 16 m, 27.V.1998 (Sample: CRRF).

DESCRIPTION

The colonies are thick crusts totally embedded with sand (Fig. 113D). The common cloacal apertures open atop swellings, and they are widely open in life. The oral openings are irregularly distributed in sinuous double rows or circles. The zooids are colourless in formalin, very small, 3 mm long for the most relaxed ones, and perpendicular to the colony surface.

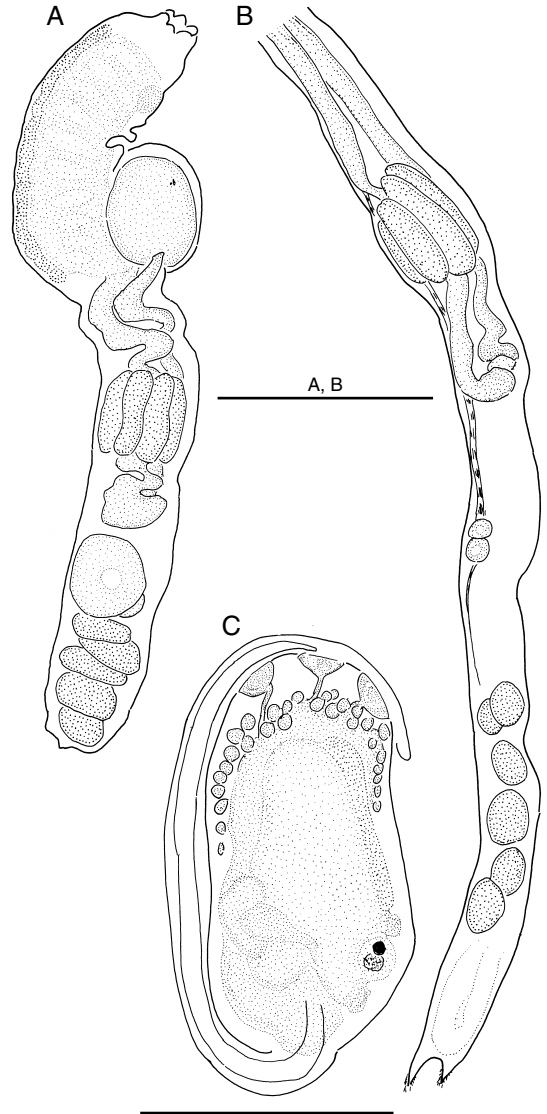


FIG. 12. — *Aplidium solidum* (Herdman, 1891); **A**, zooid; **B**, abdomen and post-abdomen for another zooid; **C**, larva. Scale bars: A, B, 0.5 mm; C, 0.3 mm.

Zooids have six short oral lobes. The cloacal aperture is distant from the oral siphon, as a simple hole whose anterior rim carries a short, simple languet. There are 10 to 11 rows of stigmata. The gut loop is straight, with a cylindrical stomach in the middle of the descending limb. There are five stomach folds and no distinct annular post-stomach (Fig. 12A).

The post-abdomen is rarely longer than the abdomen in contracted zooids. The ovary lies a little below the gut, followed by rather few testis follicles (Fig. 12A, B) either in a line in relaxed zooids or in a cluster after contraction.

The post-abdomen ends in two horns made by the longitudinal muscular bundles (Fig. 12B).

The incubation of larvae takes place at the base of the thorax. The very small larvae, 0.3 mm long, have three well-separated adhesive papillae, and an anterior crescent of spherical vesicles on each side (Fig. 12C).

REMARKS

The shape of the colony, the very small size of the zooids, their anatomy, and the structure of the larva are characteristic.

The new collection extends the distribution of the species, which has been recorded from several places in eastern and western Australia and in Tanzania.

Aplidium vulcanium n. sp.

(Figs 13; 113E)

TYPE MATERIAL. — Papua New Guinea. Milne Bay Province, East Cape, Boia Boia Waga Island, 30 m, 27.V.1999 (MNHN A1 APL.B 419).

ETYMOLOGY. — From the Latin *vulcanius*: vulcanian.

DESCRIPTION

Two specimens were collected with colonies of the same ovoid shape, one 45 mm in height × 25 mm in diameter and the other 20 mm in height. The top side is depressed into a cup in the centre of which a long, funnel-like common cloacal siphon protrudes (Fig. 113E). The external wall of each colony is incrustated with sand and various epibionts up to the thick rolled rim of the hollow. The hollow and bottom of the cup and the tubular cloacal siphon are naked. The oral apertures do not protrude; they open in small groups in the deepest part of the hollow. The internal tunic contains sand but less densely than at the surface.

The tunic is dark blue-green in life and turns dark brown in formalin. It has a spongy consis-

tency except on the top side (in the cup) of the colony, where it is smooth and thin.

The zooids (Fig. 13A, B) are about 18 mm long, parallel to the colony axis. The oral siphon has six finger-like lobes. The oral sphincter and the oral tentacle ring lie immediately behind the oral lobes. As the siphon widens toward the pharynx a large anterior inflated area precedes the prepharyngeal band (Fig. 13C).

The cloacal aperture, atop a short tube, opens in front of the third or fourth stigmata row (Fig. 13C). A thin, long languet is inserted well ahead of the siphon (Fig. 13A, C).

The body wall is thin. We counted a dozen thin longitudinal muscular fibres on each side of the thorax. The branchial sac contains 18 to 20 rows of stigmata. Stigmata are missing along the medio-dorsal line and under the line of rapheal languets, which is displaced on the left side (Fig. 13G). In the middle of the thorax we counted 13 to 14 stigmata in a row on the right side, a medio-dorsal space, then more seven stigmata, a dorsal languet, and then 11 stigmata on the left side. There is also a large unperforated band on each side of the endostyle.

The abdomen is shorter than the thorax. The stomach is cylindrical with seven or eight deep longitudinal folds (Fig. 13D). The annular enlargement of the post-stomach is moderate. The mid-intestine is short and globular. The rectum begins with caeca.

The post-abdomen is extremely long (Fig. 13B). The ovary is very far from the abdomen, and poorly developed when the testis begin to regress. The oocytes are very large (Fig. 13E, F).

A double row of numerous testis follicles extends through the posterior part of the post-abdomen down to the heart. No mature larvae were found in this material.

REMARKS

The long tubular common cloacal siphon protruding from a deep cup-like hollow is unique. It recalls the pattern found in each system in colonies of *A. clivosum* Kott, 1992, *Aplidium lunacratum* Kott, 1992 and *A. crateriferum* (Sluiter, 1909). But in those species, the

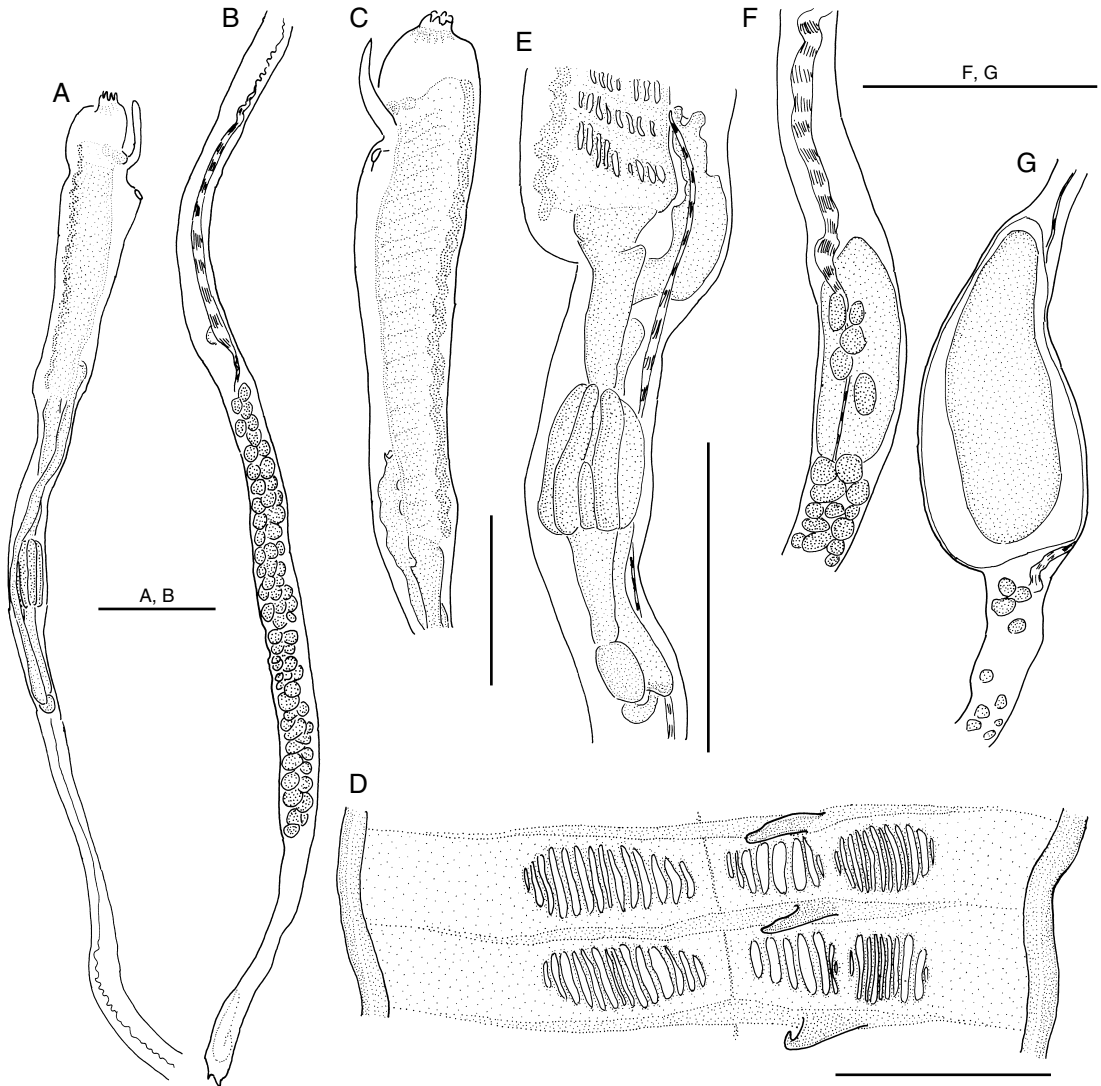


FIG. 13. — *Aplidium vulcanium* n. sp.; **A, B**, two parts of the same zoid; **C**, thorax; **D**, abdomen; **E, F**, ovaries; **G**, part of the branchial sac. Scale bars: A-C, E-G, 1 mm; D, 0.5 mm.

colonies comprise numerous systems and the common cloacal apertures are on shorter chimneys. In those species, the structure of the zooids is very similar, with long oral siphons, a cloacal languet anterior to the cloacal aperture, numerous rows of stigmata with an unperforated area on each side of the endostyle, and very posterior gonads. In *A. vulcanium* n. sp., the stomach has more folds, seven or eight instead of the five in these three other species.

Genus *Aplidiopsis* Lahille, 1890

Aplidiopsis ocellatus

Monniot F. & Monniot C., 1996

Aplidiopsis ocellatus Monniot F. & Monniot C., 1996: 142, fig. 4, pl. 1G. Type locality: Indonesia.

MATERIAL EXAMINED. — **Philippines.** Mindanao, Davao, E Samal Island, 7°03.29'N, 125°46.86'E, 12 m, 2.IV.1996 (MNHN A1 APLA 18).

Palau. West channel, 7°32.42'N, 134°28.37'E, 12 m, 21.X.1997 (MNHN A1 APLA 19).

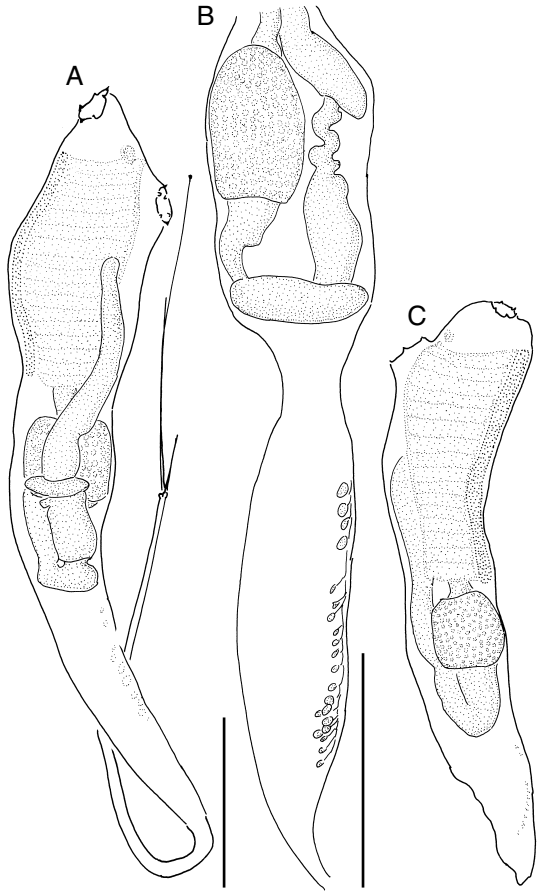


FIG. 14. — *Monniotus pacificus* n. sp.; A, B, zooids; C, abdomen and post-abdomen. Scale bars: 2 mm.

Genus *Monniotus* Millar, 1988

Monniotus pacificus n. sp.
(Figs 14; 113F)

TYPE MATERIAL. — Palau. Koror, Uchelbeluu Reef, W side, on wall, 7°16.41'N, 134°31.43'E, 72 m, 11.VIII.1997 (MNH A1 MON 1).

ETYMOLOGY. — From the Pacific Ocean.

DESCRIPTION

The colonies are large masses, 5 cm in diameter, with erect zooids isolated for almost their whole length on branch-like lobes (Fig. 113F). The tunic is thin, colourless, and impregnated with

sand. The zooids are elongated (Fig. 14A). Both siphons are terminal and at the same level, at the anterior corners of the zooids. Each lobe reaches 4.5 cm in length and a maximum diameter of 0.8 mm at its free end.

In some parts of the colony the branches are ramified, some zooids arising from the post-abdomens of other zooids.

Out of the tunic, the siphons are red. The oral siphon has five red teeth and a flat colourless dorsal lobe. The cloacal siphon has six pointed teeth. The body wall is strongly muscular with longitudinal and transverse fibres. The longitudinal muscles extend posteriorly along the whole length of the post-abdomen. There is a velum before the ring of oral tentacles, which are in three orders of size. The dorsal tubercle opens in a transverse slit. The branchial sac has 20 rows of about 40 narrow and elongated stigmata on each side. The dorsal lamina has 19 pointed languets increasing in size posteriorly. Each transverse vessel bears large erect languets, pressed against each other in the posterior part of the branchial sac. These languets are less numerous and shorter on the secondary transverse vessels.

The abdomen is shorter than the thorax (Fig. 14A-C) but the animals examined are strongly contracted. The oesophagus is narrow. The stomach is wide and elongated, barrel-like with either low ridges or lines of areolations (Fig. 14C). The other parts of the digestive tract are similar to those in the genus *Aplidium* including an annular post-stomach and rectal caeca.

The post-abdomen is particularly long, inflated in the anterior part and progressively thinner posteriorly (Fig. 14A, B). The zooids are not fully mature. Only some very small round testis follicles are aligned in the anterior part of the post-abdomen (Fig. 14C). The heart lies in the middle of the post-abdomen. Neither ovary nor larvae were present in the specimens examined.

REMARKS

Kott (1992a) created the family Pseudodistomidae for two genera: *Pseudodistoma*

Michaelsen, 1924 and *Anadistoma* Kott, 1992. They only differ from other genera placed in the family Polyclinidae in having only three rows of stigmata. In our opinion this does not justify a new family. Another new family, the Protopolyclinidae Kott, 1992 includes three genera rather different from each other, and among them *Monniotus* Millar, 1988. We do not follow this opinion considering that the characters separating the three genera are more important than those differentiating them from the Polyclinidae.

This species differs from the four other *Monniotus* species in having an areolated stomach wall instead of one with a few longitudinal ridges. The colonies look like those of *M. ramosus* Millar, 1988 from Mozambique, which has ramified branches but different siphons, less numerous stigmata, and fewer branchial papillae.

M. australis (Kott, 1957) from southern and western Australia has only 10 rows of stigmata and a single papilla on each transverse vessel.

M. radiatus Kott, 1992 from Victoria and New South Wales has nine rows of 20 stigmata cut by parastigmatic vessels and only 10 papillae on each of the transverse vessels.

Mo. pacificus n. sp. and *M. papillosus* n. sp. are the first species of *Monniotus* described from the northern hemisphere.

Monniotus papillosus n. sp.
(Figs 15; 114A)

TYPE MATERIAL. — Papua New Guinea. Milne Bay Province, East Cape, Boia Boia Waga Island, in cave, 10°12.26'S, 150°44.75'E, 25 m, 27.V.1998 (MNHN A1 MON 2).

ETYMOLOGY. — From the Latin *papillosus*: with papillae.

DESCRIPTION

The colony is made of sand-covered branched lobes, each ending in an enlarged tip and containing only one zooid (Fig. 114A). Each zooid's thorax and abdomen and a part of its post-abdomen are in a lobe: the very thin posterior part of its post-abdomen lies in the narrow basal erect branches of the colony.

The zooids are very elongated (Fig. 15A, B, D, E), with the 6 mm thorax longer than the 3 mm abdomen. The post-abdomen is of variable length, shorter when the ovary is developed and particularly long when the zooids have only mature testis follicles, at which time it can reach 18 mm.

Both siphons open at the same level, and in life have red pigment on their rim. Each has six pointed lobes. The oral siphon curves to the ventral side.

The body wall is thin and transparent. The thoracic musculature is mostly transverse with regularly spaced fibres. The longitudinal muscles are thinner, prolonged down to the posterior extremity of the post-abdomen.

The oral tentacles are in three orders of size at the base of a velum. The dorsal tubercle opens as a transverse slit. The branchial sac has very elongated stigmata. The rows are difficult to count as parastigmatic vessels are anteriorly transformed into true transverse vessels while posteriorly the stigmata remain continuous under the vessels. Numerous papillae arise from the transverse and parastigmatic vessels (Fig. 15F). We counted 17 languets along the dorsal lamina and about 30 stigmata per half-row in the middle of the branchial sac.

The anus opens at the mid-level of the thorax. The gut forms a straight, closed loop (Fig. 15A, C). The oesophagus is short and narrow. The stomach is elongatedly cylindrical; its wall is smooth against the intestine and has eight folds, some of them interrupted, on the opposite side (Fig. 15C). There is a post-stomach widened in a ring, and a mid-intestine separated by a narrowing from the posterior intestine, which begins with caeca.

When fully developed, the gonads occupy a large part of the long post-abdomen (Fig. 15B, D). The ovary is at some distance from the gut, immediately followed by a double row of very numerous testis follicles. Behind the testis is the heart, and the post-abdomen then extends posteriorly as a very thin thread with two or three terminal branches (Fig. 15E). No larvae were present in the colony.

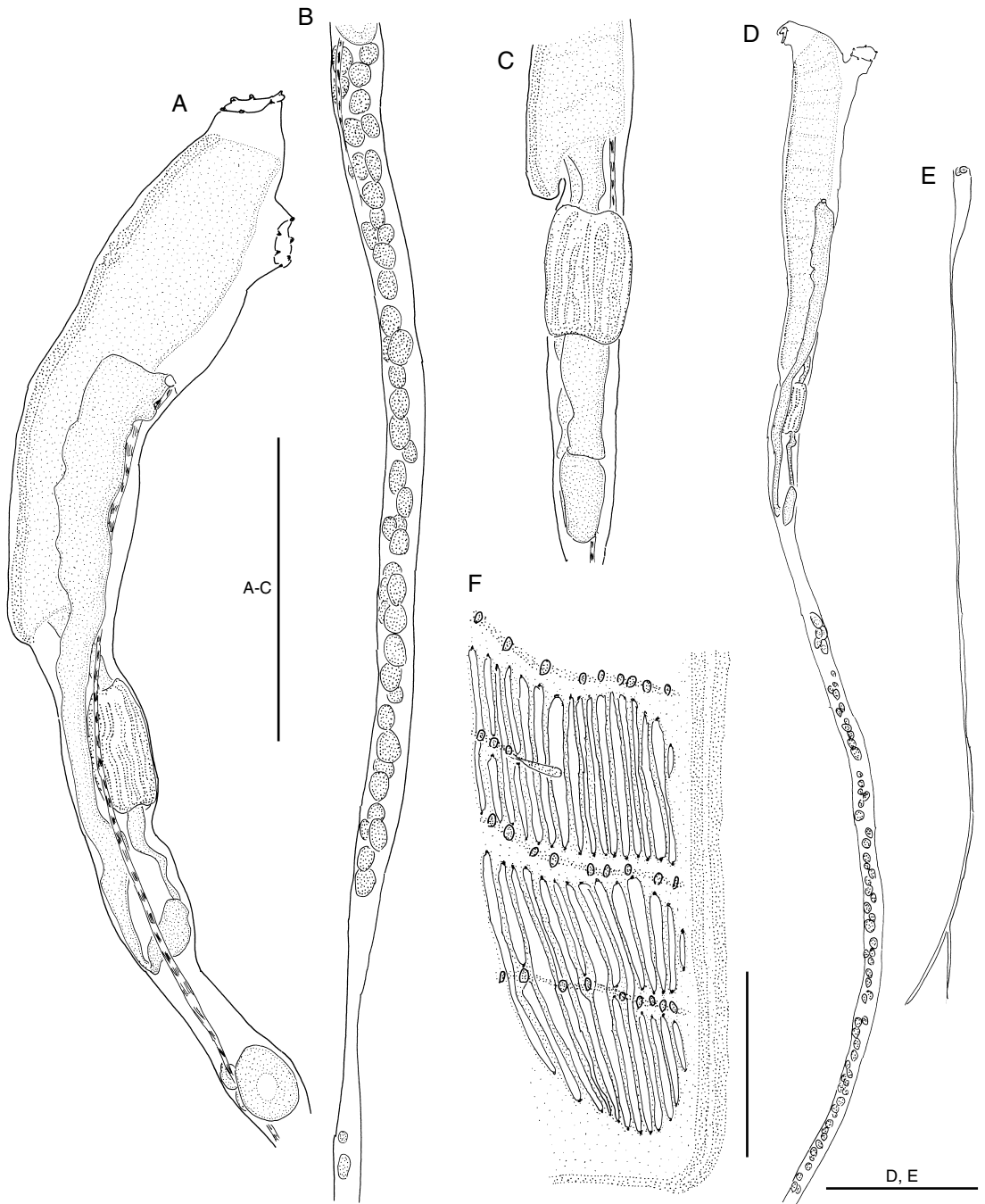


FIG. 15. — *Monniotus papillosus* n. sp.; **A, B**, two parts of a zooid; **C**, abdomen; **D, E**, two parts of a zooid; **F**, part of a branchial sac. Scale bars: A-E, 2 mm; F, 0.5 mm.

REMARKS

This species differs from *M. ramosus* Millar, 1988 in the shape of the stomach, and the number of branchial papillae. The gonads of *M. ramosus* are unknown. The shape of the oral siphon is the same in both species.

M. australis Kott, 1957 has only one branchial papilla on each transverse vessel, and the testis is not elongated. *M. radiatus* Kott, 1992 has only nine stigmata rows, a stomach with 12 folds, and bunched testis follicles.

Mo. pacificus n. sp. essentially differs from the other *Monniotus* species in its areolated stomach.

Genus *Polyclinum* Savigny, 1816

Polyclinum constellatum Savigny, 1816

Polyclinum constellatum Savigny, 1816: 189. Type locality: Red Sea. — Monniot C. & Monniot F. 1987: 83, Polynesia.

MATERIAL EXAMINED. — Mariana Islands. Guam, Apra Harbour off Buoys, 0-3 m, 12.VI.1997 (MNHN A1 POL.B 70).

Polyclinum psammiferum Hartmeyer, 1911
(Figs 16; 114B)

Polyclinum sabulosum Sluiter, 1909: 96, preoccupied by *Polyclinum sabulosum* Lahille, 1890. Type locality: Indonesia.

Polyclinum psammiferum Hartmeyer, 1911. Replacement name.

Polyclinum solum Kott, 1992a: 458, fig. 31, Queensland; 1998: 124.

MATERIAL EXAMINED. — Palau. Koror, Ngermerrangel Island, Flatworm Lake, marine lake, 7°19.12'N, 134°30.40'E, 0.5 m, 23.VII.1997 (MNHN A1 POL.B 69).

DESCRIPTION

The colonies are pale yellow cushions (Fig. 114B), 1 cm thick and about 3.5 cm in diameter, with a translucent tunic allowing one to see yellow zooids through the embedded sand. The systems are circular or in concentric circles around the common cloacal apertures. The tunic has a soft consistency.

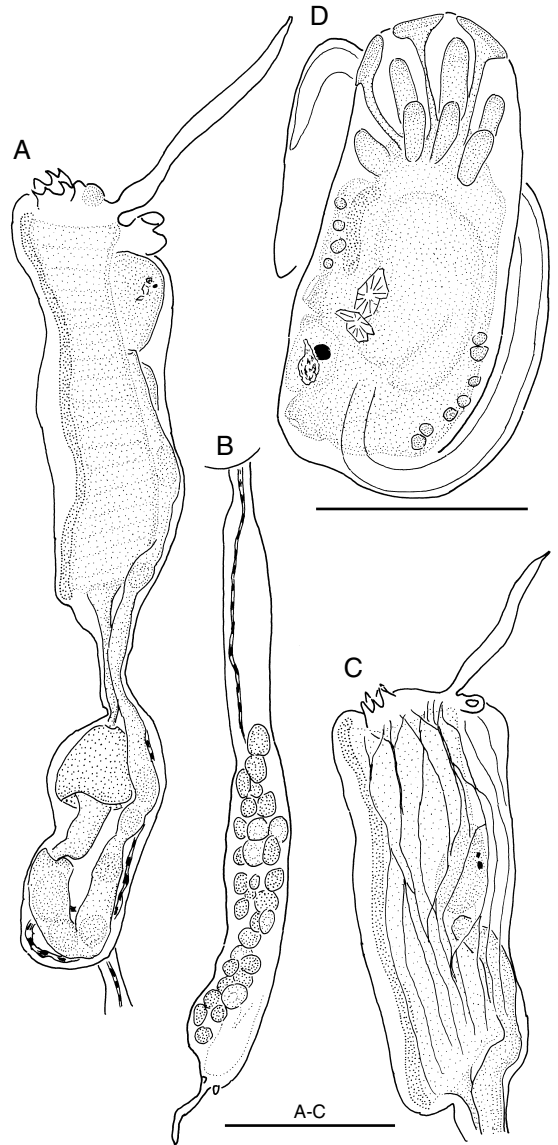


FIG. 16. — *Polyclinum psammiferum* Hartmeyer, 1911; **A, B**, two parts of a zooid; **C**, thorax; **D**, larva. Scale bars: A-C, 1 mm; D, 0.25 mm.

The zooids are 6 to 8 mm long. The oral siphon has six pointed lobes. The cloacal siphon is a narrow tube (Fig. 16A). The cloacal languet is thin and long with a pointed tip (Fig. 16A, C). The oral tentacles are numerous, in three orders of size. The branchial sac has 15 to 18 rows of

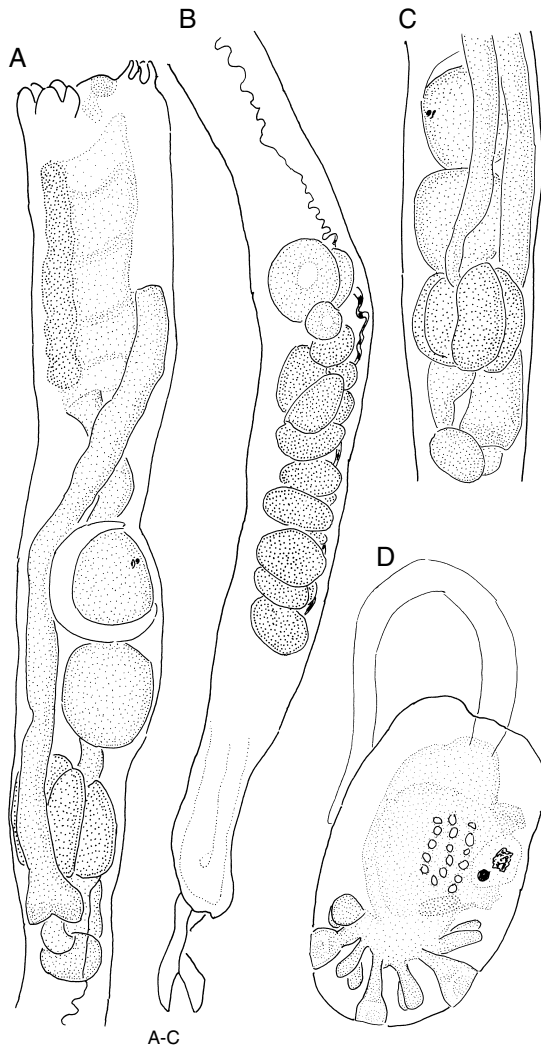


FIG. 17. — *Pseudodistoma aureum* Brewin, 1957; **A, B**, two parts of a zooid; **C**, abdomen; **D**, larva. Scale bars: A-C, 1 mm; D, 0.25 mm.

stigmata with 22 stigmata in a half row in the middle of the thorax.

There is an unperforated band along the dorsal line, and the rapheal languets are progressively displaced to the left side on the transverse vessels. There are no papillae or undulations on the rim of the transverse vessels.

The abdomen has the usual shape of the genus but the gut loop is only slightly twisted (Fig. 16A). The peduncle of the post-abdomen arises from the pos-

terior part of the gut loop; the sperm duct makes a curl at this level (Fig. 16A). The elongated post-abdomen contains a double row of testis follicles. The ovary lies mid-way down the testis line (Fig. 16B).

The larvae (Fig. 16D) are incubated in the cloacal cavity. They have an elongated trunk and three long adhesive papillae alternating with finger-like ampullae. In addition there are four round ampullae on each side of the trunk at the base of the adhesive papillae. A crystal of calcium oxalate (Fig. 16D) is present in the larval body, as usual in the genus *Polyclinum*. Two clusters of small vesicles, one dorsal and one ventral, lie on each side of the trunk (Fig. 16D).

REMARKS

This species seems to be intermediate between the genera *Aplidiopsis* and *Polyclinum* by virtue of the absence of papillae on the transverse vessels and a slightly twisted gut loop. Nevertheless, it has the larval calcium crystal characteristic of the genus *Polyclinum*.

The species is recorded here for the third time. It has been found in Indonesia and Queensland.

Genus *Pseudodistoma* Michaelsen, 1924

Pseudodistoma aureum (Brewin, 1957)
(Figs 17; 114C)

Sigillinaria aurea Brewin, 1957: 580. Type locality: New Zealand.

Synonymy: see *Pseudodistoma aureum* – Kott 1992a: 426.

MATERIAL EXAMINED. — **Tonga**. Vava'u Fotula, small rock off west coast of Vava'u, 18°38.92'S, 174°04.12'W, 30 m, 13.XI.1997 (MNHN A1 PSE 50).

DESCRIPTION

The colonies are bulbous and pale yellow. The surface is slippery and without sand (Fig. 114C). A colony with a diameter of 25 mm has a length of 20 mm. There are no systems. The superficial layer of the tunic is very soft, the internal tunic tougher. When preserved, a white pigment makes the tunic opaque.

Both siphons are of equal length, with six lobes. The thorax is shorter than the abdomen (Fig. 17A). The gut loop is long. The stomach, with four folds (Fig. 17A, C) lies well posteriorly, followed by a short conical post-stomach. The mid-intestine is short and transverse, and the rectum begins with caeca. The post-abdomen (Fig. 17B) has a variable length; when the testis and ovary are fully mature, it is about twice as long as the abdomen. The ovary is far from the gut and is followed by a string of testis follicles that reaches the heart.

The larvae (Fig. 17D) are incubated in the abdomen, alongside the oesophagus. The trunk measures 0.5 mm. The larva's three rows of stigmata are already differentiated. The three long, diverging adhesive papillae alternate with four pairs of digitiform ampullae.

REMARKS

This species is characterised mainly by the ball-like shape of its sand-free, yellow colonies, as well as by their translucent tunic and the zooid's long oesophagus. It is distributed through the whole tropical western Pacific Ocean.

Pseudodistoma coronatum

Monniot F. & Monniot C., 1996

Pseudodistoma coronatum Monniot F. & Monniot C., 1996: 145, fig. 64, pl. 1H. Type locality: Papua New Guinea.

MATERIAL EXAMINED. — Papua New Guinea. Kavieng, Albatross Channel, 2°45.06'S, 150°42.84'E, 20 m, 29.X.1993 (MNHN A1 PSE 40).

Pseudodistoma digitata n. sp.
(Figs 18; 114D)

TYPE MATERIAL. — Papua New Guinea. Louisiade Archipelago, Deboyne Islands, Panaete Island, 10°41.72'S, 152°20.13'E, 12 m, 30.V.1998 (MNHN A1 PSE 56).

ETYMOLOGY. — From the Latin *digitus*: finger.

OTHER MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, N side Tagula Island, Ima Channel, wall, 11°25.92'S, 153°26.78'E, 7 m, 3.VI.1998 (MNHN A1 PSE 51).

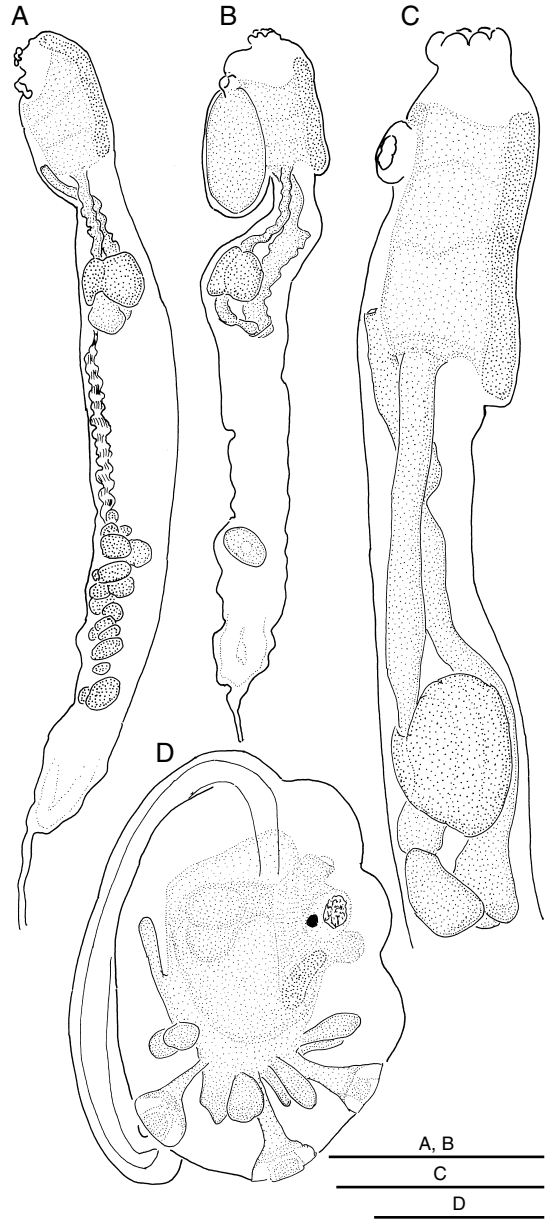


FIG. 18. — *Pseudodistoma digitata* n. sp.; **A, B**, zooids; **C**, thorax and abdomen of another zooid; **D**, larva. Scale bars: A, B, 1 mm; C, 0.5 mm; D, 0.25 mm.

DESCRIPTION

Yellow in life, this species becomes brown in formalin. The colonies are bushes of lobes (Fig. 114D), single or branched, with stiff long

peduncles ending in soft enlarged heads. Each lobe may reach 25 mm in length with a head 6 to 7 mm in diameter. The peduncle is coated with sand and many epibionts but the head is naked. The internal tunic contains some sand. Zooids are not in systems. The siphons open at the top of the head. The abdomens and post-abdomens extend into the peduncle, each prolonged there by a thin vascular appendage.

The zooids have two short siphons with six lobes each. The oral aperture is terminal (Fig. 18A-C). The cloacal siphon is often displaced posteriorly by contraction. The body wall has a strong musculature along the whole body length, grouped in bundles on each side of the post-abdomen.

The thorax and abdomen have about the same length when expanded. The branchial sac contains about 25 long, narrow stigmata on each side in the first row and 20 in the two last rows.

The stomach lies in the lower third or quarter of the gut loop, at the base of a long cylindrical oesophagus (Fig. 18A-C). The stomach wall has four low ridges (Fig. 18C). The mid-intestine is very short and the rectum begins with caeca (Fig. 18C).

The post-abdomen has a variable length but is always longer than the thorax and abdomen together (Fig. 18A, B). The gonads lie in its posterior half or even farther down its length. Ovary and testis were found in separate zooids (Fig. 18A, B), they mature successively. The ovary is anterior to the testis lobes which form a double row down to the heart. A single larva is incubated at a time in the cloacal cavity (Fig. 18B). The tail makes a half circle around a trunk that is 550 µm long. There are three adhesive papillae that are well-separated on long stems, and four pairs of round ampullae. An odd vesicle appears ventrally. Ocellus and otolith are present (Fig. 18D).

REMARKS

The shape of the colony, with its ramified lobes, is exactly the same as in *Pseudodistoma arborescens* Millar, 1967 which differs in its blue colour. The characters of the zooids are not very different in both species, but several species of the genus have

a similar organisation. *P. arborescens* has a stomach with deeper folds and its larva is more elongated with more anterior ampullae. The distinction between these two species is almost impossible in the absence of larvae, and so previous identifications of *P. arborescens* in the Pacific Ocean now appear doubtful (Monniot F. 1987, New Caledonia).

Pseudodistoma poculum Monniot F. & Monniot C., 1996 has also pedunculate lobes, but they are deep red and have a central hollow at the top of each head in which the cloacal siphons open. Zooids and larvae are similar to *P. digitata* n. sp.

Pseudodistoma aureum (Brewin, 1957) and *P. coronatum* Monniot F. & Monniot C., 1996 have pillow-like colonies without embedded sand, and they incubate several larvae at once.

Pseudodistoma fragile Tokioka, 1958 (Figs 19; 114E)

Pseudodistoma fragile Tokioka, 1958: 316, fig. 3. Type locality: Japan. — Monniot F. 1987: 508, fig. 5, New Caledonia.

Pseudodistoma gracilum Kott, 1992a: 433, fig. 19, pl. 4a-e, Australia.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Camiguin Island, 9°15.38'N, 124°39.12'E, 8 m, 19.IV.1997 (MNHN A1 PSE 39).

Papua New Guinea. Coral Sea, Eastern fields, 10°01.02'S, 145°38.66'E, 7 m, 14.VI.1998 (MNHN A1 PSE 52). — Coral Sea, Eastern fields, 10°09.35'S, 145°33.92'E, 20 m, 15.VI.1998 (MNHN A1 PSE 55).

Mozambique. Ibo, 1995, coll. Monniot (MNHN A1 PSE 37).

DESCRIPTION

The colonies are the same in all locations; gelatinous balls of vitreous tunic containing zooids arranged in circular systems (Fig. 114E). The colonies are white or for some of the colonies in Papua New Guinea show light brown pigment. The zooids everywhere have the same anatomy as the type specimen: a wide thorax, an appended incubation pouch, a wide oesophagus with a thickened ring, and a stomach with a square section and sometimes two longitudinal crests. The gonads

are in a cluster at the posterior part of the post-abdomen. The large larvae have three bulky adhesive papillae, one dorsal and one ventral ampulla, and two pairs of intermediate ampullae (Fig. 19).

REMARKS

In the West Pacific stations, the zooids contain generally one fully developed larva and one younger embryo, as the specimens described from New Caledonia (Monniot F. 1987). In the Japanese type specimens that we examined, contrary to Tokioka's (1958) description, the zooids have only one fully developed larva, 1.75 to 1.90 mm in length, and one or two young embryos. Consequently *Pseudodistoma gracilum* Kott, 1992 is synonym of *P. fragile*.

The collection of *P. fragile* in Mozambique extends the distribution of the species to the Indian Ocean.

Pseudodistoma megalarva

Monniot F. & Monniot C., 1996

Pseudodistoma megalarva Monniot F. & Monniot C., 1996: 147, fig. 6F, J, pl. 2A. Type locality: Indonesia.

MATERIAL EXAMINED. — Palau. Koror, West Uchelbeluu Reef, Short Dropoff, 7°16.51'N, 134°31.55'E, 10 m, 12.VIII.1996 (MNHN A1 PSE 38). — Siaes tunnel, west barrier reef, 7°18.76'N, 134°13.50'E, 3 m, 22.XII.1997 (MNHN A1 PSE 48).

Pseudodistoma novaehollandiae (Brewin, 1950)
(Figs 20; 114F)

Sigillinaria novaehollandiae Brewin, 1950: 534. Type locality: New Zealand.

Pseudodistoma novaehollandiae – Millar 1982: 44.

MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, Conflict Group, 10°43.52'S, 151°44.54'E, 40 m, 29.V.1998 (MNHN A1 PSE 54). — Coral Sea, eastern fields, 10°02.22'S, 145°33.01'E, 23 m, 14.VI.1998 (MNHN A1 PSE 53).

DESCRIPTION

The colonies form elongate, ovoid stoutly pedunculate lobes arising from a common base. The

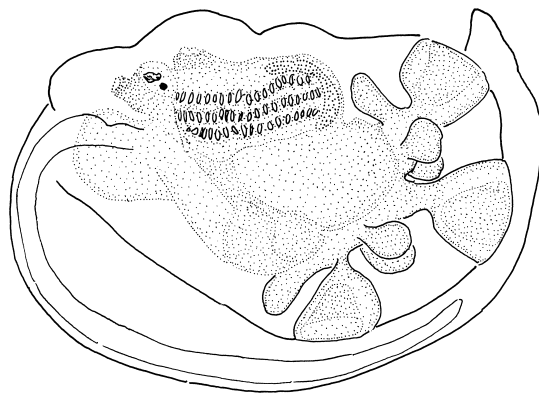


FIG. 19. — *Pseudodistoma fragile* Tokioka, 1958, larva. Scale bar: 1 mm.

sand-free tunic is opaque, brown (Fig. 114F) or dark grey with white perisiphonal patches. There are no systems. The thoraces lie perpendicular to the colony surface, both siphons opening near each other. The abdomen and very long post-abdomen lie parallel to the lobe's long axis. The post-abdomen is so long that the zooid may reach 5 cm. Both siphons have six lobes (Fig. 20A). The thorax is wider than high. There are three rows of numerous stigmata. We counted about 20 longitudinal muscles on each side, regularly spaced.

The abdomen (Fig. 20A) is longer than the thorax and has a long oesophagus. The stomach has a smooth wall or four folds. The post-abdomen is particularly long and contains the gonads in its very posterior part, with the ovary immediately anterior to the testis follicles (Fig. 20B).

The larvae are incubated in a dilated pouch of the cloacal cavity, without peduncle.

The larval trunk measures 0.72 mm. It has three large adhesive papillae in a line, each encircled by a cup-shaped structure made of thin lamellae (Fig. 20C).

REMARKS

This species is characterised by its larvae and by the opaque and pigmented tunic of the pedunculate lobes of the colony. It has been known only from the north of New Zealand.

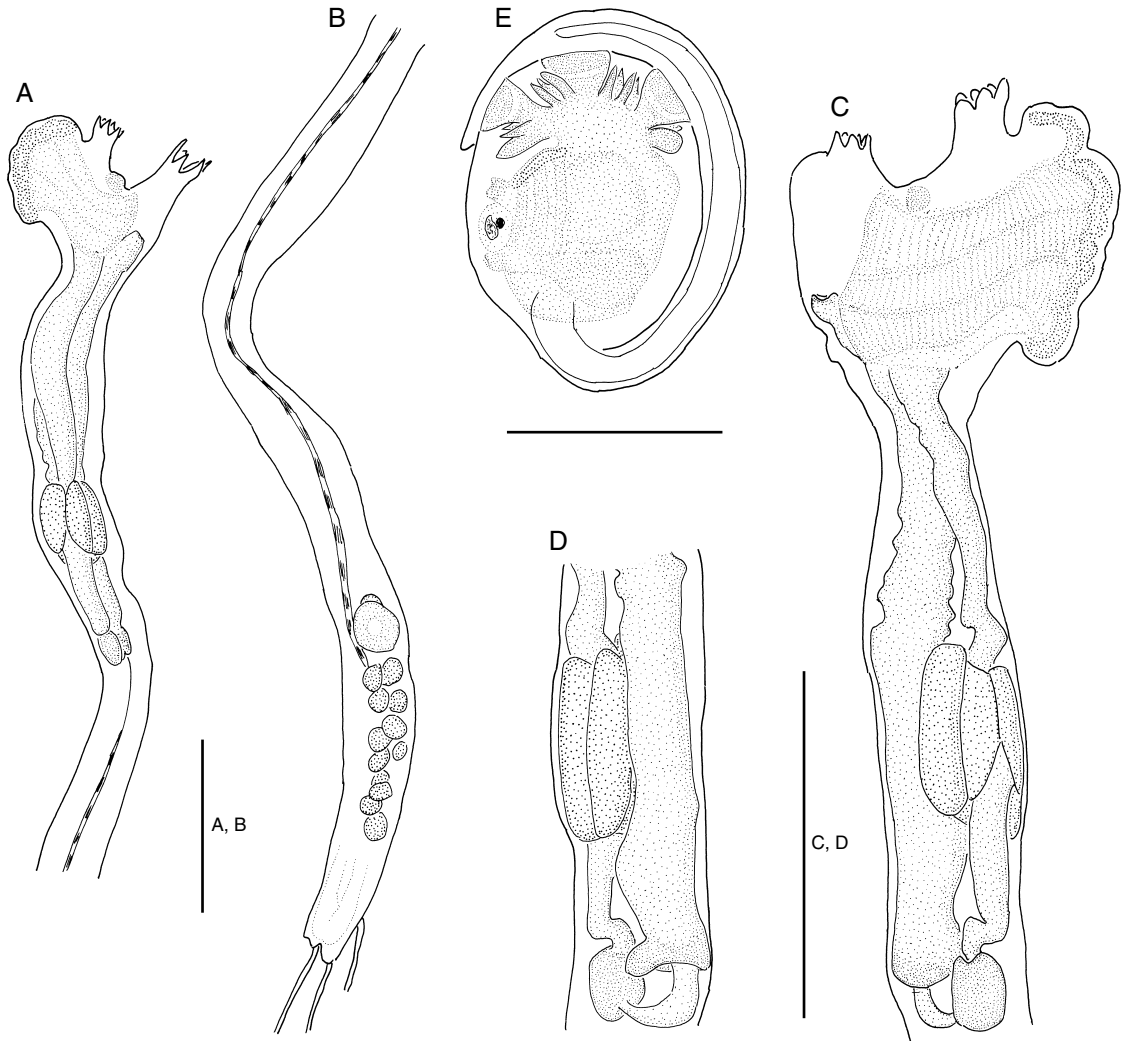


FIG. 20. — *Pseudodistoma novaezelandiae* (Brewin, 1950); **A, B**, two parts of a zoid; **C, D**, abdomen; **E**, larva. Scale bars: A-D, 1 mm; E, 0.5 mm.

Genus *Synoicum* Phipps, 1774

Synoicum castellatum Kott, 1992
(Figs 21; 115A)

Synoicum castellatum Kott, 1992a: 483, fig. 44, pl. 8c-e.
Type locality: Queensland, Australia.

MATERIAL EXAMINED. — **Papua New Guinea.** Louisiade, Calvados Island, Brooker Channel, 11°03.09'S, 152°28.62'E, 7 m, 1.VI.1998 (MNHN AI SYN 68).

DESCRIPTION

The colonies form large, firm, sand-free cushions about 2.5 cm thick. The colour in life is pale grey (Fig. 115A) or peach. Irregular round systems are conspicuous, well-separated at the colony surface. Each one forms a hollow in the centre of which opens the system's common cloacal aperture as a round hole (Fig. 115A); at the periphery of the hollow there are about 30 closely placed oral siphons. In sections of colonies made in life the zooids are brown.

The zooids are large, some of them exceeding 2 cm in length. They lie perpendicular to the colony surface in a tunic that becomes brown in formalin. The oral siphon has six lobes (Fig. 21A, C), of which the ventral ones are often longer than the dorsal ones. The cloacal siphon forms a short tube with generally eight papillae on its rim. A simple languet (Fig. 21A, C), or sometimes a three-toothed one, is inserted a short distance from the cloacal opening but not on its rim.

The branchial sac contains 18 rows of elongated stigmata. Posteriorly the rapheal languets are displaced to the left side.

The abdomen is as long as the thorax in relaxed zooids (Fig. 21A), the oesophagus being particularly long. The stomach is cylindrical. Its wall is smooth in the most relaxed zooids, but with contraction a few longitudinal ridges appear (Fig. 21C), that in section turns out not to be true folds. There is a prominent annular post-stomach (Fig. 21C). The bilobed anus opens at the level of the thirteenth stigmata row.

The post-abdomen is especially long (Fig. 21B), with a very posterior ovary followed by the testis follicles. The gonads were poorly developed in our material, and no larvae were present.

REMARKS

Except for the cloacal languet, which is not on the rim of the cloacal siphon here, all characters correspond well to Kott's description.

The present record in Papua New Guinea extends to the north the distribution of the species, which was known until now from western, northern and eastern Australia.

Family CLAVELINIDAE Forbes & Hanley, 1848
Genus *Clavelina* Savigny, 1816

Clavelina arafurensis Tokioka, 1952
(Figs 22; 115B)

Clavelina (*Synclavelina*) *arafurensis* Tokioka, 1952: 97, fig. 5. Type locality: Papua New Guinea, Melville Bank. — Tokioka 1967: 106, fig. 36, Palau Islands.

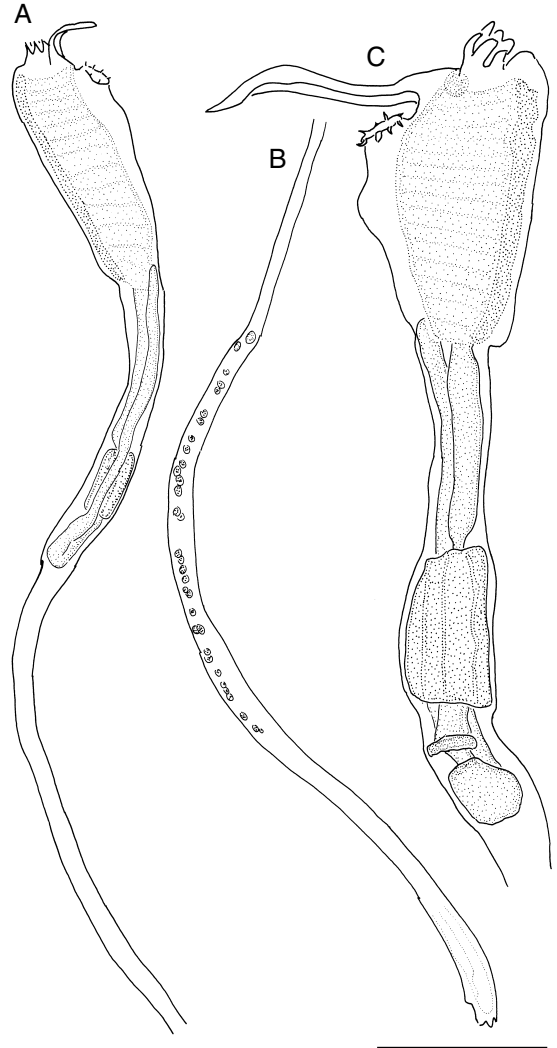


FIG. 21. — *Synoicum castellatum* Kott, 1992; **A, B**, two parts of a zooid; **C**, thorax and abdomen. Scale bar: A, B, 2 mm; C, 1 mm.

Clavelina arafurensis – Kott 1990: 38, fig. 7, pl. 1e, f, western Australia, Philippines. — Monniot F. & Monniot C. 1996: 205, fig. 35e, pl. 6b, Palau Islands. — Monniot C. 1997a: 197, fig. 2, Mozambique.

MATERIAL EXAMINED. — **Philippines**. Bohol Sea, Balicasag Island SW of Bohol, 9°31.23'N, 123°40.98'E, 22.IV.1997 (MNHN A3 CLA 111). — SW Bohol, Panglao Island, 9°37.14'N, 123°46.48'E, 21.IV.1997 (MNHN A3 CLA 110).

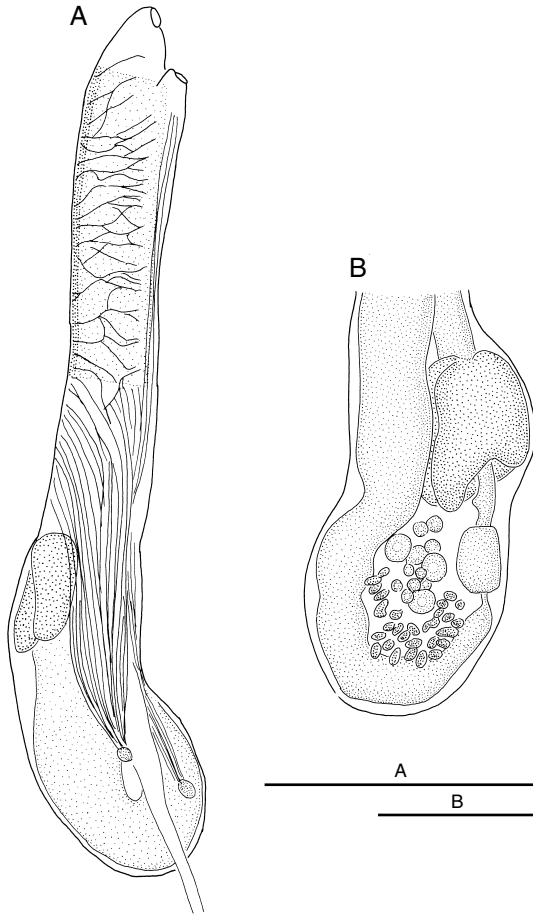


FIG. 22. — *Clavelina arafurensis* Tokioka, 1952; **A**, zooid; **B**, abdomen. Scale bars: A, 2 mm; B, 1 mm.

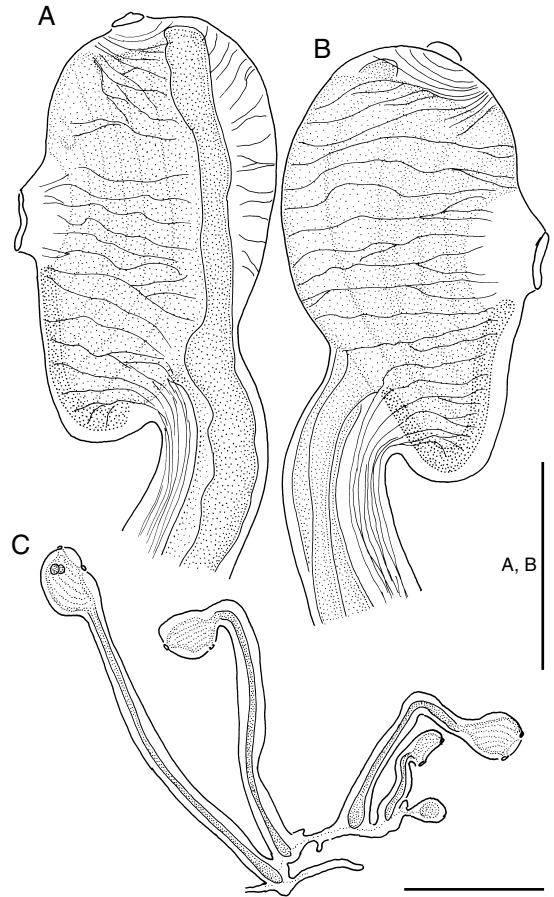


FIG. 23. — *Clavelina detorta* (Sluiter, 1904); **A**, **B**, both sides of the thorax; **C**, part of the colony. Scale bars: A, B, 2 mm; C, 1 cm.

DESCRIPTION

The colour of the Philippines specimens in this collection (Fig. 115B) departs from the species' more common appearance, which is to have a large yellow patch on each side of the siphons, as figured by Kott (1990: pl. 1e, f) and Monniot F. & Monniot C. (1996: pl. 6b), and is also unlike that of the Mozambican specimens. In the Philippines the tunic is transparent, and the rim of the siphons, the prepharyngeal band, the endostyle, and the transverse vessels have a black pigment. In one of the colonies, zooids have two white patches, denser at the periphery than in the centre, disposed anterolaterally as in

other geographic regions. In other specimens no patch at all could be seen.

The peculiar structure of the colonies, with the zooids' thoraces partially isolated and their parallel abdomens included in a cylinder of common tunic, is present here. The thoracic musculature (Fig. 22A) is mostly transverse; it is as figured rather schematically by Tokioka (1967) but not at all as figured by Kott (1990). We have not observed ventral longitudinal muscles. The disposition of the muscles on the abdomen and their anchoring (Fig. 22A) was not made clear by previous authors. The muscular attachments are clearly

visible in the Philippine specimens; they are less developed in colonies from Palau and Mozambique. The presence of a well-defined post-stomach (Fig. 22B) is characteristic of the species.

There are no anatomical characters allowing one to distinguish these specimens from those described with yellow patches.

Clavelina detorta (Sluiter, 1904)
(Figs 23; 115C)

Podoclavella detorta Sluiter, 1904: 6, pl. 3, figs 18-22.
Type locality: Indonesia.

Synonymy and distribution: see *Pycnoclavella detorta* – Kott 1990: 71, fig. 23b, c.

MATERIAL EXAMINED. — **Philippines.** Palawan, Verde Islands North of Puerto Princessa, 10°05.31'N, 119°13.86'E, 5 m, 23.IV.1995 (MNHN A3 CLA 88).

REMARKS

The specimens were well-relaxed, and one can ascertain the disposition of the thoracic muscles of this species and the absence of ventral muscles (Fig. 23A, B). The lengthening of the oesophageal peduncle in zooids depends on their age. A growing stolon produces several zooids (Figs 23C; 115C).

In the species distribution, Kott (1990) mentions the Red Sea, referring to Kott (1957b). Those samples collected in southern Arabia, are described as having only four rows of stigmata instead of six in Pacific specimens; so this identification seems doubtful.

Clavelina fecunda (Sluiter, 1904)
(Figs 24A-C; 115D)

Podoclavella fecunda Sluiter, 1904: 7, pl. 3, figs 23; 24.
Type locality: Indonesia.

Synonymy: see *Clavelina fecunda* – Monniot C. 1997a: 204, fig. 4f, g, Mozambique, Madagascar.

Clavelina sp. – Monniot F. & Monniot C. 1996: 212, fig. 37c, d, pl. 6f, Palau.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Balicasag Island SW of Bohol, 9°31.26'N,

123°41.05'E, 13 m, 16.IV.1997 (MNHN A3 CLA 113). — Bohol Sea, Balicasag Island SW of Bohol, 9°31.23'N, 123°40.98'E, 7 m, 22.IV.1997 (MNHN A3 CLA 108).

Malaysia. P. Payar; Kaca, 20 m, 15.X.1998, coll. Nora (MNHN A3 CLA 118).

DESCRIPTION

The colony is made up of zooids that are almost completely isolated (Fig. 115D) from each other but whose most posterior parts are included in a mass of short stolons containing many vascular ampullae. This mass encrusts the substrate. The tunic is devoid of epibionts, even on the abdomens, and only some small didemnids grow on the mass of basal stolons. The specimens are slightly transparent. The colour in life is pale blue (Fig. 115D), staining the zooids' body wall and their transverse vessels. There is a white spot on the neural ganglion and at the top of the endostyle. The transparent rim of the siphons lacks the usual yellow line in this species.

The musculature comprises fibres that converge toward the abdomen but do not anastomose (Fig. 24A). They group into two bundles ending in well-defined anchoring masses on each side of the base of the abdomen (Fig. 24A, B). The largest specimens have 28 rows of stigmata. A few zooids are incubating larvae; these zooids always are retracted, with a very short oesophageal peduncle. Egg development begins in the oviduct below the cloacal cavity (Fig. 24B). The larvae are not pigmented; they have three adhesive papillae in a triangle (Fig. 24C).

REMARKS

By its colour, the colonies look like those of *C. moluccensis* (Sluiter, 1904) collected in the same region, but they do not have dark spots. The musculature is different from the transverse one of *C. moluccensis* but very similar to that in other descriptions of *C. fecunda*. It is only the absence of the yellow ring around the siphons that leaves any doubt about the synonymy with *C. fecunda*.

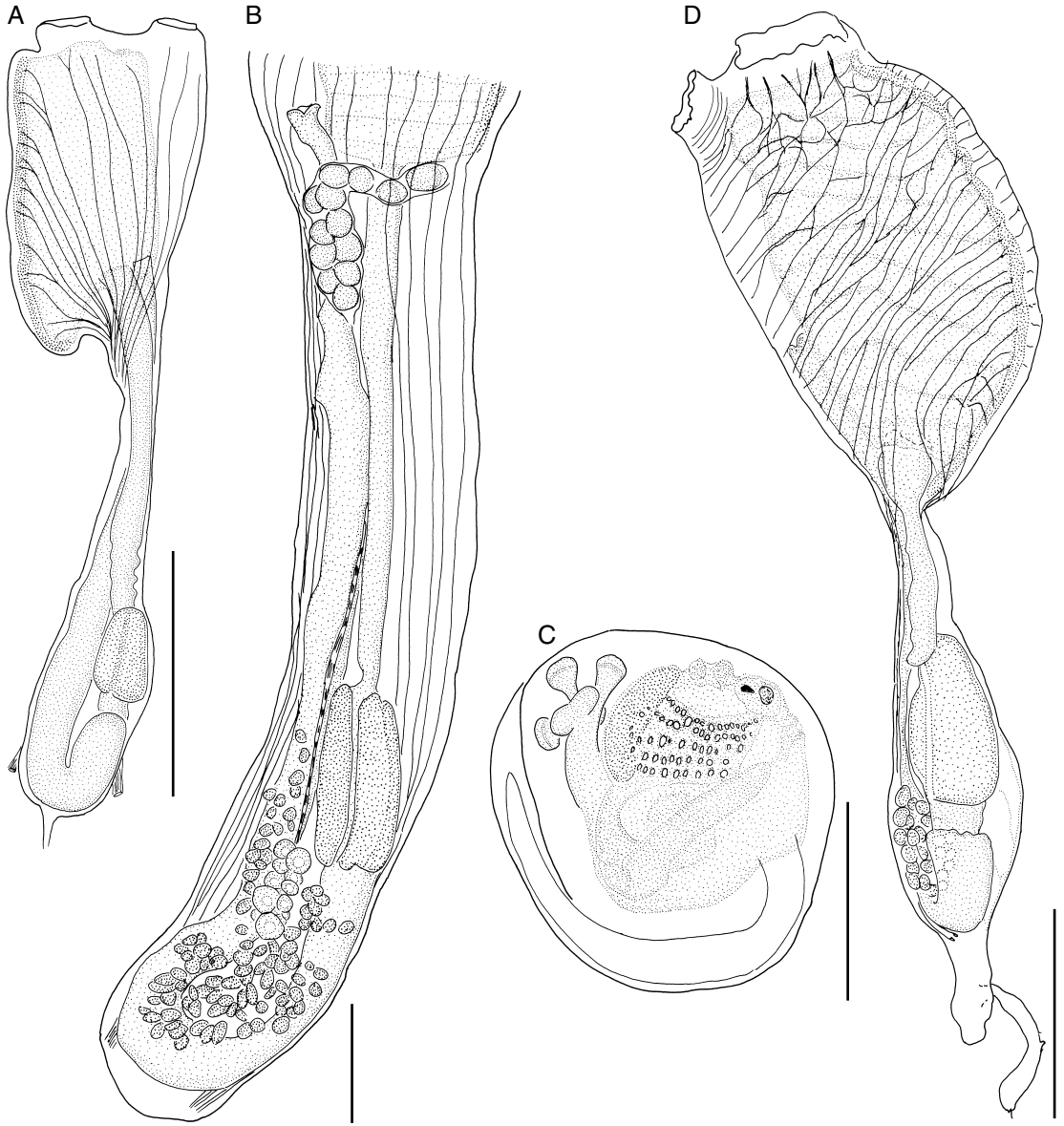


FIG. 24. — *Clavelina fecunda* (Sluiter, 1904); A, zooid; B, abdomen; C, larva; D, *Clavelina moluccensis* (Sluiter, 1904), zooid. Scale bars: A, C, 0.5 mm; B, D, 2 mm.

C. caerulea Oka, 1934, from Japan, appears similar to our samples, but it has a peculiar disposition of the thoracic muscles. Kott (1990) compares *C. elegans* (Oka, 1927) and *C. fecunda* and states that the distinction between the species is the absence of the yellow ring around the

siphons in *C. elegans*, a cobalt blue species in life. In addition, the musculature of *C. elegans* differs slightly from that of *C. fecunda*: “Thoracic muscles are up to ten, main ones converging to the branchial siphon are longitudinal rather than oblique” (Nishikawa & Tokioka 1976: 73).

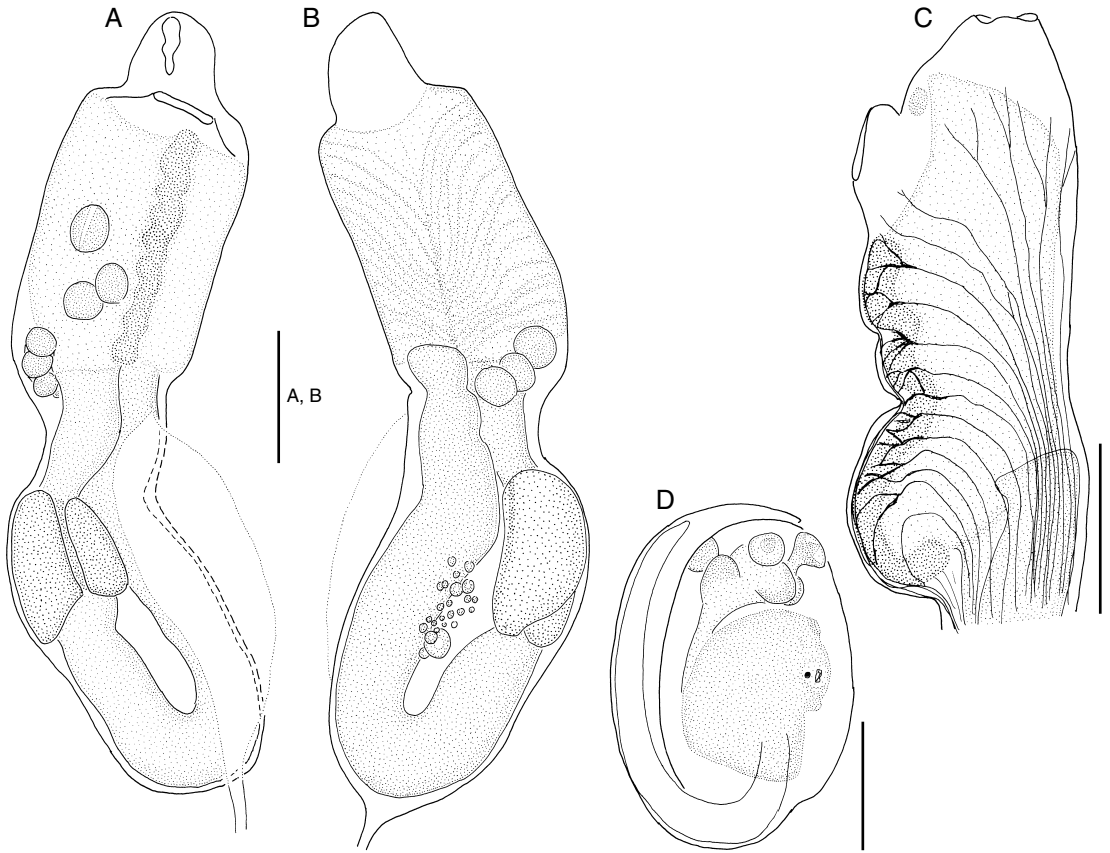


FIG. 25. — *Clavelina maculata* n. sp.; **A, B**, both sides of a zooid; **C**, thorax; **D**, larva. Scale bars: A-C, 2 mm; D, 0.5 mm.

Clavelina maculata n. sp.
(Figs 25; 115E)

TYPE MATERIAL. — Philippines. Bohol Sea, Balicasag Island SW of Bohol, 9°31.23'N, 123°40.98'E, 22.IV.1997 (MNHN A3 CLA 114).

ETYMOLOGY. — From the Latin *maculatus*: spotted.

DESCRIPTION

The sample is a group in which large zooids are isolated down to their base (Fig. 115E). Each zooid produces long, ramified stolons interlaced with those of nearby individuals. This bush of zooids does not contain developing buds, so it is difficult to decide if it is a colony or a group of solitary individuals. The tunic is soft on the thorax and more resistant on the abdomen, which is

frequently covered by epibionts. In a relaxed animal, the thorax and abdomen are of equal length (Fig. 25A, B). In living specimens the tunic is opaque white with dark blue spots distributed without particular order (Fig. 115E). The terminal oral siphon has two latero-dorsal white triangles. The cloacal siphon is slightly posterior.

The internal surface of the siphons and the transverse vessels are black. When preserved in formalin, the tunic becomes transparent and the body takes on a reddish colour, making the examination of the muscles difficult.

The thoracic musculature (Fig. 25C) comprises bundles issuing from both siphons and about 10 bundles coming from the ventral zone. On the lateral and dorsal sides of the body, these fibres are thin and rarely anastomosed. Left and

right musculatures join in the postero-dorsal part of the thorax. Ventrally the bundles are much stronger, ramifying and anastomosing before fusing with the muscles alongside the endostyle. As the musculature is stronger ventrally, the contraction of the body displaces the cloacal siphon to an apical position and the oral siphon laterally (Fig. 25C). On the abdomen, the musculature becomes more delicate and almost invisible below the stomach.

There are a dozen oral tentacles, all large, planted on the posterior side of a high crest and linked to it by ribs. The prepharyngeal band has two high parallel crests; it is not indented dorsally. The dorsal tubercle opens as a simple hole. The dorsal lamina has long languets on the transverse vessels. The branchial sac has 19 rows of stigmata.

The oesophagus is short in these contracted specimens but probably longer in life. We have not seen a dilation of the oesophagus anterior to the stomach, but its absence may be due to the contracted state of the body. The stomach has the shape of a saddle, its concave side applied to the dilated intestine. A conspicuous typhlosole separates two glandular areas with lateral crests (Fig. 25A). The intestine is not differentiated into regions. The anus opens at the base of the cloacal cavity (Fig. 25B).

The diffuse ovary is on the left side of the gut loop. The testis lobes, which lie on the intestine posteriorly to the stomach, are not well-developed in these specimens (Fig. 25B). An enormous heart with an obvious internal membrane dilates all the right side of the abdomen below the stomach.

The larvae are incubated inside a dilated oviduct in the posterior part of the left cloacal cavity, and they develop further in the cloacal cavity. The fully developed larvae become blackish and reach 1.1 mm in length. They have three adhesive papillae in a triangle (Fig. 25D).

REMARKS

By its morphology *C. maculata* n. sp. is close to *C. meridionalis* (Herdman, 1891), a solitary species. Both species have these traits in common: a pigmentation concentrated in the tunic and

making it opaque, a darkly coloured body wall and branchial vessels that become reddish in formalin, and the disposition of the thoracic musculature and its progressive disappearance posterior to the stomach. But in the solitary species of *Clavelina*, the bottom of the gut loop reaches to the stolons at the base of the tunic, while in *C. maculata* n. sp. there is still an erect part of the tunic under the abdomen containing a long vascular process. *C. maculata* n. sp. does not have the basal thickening of hard tunic which, in *C. meridionalis* (Monniot F. & Monniot C. 1996), represents the trace of the successive regenerations of the solitary zooid. The dense stolonial network, probably related to the large size of the heart, is far different from the short root-like vascular processes of solitary species.

Clavelina moluccensis (Sluiter, 1904) (Figs 24D; 115F)

Podoclavella moluccensis Sluiter, 1904: 5. Type locality: Indonesia.

Synonymy and distribution: see *Clavelina moluccensis* – Monniot C. 1997a: 208, fig. 7e.

MATERIAL EXAMINED. — **Papua New Guinea.** Milne Bay Province, China Straits, 10°34.50'S, 150°40.73'E, 9 m, 9.VI.1998 (Sample: CRRF).

Philippines. Bohol Sea, Balicasag Island SW of Bohol, 9°31.02'N, 123°40.83'E, 3 m, 15.IV.1997 (MNHN A3 CLA 107).

Mariana Islands. Guam, Apra Harbour, Jade Shoals, 6-18 m, 5.VI.1997, coll. Paulay (MNHN A3 CLA 121).

REMARKS

Some specimens in this collection have the usual appearance of the species, with transparent zooids with three dark spots in a line perpendicular to the siphon axis (Fig. 115F). In another colony the colour is more opaque and intensifies in older zooids, in which, as well, the three characteristic spots, present in young specimens disappear. In colonies with zooids of both colours, many zooids show dilations of some branchial vessels to produce clear ampullae.

This species is well-characterised by its musculature (Fig. 24D) and the position of the anus well anterior to the oesophagus entrance.

Clavelina robusta Kott, 1990
(Fig. 116A)

Clavelina robusta Kott, 1990: 61, fig. 20, pl. 4g. Type locality: western Australia. — Monniot F. & Monniot C. 1996: 210, fig. 37a-c, pl. 6E.

MATERIAL EXAMINED. — **Philippines**. SW Bohol, Panglao Island, 9°33.45'N, 123°48.56'E, 10 m, 20.IV.1997 (MNHN A3 CLA 109).

REMARKS

The colony has the typical colour of the species, with yellow rings around the siphons (Fig. 116A). The tunic is transparent. Dark blue and almost black pigment, is concentrated in the body wall, and this makes contracted animals opaque. In formalin, the musculature appears white on a purplish background. This colony contains numerous larvae incubated in the oviduct at the base of the cloacal cavity.

Family POLYCITORIDAE Michaelsen, 1904
Genus *Citorclinum* Monniot F. & Millar, 1988

Citorclinum laboutei

Monniot F. & Millar, 1988
(Fig. 116B)

Citorclinum laboutei Monniot F. & Millar, 1988: 321, fig. 1, pl. 1. Type locality: New Caledonia.

MATERIAL EXAMINED. — **Papua New Guinea**. Coral Sea, eastern Fields, 10°00.66'S, 145°39.90'E, 10 m, 14.VI.1998 (MNHN A3 CIT 4).

DESCRIPTION

As in New Caledonia, the colonies of this polycitorid species form round heads, from 2 to 5 cm in diameter raised on peduncles. The tunic is white, vitreous, smooth and naked (Fig. 116B). Both siphons of the zooids are obvious at the colony surface, but they are not circled here with white rings. The zooids are well apart, perpendicular to the colony surface. The characters of the zooids are very consistent with six lobes at each siphon, about 16 longitudinal muscles on each side, three rows of numerous stigmata, a smooth stomach wall, and a long post-abdomen. The

ovary lies in the intestinal loop, the testis in the posterior part of the post-abdomen. The heart lies to one side of the gut loop. A few embryos are being incubated in the cloacal cavity, but no tadpole is fully developed.

REMARKS

This monospecific genus is recorded again, and here for the first time. This extends its geographical distribution to the north.

Genus *Cystodytes* Drasche, 1884

Cystodytes aucklandicus Nott, 1892

Cystodytes aucklandicus Nott, 1892: 323. Type locality: New Zealand. — Monniot F. & Monniot C. 1996: 199, pl. 5G, Micronesia, and synonymy.

MATERIAL EXAMINED. — **Papua New Guinea**. Milne Bay Province, N side of E Cape, Hiliwau, 10°15.65'S, 150°42.75'E, 7 m, 28.V.1998 (MNHN A3 CYS 112).

Cystodytes hapu

Monniot C. & Monniot F., 1987
(Figs 26; 27; 116C)

Cystodytes hapu Monniot C. & Monniot F., 1987: 64, fig. 23A-D, pl. IVE-F. Type locality: New Caledonia.

MATERIAL EXAMINED. — **Palau**. Koror, Ngerikuul Pass, 7°19.22'N, 134°29.24'E, 7 m, 23.V.1994 (MNHN A3 CYS 96).

Maldives. S Male Atoll, oceanside North reef, 4°07.54'N, 73°30.55'E, 7 m, 1.X.1997 (MNHN A3 CYS 105).

DISTRIBUTION. — Polynesia, Palau, and Maldives Islands.

DESCRIPTION

The colonies are encrusting, 5 mm thick, grey, with a round edge. The smooth surface is pierced by slits that are the openings of amphipod-sheltering cavities. The systems are not very regular. The superficial tunic is translucent and without spicules but contains brown, round pigment cells (Fig. 116C), which are also found around the zooids in formalin preserved specimens. Deeper inside the colony the spherical brown cells are irregularly scattered.

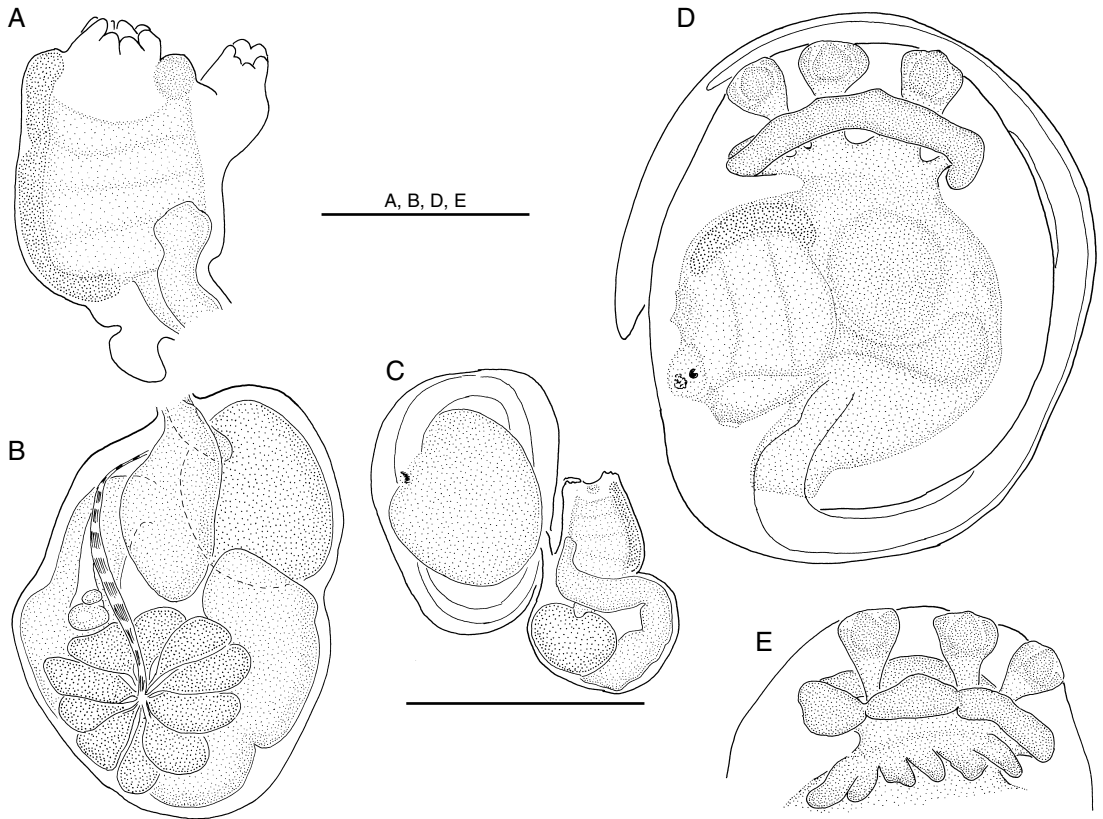


FIG. 26. — *Cystodytes hapu* Monniot C. & Monniot F., 1987; **A, B**, zooid in two parts; **C**, incubating zooid; **D**, right side of the larva; **E**, anterior part of the left side of the larva. Scale bars: A, B, D, E, 0.5 mm; C, 1 mm.

Numerous small spherical spicules made of concentric needles are distributed through the subsurface thickness of the tunic, but are more numerous below that and between the zooids. They have an average diameter of 50 μm (Fig. 27). Disc-shaped spicules 600 to 800 μm in diameter (Fig. 27) make capsules around the zooids and around the larvae. There are very few spicules of intermediate size.

The zooids lie perpendicular to the colony surface. The oral siphon has six to eight lobes, the cloacal siphon six to seven lobes (Fig. 26A). The thoraces are too contracted to count the stigmata or to distinguish a body-wall fold on the waist.

The digestive loop has the common shape of the genus, with a large central space containing the rosette of testis lobes. Ten to 12 oval testis lobes

converge on the sperm duct, which runs straight from its origin (Fig. 26B). The oocytes are located near the oesophagus. Developed larvae are incubated in a pouch protruding on a short and narrow peduncle from the waist of the zooid (Fig. 26C) (giving the species its Polynesian name). The larval size varies, with a maximum trunk length of 1.4 mm. The three anterior papillae, in a line, are encircled by a ring made of four fused pairs of ampullae (Fig. 26D, E), a common structure in the genus *Cystodytes*. On the left side only, an ampullar structure with a deeply toothed margin lies over the anterior part of the larval body (Fig. 26E). The larvae are not gemmiparous, but two stigmata rows are soon pierced. Each larva has its own capsule of flat spicules.

REMARKS

This sample from Palau differs from the type of *C. hapu* Monniot C. & Monniot F., 1987 from Polynesia in the abundance of small spicules, and the tooth-edged structure on the larva. Nevertheless, thin vascular processes are also present on the left larval body side in Polynesian colonies. Specimens collected in the Indian Ocean have both small spicules and larger ones in capsules and larvae in a pedunculate brood pouch with ampullae on the left side. They are assigned to the same species.

Two New Caledonian species have spicules in pin-cushions. *Cystodytes luteus* Monniot F., 1988 has a different anatomy of its zooids and larvae, and *Cystodytes mucosus* Monniot F., 1988 has numerous siphonal lobes, abundant mucus, and no dark pigment, and its larvae are incubated at the stomach level.

Cystodytes solitus Monniot F., 1988

Cystodytes solitus Monniot F., 1988: 223, fig. 12A, C. Type locality: New Caledonia. — Monniot F. & Monniot C. 1996: 200, Palau.

MATERIAL EXAMINED. — Palau. West channel, 7°32.42'N, 134°28.37'E, 5 m, 11.XII.1997 (MNHN A3 CYS 107).

Cystodytes violatinctus Monniot F., 1988

Cystodytes violatinctus Monniot F., 1988: 224, fig. 12D, F, pl. 2C-E. Type locality: New Caledonia.

MATERIAL EXAMINED. — Tonga. Vava'u, Ava Island just West of Kapa Island, 18°42.45'S, 174°02.55'W, 7 m, 8.XI.1997 (MNHN A3 CYS 104).

Genus *Eudistoma* Caullery, 1909

Eudistoma album Monniot F., 1988
(Fig. 116D)

Eudistoma album Monniot F., 1988: 210, fig. 6a-c. Type locality: New Caledonia.

MATERIAL EXAMINED. — Tonga. Tongatapu Lagoon, E side, Alaki, 21°09.87'S, 175°08.33'W, 1 m, 22.XI.1997 (MNHN A3 EUD 201).

Mariana Islands. Guam, South of Pati Point, 10 m, coll. Paulay (MNHN A3 EUD 218).



FIG. 27. — *Cystodytes hapu* Monniot C. & Monniot F., 1987, spicules. Scale bar: 100 µm.

DESCRIPTION

The colonies have a very characteristic pearly colour when alive (Fig. 116D) but become black when preserved in formalin. They are pedunculate with round heads. The common base of the lobes and the peduncles are incrustated with sand. There are no systems. The colorless zooids protrude slightly at the colony surface. Both siphons are at the same level. The thoracic musculature is strong. The abdomen, much longer than the thorax, has a posterior stomach. The rectum makes a curve at the level of the stomach in the most relaxed zooids. The male follicles are grouped at the base of the gut loop and the ovary is lateral to them. The larvae are small, 350 µm in length, incubated in small numbers in the cloacal cavity. They have three adhesive papillae alternating with four pairs of ampullae.

REMARKS

The iridescent white colour of the colonies in life is particularly characteristic. This species, described from New Caledonia, is recollected for the first time. Its presence in Guam and Tonga at very shallow depth suggests a more extensive distribution in the western Pacific.

Eudistoma amplum (Sluiter, 1909)

Polycitor amplus Sluiter, 1909: 21. Type locality: Indonesia.

Eudistoma amplum (Sluiter, 1909). — Monniot F. & Monniot C. 1996: 185, fig. 27, pl. 4F, western Pacific.

MATERIAL EXAMINED. — **Philippines**. Mindinao, Davao, N side Talikud Island, Angel Cove, 6°57.59'N, 125°40.76'E, 8 m, 27.III.1996 (MNHN A3 EUD 156).

Federated States of Micronesia. Pohnpei, Mwand Island, 6°59.65'N, 158°18.14'E, 7 m, 12.X.1996 (MNHN A3 EUD 174). — Pohnpei, Mwand Island, 6°59.48'N, 158°18.06'E, 1 m, 12.X.1996 (MNHN A3 EUD 172). — Yap, Miil Channel, 9°34.16'N, 138°08.64'E, 1 m, 6.VIII.1995 (MNHN A3 EUD 153).

Palau. Babeldaob, SE Airai, Ngerdwais, 7°21.11'N, 134°34.47'E, 1 m, 19.V.1994 (MNHN A3 EUD 121). — E Ngeruktabel, Long Lake (elongate marine basin with long, narrow inlet), 7°15.08'N, 134°24.62'E, 1 m, 20.VI.1995 (MNHN A3 EUD 151). — West channel, 7°32.42'N, 134°28.37'E, 7 m, 11.XII.1997 (MNHN A3 EUD 208). — W Babeldaob, Ibobang, 7°30.58'N, 134°29.66'E, 7 m, 11.VI.1996 (MNHN A3 EUD 171).

Indonesia. N Sulawesi, West of Manado, 1°24.38'N, 124°34.77'E, 10 m, 15.V.1993 (MNHN A3 EUD 177).

Eudistoma fasciculum

Monniot F. & Monniot C., 1996

Eudistoma fasciculum Monniot F. & Monniot C., 1996: 187, fig. 28A, C, pl. 4G. Type locality: Palau.

MATERIAL EXAMINED. — **Palau**. E. Ngeruktabel, Mekeald Lake, marine lake, 7°16.08'N, 134°26.40'E, 1 m, 27.VI.1994 (MNHN A3 EUD 122).

Federated States of Micronesia. Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm growing on nylon line, 6°57.68'N, 158°17.85'E, 8 m, 15.X.1996 (MNHN A3 EUD 175).

Eudistoma fluorescens n. sp.

(Figs 28; 116E)

TYPE MATERIAL. — **Philippines**. Bohol Sea, Balicasag Island SW of Bohol, 9°31.24'N, 123°41.11'E, 16.IV.1997 (MNHN A3 EUD 179).

ETYMOLOGY. — Latinisation of fluorescent.

DESCRIPTION

The sand-free colonies form cushions 1.5 cm thick and 5 to 6 cm across. In life they are a bright orange spotted with irregular white patches, especially around the oral apertures (Fig. 116E). In formalin the colour turns uniformly brownish and the preservative itself takes on an iridescent colour similar to fluorescein (hence the species name). The zooids become slightly visible through the tunic when the colony is fixed. They constitute systems of rosettes, circular or oval. The rim of the oral siphon has a thin orange ring. The cloacal apertures are grouped in the centre of each system. The thoraces are perpendicular to the surface in the superficial layer of the colony, but the abdomens have no consistent orientation.

The zooids (Fig. 28A) measure up to 7 mm when relaxed. The oral siphon is short with six lobes: the cloacal siphon is a little longer, ending in six equal lobes or in four dorsal and two ventral lobes. The branchial sac is large, with more than 25 stigmata in a half row. The abdomen is considerably longer than the thorax, widened in the cardiac region and ending in several digitiform vascular appendages (Fig. 28A). The two muscular bundles coming from the thorax extend in two ribbons on each side of the abdomen and end by forming two horns at the bottom of the abdomen. The stomach is asymmetric. The gonads have numerous testis follicles in the gut loop posterior to the stomach.

There are up to five larvae incubated in the cloacal cavity. The most aged measure 1 mm for the trunk. They have three long adhesive papillae on a line alternating with four odd vesicles (Fig. 28B). A thickened crescent bulges on each side of the anterior trunk.

REMARKS

This species differs from all described *Eudistoma* species in its colour and the peculiar structure of the larvae.

Eudistoma fragum Monniot F., 1988

Eudistoma fragum Monniot F., 1988: 210, fig. 6E-I.
Type locality: New Caledonia.

MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, Tagula Island, Yuma Pass, 11°20.79'S, 153°22.46'E, 7 m, 4.VI.1998 (MNHN A3 EUD 219).

Eudistoma fucatum n. sp.
(Figs 29; 116F)

TYPE MATERIAL. — Palau. Koror, SW end of Uchelbeluu Reef, wall, 7°16.54'N, 134°31.58'E, 7 m, 25.IX.97 (MNHN A3 EUD 230).

ETYMOLOGY. — From the Latin *fucatus*: make up.

DESCRIPTION

The colonies are firm oval cushions with a sand-free surface. They are fixed by a part of their base, which is encrusted with some sand; there is no sand in the internal tunic. The colour in life was green (Fig. 116F) and turned brown in formalin. The zooids are arranged in circular systems that are very close to each other, with the cloacal apertures tightly grouped in the centre of each system. The tunic is very resistant in the upper layer of the colonies, more gelatinous inside when zooids are strongly retracted. The zooids (Fig. 29A, B) are perpendicular to the colony surface, but the abdomens often cross each other. When relaxed the zooids are 7 to 8 mm long, but only 3-4 mm when contracted. The cloacal siphon is longer than the oral siphon. Both siphons are black in formalin (Fig. 29A), and in some zooids the pigment extends onto the upper part of the thorax (hence the species name: *fucatus* means make-up). The remainder of the body is colourless and lies in a vitreous tunic.

The thoracic musculature is dense.

The dorsal part of the first row of stigmata is curved. The second row has 25 stigmata on each side. There is an unperforated area anterior to the branchial sac but not in the posterior part.

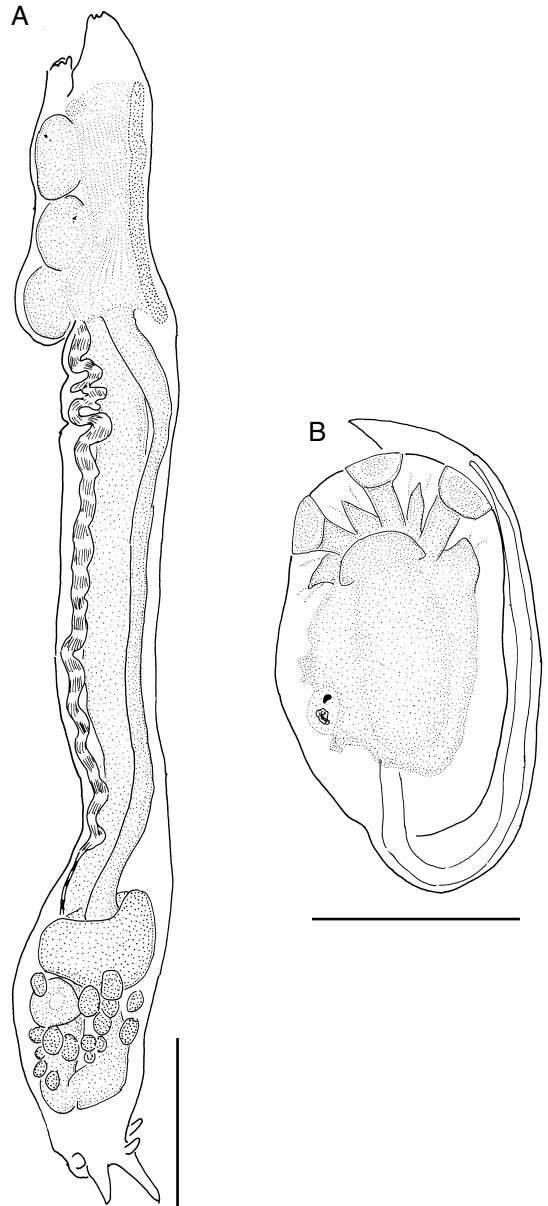


FIG. 28. — *Eudistoma fluorescens* n. sp.; A, zooid; B, larva. Scale bars: A, 1 mm; B, 0.5 mm.

The abdomen is at least six times longer than the thorax (Fig. 29A, B). The stomach is posterior and short (Fig. 29C). The gut loop is straight. There are 30 to 40 round testis follicles in the gut loop. The ovary was not developed and no larvae were found.

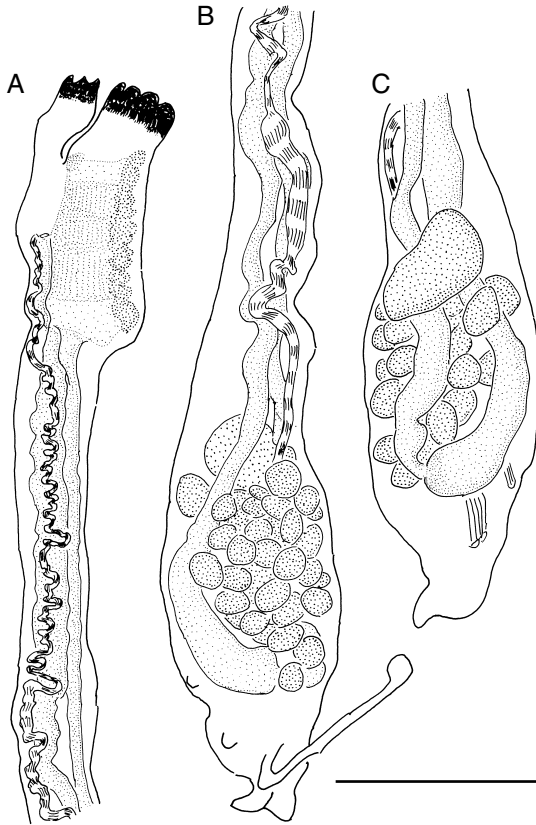


FIG. 29. — *Eudistoma fucatum* n. sp.; **A, B** two parts of a zooid; **C**, base of the abdomen. Scale bar: 1 mm.

REMARKS

This species is mostly characterised by the very constant pigmentation of the tip of the siphons. The green colour of the colony in life and the arrangement of the zooids are also distinctive. The systems are so tightly packed together that the distance between the oral and cloacal openings of a zooid is greater than the distance between the oral openings of adjacent zooids belonging to different systems.

Eudistoma gilboviride (Sluiter, 1909)

Polycitor gilboviridis Sluiter, 1909: 6. Type locality: Indonesia.

Eudistoma gilboviride – Monniot F. & Monniot C. 1996: 188, fig. 28D, E, pl. 4H, western Pacific, and synonymy.

MATERIAL EXAMINED. — **Palau**. Siaes Tunnel, West barrier reef, 7°18.76'N, 134°13.50'E, 28 m, 22.XII.1997 (MNHN A3 EUD 203).

Philippines. Bohol Sea, Camiguin Island, 9°13.73'N, 124°38.56'E, 1 m, 20.IV.1997 (MNHN A3 EUD 175).

Papua New Guinea. Louisiade Archipelago, Calvados Chain, Migemma Gemma Pass, 11°06.15'S, 152°38.30'E, 18 m, 2.VI.1998 (MNHN A3 EUD 229). — Milne Bay, Taodovu Reef, 10°21.21'S, 150°56.27'E, 10 m, 6.VI.1998 (MNHN A3 EUD 223).

Eudistoma glaucum (Sluiter, 1909)

Polycitor glaucus Sluiter, 1909: 12. Type locality: Indonesia.

Eudistoma glaucum – Kott 1990: 208, fig. 78, Australia.

MATERIAL EXAMINED. — **Papua New Guinea**. Louisiade Archipelago, barrier reef N of Calvados Chain, Chubudi Pass, 11°06.42'S, 153°01.90'E, 16 m (MNHN A3 EUD 228).

?*Eudistoma gracilum* Kott, 1990 (Fig. 30)

Eudistoma gracilum Kott, 1990: 211, fig. 79e, f. Type locality: Queensland.

MATERIAL EXAMINED. — **Palau**. Ngemelis, Bailechesengel Island, Big Drop Off, 7°06.22'N, 134°15.06'E, 1.5 m, 21.XI.1996 (MNHN A3 EUD 221).

DESCRIPTION

Colonies consist of flat cushions 0.5 cm thick and 1 to 3 cm in diameter made of one lobe or several lobes pressed together, arising from a harder common base. The tunic is translucent and soft, but difficult to tear. It is colourless in formalin.

The zooids are very short (Fig. 30A): well-relaxed ones are only 3 mm long, with a 1 mm thorax and 2 mm abdomen. They extend from the surface of the colony to its common base. Both siphons have six lobes. The cloacal siphon is inserted a little lower than the neural ganglion and is longer than the oral siphon. There are six short oral tentacles. The three rows of stigmata have about 12 perforations in each half row.

The thoracic musculature is made of strong longitudinal fibres extending down to the abdominal extremity and fine transverse fibres particularly visible around the incubatory cavity.

The abdomen is twice the length of the thorax when relaxed, and then the gut loop is straight. The round, smooth walled stomach is posterior, followed by an inflated mid-intestine (Fig. 30A, B). There are a few testis follicles in a bunch in the bottom of the gut loop and one central oocyte. The mature gonads protrude on the left side of the gut loop. There are one or two vascular extensions at the posterior end of the abdomen.

Two or three embryos are incubated in the cloacal cavity. They are very small, with trunks only 300 µm long (Fig. 30C). They have three adhesive papillae on short, stout peduncles separated by two odd ampullae.

REMARKS

This example of this species differs from the original species description in a tunic with a firmer consistency, the absence of dark pigment cells in preservative, and a smaller larva. Also the colonies may be constituted of several flat cushions on a common base. Nevertheless, the general organisation of the zooids and larvae and their very small size place our colonies in the species *Eudistoma gracilum* Kott, 1990.

Eudistoma hospitale Monniot F., 1998

Eudistoma hospitale Monniot F., 1998: 429, figs 1-4, Chesterfield Island and South Africa. — Monniot F. & Monniot C. 1999: 19, Tanzania.

MATERIAL EXAMINED. — Fiji. Nggamea Island, Nukubalavu, 16°45.06'S, 179°47.83'W, 10 m, 28.X.1996 (MNHN A3 EUD 173).

Eudistoma inauratum n. sp.

(Figs 31; 117A)

TYPE MATERIAL. — Palau. Mecherchar, Jellyfish Lake, marine lake, on carbonate rock, 7°09.83'N, 134°22.50'E, 1 m, 8.VI.1994 (MNHN A3 EUD 178).

ETYMOLOGY. — From the Latin *inauratus*: golden.

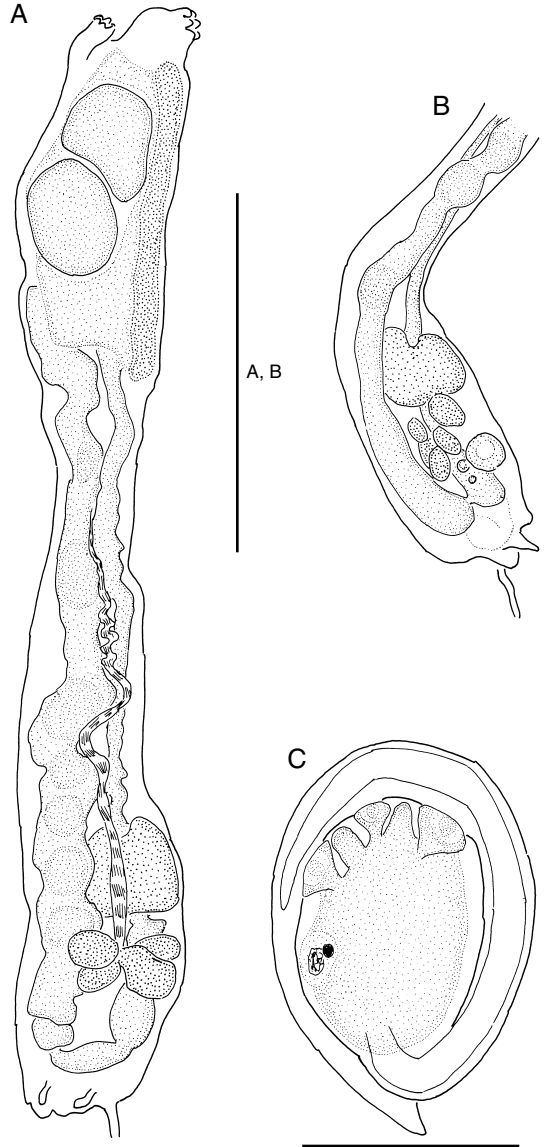


FIG. 30. — *Eudistoma gracilum* Kott, 1990; **A**, zooid; **B**, other side of the abdomen; **C**, larva. Scale bars: A, B, 1 mm; C, 0.25 mm.

DESCRIPTION

The colonies are cushions several centimetres in diameter, constituted of several lobes whose short peduncles arise from a common base. The general colour in life is orange (Fig. 117A) with paler siphonal openings; the colony turns dark brown

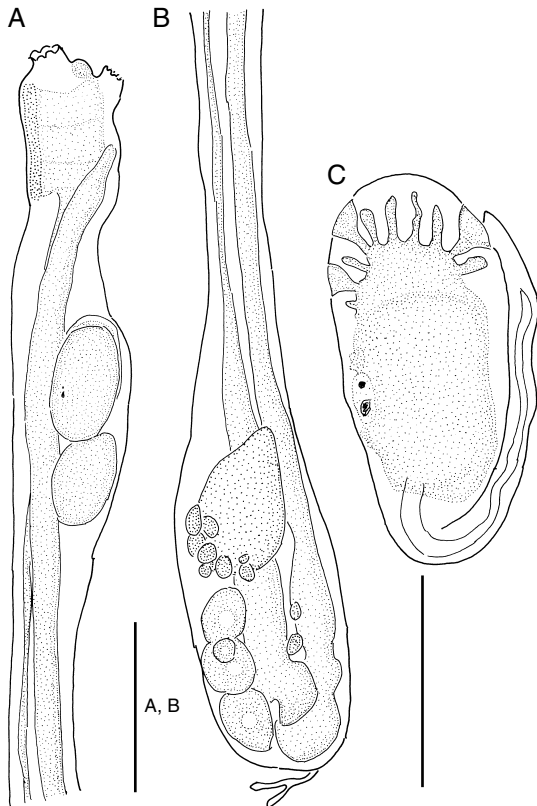


FIG. 31. — *Eudistoma inauratum* n. sp.; **A, B**, two parts of a zooid; **C**, larva. Scale bars: A, B, 1 mm; C, 0.5 mm.

in formalin. The tunic's consistency is firm and there is no impregnation of sediment. The zooids are not arranged in systems. Zooids are elongated, up to 12 mm long (Fig. 31A, B).

Both siphons are short with six lobes. The branchial sac was too contracted to count the stigmata. The oesophagus is particularly long, reaching to a stomach that lies in the very rear of the abdomen (Fig. 31B). The stomach is elongated, separated by a narrowing from the mid-intestine. The rectum is wide from its origin at the bottom of the gut loop and runs straight to the anus in the thorax.

The gonads comprise an elongated group of numerous testis follicles in the bottom of the gut loop, and an ovary located at the centre of this array (Fig. 31B). A thin and long vascular process extends from the bottom of the abdomen.

The larvae are brooded in the oviduct (Fig. 31A) beside the oesophagus, behind the thorax. There may be four embryos at a time at different stages of development. They inflate the body wall but do not make a pouch.

The larvae (Fig. 31C) have a trunk 0.9 mm long. The curled tail is short and does not reach even the anterior pole of the larva. The three adhesive papillae on a line are not regularly spaced, the two dorsal ones being closer to each other than to the ventral one. They are separated by a variable number of elongated vesicles that are flattened dorso-ventrally. Their extremity is pointed and they bear small, very irregular ramifications.

The ocellus and otolith are clearly visible, but no differentiation of the larval organs is apparent.

REMARKS

The combination itself of several characters isolate this new species from all other *Eudistoma*: colonies with erect lobes on a common base, the orange colour, the absence of systems, the oesophageal brooding, and the larvae with irregularly spaced adhesive papillae.

Eudistoma incrustatum

Monniot F. & Monniot C., 1996

Eudistoma incrustatum Monniot F. & Monniot C., 1996: 189, figs 5A; 29A-C. Type locality: Indonesia.

MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, Deboyne Islands, Panaete Island, 10°40.11'S, 152°21.08'E, 7 m, 31.V.1998 (MNHN A3 EUD 214). — Louisiade, Calvados Islands, Brooker Channel, 11°03.09'S, 152°28.62'E, 7 m, 1.VI.1998 (MNHN A3 EUD 215).

Eudistoma laysani (Sluiter, 1900)

Distoma laysani Sluiter, 1900: 9. Type locality: Indonesia.

Eudistoma laysani – Monniot F. & Monniot C. 1996: 190, Papua New Guinea. — Kott 1990: 193, Australia.

MATERIAL EXAMINED. — Fiji. Somosomo Straits, 16°46.75'S, 179°55.81'E, 8 m (MNHN A3 EUD 167).

Eudistoma ovatum (Herdman, 1886)
(Figs 32; 117B)

Psammaphidium ovatum Herdman, 1886: 246. Type locality: northern Australia.

Eudistoma ovatum – Hastings 1931: 82. — Kott 1972a: 43; 1990: 222, fig. 85a-f.

MATERIAL EXAMINED. — **Palau.** Ongael Marine Lake, marine lake on island just west of Ongael Island, 7°15.09'N, 134°22.53'E, 1 m, 14.III.1994 (MNHN A3 EUD 123).

Papua New Guinea. Louisiade Archipelago, Deboyne Lagoon, Nivani Island, 10°47.46'S, 152°23.08'E, 12 m, 30.V.1998 (MNHN A3 EUD 225).

DESCRIPTION

The colonies are up to 2 cm thick and 12 cm in length. They contain fine sand embedded in the tunic. The zooids' apertures are arranged in regular, round systems (Fig. 117B). The colour in life was brown or pale yellow. In addition to the sand, there are abundant crystals inside the tunic. The zooids are elongated. Both siphons have six lobes. The number of stigmata could not be counted. The abdomen is much longer than the thorax and thin in the oesophageal region. The rectum is twisted below the stomach, as described by Hastings (1931). The gonads are in the gut loop, protruding on each side of the abdomen. One or two larvae are incubated in the distended cloacal cavity, which does not form a pouch. Larval trunks are about 1 mm long (Fig. 32). They have three adhesive papillae that are not equidistant and numerous ampullae arranged in two irregular circles around the papillae. These ampullae become more numerous by division: they extend into the ventral region.

REMARKS

Abundant large vesicles of symbiotic algae are distributed through the entire thickness of the colonies, but more abundantly in the surface layer. The species is mostly characterised by its colony: a surface incrustated with fine sand, an annular pattern of siphons, and the presence of crystals in the tunic. Additionally, the twisted basal part of the rectum and the larva with numerous anterior ampullae help to distinguish this ascidian.

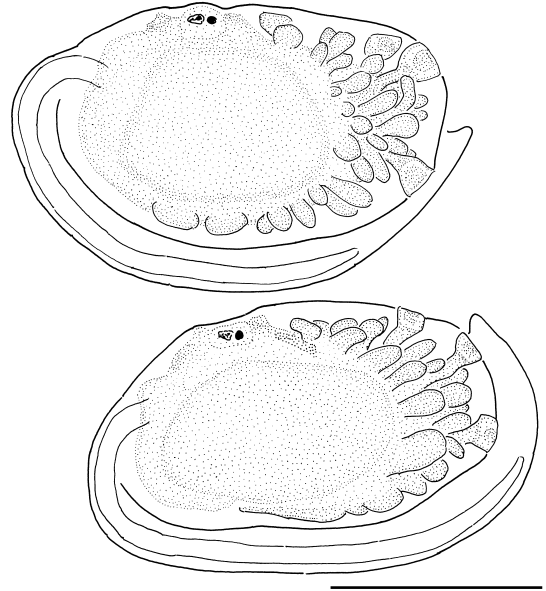


FIG. 32. — *Eudistoma ovatum* (Herdman, 1886), larvae. Scale bar: 0.5 mm.

The species seems widely distributed in western, northern, and eastern Australia and in Palau. The synonymy with *Eudistoma vulgare* Monniot F., 1988, suggested by Kott (1990), cannot be retained, as that species has a smaller and different larva with fewer ampullae.

Eudistoma punctatum n. sp.
(Figs 33; 117C)

TYPE MATERIAL. — **Papua New Guinea.** East Cape, Taodovu Reef, 10°21.21'S, 150°56.27'E, 6 m, 6.VI.1998 (MNHN A3 EUD 222).

ETYMOLOGY. — From the Latin *punctus*: point.

DESCRIPTION

The colony is made of several lobes arising from a common base. Each lobe has a cylindrical peduncle covered with epibionts and an enlarged transparent head, in which one can see the zooids arranged in a circle. The cloacal openings are grouped in the centre of each system. The zooids have two large yellow spots between the siphons (Fig. 117C): this emphasizes the arrangement of

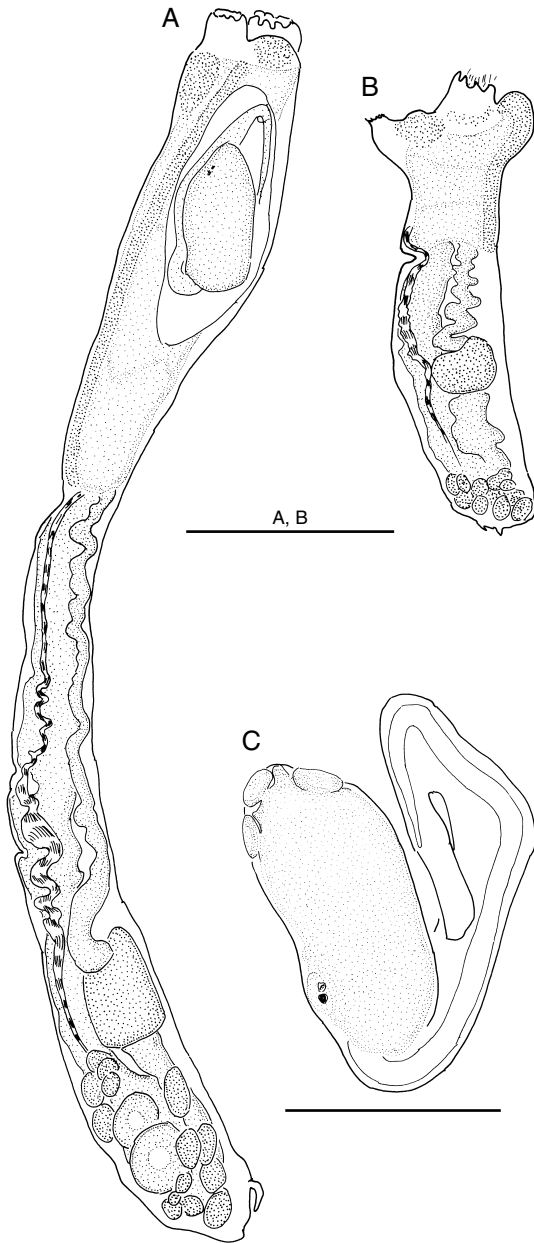


FIG. 33. — *Eudistoma punctatum* n. sp.; A, B, zooids; C, larva. Scale bars: A, B, 1 mm; C, 0.5 mm.

zooids in one circular system in each lobe. The largest lobes of the colony reach only 8 mm in height. The zooids (Fig. 33A, B) are long, with their thoraces in the heads of the colony and their

abdomens in the peduncles. All were contracted. The siphons are tubular with six elongated lobes. They each have a pale yellow ring that becomes brown in formalin. Two large spots lie on each side of the neural ganglion, yellow in life and dark brown in formalin preservative. The remainder of the zooid is colourless.

The strong musculature is made of longitudinal and transverse fibres covering the whole thoracic surface. The longitudinal bundles are prolonged on the abdomen.

There are three rows of elongated stigmata. The first row is curved anteriorly on the dorsal side. There are about 30 stigmata in the second row on each side. The abdomen is longer than the thorax and has a posterior stomach. The gonads are located in the bottom of the gut loop, with numerous testis lobes and a central ovary (Fig. 33A).

In a few zooids, one immature larva with ocellus and otolith was incubated in the cloacal cavity (Fig. 33C). The three anterior adhesive papillae were not well-developed. The trunk is 0.75 mm in length.

REMARKS

The shape of the colonies, the translucent tunic, and the expanded head on a stiff peduncle reminds one of *Eudistoma rubra* Tokioka, 1954, but that species is much larger and lacks the two well-marked pigment spots between the siphons. The first row of stigmata runs anteriorly beside the dorso-median line in both species, but this is a rather common arrangement in the genus *Eudistoma*. The pigmentation and the translucent heads of these colonies are uncommon in the genus *Eudistoma* Caullery, 1909.

Eudistoma reginum Kott, 1990

Eudistoma reginum Kott, 1990: 228. Type locality: Queensland. — Monniot F. & Monniot C. 1996: 191, fig. 30, pl. 5C, D, western Pacific, and synonymy.

MATERIAL EXAMINED. — Federated States of Micronesia. Chuuk, southern barrier reef, Pizion Reef, 7°10.09'N, 151°51.98'E, 20 m, 26.V.1995 (MNHN

A3 EUD 128). — Pohnpei, Mwand Island, 7 m, 6°59.65'N, 158°18.14'E, 12.X.1996 (MNHN A3 EUD 170).

Palau. Ngiwal, 7°31.43'N, 134°37.66'E, 20 m, 8.V.1996 (MNHN A3 EUD 169).

Mariana Islands. Guam, Pago Bay outer reef slope, 6 m, 28.VIII.1997, coll. Paulay.

Eudistoma toalense Millar, 1975

Eudistoma toalense Millar, 1975: 222. Type locality: Toal. — Monniot F. & Monniot C. 1996: 194, fig. 32, pl. 5E, Palau, Indonesia.

MATERIAL EXAMINED. — **Palau.** E Ngeruktabel, Big Fish Lake, marine lake, 7°15.81'N, 134°24.91'E, 0.5 m, 11.VII.1994 (MNHN A3 EUD 133).

Federated States of Micronesia. Chuuk, E Dublon, mangrove lagoon, 7°22.90'N, 151°53.55'E, 0.5 m, 9.VII.1992 (MNHN A3 EUD 134). — Yap, Tagreng, 9°33.38'N, 138°08.45'E, 0.5 m, 6.VIII.1995 (MNHN A3 EUD 155). — Pohnpei, Saladak, 6°55.81'N, 158°16.90'E, 1 m, 13.X.1996 (MNHN A3 EUD 168).

Eudistoma tumidum Kott, 1990
(Figs 34; 117D)

Eudistoma tumidum Kott, 1990: 232, fig. 91. Type locality: Australia, Gulf of Carpentaria.

MATERIAL EXAMINED. — **Philippines.** Mindanao, Davao, NE side of Samal Island, 7°09.63'N, 125°47.05'E, 10 m, 30.III.1996 (MNHN A3 EUD 226).

DESCRIPTION

The colonies are thick, encrusting cushions, 2.5 cm thick and 5 cm across. The surface is smooth with irregular swellings depending on the substrate. The colour is a translucent light grey, with pale yellow spots (Fig. 117D) that correspond to visible zooids and faecal pellets. The zooids are arranged in circular systems. There is no embedded sediment but rather abundant faecal material.

The zooids (Fig. 34A) are slender when relaxed, 8 mm long, perpendicular to the colony surface. Both siphons have six lobes; the cloacal siphon is often a little longer than the oral. The thoracic musculature comprises numerous dense transverse fibres and about 15 evenly spaced longitu-

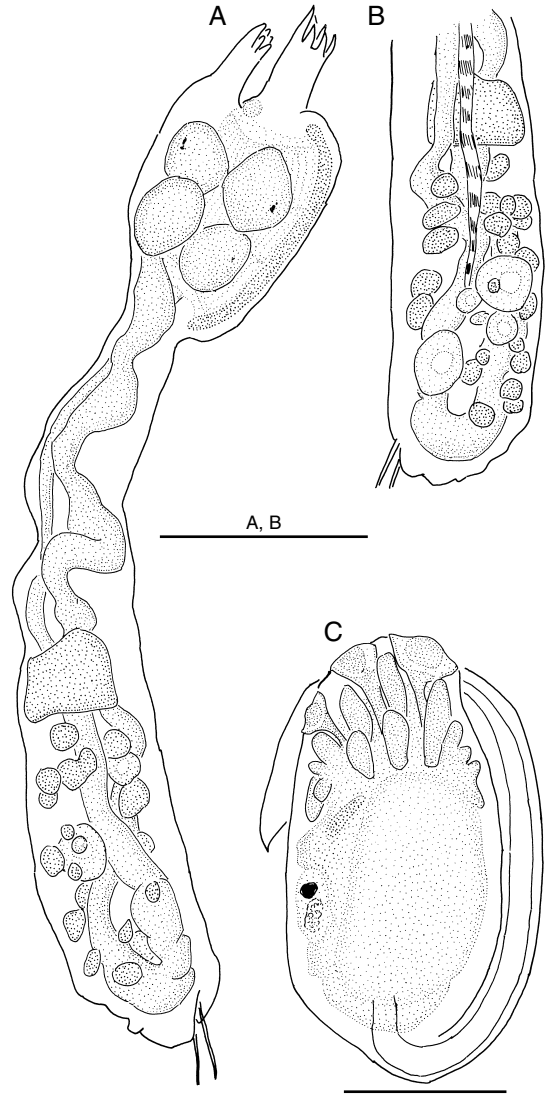


FIG. 34. — *Eudistoma tumidum* Kott, 1990; **A**, zooid; **B**, base of the abdomen; **C**, larva. Scale bars: A, B, 1 mm; C, 0.25 mm.

dinal bundles, which extend in two ribbons along the abdomen. There are three rows of oral tentacles. The branchial sac has about 25 stigmata on each side in the first row, which is slightly curved anteriorly.

The abdomen is much longer than the thorax. The stomach lies only half or two third down the length of the abdomen (Fig. 34A, B), so there is more space as usual in the genus for

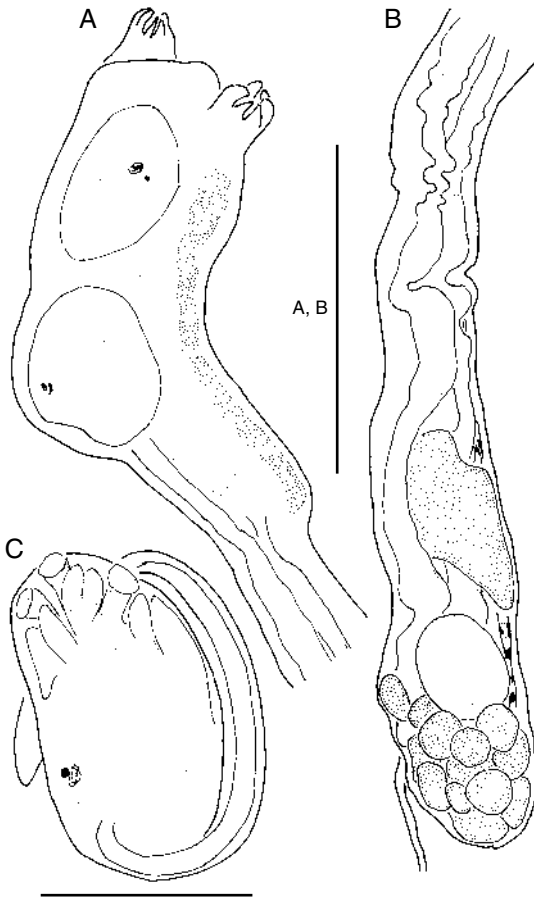


FIG. 35. — *Eudistoma vineum* n. sp.; A, B, zoid in two parts; C, larva. Scale bars: A, B, 1 mm; C, 0.5 mm.

the gonads. The gut loop is straight when the zoid is extended. The round testis lobes are numerous (≈ 40) throughout the space below the stomach (Fig. 34B). The ovary lies centrally among these male lobes. One to four larvae are incubated in the cloacal cavity. They are rather small, 0.65 mm for the trunk, and only one matures at a time (Fig. 34C). They have three adhesive papillae, which are not equidistant, and six ampullae on each side; the four central ones are branched, giving an appearance of two series of ampullae.

The ocellus and otolith are present. The larval branchial sac is not yet differentiated.

REMARKS

By its colony shape, the circular systems of zooids, and the structure of the larva, this species closely resembles *E. ovatum*; but it does not contain sand and the larvae are much smaller, with fewer ampullae.

Eudistoma vineum n. sp. (Figs 35; 117E)

TYPE MATERIAL. — Papua New Guinea. Louisiade Archipelago, Deboyne Islands, Panaete Island, 10°41.72'S, 152°20.13'E, 5 m, 30.V.1998 (MNHN A3 EUD 227).

ETYMOLOGY. — From the Latin *vinum*: wine.

DESCRIPTION

The colonies are made of small lobes about 2 cm in height and 1 cm in diameter for the head. The lobes arise from a common base and are sometimes ramified. There are some epibionts on the peduncles but not on the heads which hold the thoraces and abdomens of the zooids. The colony surface is sand-free but there is some sparse sand inside. The colour is wine purple (Fig. 117E) (hence the species name). The most extended zooids are 8 mm long (Fig. 35A, B). Both siphons are short with six lobes. No arrangement in systems could be seen. In formalin the dark pigment is mostly present in the upper layer of the tunic and in the upper part of the thoraces.

The strong thoracic musculature is prolonged in two ribbons along the abdomen, at the bottom of which they make little horns. The body is prolonged by a vascular process. The first stigmata row has about 12 stigmata on each side. The abdomen is longer than the thorax. The stomach is posterior. The gut loop is straight and the rectum is not twisted. The gonads are normally placed in the bottom of the gut loop, with many round testis follicles and a central ovary (Fig. 35B).

One larva is incubated at a time in the cloacal cavity (Fig. 35C). The larval trunk measures 0.85 mm. There are three adhesive papillae in a line and four pairs of flat, stout ampullae, partly

bifurcated, the posterior ones ventrally elongated into triangle.

REMARKS

The species has no very distinctive adult character; it is best characterised by the structure of its larva. But the colour of the colonies and their development of ramified lobes, while not distinctive, are nonetheless uncommon.

Eudistoma viride Tokioka, 1955
(Figs 36; 117F)

Eudistoma viridis Tokioka, 1955: 49, pl. IV, figs 1-5. Type locality: Palau.

Eudistoma viride – Tokioka 1967: 122, Palau. — Millar 1975: 220, fig. 12, Philippines. — Nishikawa 1984: 118, Chuuk, Ponape. — Rho & Huh 1984: 106, pl. 9, figs 1-4, Korea. — Rho & Lee 1989: 65, Korea.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Chuuk Lagoon, Dublon Island, on mangrove roots, 7°22.90'N, 151°53.55'E, 0.5 m, 9.VII.1992 (MNHN A3 EUD 136).

Palau. Koror, Ngermerrangel Island, Flatworm, marine lake, 7°19.12'N, 134°30.40'E, 1 m, 4.VII.1994 (MNHN A3 EUD 135); Shrimp lake, marine lake on E side Ngerruktabel Island, Ngeremdiu, 7°15.27'N, 134°26.68'E, 1 m, 26.XII.1994 (MNHN A3 EUD 152).

Fiji. coll. Ireland (MNHN A3 EUD 92).

DESCRIPTION

The colonies are bushes of small lobes (Fig. 117F). The zooids, arranged in one to three systems per lobe, protrude slightly on round heads. The tunic is translucent. The zooids have a yellow-green pigment in the body wall with a black spot on the neural ganglion and at the top of the endostyle. Both siphons are short. There are six oral lobes and six, sometimes eight, cloacal lobes. There are unperforated areas anteriorly and posteriorly to the branchial sac, which has about 25 stigmata in a half row (but this was difficult to count, the zooids being contracted). There is no narrowing between the thorax and abdomen. The gut loop is long with a posterior smooth-walled stomach in trapezium. The rectum bends at the stomach level even in less contracted zooids (Fig. 36). The gonads lie in the posterior gut loop (Fig. 36).

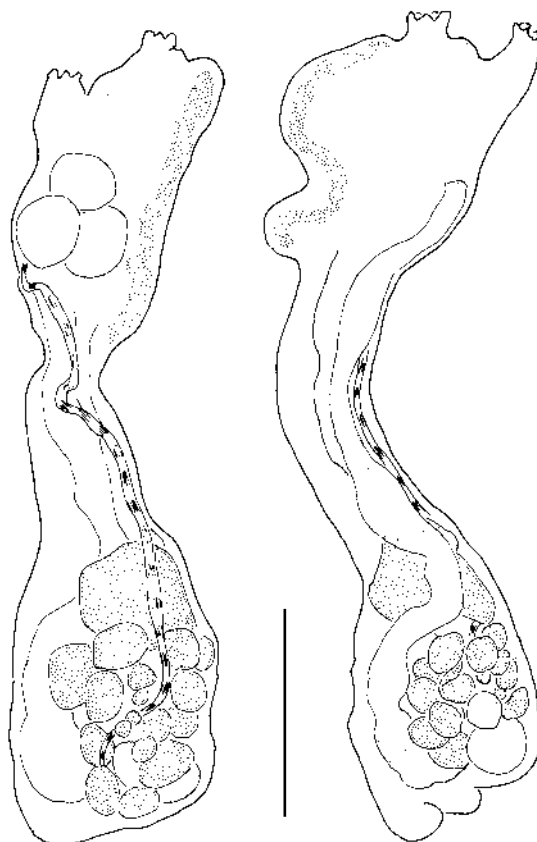


FIG. 36. — *Eudistoma viride* Tokioka, 1955, two zooids. Scale bar: 1 mm.

One to three larvae are incubated in the cloacal cavity. They were not mature in the specimens we examined.

REMARKS

By the shape of the colonies, the pigmentation, and the size of the zooids, this material corresponds well to the original description of the species, and was collected in the same area.

Eudistoma vulgare Monniot F., 1988

Eudistoma vulgare Monniot F., 1988: 213, fig. 7 E, H. Type locality: New Caledonia.

MATERIAL EXAMINED. — **Palau.** Siaes tunnel, West barrier reef, 7°18.76'N, 134°13.50'E, 30 m, 16.XII.1997 (MNHN A3 EUD 199-200).

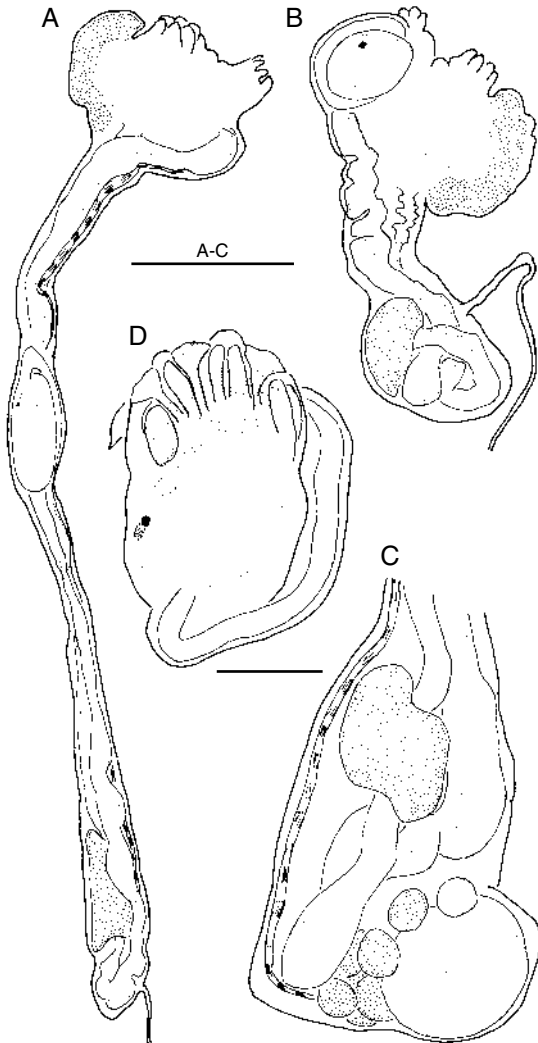


FIG. 37. — *Eudistoma* sp.; A, B, two zooids; C, abdomen; D, larva. Scale bars: A, B, 1 mm; C, 0.5 mm; D, 0.25 mm.

Eudistoma sp.
(Figs 37; 118)

MATERIAL EXAMINED. — Palau, Western barrier reef, Blue Hole, 7°08.10'N, 134°13.90'E, 12 m, 11.V.97 (MNHN A3 EUD 231).

DESCRIPTION

The colonies are flat cushions, the largest 5 mm in thickness and 25 mm in diameter. The tunic is entirely embedded with sand: but a small area

around each oral siphon remains clear. This gives an areolated appearance to the smooth colony surface (Fig. 118A). The tunic and zooids are colourless. Some white pigment spots are present in the mucous layer surrounding the zooids.

The zooids are very contracted. The most relaxed ones reach 5 mm, but they may be longer in life. The abdomen is much longer than the thorax (Fig. 37A). Both siphons are short. The number of stigmata could not be counted.

The abdomen is much narrower than the thorax. The oesophageal part is especially slender. The abdomen is enlarged only in its basal part, which contains a round stomach and the gonads (Fig. 37C). The gut loop is straight in the most relaxed zooids. The testis, at the bottom of the gut loop, has numerous lobes. The ovary, beside the testis, is poorly developed in this specimen. One or two larvae are incubated inside the cloacal cavity (Fig. 37B). Only one mature larva has been found (Fig. 37D). It has three adhesive papillae on a line, paired ampullae dorsally and ventrally, and three odd, alternating ampullae. The trunk measures 0.7 mm.

REMARKS

The strongly contracted state of the colonies does not allow one to ascertain the musculature, the branchial sac, or shape of the gut loop. The single larva, though, is enough to indicate that this specimen cannot be assigned to a known species. An arrangement of zooids into systems was not evident, and it was not possible to decide if the siphons were in circles or not.

By its colonial structure as low cushions, the embedded sand, and the clear spots around the oral apertures, this species looks like *Eudistoma constrictum* Kott, 1990. But the larva, with only odd ampullae between its adhesive papillae, does not correspond to the description of this species.

Genus *Exostoma* Kott, 1990

Exostoma ianthinum (Sluiter, 1909)

Polycitor ianthinus Sluiter, 1909: 20. Type locality: Indonesia.

Exostoma ianthinum – Monniot F. & Monniot C. 1996: 197, fig. 33, pl. 5F, western Pacific.

MATERIAL EXAMINED. — **Federated States of Micronesia**. Chuuk lagoon, Nemoton Bay, Polle Reef, 7°21.54'N, 151°35.63'E, 10 m, 9.VIII.1993 (MNHN A3 EXO 8).

Palau. Wonder Channel, 7°10.83'N, 134°21.67'E, 1 m, 30.VIII.1996 (MNHN A3 EXO 9).

Papua New Guinea. Louisiade archipelago, Beboyne lagoon, Nivani Island, 10°47.46'S, 152°23.08'E, 10 m, 30.V.1998 (MNHN A3 EXO 10).

Genus *Hypodistoma* Tokioka, 1967

Hypodistoma deerratum (Sluiter, 1895)

Distoma deerrata Sluiter, 1895: 167. Type locality: Australia.

Hypodistoma deerratum – Monniot F. & Monniot C. 1996: 198, pl. 5H, Papua New Guinea.

MATERIAL EXAMINED. — **Papua New Guinea**. Milne Bay Province, East Cape, Boia Boia Waga Island, 10°12.26'S, 150°44.75'E, 18 m, 27.V.1998 (MNHN A3 HYP.B 3).

Genus *Nephtheis* Gould, 1856

Nephtheis fascicularis (Drasche, 1882)

Oxycorynia fascicularis Drasche, 1882: 175. Type locality: Caroline Islands.

Nephtheis fascicularis – Monniot F. & Monniot C. 1996: 201, fig. 34, pl. 6A, western Pacific.

MATERIAL EXAMINED. — **Philippines**. Luzon, Maricaban Island, Bethlehem, 13°40.36'N, 120°50.50'E, 13 m, 22.VII.1994 (MNHN A3 NEP 4).

Federated States of Micronesia. Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm growing on nylon line, 6°57.68'N, 158°17.85'E, 8 m, 15.X.1996 (MNHN A3 NEP 5).

Palau. West channel, 7°32.42'N, 134°28.37'E, 7 m, 21.X.1997 (MNHN A3 NEP 7); 12 m (MNHN A3 NEP 8).

Indonesia. Komodo Island, coll. Erhardt (MNHN A2 NEP 6).

Genus *Polycitor* Renier, 1804

Polycitor circes Michaelsen, 1930

Polycitor circes Michaelsen, 1930: 495. Type locality: Australia. — Monniot F. & Monniot C. 1996: 184, Indonesia, and synonymy.

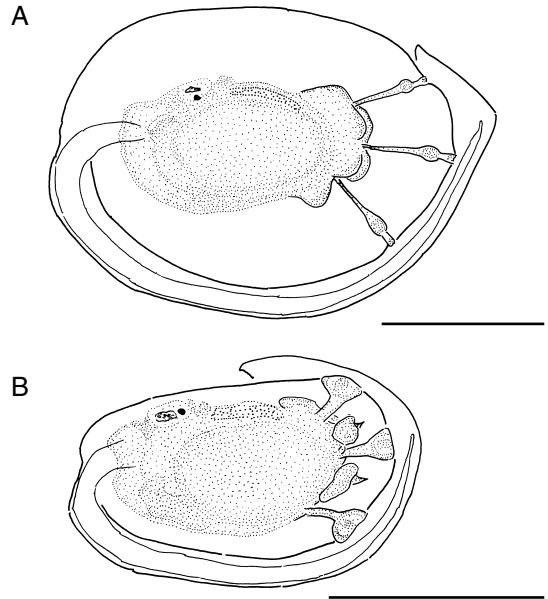


FIG. 38. — Larva; **A**, *Polycitor giganteus* (Herdman, 1899); **B**, *Polycitor translucidus* Kott, 1957. Scale bars: 0.5 mm.

MATERIAL EXAMINED. — **Papua New Guinea**. Louisiade Archipelago, Conflict Group, 10°43.52'S, 151°44.54'E, 20 m, 29.V.1998 (MNHN A3 POLA 32).

Polycitor giganteus (Herdman, 1899)
(Figs 38A; 118B)

Polyclinum giganteum Herdman, 1899: 79. Type locality: South Australia.

Synonymy: see *Polycitor giganteus* – Kott 1990: 171, fig. 64, pl. 13d-h.

MATERIAL EXAMINED. — **Papua New Guinea**. Louisiade, Nivani, 10°47.46'S, 152°23.08'E, 7 m, 30.V.1998 (MNHN A3 POLA 33).

DESCRIPTION

The translucent colony (Fig. 118B), 6 cm in diameter, was collected in a crevice. From the surface, the zooids can be seen in the tunic, but there are no white rings around the siphons, only white spots on the oral lobes. The tunic's consistency is firm with a very resistant surface layer and a more gelatinous internal tunic.

The zooids are not crowded and not distributed in organised systems. Both siphons are tubular

with six lobes. The longitudinal thoracic muscles converge toward the base of the endostyle. There are 14 rows of numerous stigmata. The zooids are strongly contracted, and so the structure of the abdomen was not clearly evident. The stomach has two longitudinal bands.

The larvae are numerous in the cloacal cavity, up to six in a zooid. The larval trunk measures 1.25 mm. The three adhesive papillae, in a line, have long thin stems; between them are four round ampullae which are not well-formed (Fig. 38A).

REMARKS

This spectacular species was, until now, known only from Australia, so it is surprising to find it in Papua New Guinea. It differs from *P. circes* Michaelsen, 1930 in its larval structure.

Polycitor translucidus Kott, 1957 (Figs 38B; 118C)

Polycitor translucidus Kott, 1957a: 81. Type locality: western Australia. Synonymy: see Kott 1990: 177, fig. 66 d-g.

MATERIAL EXAMINED. — Palau. Babeldaob, West channel, 7°32.42'N, 134°28.37'E, 10 m, 25.X.1997 (MNHN A3 POLA 29).

DESCRIPTION

The colonies are dome-shaped, firm, gelatinous, glassy, with a short and thick peduncle. The tunic is perfectly transparent and colourless, and reveals the widely spaced, radially arranged zooids (Fig. 118C). The largest colonies have a hemispherical head 5 to 6 cm in diameter and 2 to 3 cm thick. There is no sediment on or in the colonies.

The fixed zooids are deeply retracted into the colony head. Both siphons have six rounded lobes. The thoracic musculature is mostly longitudinal with eight to 10 strong bundles, prolonged in ribbons along the abdomen. There are 12 to 14 rows of elongated stigmata, separated by high transverse membranes. About 35 stigmata were counted in the second half-row.

The abdomen is long, but so contracted that the different parts of the gut cannot be detailed. The

stomach is very posterior, cylindrical, with a smooth wall raised in two longitudinal crests on each side of the typhlosole. The gonads, of ordinary appearance, are located in the gut loop. One or several irregular but thick vascular processes prolong the abdomen.

The embryos are incubated (up to 10) in large number in the thoracic cloacal cavity. The most advanced larvae are rather small (0.75 mm for the trunk), with three adhesive papillae in a line at the top of long and very thin stems. Between them are three pairs of odd ampullae that have a round tip on one side and pointed tip on the other side (Fig. 38B).

REMARKS

This species is very close to the European *P. crystallinus* (Renier, 1804), which has even smaller but very similar larvae. *P. translucidus* is widely distributed from western Australia into the western and central tropical Pacific Ocean.

Genus *Polycitorella* Michaelsen, 1924

Polycitorella coronaria Monniot F., 1988 (Figs 39; 118D)

Polycitorella coronaria Monniot F., 1988: 228. Type locality: South Australia. Synonymy: see Kott 1990: 184, fig. 68, South and western Australia.

MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 12 m, 1.VI.1998 (Sample: CRRF). — Louisiade Archipelago, N side Tagula Island, Ima Channel, 11°25.92'S, 153°26.78'E, 7 m, 4.VI.1998 (MNHN A3 POL.B 5). — Coral Sea, Eastern Fields, 10°02.22'S, 145°33.01'E, 25 m, 14.VI.1998 (Sample: CRRF). — Coral Sea, Eastern Fields, 10°00.66'S, 145°39.90'E, 12 m, 14.VI.1998 (MNHN A3 POL.B 6).

DESCRIPTION

The colonies are flat cushions, the largest 4.5 × 2.5 cm across and 12 mm thick. The tunic's consistency is firm. The colour in life is white (Fig. 118D) or grey, while in formalin the

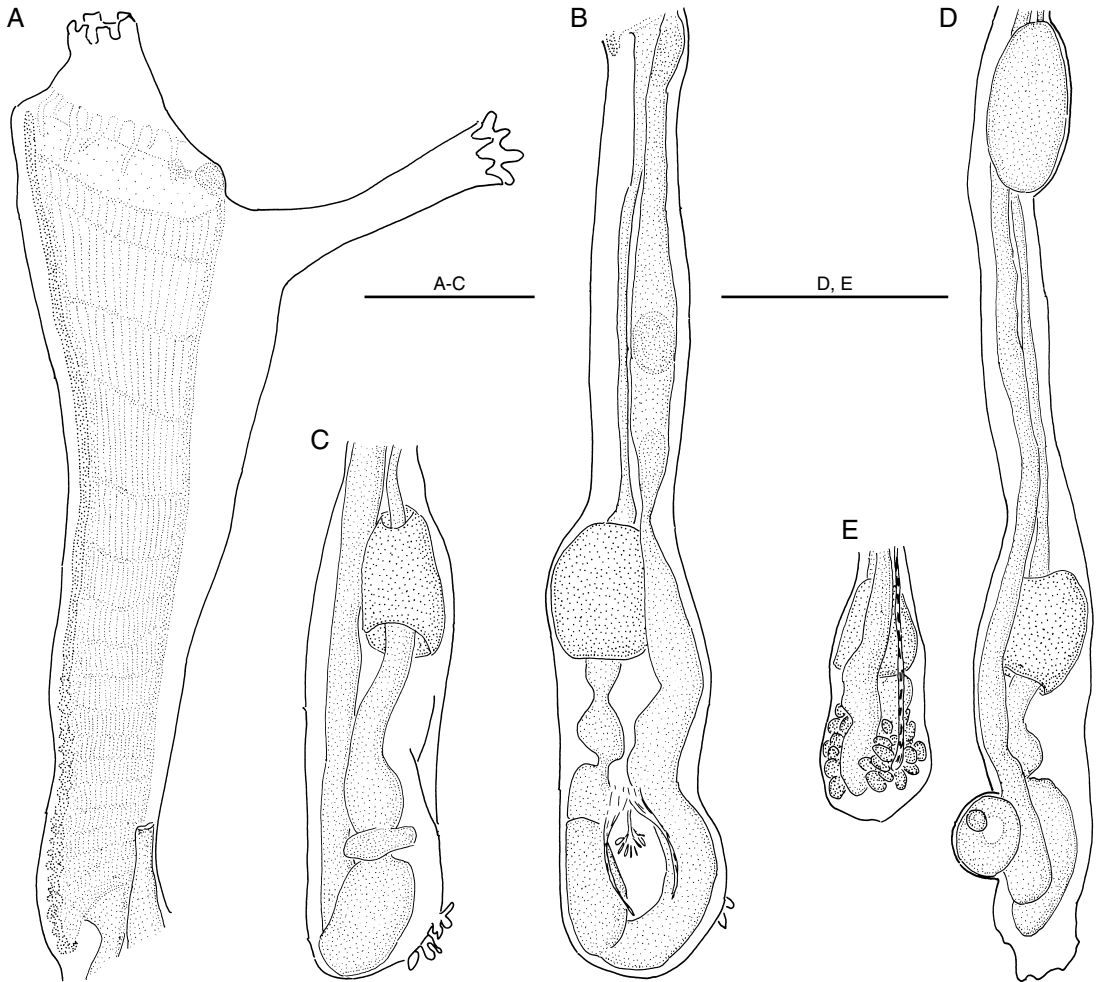


FIG. 39. — *Polycitorella coronaria* Monniot F., 1988; **A, B**, two parts of a zooid; **C**, shape of the gut; **D**, abdomen with a female gonad; **E**, testis. Scale bars: A-C, 1 mm; D, E, 2 mm.

animal is pale grey with black inclusions at the level of the oesophagus. The pigment cells are mostly distributed in the upper layers of the colony; at the surface and around the thoraces. The thoraces can be extracted easily, but the abdomens are more tightly encased in the tunic. Spicules in the tunic are sparse, and they are less numerous in the upper layer, but denser in the abdominal layer. They are stellate, comprising bi-pyramidal rays, and small, 45 µm in diameter. They are often dissociated or grouped into irregular balls. The zooids are

arranged in stellate systems of six to seven individuals, the oral siphons far apart in a circle and the cloacal siphons grouped in the centre.

The zooids (Fig. 39A, B) are 1 to 1.5 cm long, the thorax equal to the abdomen except when retracted. The oral siphon has six lobes with flat tips. The cloacal siphon is very long, ending in six equal lobes. The thoracic musculature has transverse and longitudinal fibres regularly criss-crossed on the thorax, united in two bundles on the abdomen.

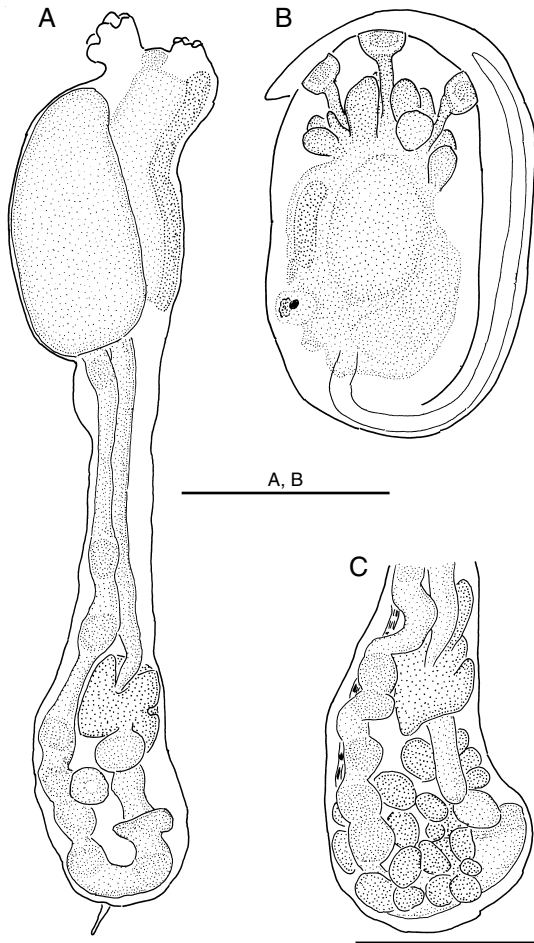


FIG. 40. — *Polycitorella mariae* Michaelsen, 1924; **A**, zoid; **B**, testis; **C**, larva. Scale bars: A, B, 1 mm; C, 0.5 mm.

There are 24 oral tentacles in three orders of size. The branchial sac is elongated with up to 18 rows of stigmata, and there are 30 to 40 stigmata in the first row. There are no parastigmatic vessels. The digestive loop is straight; the ovoid stomach is asymmetrical with its dorsal side shorter. There is a short, annular post-stomach (Fig. 39B) separated by a constriction from a short, round mid-intestine (Fig. 39C). The rectum begins without caeca in the descending limb of the gut loop. It makes a slight curve facing the mid-intestine. The bilobed anus opens at the base of the branchial sac (Fig. 39A). The gonads lie in the

gut loop. The colonies were either male or female (Fig. 39D, E). No larvae were mature: only embryos were found in the oviduct, against the oesophagus.

REMARKS

This species has a very variable colour pattern in life, from pure white to grey, but always has a grey tint in formalin. The number of stigmata rows is variable and increases with the size of the zoid and of the colony.

This widely distributed species has been collected in southern and western Australia (Kott 1990; Monniot F. 1988) and now in Papua New Guinea.

Polycitorella mariae Michaelsen, 1924 (Figs 40; 41A; 118E)

Polycitorella mariae Michaelsen, 1924: 279, figs 5; 6. Type locality: New Zealand. — Monniot F. 1988: 227, fig. 13, pl. IIIE, F, Chesterfield Islands.

MATERIAL EXAMINED. — Fiji. Viti Levu, Beqa Passage, Shark Reef, 18°18.08'S, 178°01.05'E, 26.X.1996 (MNHN A3 POL.B 4). — Viti Levu, Suva Harbour, 5-15 m, coll. Ireland (MNHN A3 POL.B 18).

DESCRIPTION

The colonies make very hard cushions 2 cm in thickness and up to 4 cm in diameter. The oral siphons are stellate, grouped in irregular circles around a depression of the tunic in which the cloacal siphons open. The general surface is smooth. The colony's colour in life is cream or pale yellow (Fig. 118E); its zooids are yellow. In formalin preservative the colonies are white. The zooids lie parallel to each other and perpendicular to the colony surface.

The zooids (Fig. 40A) are generally very contracted. Both siphons are tubular with six lobes, the cloacal siphon often longer. The body wall is thick and opaque with a strong longitudinal musculature extending below the thorax in two ribbons along the abdomen. There are 14 rows of stigmata. A narrowing separates the thorax and

abdomen. No crease of the body wall was seen there.

The gut loop is straight (Fig. 40A, B). The stomach, asymmetrical with a smooth wall, lies low in the abdomen. The post-stomach and the mid-intestine are cylindrical.

The gonads lie in the gut loop below the stomach. There are numerous round testis lobes (Fig. 40B). The ovary is central. There is one larva incubated at a time in the inflated cloacal cavity. The trunk is 1.2 mm long. It has three adhesive papillae in a line and four pairs of elongated ampullae (Fig. 40C), and sometimes an additional lateral ampulla. The tail is curled in half a turn around the trunk.

The small spicules have diverse sizes, the largest about 35 μm , but always with the same shape, irregular balls made of short fibrous rays (Fig. 41A).

REMARKS

The diverse colonies collected in the Fiji Islands have different shapes – cushions or lobes with short peduncles – but the base of the colony from which these elements arise is always thick. The size of the zooids and the number of stigmata rows increase with the size of the colony. The spicules in our specimens are the same as in the type specimen. Kott (1990) created *P. orientalis* for a species from Queensland that she synonymized with *Polycitorella mariae* identified by F. Monniot (1988) in the Chesterfield Islands. Her species, without larvae, does not show characters justifying a synonymy. The arrangement of spicules in sheets around the abdomens and their absence elsewhere between the zooids seem distinctive of *P. mariae*.

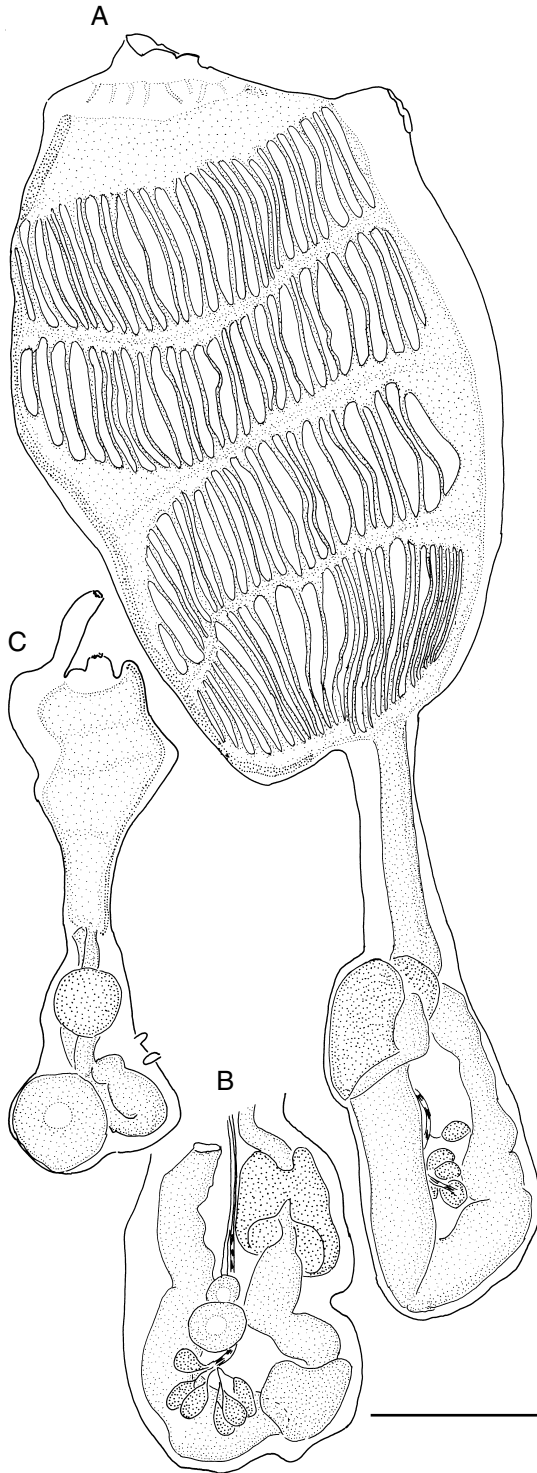
Polycitorella stellifera n. sp.
(Figs 41B; 42; 118F)

TYPE MATERIAL. — Papua New Guinea. Milne Bay Province, East Cape, Boia Boia Waga Island, overhang wall, 10°12.26'S, 150°44.75'E, 18 m, 27.V.1998 (MNHN A3 POL.B 7).

ETYMOLOGY. — From the Latin *stellifer*: stellate.



FIG. 41. — Spicules; A, *Polycitorella mariae* Michaelsen, 1924; B, *Polycitorella stellifera* n. sp. Scale bars: 10 μm .



DESCRIPTION

The incrusting colonies are 1 cm thick, with stellate white systems encircled by greenish-brown areas (Fig. 118F). The colony is soft, rather gelatinous at the surface. There are nine to 10 zooids in a system's circle, and the cloacal openings are grouped in the centre of each system.

The expanded zooids (Fig. 42A) measure 8 to 9 mm in length, with the thorax much longer than the abdomen. Both siphons are very short with six lobes. There are 24 oral tentacles in two orders, sometimes with small ones between them. The thorax is wide and inflated, with very thin longitudinal and transverse muscular fibres that are regularly spaced and crossed. The branchial sac contains four stigmata rows grouped in pairs (Fig. 42A), with 35 to 40 stigmata in the first two half rows. The dorsal part of the first row curves anteriorly.

The gut loop is straight with a smooth-walled stomach (Fig. 42A, B) in the middle of the abdomen or slightly anteriorly of that. The different parts of the intestine are not well-separated. The anus opens at the base of the last row of stigmata. The gonads lie in the gut loop. There are about 10 elongated testis follicles, and the ovary lies close to the sperm duct (Fig. 42B): when mature, an oocyte protrudes beneath the abdomen (Fig. 42C).

The spicules are large (0.4 mm in diameter), with a few long, tapering branches (Fig. 41B). They look like some spicules of *Lissoclinum* species. Pigment cells, brown and round lie scattered in the tunic between the spicules.

REMARKS

This species differs from all other *Polycitorella* species in its branchial sac with only four rows of stigmata. *P. hospitulum* (Savigny, 1816) has six rows of stigmata; all others species have many more rows.

◀ FIG. 42. — *Polycitorella stellifera* n. sp.; A, zooid in a male phase; B, detail of the gut; C, zooids in a female phase. Scale bar: A, B, 1 mm; C, 2 mm.

Genus *Polydistoma* Kott, 1990

Polydistoma oculenum n. sp.
(Figs 43; 119A)

TYPE MATERIAL. — **Philippines**. Mindanao, Davao, SW side of Samal Island, wall, 6°56.31'N, 125°47.66'E, 12 m, 7.IV.1996 (MNHN A3 POL.C 1).

ETYMOLOGY. — From the Latin *oculus*: with eyes.

DESCRIPTION

The dark green colonies (Fig. 119A) are crusts 5 cm thick and up to 15 cm across with an irregular outline. The surface has numerous wide common cloacal apertures each on a short raised cylinder of tunic. Each aperture corresponds to a system's independent common cloacal cavity. The oral openings of the zooids form irregular rings around these common cloacal apertures, and after fixation in formalin they, too, protrude a little at the colony surface.

The tunic is opaque, very dark, and soft, but the surface layer is more elastic. When fixed, the colonies are very contracted and curled, the upper surface becoming concave. The tunic's pigment diffuses in formalin but not in alcohol. The zooids (Fig. 43A) lie perpendicular to the colony surface and are almost black. Both siphons are tubular, narrow, with plain rims. Equal to or slightly longer than the oral siphon, the cloacal siphon is located anteriorly in the thorax and opens into the common cloacal cavity of the system. Sixteen long oral tentacles are distributed along two circles. The neural ganglion is very close to the tentacle ring. Muscles make a strong sphincter around each siphon. Some thin transverse fibres run between the siphons, and, starting from the oral siphon, six to eight thin, regularly spaced longitudinal bundles run down each side of the thorax toward the abdomen. These longitudinal fibres join to make two ribbons on the wall of the abdomen itself, converging toward the posterior part of the gut loop, where they make an anchoring point. A few muscle fibres extend into a post-abdominal process.

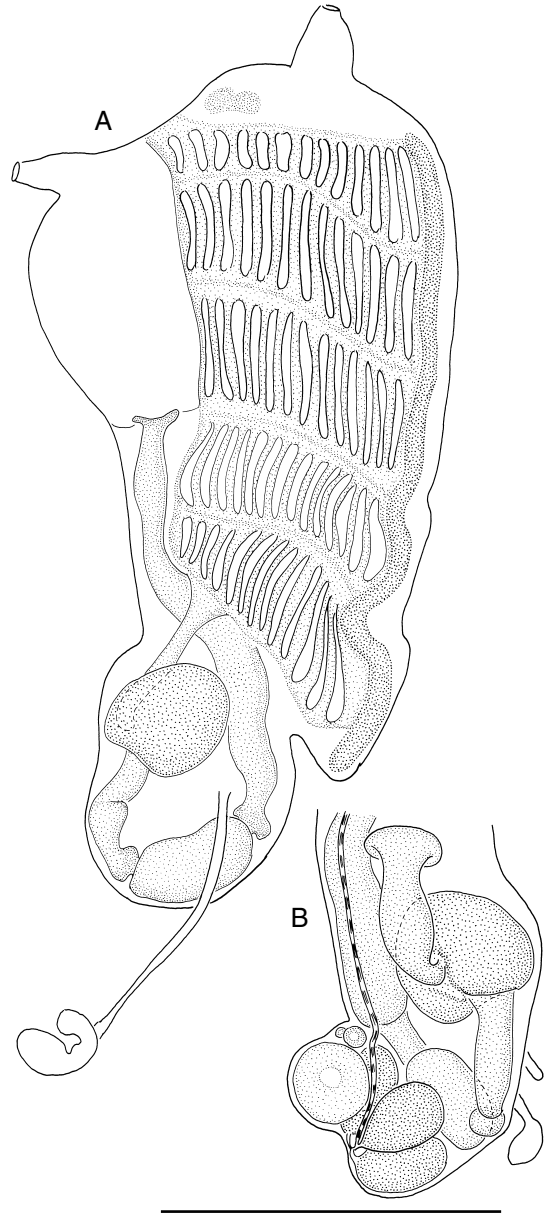


FIG. 43. — *Polydistoma oculenum* n. sp.; A, zooid; B, gonads and gut. Scale bar: 1 mm.

The branchial sac has five rows of 12 to 14 elongated stigmata (Fig. 43A). The languets of the dorsal lamina are clearly displaced on the left side. There are no parastigmatic vessels.

The abdomen is not neatly separated from the thorax (Fig. 43A). The cylindrical oesophagus is short and narrow. The stomach is spherical and smooth-walled, with the oesophageal and intestinal connections close to each other (Fig. 43B). The first intestinal segment following the stomach is narrow with a slightly protruding ring at its middle. The mid-intestine is inflated between two narrowings. The posterior intestine begins with caeca. The rectum crosses the oesophagus and opens through a bilobed anus at the level of the third transverse vessel, to which it is attached by a strip of tissue.

The gonads (Fig. 43B) are located far posteriorly on the left side of the body, against the mid-intestine, and bulge around it beneath the gut loop. The testis is divided into two to five (more often three or four) joined lobes, with short sperm ducts fused into a straight common sperm duct that runs alongside the rectum. The ovary develops on the external side of the testis (Fig. 43B). Only one oocyte grows at a time, protruding below the abdomen.

There are one or two vascular processes (Fig. 43A) issuing from the right side of the abdomen, one of which always has some muscular fibres at its origin and ends in a clear, wide ampulla. In addition one or two cylindrical prolongations, more opaque and of variable length, extend from the zooid into the deeper part of the tunic.

No larvae were present in the colonies examined, and no trace of an incubatory pouch was detected. Some rare and poorly developed buds lie isolated in the depths of the colony.

REMARKS

The characters leading us to include this species in the genus *Polydistoma* Kott, 1990 are the five rows of stigmata in the branchial sac, the oesophagus placed as it is partly inside the thorax, and the position of the gonads beside the gut loop. *Polydistoma oculeum* n. sp. differs from the two other species of the genus, *P. fungiforme* Kott, 1990 and *P. longitube* (Kott, 1957), in several characters. It has common cloacal cavities that are absent in the others and

a very different colony shape, no lobes on the siphonal rim, and a short cloacal siphon directed dorsally. This last character results in the circular disposition of the zooids around a nearby common cloacal opening.

The genera *Hypodistoma* and *Exostoma* have common cloacal cavities, but only three rows of stigmata, and the abdomen in them is clearly separated from the thorax.

Family HOLOZOIDAE Berrill, 1950

Genus *Distaplia* Della Valle, 1881

Distaplia mikropnoa (Sluiter, 1909)
(Figs 44; 119B)

Polyclinum mikropnous Sluiter, 1909: 94, pl. 5, fig. 1.
Type locality: Indonesia.

Distaplia mikropnoa – Tokioka 1967: 129, fig. 46,
Palau.

MATERIAL EXAMINED. — Palau. Koror, West Malakal Harbour mouth, 7°20.37'N, 134°25.7'E, 40 m, 20.V.1994 (MNHN A3 DIS 69).

DESCRIPTION

The colonies have several lobes on thick peduncles arising from a common base. In formalin, the largest lobe has a head as long as the peduncle 2 cm and a head diameter of 1.8 cm. The colonies in life were pink; the colour has faded in formalin fixative but a red spot remains at the neural ganglion. There are several common cloacal openings on each head; these apertures have a lobed edge and are situated apically at the ends of double rows of zooids (Fig. 117B). The zooids lie perpendicular to the colony surface.

The zooids have wide cloacal openings with two lips (Fig. 44A). The anterior one has a pointed or lobed tip and some transverse musculature. There are 12 oral tentacles of two orders. The branchial sac has more than 25 stigmata on each side in the first row. There are no parastigmatic vessels.

The gut forms a wide open loop (Fig. 44A). The stomach has numerous neat folds. There is a pyloric ampulla in the loop.

The gonads are appended in a posterior pouch of the abdomen (Fig. 44A). About 15 male follicles are in a tight cluster. The sperm duct is directed posteriorly and then forms a loop against the ovary before running anteriorly to follow the rectum (Fig. 44A).

The larvae (Fig. 44B) are incubated in pouches hanging on the right side of the zooid's thorax (Fig. 44A). They have a trunk 1.1 mm long and three adhesive papillae in a triangle. The larval gut, folded under the thorax, already has a plicate stomach.

REMARKS

The zooids of this species are very similar to those of *Distaplia stylifera* (Kowalevsky, 1874). They differ essentially in the absence of parastigmatic vessels.

Tokioka's (1967) description from Palau specimens exactly corresponds to our material, with similar irregular double rows of zooids, pedunculate colonies, and an absence of parastigmatic vessels.

Distaplia regina Kott, 1990
(Fig. 45)

Distaplia regina Kott, 1990: 125, fig. 44c. Type locality: Australia, Queensland. — Monniot F. & Monniot C. 1996: 216, fig. 38B, C, pl. 7A, Palau.

MATERIAL EXAMINED. — Palau. Koror, West Malakal Harbour mouth, 7°20.37'N, 134°25.78'E, 40 m, 21.V.1994 (MNHN A3 DIS 76).

DESCRIPTION

The colonies are club-shaped, or cushion-like sometimes with a short peduncle. They reach 3 cm in height and 1 to 3 cm in diameter. The colour in life is slightly translucent cream, and the consistency is firm and rubbery. No sediment is embedded. The zooids are arranged in lines converging at the apex of the colony, where the common cloacal cavities open.

The zooids are in the outer part of systems, while the large larvae are incubated near the centres of the systems. The wide thorax has a large cloacal opening (Fig. 45A). The languet is either triangular or enlarged with its rim cleft into several teeth

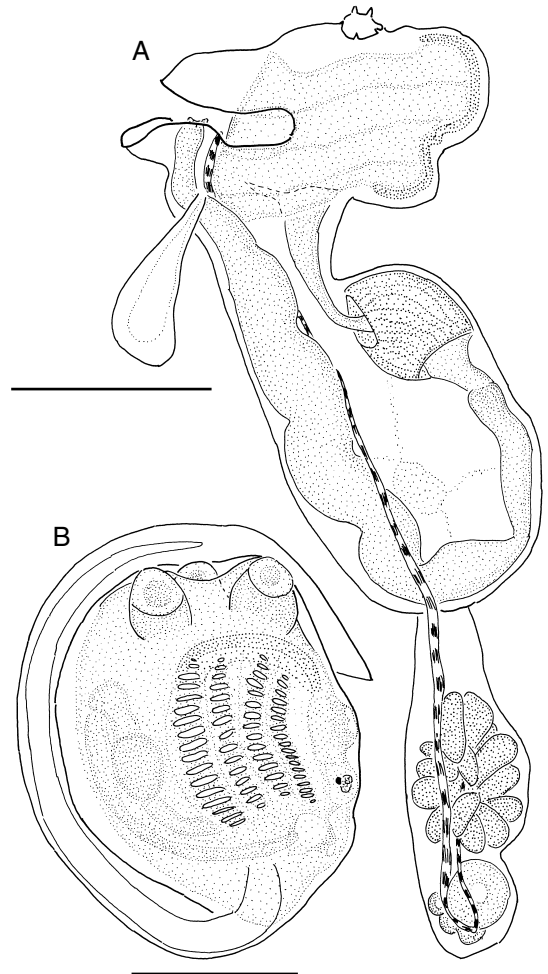


FIG. 44. — *Distaplia mikropnoa* (Sluiter, 1909); A, zooid; B, larva. Scale bars: A, 1 mm; B, 0.5 mm.

when it is close to the common cloacal aperture. The thoracic muscles are mostly longitudinal, thin but dense. There are 12 oral tentacles of two sizes.

The branchial sac has more than 20 stigmata even in the posterior half row. They are not crossed by parastigmatic vessels. Numerous stigmata are already pierced in buds. The gut loop is twisted. The round stomach has an areolated wall (Fig. 45B). The intestine lacks definite compartments; its shape depends on the gut contents. The anus has two large lobes.

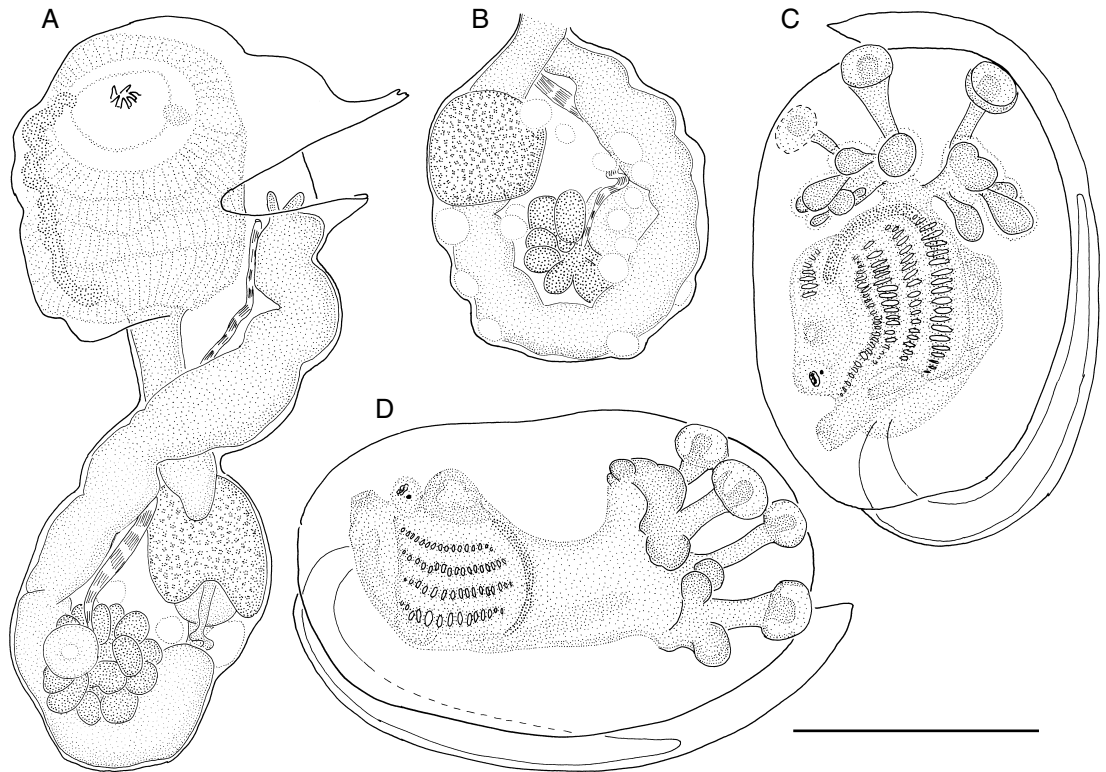


FIG. 45. — *Distaplia regina* Kott, 1990; **A**, zooid; **B**, abdomen; **C**, **D**, larvae. Scale bar: 1 mm.

Clear vesicles occur along the whole length of the gut. Ten to 15 testis follicles in a cluster occupy the centre of the gut loop, with the ovary against them (Fig. 45B). The sperm duct is straight. The vascular process is thin and short. The larvae are very large, 2 mm for the trunk (Fig. 45C, D). They are isolated early from the mother zooid into a pedunculate brood pouch. The tail does not reach around half the trunk. The three adhesive papillae, in a triangle, are circled at their base by large irregularly shaped ampullae whose number is not constant (Fig. 45C, D). The larval gut and branchial sac are developed early, and the clear pyloric vesicle already is apparent.

REMARKS

This species has been collected at the same station as *Distaplia mikropnoa*, which differs in having a plicated stomach wall, gonads in a long

pedunculate pouch posterior to the abdomen as in *Distaplia stylifera*, and much smaller larvae. Larger but not brooding specimens were previously collected in Palau (Monniot F. & Monniot C. 1996).

The species is presently known from Australia and Palau.

Distaplia stylifera (Kowalevsky, 1874) (Fig. 119C)

Didemnum stylifera Kowalevsky, 1874: 43. Type locality: Red Sea.

Distaplia stylifera – Millar 1975: 224. Synonymy: see Monniot C. & Monniot F. 1984: 571. — Monniot F. 1988: 197, fig. 1. — Kott 1990: 127, part.

MATERIAL EXAMINED. — **Philippines**. Bohol Sea, Balicasag Island SW of Bohol, 9°31.24'N, 123°41.11'E, 12 m, 16.IV.1997 (MNHN A3 DIS 75).

DESCRIPTION

In the Philippines, this species occurs as pale yellow cushions about 1 cm thick. The oral siphons are arranged in circles around round common cloacal apertures (Fig. 119C). The colony surface is either flat or has grooves delimiting the systems. The zooids are perpendicular to the colony surface. Young zooids have a tubular cloacal siphon, but in aged zooids the cloacal aperture is large with a large upper languet and a shorter or absent posterior lip. The oral siphon has six short lobes. The thorax has numerous longitudinal muscular fibres. The four rows of stigmata are each cut by a parastigmatic vessel, which is not complete in the youngest zooids. There are on average 20 stigmata in a half row. The stomach is oval with thickenings forming longitudinal folds that are irregular and often cut. There was no obvious regional differentiation in the intestine. A large, spherical pyloric ampulla lies in the gut loop.

Both the male and female gonads are located in a pouch on a long peduncle below the abdomen. The testis follicles are not numerous, about five. The ovary lies against the testis. The sperm duct is straight.

The incubatory pouch, with a long peduncle, normally contains a single embryo. The larva has a well-pigmented ocellus and an irregular brown otolith. The three adhesive papillae are short and in a triangle. The larva has already four rows of stigmata. The tail describes half a circle around the trunk.

REMARKS

This material corresponds well to other specimens described from the Atlantic, Indian, and Pacific Oceans. It differs from other *Distaplia* species with pedunculate gonads:

- *D. australensis* Brewin, 1953 has pedunculate colonies, a single common cloacal aperture, and no parastigmatic vessel;
- *D. knoxi* Brewin, 1954 has a pedunculate colony and no parastigmatic vessels;
- *D. mikropnoa* (Sluiter, 1909) has pedunculate colonies, no parastigmatic vessels, and systems of a different shape than *D. stylifera*;

– *D. prolifera* Kott, 1990 has large zooids, circular systems, and parastigmatic vessels, but the stomach does not have folds;

– *D. tokioka* Kott, 1990 and *D. violetta*, Kott, 1990 are sessile: they have parastigmatic vessels and few stomach folds;

– *D. skoogi* Michaelsen, 1934 has a smooth stomach;

– *D. stylifera* may have very different colony shapes at one locale: completely sessile and encrusting colonies or pedunculate ones. The systems are always circular. The species is widely distributed in tropical areas of all oceans.

Genus *Sycozoa* Lesson, 1832

Sycozoa cerebriformis (Quoy & Gaimard, 1834)
(Fig. 46)

Aplidie cerebriforme Quoy & Gaimard, 1834: 625, pl. 92, figs 16; 17. Type locality: Australia western Port (MNHN A3 SYC.A 29).

Sycozoa cerebriformis – Hartmeyer 1919: 121. — Brewin 1953: 58, and synonymy. — Kott 1957a: 99; 1972b: 8; 1972c: 170; 1976: 57. — Millar 1963: 708; 1966: 365. — Kott 1990: 143.

Sycozoa seiziwadai Tokioka, 1952: 99. — Kott 1990: 152.

MATERIAL EXAMINED. — **Indonesia.** Komodo Island, Padar Kecil, Drop-off 7-15 m, coll. Erhardt (MNHN A3 SYC 31).

DESCRIPTION

Colonies at the same station have various sizes and colours. They form simple or multiple fan-like lobes a top peduncles of ovoid or round section. The flattened lobes contain the zooids. The peduncles sometimes branch at mid-length. The peduncles are about 2 cm long and the heads 1.5 cm long. A lobe has several double rows of oral openings on the sides and the common cloacal openings of those systems at the top.

There are 10 to 12 functional zooids in a row, as in the holotype. The colonies are dioecious (Fig. 46A, B). The colour varies from purple to orange or yellow-green, unrelated to one sex or

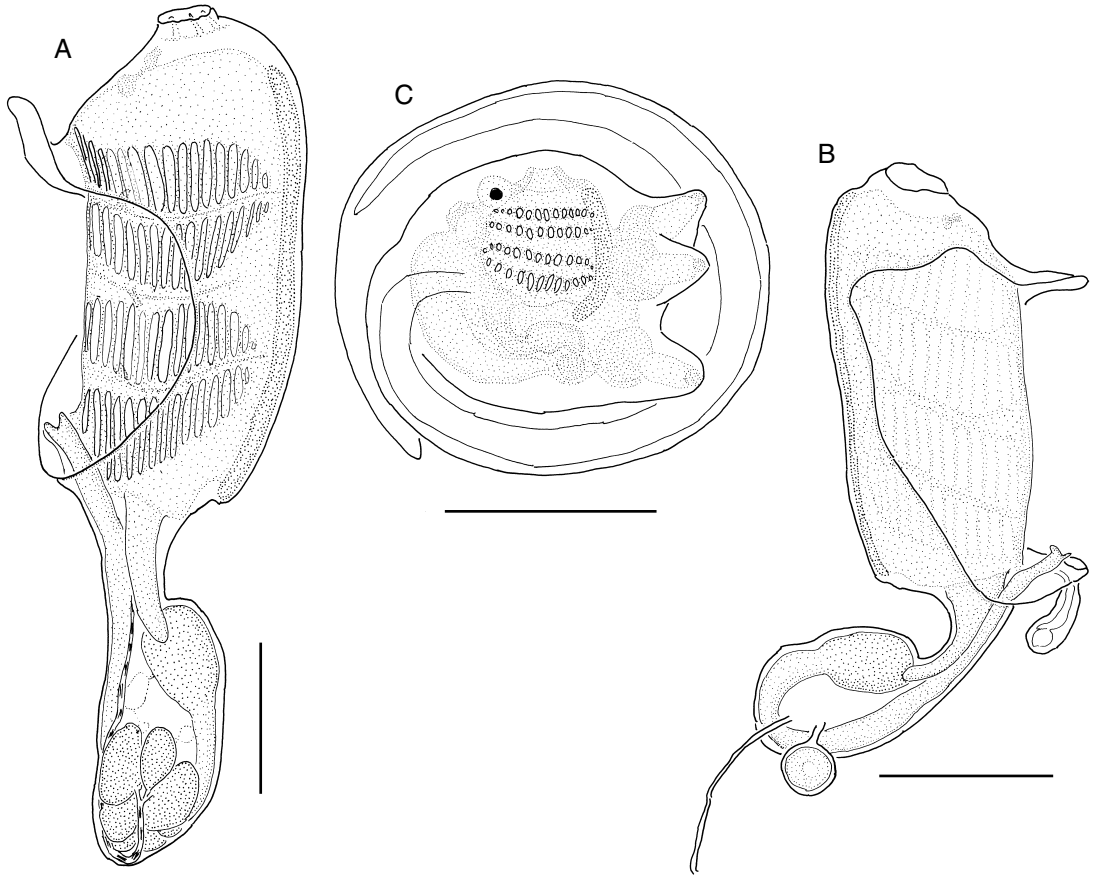


FIG. 46. — *Sycozoa cerebriformis* Quoy & Gaimard, 1834; **A**, male zooid; **B**, female zooid; **C**, larva. Scale bars: A, C, 0.5 mm; B, 1 mm.

the other. The mature larvae are isolated in the upper part of the colony.

Amphipods inhabit the cloacal channels.

The size of the zooids varies slightly with colony size, and in the same double row their size increases from the base of the row to the common cloacal opening. The oral siphon is very short with six teeth. The branchial sac is not contracted (Fig. 46A). In the largest female zooids, we counted about 20 stigmata in the first half row and 19 in the fourth half row, 19 and 18 in male zooids. The cloacal opening is wide; the upper margin elongated in a languet with a round tip. Both siphons have a weak muscular sphincter.

The abdomen and thorax are linked by a narrow waist (Fig. 46A, B). The stomach is barrel-

shaped, not clearly separated from the tubular remainder of the gut. The anus has two lobes. A small number of sinuous but parallel pyloric tubules lines the rectum. They converge at an elongate ampulla in the gut loop which opens by a short channel into the middle of the stomach. The gonads are in the gut loop. The immature ovary lies in the gut loop, but as it develops, it becomes pedunculate and projects from the abdomen (Fig. 46B).

The testis, with four to six lobes in a cluster lies inside the gut loop (Fig. 46A). The sperm duct makes a hook at the bottom of the abdomen and follows the rectum.

The embryos (Fig. 46C) are quickly separated from the mother zooid. The brood pouch hangs

by a very short peduncle from the thorax, under the cloacal aperture. There is a single embryo in each pouch. The developed larvae (Fig. 46C) all lie in the upper part of the colony, in the tunic. Their trunk is 0.8 mm long; the tail describes a little more than one turn around it. The three long, conical adhesive papillae diverge from each other; four rows of stigmata and the gut are already differentiated, and one to three very small buds are to be found in the ventral part of the larva. There is an otolith but no ocellus (Fig. 46C).

The epicardic tube has not been seen.

REMARKS

These specimens correspond perfectly to those collected by the Astrolabe Expedition in 1829 at Western Port (southern Australia) which were briefly described by Quoy & Gaimard (1834). Three of those colonies are stored in alcohol in the MNHN collections; one male and two females with larvae. One colony has two lobes and the peduncle is divided in two parts. One colony has the top part rolled. The colonies are well-preserved. There are 10 to 14 zooids in a row, more often 10 to 12. The zooids are slightly contracted and permit a detailed observation. We have not seen papillae at the colony surface but have found crystals, which may be of salt as they melt in water. We have counted up to 15 stigmata in the two last half rows. The ovary is pedunculate, protruding well outside the gut loop. The testis, with four lobes, also protrudes but remains in the basal part of the gut loop.

The larvae in these old specimens have the same size and anatomy as those collected in Komodo. *Sycozoa seiziwadai* Tokioka, 1952 from the Arafura Sea is probably a synonym of *S. cerebri-formis*. The colonies do not show differences in size or shape. Tokioka indicates 15 to 20 stigmata per row. This number is higher than that in the type but similar to what is found at Komodo. All other characters correspond. Tokioka's description is short, and he only describes the colony shape. He probably did not know of Quoy & Gaimard's work.

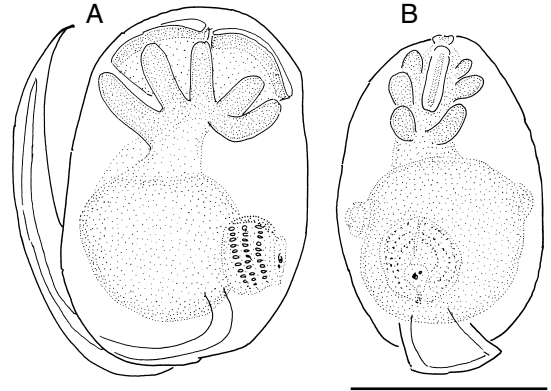


FIG. 47. — *Sigillina cyanea* (Herdman, 1899), larva. Scale bar: 2 mm.

Genus *Sigillina* Savigny, 1816

Sigillina cyanea (Herdman, 1899)
(Fig. 47)

Colella cyanea Herdman, 1899: 69. Type locality: Australia, Port Jackson.

Sigillina cyanea – Kott 1990: 89, figs 9; 29, pl. 7, Australia.

MATERIAL EXAMINED. — **Indonesia**. Komodo Island, coll. Erhardt (MNHN A3 SIG 11).

DESCRIPTION

Two deep, dark blue colonies 20 cm long each have a cylindrical head in continuity with the peduncle. The tunic's general consistency is hard, and the superficial tunic is particularly resistant. The zooids open by unpigmented siphons placed close to each other. The body wall has a dark blue pigment. The thorax is wider than long, separated from the abdomen by a narrowing. The largest zooids measure 4 mm in length.

Both siphons are very short with six round lobes and a sphincter. No transverse muscles were seen on the thorax, but there are 15 to 18 longitudinal muscles on each side.

There are 12 oral tentacles in two orders along two different circles. A large unperforated space extends anteriorly as well as posteriorly to the branchial sac. The transverse vessels form high

blades. We counted at least 30 stigmata in the first half row and 25 in the last half row. A brood pouch is appended to the postero-dorsal part of the thorax.

The drop-shaped abdomen is prolonged by a long, thin vascular appendage. The stomach is small and rounded, followed without constriction by a post-stomach that is slightly wider than the intestine. The anus opens by two lobes at the second stigmata row. The pyloric gland is a complex network of curved tubules and ampullae on the rectum at the stomach level. Several pyloric ducts converge towards the stomach, where they fuse. There is no pyloric vesicle.

The gonads are entirely located inside the gut loop below the stomach. The testis has about 30 follicles, almost all in a plane, each having a duct; these converge toward the centre of the testis to form a single common sperm duct, which follows the rectum. The ovary is central, with only a small oocyte in the examined colonies, which are mostly in the male phase.

A few larvae (Fig. 47) are present between the zooids, close to the colony surface. They are large, up to 4 mm. They have the same dark blue pigment as the zooids in the surface epithelium, the visceral mass, and the ampullae around the adhesive papillae. The tail winds in less than a half-turn around the trunk (Fig. 47A). Two flat adhesive papillae are elongated and bilaterally compressed to form an anterior groove. On each side the adhesive papillae are lined by five or six digitiform ampullae. The larval branchial sac is very posterior, well-differentiated with three rows of numerous stigmata. There is an ocellus and an otolith.

REMARKS

This species does not show the structure of the adhesive papillae described by Kott (1990), but rather that described for *Sigillina australis* Savigny, 1816. The type of the latter species (MNHN A3 SIG 2) is described as transparent with a reddish-brown colour.

Sigillina signifera (Sluiter, 1909)

Polycitor signiferus Sluiter, 1909: 5. Type locality: Indonesia.

Sigillina signifera – Monniot F. & Monniot C. 1996: 214, Indonesia.

MATERIAL EXAMINED. — **Philippines**. Mindanao, Davao, NE side of Samal Island, 7°09.63'N, 125°47.05'E, 18 m, 7.IV.1996 (MNHN A3 SIG 10).

Family DIDEMNIDAE Giard, 1872
Genus *Trididemnum* Della Valle, 1881

Trididemnum cyclops Michaelsen, 1921

Trididemnum cyclops Michaelsen, 1921: 19. Type locality: Madagascar. — Monniot F. & Monniot C. 1996: 149, western Pacific, and synonymy.

MATERIAL EXAMINED. — **Palau**. KB Channel, Airai seagrass bed, 7°19.35'N, 134°31.73'E, 0.5 m, 20.VI.1996 (MNHN A2 TRI 133).

Trididemnum discrepans (Sluiter, 1909) (Fig. 48)

Leptoclinum discrepans Sluiter, 1909: 77. Type locality: Indonesia. Synonymy: see Monniot F. 1990a: 520, fig. 2.

MATERIAL EXAMINED. — **Tonga**. Vava'u, Vaipua Inlet, 18°37.92'S, 173°58.79'W, 1 m, 14.XI.1997 (MNHN A2 TRI 148).

Philippines. Palawan, Honda Bay, 9°55.87'N, 118°55.02'E, 20 m, 24.XI.1997 (MNHN A2 TRI 119).

DESCRIPTION

This species forms colonies that break up into aggregations of small lobes. The size of each lobe is 5–6 mm in diameter and 3–5 mm in thickness. The very soft gelatinous cushions are black with a translucent tunic. There are no spicules in the upper layer and they are rare in the basal parts, where they are mixed with faecal pellets. The siphons are short. There is a particularly large unperforated area between the oral tentacles and the branchial sac (Fig. 48A). The stigmata are numerous, up to 14 in the first half row, but fewer posteriorly. The waist is very

long and the retractor muscle extends from it. The gut loop is wide and flat. The single testis lobe lies in its middle, covered by five to six coils of the sperm duct (Fig. 48A). The ovary lies against the testis.

The larvae (Fig. 48B) are large, 1.3 mm for the trunk. The tail is wound in a half turn around the trunk. The three adhesive papillae have long stalks. On each side are six digitiform ampullae. The larvae are not gemmiparous.

REMARKS

This species is characterised by the small joined lobes of the colony, the colony's black colour, and the absence of spicules from almost all the tunic, as well as by the numerous stigmata in the zooid and the larval structure. It is a species of very shallow water found in Indonesia, Australia, New Caledonia, Fiji, and now Tonga.

Trididemnum inermum n. sp.
(Figs 49; 119D)

TYPE MATERIAL. — Papua New Guinea. Coral Sea, eastern Fields, 10°09.35'S, 145°33.92'E, 31 m, 15.VI.1998 (MNHN A2 TRI 150).

ETYMOLOGY. — From the Latin *inermus*: without arms.

DESCRIPTION

The largest colony is 6 cm in extent and 2 mm thick. It is semi-transparent, colourless (Fig. 119D) and without any spicules. It is lobed, mammillated, with wide common cloacal openings. The colony's consistency is fleshy and rather firm. The tunic is resistant, making the small zooids difficult to extract. There are large cloacal channels, some of them occupied by shrimp.

A long waist elongates the zooid between the thorax and the abdomen (Fig. 49A). The oral aperture is small with six lobes. The cloacal siphon makes a short tube, directed backwards, encircled by a sphincter. The 24 oral tentacles are short and in three orders of size. There is a

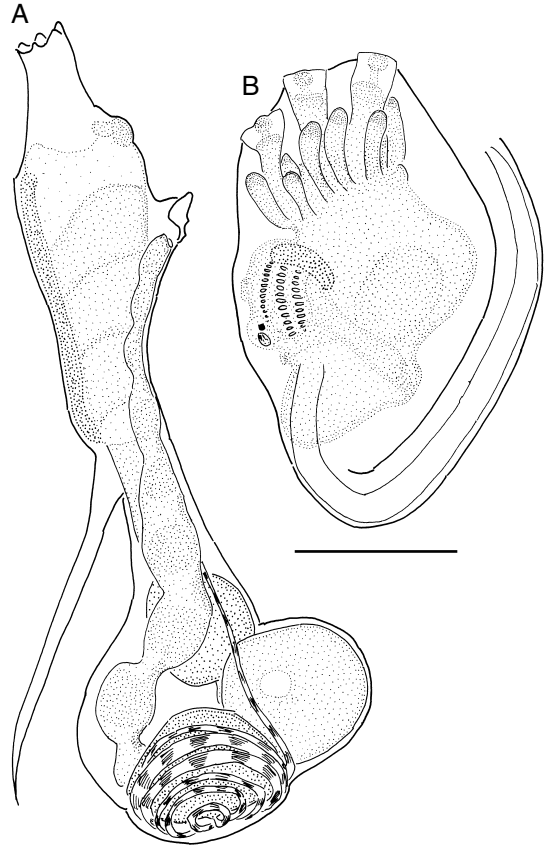


FIG. 48. — *Trididemnum discrepans* (Sluiter, 1909); A, zooid; B, larva. Scale bar: 0.5 mm.

wide unperforated area anteriorly (Fig. 49A). The branchial sac is large with up to 15 stigmata in the first half row. The second row is slightly shorter but the last row is long and protrudes slightly below the level of the cloacal siphon.

The retractor muscle is very short (Fig. 49A), thread-like, arising from the upper part of the long oesophageal peduncle. The gut forms an elongated loop. The single testis follicle occupies its centre, covered with five to eight turns of the sperm duct (Fig. 49B). The first turn is set apart from the adjacent coils. The ovary, poorly developed in this specimen, is located against the testis.

No larvae were found.

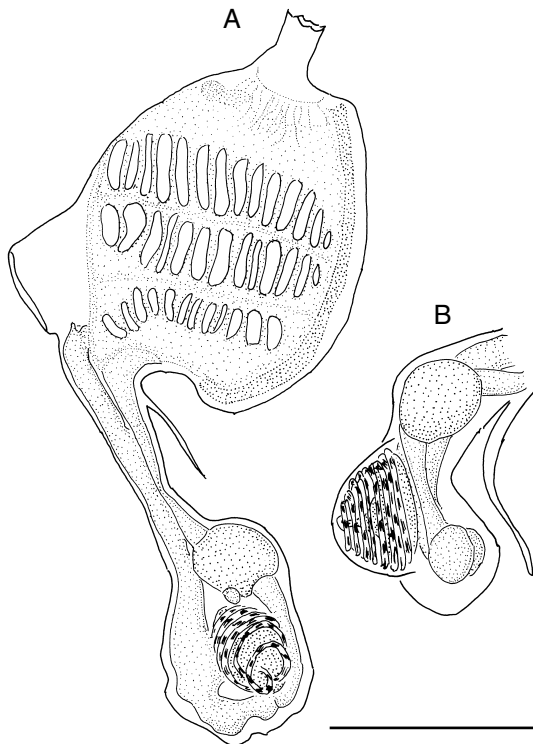


FIG. 49. — *Trididemnum inermum* n. sp.; **A**, zooid; **B**, testis. Scale bar: 0.5 mm.

In some but not all zooids, very small spots can be seen on each side of the thorax near the cloacal siphon. They may be an indication of lateral thoracic organs, but no trace of spicules was found in the colonies.

REMARKS

This species differs from other *Trididemnum* in its total absence of spicules and its massive and lobed colonies. It lacks the pigment which is present in the black, almost spicule-less, species *Trididemnum discrepans* (Sluiter, 1909).

Trididemnum polyorchis

Monniot F. & Monniot C., 1996

Trididemnum polyorchis Monniot F. & Monniot C., 1996: 150, figs 8; 9A, B. Type locality: Palau.

MATERIAL EXAMINED. — **Philippines**. Palawan, Honda Bay, 9°52.90'N, 118°49.01'E, 1 m, 18.IV.1995 (MNHN A2 TRI 120).

Trididemnum poma n. sp.

(Figs 50; 51A; 119E)

TYPE MATERIAL. — **Commonwealth of the Northern Marianas**. Saipan, 6 m, coll. Paulay (MNHN A2 TRI 152).

ETYMOLOGY. — From the Latin *poma*: lid.

DESCRIPTION

The brittle colony is encrusting, 1 mm thick when preserved in formalin, with a pattern of deep, curved grooves in which the cloacal siphons open. The colour in life is pure white (Fig. 119E). The spicules are dense and the zooids extremely small.

The zooids are distributed in double rows along the cloacal channels, the cloacal siphons opening directly into the grooves when the colony is contracted. The two rims of each channel are folded above the groove and shut it as would a lid (hence the species name *poma* = lid). There is no roof of tunic above the grooves.

The oral siphon is short. The cloacal aperture uncovers a large part of the branchial sac when relaxed (Fig. 50A) but becomes a transverse slit by contraction. There are only three stigmata in a row on each side (Fig. 50A). The retractor muscle is very short, as short as the oesophageal peduncle. The abdomen has the same size as the thorax (Fig. 50B-D). The gut is a flat open loop with the usual compartments (Fig. 50D).

The testis, in a single follicle (Fig. 50B), lies inside the intestinal loop covered by six to seven coils of the sperm duct. The ovary (Fig. 50C) is on the side of the testis.

The larvae (Fig. 50E) are small in the basal layer of the colony. The trunk is 0.25 mm in length and the tail makes one turn around it. The larvae have an ocellus and an otolith. There are three adhesive papillae, four pairs of ampullae, and no buds.

The spicules, 35 µm in diameter, have short conical rays (Fig. 51A).

REMARKS

This species has a very peculiar colonial anatomy, with the cloacal channels opened at the colony surface and only covered by a lid made by their

folded rims when the colony is contracted. The zooids and larvae are particularly small. This species has been found only in a submarine cave.

Trididemnum strigosum Kott, 1980
(Fig. 119F)

Trididemnum strigosum Kott, 1980: 8, figs 9; 10, pl. 3-3. Type locality: Philippines; 1981: 188, Fiji. — Monniot C. & Monniot F. 1987: 22, fig. 4A-D, Polynesia.

MATERIAL EXAMINED. — Palau. KB Channel, Airai on sea grass, 7°19.35'N, 134°31.73'E, 0.5 m, 20.VI.1996 (MNHN A2 TRI 134).

DESCRIPTION

This species has algal cells embedded in the tunic. The colonies are small round or oval patches, grouped in clusters. The colour is green to pale green (Fig. 119F), the intensity depending on the abundance of spicules in the superficial layer of the colonies. There is generally a single common cloacal aperture in the centre of each colony. There are accumulations of dark brown bodies in the abdominal layer.

The zooids are extremely small. They have six sharp oral lobes. The cloacal aperture is a wide transverse slit. The leaf-like lateral thoracic organs protrude at the level of the second stigmata row. There is a short retractor muscle.

The abdomen is the same size as the thorax and has a single testis follicle. The larvae contain algal cells but are not fully developed. The spicules are stellate with a few short rays.

REMARKS

This species, first collected in the Philippines, then in Fiji and Polynesia, is now recorded in Palau. The species probably has a wide distribution in the western Pacific region, but is rather inconspicuous with its small colonies.

Genus *Didemnum* Savigny, 1816

Didemnum algasedens n. sp.
(Figs 51B; 52; 120A)

TYPE MATERIAL. — Federated States of Micronesia. Chuuk Lagoon, sediment bottom surrounding

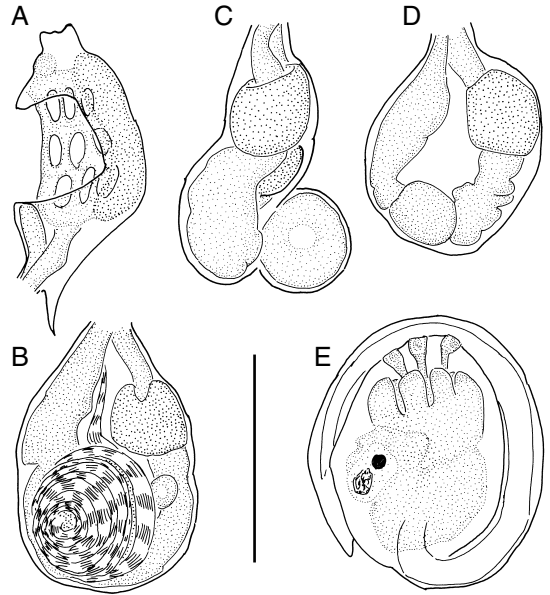


FIG. 50. — *Trididemnum poma* n. sp.; A, thorax; B-D, abdomen; E, larva. Scale bar: 0.25 mm.

Fujikawa wreck, 7°20.92'N, 151°52.70'E, 36 m on *Halimeda*, 22.I.1993 (MNHN A2 DID.C 417).

ETYMOLOGY. — From the Latin *alga*: seaweed and *sedens*: settled.

DESCRIPTION

The white colonies (Fig. 120A), 1 mm thick, do not exceed 2 cm across and are generally less. The oral openings are hardly visible on the smooth colony surface. The spicules are dense throughout the colony. The common cloacal cavity forms channels surrounding grouped thoraces. The oral siphons have six pointed lobes. The cloacal aperture is narrow (Fig. 52A), round or cut in a slit in the thick body wall. There is no languet. The lateral thoracic organs protrude at the level of the third stigmata row. The oesophageal peduncle (Fig. 52A) is particularly long in such a thin colony. The retractor muscle is as long as the thorax.

The abdomen (Fig. 52B) which is the same length as the thorax, has a wide gut loop. A post-stomach and mid-intestine follow the spherical stomach: at its beginning the wide posterior

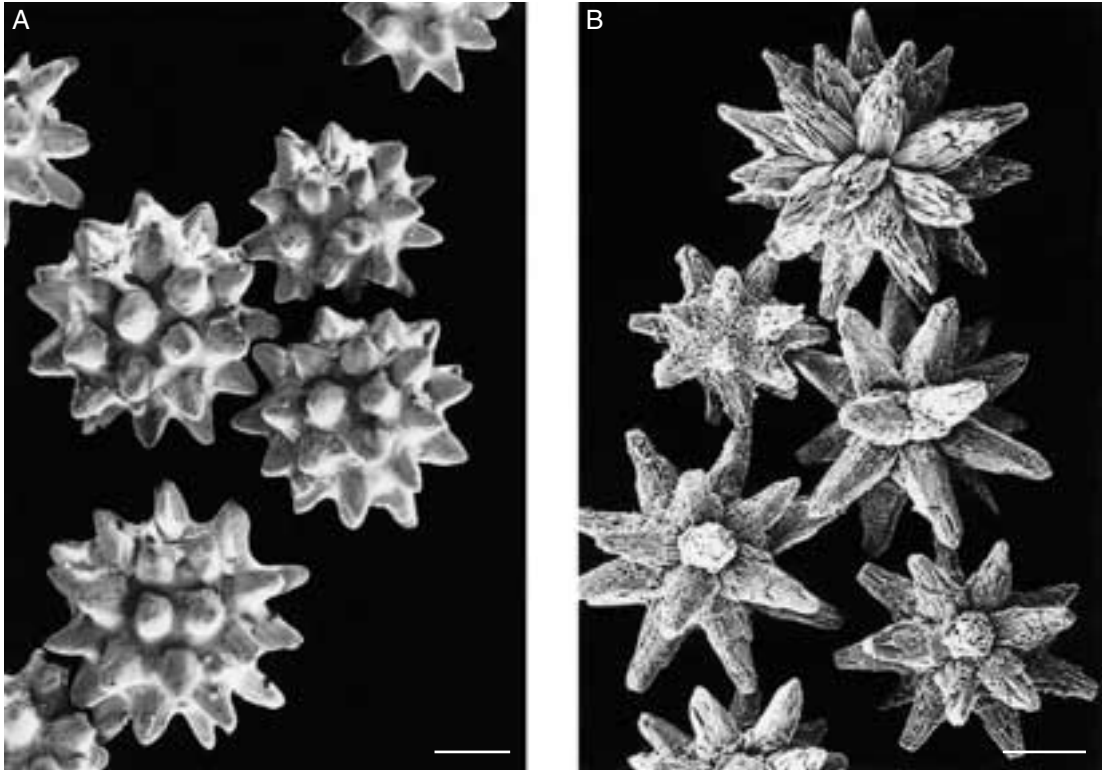


FIG. 51. — Spicules; **A**, *Trididemnum poma* n. sp.; **B**, *Didemnum algasedens* n. sp. Scale bars: 10 μ m.

intestine, red in life, is thicker than the remainder of the gut. The rectal extremity is narrow. The whole gut loop is folded on itself (Fig. 52B).

The single testis follicle is located on the posterior intestine and protrudes to the side (Fig. 52B), its development accentuating the abdominal fold. The sperm duct is coiled in seven turns. The ovary is on the side of the testis (Fig. 52B).

The general outline of the larva is round. The larvae (Fig. 52C) are incubated in the abdominal layer of the colony. The trunk measures 430 μ m and is encircled by the tail in three quarter of a turn. Beside the three adhesive papillae are four pairs of elongated ampullae. A light brown pigment extends anteriorly on the base of the ampullae.

Ocellus, otolith, three rows of stigmata, and the outline of the gut are clearly visible; there is no trace of budding.

The spicules (Fig. 51B) are stellate with pointed rays. They measure 40 μ m in diameter.

REMARKS

This species differs from other white *Didemnum* in the addition of several characters which individually are not distinctive but in combination are. They are a rather long oral siphon, a small cloacal aperture, a spherical larva with a brown pigment, stellate spicules with sharp rays.

D. algasedens n. sp. closely resembles the Caribbean *D. halimeda* F. Monniot, 1983, in having the same zooid and larva but different spicules with shorter and more numerous rays.

Didemnum biglutinum Monniot F., 1995

Didemnum biglutinum Monniot F., 1995: 300. Type locality: New Caledonia. — Monniot F. & Monniot C. 1996: 152, fig. 9C, pl. 2D, Palau.

MATERIAL EXAMINED. — **Palau.** E Ngeruktabel, Topkukau, marine cove, 7°15.94'N, 134°27.01'E, 1 m, 9.III.1994 (MNHN A2 DID.C 418).

Federated States of Micronesia. Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm growing on nylon line, 6°57.68'N, 158°17.85'E, 8 m, 15.X.1996 (MNHN A2 DID.C 416).

Didemnum cuculliferum (Sluiter, 1909)
(Fig. 120B)

Diplosomoides cuculliferum Sluiter, 1909: 90. Type locality: Indonesia.

Didemnum cuculliferum – Kott 1981: 164, figs 16; 22a, b, Fiji. — Monniot C. & Monniot F. 1987: 28, fig. 7D, E, pl. VB, Polynesia. — Monniot F. 1995: 305, pl. 1D, 4A, New Caledonia.

MATERIAL EXAMINED. — **Palau.** Ngermutidech, 7°18.74'N, 134°31.12'E, 0.5 m, 14.VI.1996 (MNHN A2 DID.C 425).

Fiji. Coll. Ireland (MNHN A2 DID.C 72).

DESCRIPTION

In life the colonies have the colour of red currant (Fig. 120B). They are 1-2 cm in diameter, thin and soft, growing on sea grass. The upper surface is marked by many long irregular papillae. The spicules are dense throughout the colony. The oral siphon has six very short lobes. The cloacal aperture is not very wide, and there is no cloacal languet. The lateral thoracic organs lie on the middle of each side above the third or fourth stigmata row. The thorax has a rectangular shape. The retractor muscle is about as long as the thorax. The waist is short. The abdomen folds under the thorax and contains a twisted gut loop. The one large testis follicle is covered by six coils of the sperm duct. A brown crescent-like gland lies against the intestinal loop. There are no larvae in these colonies. The spicules correspond exactly to those observed in collections from New Caledonia, Fiji, and Polynesia.

REMARKS

Even without larvae this species is identifiable by its colour in life and by the papillated surface of the small colonies. Its distribution is wide in the western Pacific Ocean: Indonesia, Palau, New Caledonia, Fiji and the islands of Polynesia.

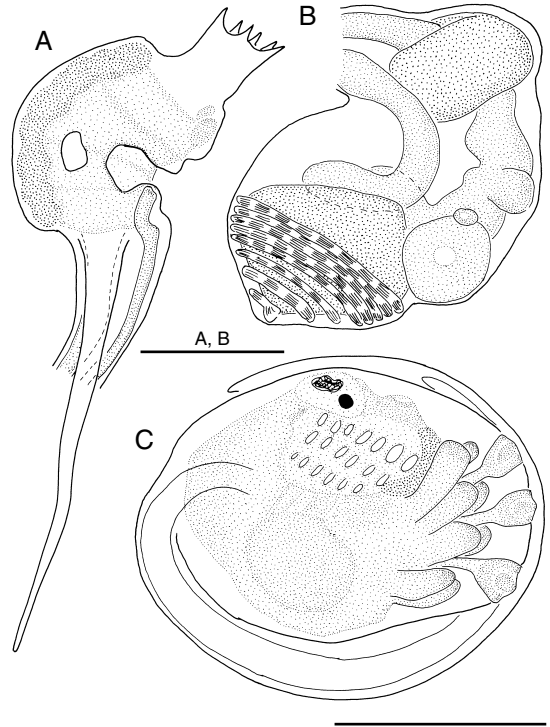


FIG. 52. — *Didemnum algasedens* n. sp.; **A**, thorax; **B**, abdomen; **C**, larva. Scale bars: 0.25 mm.

Didemnum granulatum Tokioka, 1954

Didemnum granulatum Tokioka, 1954: 244. Type locality: Japan. — Rocha & Monniot F. 1995: 341, fig. 2A, C, pl. 1B, Brazil, New Caledonia.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Cabilao Island, encrusting on underside of *Dysidea* sp. sponge, 9°53.39'N, 123°45.45'E, 10 m, IV.1997 (MNHN A2 DID.C 423). — Bohol Sea, Balicasag Island SW of Bohol, IV.1997 (MNHN A2 DID.C 422).

Papua New Guinea. Milne Bay Province, Taodovu Reef, 10°21.21'S, 150°56.27'E. 6 m, coll. CRRF.

Didemnum guttatum
Monniot F. & Monniot C., 1996

Didemnum guttatum Monniot F. & Monniot C., 1996: 153, figs 9D; 10, pl. 2E. Type locality: western Pacific.

MATERIAL EXAMINED. — **Palau.** Koror, Ngermutidech, 7°18.74'N, 134°31.12'E, 0.5 m, 21.VI.1993 (MNHN Slide 1604). — Southwest Islands, Helen

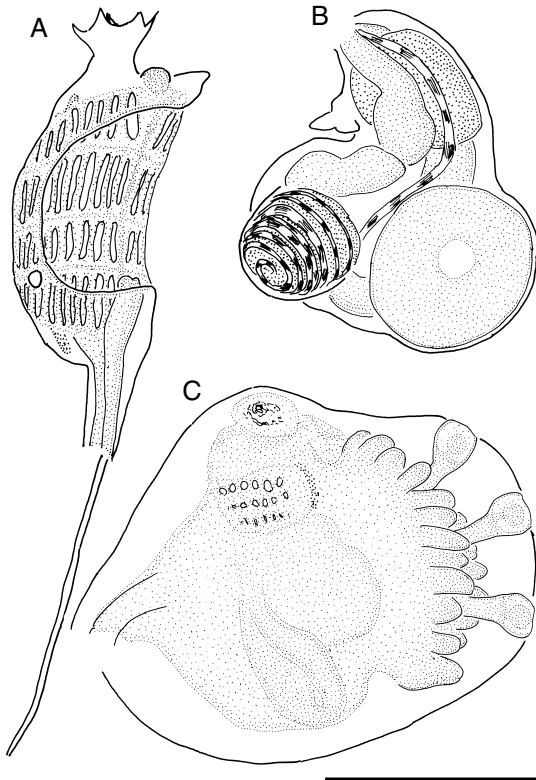


FIG. 53. — *Didemnum madeleinae* n. sp.; **A**, thorax; **B**, abdomen; **C**, larva. Scale bar: 0.5 mm.

Reef, 2°53.03'N, 131°44.94'E, 5 m, 10.XII.1996 (MNHN A2 DID.C 413).

Philippines. Palawan, Honda Bay, 9°52.90'N, 118°49.01'E, 18.IV.1995 (MNHN A2 DID.C 354).

Didemnum lacertosum Monniot F., 1995
(Fig. 120C)

Didemnum lacertosum Monniot F., 1995: 311, fig. 7, pl. IIB. Type locality: Loyalty Islands.

MATERIAL EXAMINED. — **Papua New Guinea.** Milne Bay Province, Reef SE of Drawari Island, 10°18.03'S, 151°03.94'E, 16 m, 6.VI.1998 (Sample: CRRF).

DESCRIPTION

The colonies are round, no more than 1 cm in diameter, grouped in patches on corals and sponges. There are one or two common cloacal apertures, circled in white, per colony. The periphery of the colony is purple-pink

(Fig. 120C). Spicules with numerous short rays are dense in the surface layer, sparser at the abdominal level. The zooids are very small. The oral siphon has six short, pointed lobes. The cloacal aperture is large. A bilobed languet is long in zooids near the common cloacal aperture, shorter elsewhere. The lateral thoracic organs are small, round, at the level of the third stigmata row. The retractor muscle is short, inserted high against the oesophageal peduncle. The gonads lie against the gut loop: the large testis follicle is covered by seven to eight turns of the sperm duct. The ovary contains a large protruding oocyte. The larvae are of a small size, 550 µm for the trunk. Eight to 10 pairs of ampullae encircle the three adhesive papillae. The larvae are gemmiparous. This sample corresponds exactly to the yellow or pink species described from the Loyalty Islands. It is collected again for the first time.

Didemnum linguiferum
Monniot F. & Monniot C., 1996

Didemnum linguiferum Monniot F. & Monniot C., 1996: 155, figs 9E; 11. Type locality: Indonesia.

MATERIAL EXAMINED. — **Philippines.** Mindanao, Davao, Pakiputan Strait, 7°07.36'N, 125°40.11'E, 33 m, 3.IV.1996 (MNHN A2 DID.C 379).

Federated States of Micronesia. Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm growing on nylon line, 6°57.68'N, 158°17.85'E, 8 m, 15.X.1996 (MNHN A2 DID.C 421).

Didemnum madeleinae n. sp.
(Figs 53; 54A; 120D)

TYPE MATERIAL. — **Papua New Guinea.** Louisiade Archipelago, Deboyne Lagoon, Nivani Island, overhang, 10°47.46'S, 152°23.08'E, 10 m, 30.V.1998 (MNHN A2 DID.C 470).

ETYMOLOGY. — Named after Madeleine Martin, who helped in the preparation of this paper.

DESCRIPTION

The orange colonies (Fig. 120D) form large crusts 2 mm thick that are easy to remove from the substrate. The surface is smooth with many small common cloacal apertures, which appear white in life: the orange pigment is superficial

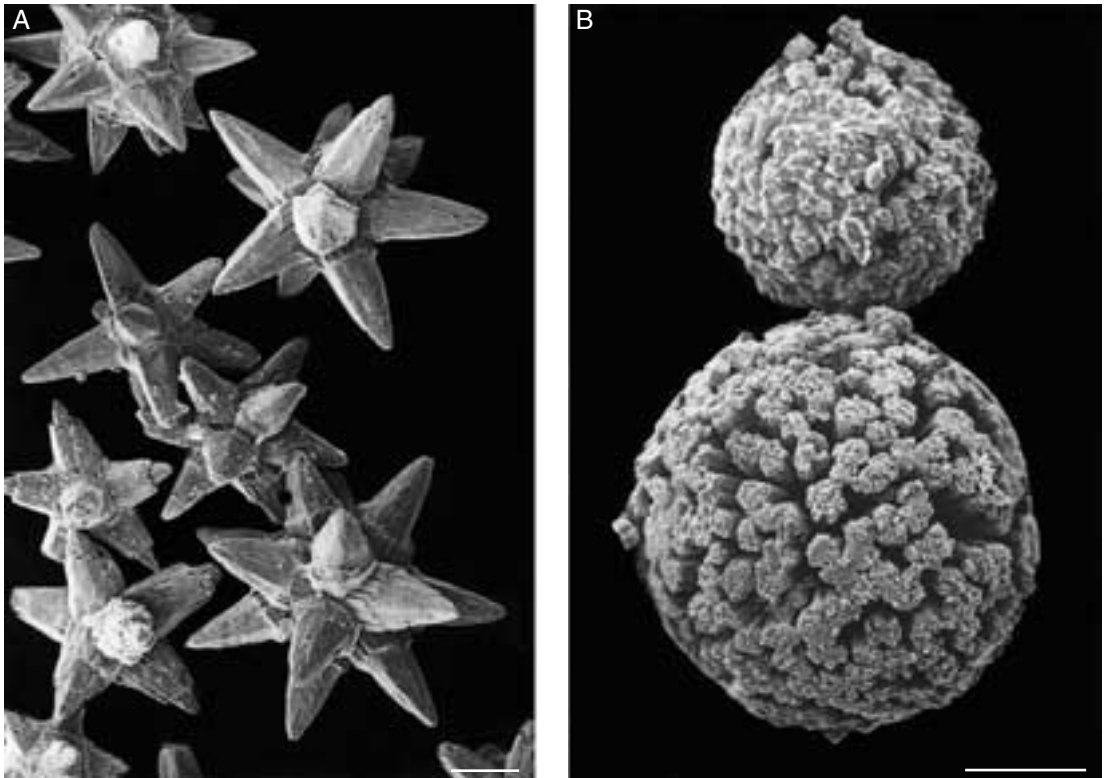


Fig. 54. — Spicules; **A**, *Didemnum madeleinae* n. sp.; **B**, *Polysyncraton adelon* n. sp. Scale bars: 10 μ m.

and disappears in formalin. The consistency is hard, as spicules are dense throughout the colony. The cloacal channels are wide but limited to the thoracic layer of the colony. Some accumulations of orange inclusions lie in the basal layer of the colony. The oral siphon with six sharp lobes, has the shape of a funnel with a basal sphincter (Fig. 53A). There is no cloacal languet. The cloacal aperture is wide and uncovers most of the four stigmata rows (Fig. 53A). The round and small lateral thoracic organs are near the edge of the cloacal aperture at the level of the third transverse vessel.

The oesophageal peduncle is long and the retractor muscle that parts from it lies against the abdomen (Fig. 53A).

The abdomen (Fig. 53B) has about the same size as the thorax. The gut loop is slightly twisted. The single testis follicle with seven turns of the

sperm duct is located inside the gut loop, beside a very large oocyte (Fig. 53B).

The rather spherical larvae (Fig. 53C) are incubated in the densely spiculated basal layer of the colony. Their trunk measures 1 mm but the larvae are not gemmiparous. They have three adhesive papillae, and about 12 short digitiform ampullae on each side. The tail is wound in three quarter of a turn around the trunk.

The spicules (Fig. 54A) are stellate with rather few conical pointed rays: they measure up to 50 μ m across.

REMARKS

D. madeleinae n. sp. is some characters in common with *Didemnum captivum* Monniot F. & Monniot C., 1999 known only from Tanzania: the orange colour, the shape and size of the spicules, the position of the lateral thoracic

organs and the retractor muscle, and the structure of the abdomen. But the shape of the oral siphon and the cloacal aperture are very different, and the larvae are very different in size. These characters and the geographical distance of this record from Tanzania argue persuasively against a synonymy.

All other *Didemnum* Savigny, 1816 species with only one testis follicle, without cloacal languet, and with a larva that has numerous anterior ampullae – all other such species have a very dark pigment and different spicules from this new one.

Didemnum molle (Herdman, 1886)

Diplosomoides molle Herdman, 1886: 310. Type locality: Aru Island.

Didemnum molle – Monniot F. & Monniot C. 1996: 157, Indonesia, and synonymy.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Chuuk, Onang Island, 7°13.46'N, 151°37.78'E, 15 m, 3.VI.1992 (MNHN A2 DID.C 420).

Papua New Guinea. Louisiade Archipelago, Deboyne Lagoon, Nivani Island, 10°47.46'S, 152°23.08'E, 8 m, 30.V.1998 (MNHN A2 DID.C 461). — Bootless Inlet, N Motupore Island, 9°31.22'S, 147°17.09'E, 0.5 m, 17.VI.1998 (MNHN A2 DID.C 462).

Didemnum moseleyi (Herdman, 1886)

Leptoclinum moseleyi Herdman, 1886: 272.

Didemnum moseleyi. — Monniot F. & Monniot C., 1996: 157, Micronesia, and synonymy.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm growing on nylon line, 6°57.68'N, 158°17.85'E, 8 m, 13.X.1996 (MNHN A2 DID.C 419).

Papua New Guinea. Louisiade Archipelago, Deboyne Lagoon, Nivani Island, 10°47.46'S, 152°23.08'E, 10 m, 30.V.1998 (MNHN A2 DID.C 466).

Didemnum obscurum Monniot F., 1969
(Fig. 120E)

Didemnum obscurum Monniot F., 1969: 453, fig. 14. Type locality: Dakar; 1995: 319, fig. 12, pl. 2f, New Caledonia. — Monniot C. & Monniot F. 1997: 1626, Bahrain. — Monniot C. *et al.* in press, figs 23E, F; 25D, South Africa.

MATERIAL EXAMINED. — **Tonga.** Tongatapu, Ualanga Lulu Reef, 21°06.02'S, 175°11.56'W, 18 m, 18.XI.1997 (MNHN A2 DID.C 452).

DESCRIPTION

The colonies are very dark inside but somewhat lighter externally, due to the spicules in the superficial layer (Fig. 120E). There is abundant mucus in the cloacal cavity. The colony is thick and not brittle. The zooids are black. The oral siphon is short. The cloacal aperture is wide with a very large bilobed languet in zooids near the common cloacal aperture but smaller elsewhere. The retractor muscle parts from the upper part of the oesophageal peduncle. The abdomen has about the same size as the thorax. The single testis follicle is large, flat and covered by the coiled sperm duct. The oocyte is large and protruding. The larvae are black with three short, stout adhesive papillae and a crown of numerous, joined digitiform ampullae.

REMARKS

All characters correspond well to previous descriptions, and the spherical spicules with many short, pointed rays are also similar. This species is widely distributed; it occurs as well in Senegal, from which it was described, and in the Indian Ocean and the western Pacific Ocean.

Didemnum parau

Monniot C. & Monniot F., 1987

Didemnum parau Monniot C. & Monniot F., 1987: 39. Type locality: Polynesia. — Monniot F. & Monniot C. 1996: 159, fig. 14A, pl. 2F, Papua New Guinea.

MATERIAL EXAMINED. — **Philippines.** Sulu Sea, Pasigshoal, 9°57.16'N, 119°21.30'E, 11 m, 23.IV.1995 (MNHN A2 DID.C 427). — Mindanao, Davao, Samal Island Beach Park, 7°06.25'N, 125°39.79'E, 12 m, 1.IV.1996 (MNHN A2 DID.C 427).

Federated States of Micronesia. Yap, Colonia, main wharf, 9°30.91'N, 138°07.57'E, 10 m, 4.VI.1996 (MNHN A2 DID.C 309).

Palau. Southwest Islands, Helen Reef, 2°52.98'N, 131°44.90'E, 10 m, 9.XII.1996 (MNHN A2 DID.C 429).

Didemnum perlucidum Monniot F., 1983

Didemnum perlucidum Monniot F., 1983: 29. Type locality: Guadeloupe. — Monniot F. & Monniot C. 1996: 160, fig. 13, pl. 2G, Indonesia.

MATERIAL EXAMINED. — **Philippines**. Bohol Sea, Camiguin Island, 9°14.71'N, 124°39.61'E, 20 m, IV.1997 (MNHN A2 DID.C 430).

Mariana Islands. Guam, Apra Harbour, off Buoy, 0-3 m, 12.VI.1998, coll. Erhardt (MNHN A2 DID.C 464).

Didemnum psammathodes (Sluiter, 1895)

Leptoclinum psammathodes Sluiter, 1895: 171. Type locality: Thursday Island.

Didemnum psammathodes – Monniot F. & Monniot C. 1996: 163, western Pacific.

MATERIAL EXAMINED. — **Palau**. Koror, Ngerbeched seagrass bed, 7°20.02'N, 134°28.18'E, 1 m, 13.IX.1994 (MNHN A2 DID.C 339).

Tonga. Tongatapu, Atata Island, 21°03.24'S, 175°15.47'W, 0.3 m, 25.XI.1997 (MNHN A2 DID.C 455).

Didemnum rodriguesi

Rocha & Monniot F., 1993

(Figs 55; 120F)

Didemnum rodriguesi Rocha & Monniot F., 1993: 261, figs 1; 2, Brazil and New Caledonia. — Monniot C. *et al.* in press, Sodwana Bay, South Africa.

MATERIAL EXAMINED. — **Papua New Guinea**. Milne Bay, China Straits, 10°34.50'S, 150°40.73'E, 23 m, 10.VI.1998 (MNHN A2 DID.C 463).

DESCRIPTION

The colonies are thin red crusts covering many kinds of substrates (Fig. 120F). The surface is smooth but appears as finely prickled and pitted, due to the distribution of spicules in the surface layer of the colony. The spicules are dense throughout the thickness of the colony: they are stellate, up to 40 µm in diameter.

The zooids have a wide cloacal aperture. The lateral thoracic organs are above the third transverse vessel. The thorax is narrowed posteriorly. The gut forms a twisted loop. There is a single testis follicle which is covered by about seven turns of the sperm duct.

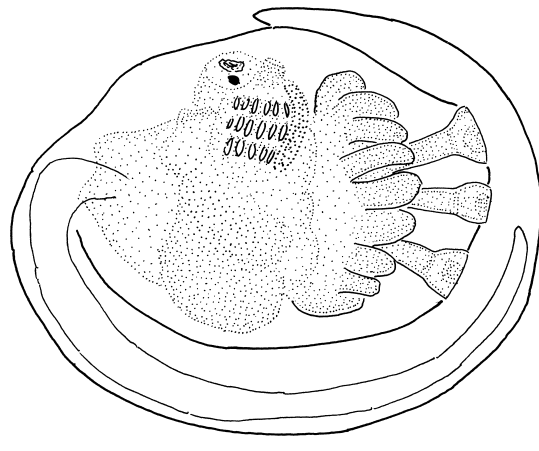


FIG. 55. — *Didemnum rodriguesi* Rocha & Monniot F., 1993, larva. Scale bar: 0.5 mm.

The developed larvae (Fig. 55) protrude at the colony surface. They have three short adhesive papillae encircled by seven to eight pairs of ampullae. They are not gemmiparous.

REMARKS

This richly coloured *Didemnum* is well-characterised by the microscopical pattern of its colony surface. Its distribution is surprisingly large, as it occurs in Papua New Guinea, New Caledonia, South Africa, and Brazil.

Didemnum rubeum

Monniot F. & Monniot C., 1996

Didemnum rubeum Monniot F. & Monniot C., 1996: 164, figs 14C; 16, pl. 3A. Type locality: Micronesia.

Didemnum recurvatum – Kott 1981: 174, Fiji.

MATERIAL EXAMINED. — **Palau**. West channel, 7°32.42'N, 134°28.37'E, 3 m, 11.XII.1997 (MNHN A2 DID.C 456).

Mariana Islands. Guam, Merizo Channel, 1 m, 23.II.1999, coll. G. Lambert (MNHN A2 DID.C 487).

REMARKS

Kott (1981: 174) described from Fiji ascidians very similar to *D. rubeum*. She assigned them to *Didemnum recurvatum* Sluiter, 1909. This cannot be retained, as Sluiter's type (ZMA TU 474,

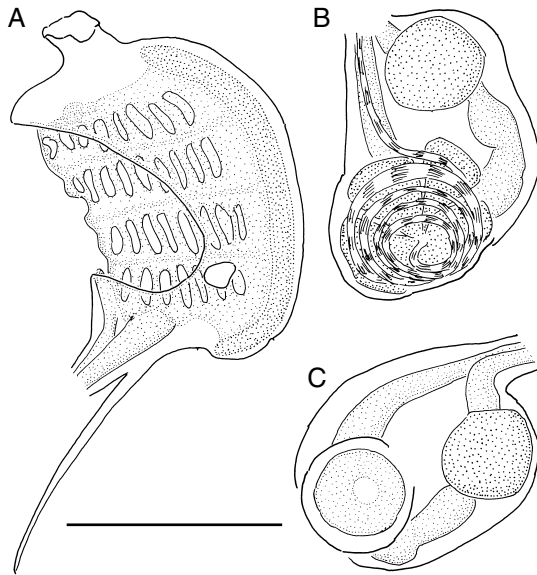


FIG. 56. — *Polysyncraton adelon* n. sp.; **A**, thorax; **B**, abdomen; **C**, larva. Scale bar: 0.5 mm.

stn 250) comprises several flat colonies less than 1 cm in diameter in which a few extracted zooids show two testis lobes and a straight sperm duct. Thus Sluiter's species belongs to the genus *Lissoclinum*. Kott's specimens, or a part of them, probably are *D. rubeum*.

Genus *Polysyncraton* Nott, 1892

Polysyncraton adelon n. sp.
(Figs 54B; 56)

TYPE MATERIAL. — Palau. Southwest Islands, Sonsoral, 5°20.88'N, 132°13.80'E, 15 m, 24.VII.1995 (MNHN A2 POL 94).

ETYMOLOGY. — From the Greek *adelon*: hardly visible.

DESCRIPTION

Grey-green in formalin, the colonies form very soft, extensive sheets 1 to 2 mm thick. They are easily delaminated, as the common cloacal cavities are extensive at the thoracic level. The spicules are dense everywhere and mixed with dark pigment cells, which are more abundant in the upper layer and around the thoraces. The

common cloacal cavity does not penetrate the abdominal layer of the colony.

The zooids are greenish in formalin. The oral siphon is short with very small lobes. The cloacal opening is very wide, without a languet, uncovering a large part of the branchial sac (Fig. 56A). There are eight or nine stigmata in the first and second half rows, seven in the posterior row. The lateral thoracic organ is round, placed above the third transverse vessel or the fourth stigmata row (Fig. 56A). The retractor muscle is of variable length, but not longer than the thorax, and arises mid-way down the oesophageal peduncle.

The abdomen (Fig. 56B) is slightly smaller than the thorax. The gut loop is wide open, with a spherical anterior stomach. The gonads are included in the digestive loop. There are three or more often four testis lobes, pressed into a rosette and covered by four to five turns of the sperm duct (Fig. 56B). The ovary (Fig. 56C) replaces the testis in the zooid's reproductive cycle.

No larvae were present in the colonies studied. The spicules reach 35 µm in diameter. They are spheres made of multiple thin blunt rays, not pointed ones (Fig. 54B).

REMARKS

This species is placed in the genus *Polysyncraton* instead of *Didemnum* according to the pragmatic understanding detailed earlier (Monniot F. 1993), as it has no cloacal languet but four testis lobes. Rather few species in this genus exist with many testis lobes but no cloacal languet. By its colour when preserved, the present species looks like *P. hartmeyeri* Michaelsen, 1923 from the Red Sea, which has five testis lobes, five to six turns of the sperm duct, more stigmata in a row, and – the most telling distinction – no retractor muscle.

P. magnetae Hastings, 1931 from the Great Barrier Reef has five testes but only two coils of the sperm duct, and its zooids are distributed in double rows. *Polysyncraton victoriensis* Kott, 1976 from southern Australia has three to four testis follicles, but the spicule shape and arrangement is different and there are only six stigmata per half row. She does not mention a cloacal languet in her description.

P. tubiporae Michaelsen, 1920 from Zanzibar has a spicule-free layer at the colony surface, lateral thoracic organs placed anteriorly, and six to eight testes encircled by two to three loose turns of the sperm duct.

Polysyncraton aspiculatum Tokioka, 1949
(Fig. 121A)

Didemnum (Polysyncraton) aspiculatum Tokioka, 1949: 2, pl. 2, fig. 1-3. Type locality: Japan. Synonymy: see Monniot C. *et al.* in press, South Africa.

MATERIAL EXAMINED. — **Philippines.** Luzon, NE side of Maricaban Island, Gamao Point, 13°38.39'N, 120°56.86'E, 16 m, 25.VII.1994 (MNHN A2 POL 81).

DESCRIPTION

The colonies are thick light brown crusts (Fig. 121A) with a network of depressed lines above the cloacal channels. The cloacal apertures are not numerous. The colony surface is smooth and clean. Spicules are totally absent. The tunic is filled with vesicular cells and round, brown pigment cells.

The structure of the zooids is the same as in specimens from other regions and in the type specimen. The cloacal languet is large with two long lobes in zooids near the common cloacal apertures. The branchial sac has eight stigmata per row on each side and is as brown as the remainder of the body. The testis follicles are numerous, about eight in a rosette encircled by two and a half coils of the sperm duct.

The larvae are large compared to the zooid size. They have three adhesive papillae and eight pairs of ampullae grouped in pairs. The body wall has vesicular cells as figured by Tokioka (1953) for this species.

REMARKS

The distribution of *P. aspiculatum* in the western Indian Ocean, southern Australia, the Philippines, and Japan is particularly wide. The variability in density of spicules and pigment cells in different locations raises questions about the presence of just a single species, but the zooids and larvae are identical.

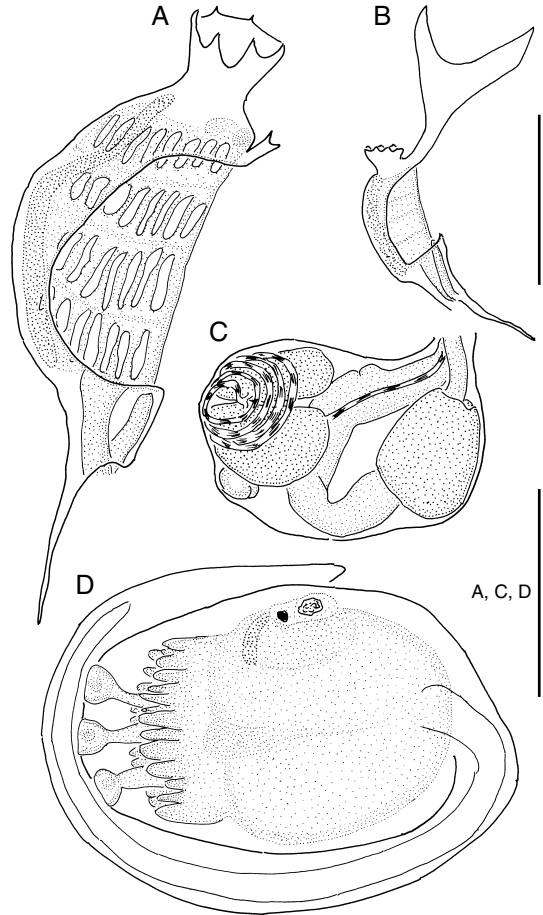


FIG. 57. — *Polysyncraton cerebellum* n. sp.; A, B, thoraces; C, abdomen; D, larva. Scale bars: A, C, D, 0.5 mm; B, 0.1 mm.

Polysyncraton cerebellum n. sp.
(Figs 57; 58A; 121B)

TYPE MATERIAL. — **Palau.** Southwest Islands, Helen Reef, overhang, 2°53.03'N, 131°44.94'E, 12 m, 10.XII.1996 (MNHN A2 POL 97).

ETYMOLOGY. — From the Latin *cerebellum*: brain.

OTHER MATERIAL EXAMINED. — **Papua New Guinea.** Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 12 m, 1.VI.1998 (MNHN A2 POL 96).

DESCRIPTION

In large crusts about 2-3 mm thick, these colonies are marbled with brown on a white ground. The

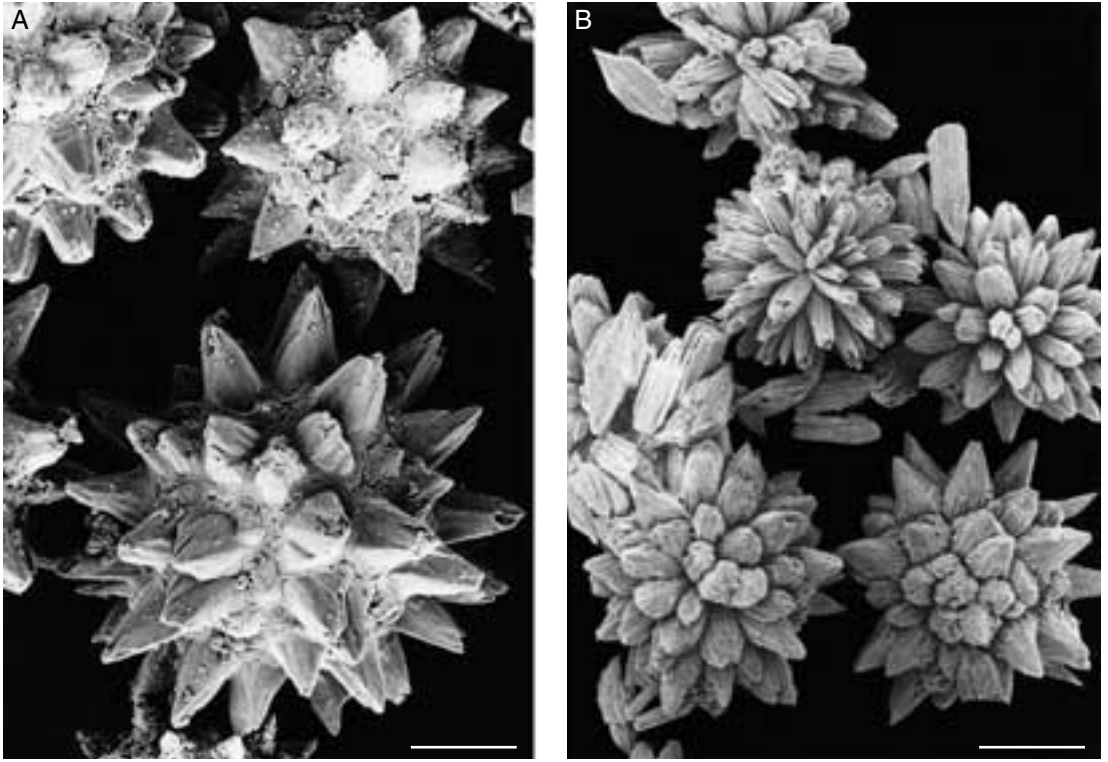


FIG. 58. — Spicules; **A**, *Polysyncraton cerebellum* n. sp.; **B**, *Polysyncraton vestiens* n. sp. Scale bars: 10 μ m.

pattern suggests a brain's surface (Fig. 121B) (hence the species name). The zooids are irregularly placed on the sides of large channels delimiting oval or polygonal areas. The common cloacal apertures are numerous and stellate. The pigment cells are superficial. Dark brown inclusions lie in the basal test. The colonies are easily delaminated into a surface layer containing the oral siphons and the cloacal languets and a basal layer containing the abdomens and larvae. The thoraxes are included in pillars of tunic uniting these layers. The oral siphons are large, funnel-shaped, with six lobes (Fig. 57A, B). The cloacal aperture uncovers most of the branchial sac. The languet is either short with a round tip (Fig. 57A) or, in zooids near the common cloacal apertures, large and T-shaped (Fig. 57B). The branchial sac has eight to 10 stigmata per side in the first row. The lateral thoracic organs protrude from the rim of the cloacal aperture at the level of the first or second stigmata row.

The retractor muscle, shorter than the thorax, projects at the base of the oesophageal peduncle (Fig. 57A). The gut loop is largely opened and only slightly twisted when the testis is fully mature. There are two testis follicles, tightly pressed against each other, covered by five turns of the sperm duct (Fig. 57C). The ovary develops against the testis with one large oocyte. The larval trunks are 1 mm long. Larvae have three adhesive papillae and at their base a comb-like crown of 24 pairs of ampullae.

The spicules (Fig. 58A) are stellate with numerous short, pointed rays. The largest spicules reach 65 μ m in diameter. They are very dense throughout the tunic, making it stiff.

REMARKS

This species is very similar to *P. thalломорpha* Monniot F., 1993. It differs in the colony's pigment pattern and the arrangement of the

zooids in meshes. Also, the oral siphon is less wide in this new species. The lateral thoracic organs are above the third row of stigmata in *P. thalломорpha*. The larvae are very similar in both species. The spicules have more rays in *P. cerebellum* n. sp.

Polysyncraton lithostrotum Brewin, 1956 from New Zealand and recorded again in New Caledonia (Monniot F. 1993: 4, fig. 1, pl. 1A) has also a mosaic pattern but a very different one; the zooids in that species are included in polygons in the centre of each of which opens a single common cloacal cavity. The anatomy of the zooids and larvae in that species are exactly the same as in *P. cerebellum* n. sp.

Polysyncraton thalломорpha Monniot F., 1993
(Fig. 121C)

Polysyncraton thalломорpha Monniot F., 1993: 13, fig. 7, pl. IIA. Type locality: New Caledonia.

MATERIAL EXAMINED. — **Philippines**. Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 7 m, 18.IV.1997 (MNHN A2 POL 88).

DESCRIPTION

The colonies have the characteristic shape described in New Caledonia; hard, thin crusts partially raised above the sediment. The colour is darker here, almost black, but the margins of the lobes remain white (Fig. 121C). The undersurface of the leaf-like crust is extremely hard with ridges.

The pigment cells are dendritic, restricted to the colony's upper surface.

The zooids have the characteristic long and wide oral siphon, and a large cloacal aperture with a languet varying in length according to the proximity of the zooids to the common cloacal cavity. The lateral thoracic organs protrude at the level of the third stigmata row. The two testis lobes overlap the gut loop and are covered by five turns of the sperm duct. The larvae have three adhesive papillae encircled by very numerous digitiform ampullae.

The spicules are irregular, as figured in Monniot F. (1993: pl. II A).

Polysyncraton vestiens n. sp.
(Figs 58B; 59)

TYPE MATERIAL. — **Palau**. Koror, Lighthouse Reef Basin, 7°17.90'N, 134°28.34'E, 47 m, 20.VII.1998 (MNHN A2 POL 95).

ETYMOLOGY. — From the Latin *vestiens*: clothing.

DESCRIPTION

The thin colonies are encrusting, 1 mm thick. They are very soft, semitransparent, and colourless in formalin preservative. The resistant tunic is only present in a superficial and basal layer and around the zooids, which are isolated in small groups in bridges uniting the surface to the base of the colony. The spicules are not dense and allow one to see the zooids through the tunic. There is no special accumulation of spicules around the oral siphons. The six oral lobes are low around the rim of a narrow siphon. The cloacal aperture uncovers most of the branchial sac (Fig. 59A). The dorsal languet is very variable, sometimes short and round but sometimes very large and T-shaped (Fig. 59A). The lateral thoracic organs, extremely small (or absent), lie at the level of the second transverse sinus or the second stigmata row. There is no retractor muscle. There are 10 to 12 stigmata in the first half row. The oesophageal peduncle is long and the abdomen, smaller than the thorax (Fig. 59A), is folded under the thorax. The abdomen has the usual components of the genus. The gonads lie in the gut loop. The testis is made of three to six lobes in a protruding rosette (Fig. 59A). The well-developed sperm duct is coiled in three turns above the centre of the testis rosette. The ovary matures after the testis.

Numerous larvae are present in the basal layer of the colony after the gonads have regressed. The trunk is 0.7 mm in length, the tail makes three quarter of a turn around it. There are three well-separated adhesive papillae on long stems and eight pairs of finger-like ampullae, resulting from the division of the four original pairs (Fig. 59B). There is one bud on each side of the larval visceral mass (Fig. 59B).

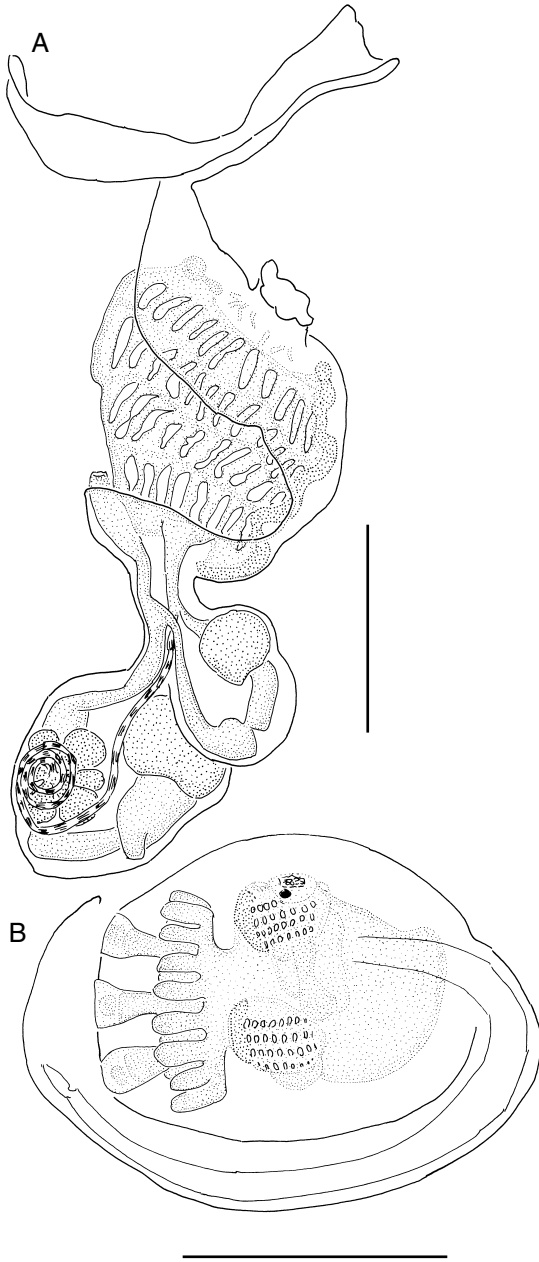


FIG. 59. — *Polysyncraton vestiens* n. sp.; **A**, zooid; **B**, larva. Scale bars: 0.5 mm.

The very small spicules (Fig. 58B) are stellate, with numerous short rays: their diameter is 30 µm.

REMARKS

This species is closely allied to *Polysyncraton purou* Monniot C. & Monniot F., 1987 from Polynesia and closely resembles it in its appearance and the structure of the larvae. It differs from *P. purou* in smaller spicules that are also present around the zooids, a wider cloacal aperture, and the absence of a retractor muscle.

Genus *Diplosoma* Macdonald, 1859

Diplosoma listerianum (Milne-Edwards, 1841)

Leptoclinium listerianum Milne-Edwards, 1841: 295. Type locality: English Channel.

Diplosoma listerianum – Rowe F. W. E. 1966: 458.

MATERIAL EXAMINED. — Mariana Islands. Guam, Apra Harbour, off Buoys, 0-3 m, 12.VI.1998, coll. Paulay (MNHN A2 DIP.A 156).

Diplosoma marsupiale n. sp.
(Figs 60; 121D)

TYPE MATERIAL. — Philippines. Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 4 m, 18.IV.1997 (MNHN A2 DIP.A 148).

ETYMOLOGY. — From the Latin *marsupium*: pouch.

DESCRIPTION

The colonies extend in thin whitish sheets on a sandy bottom. The thin and soft tunic is colourless, most transparent at the edge of the colony and between the groups of zooids. It contains a white pigment around the zooids (Fig. 121D). The basal layer includes sediment particles. Brown pigment cells make a peculiar design in the body wall of the zooids. There are six radiating lines around the base of the oral siphon, a speck with a diffuse outline at the anterior end of the endostyle, and a spot at the anterior edge of the cloacal aperture. In addition, there is a brown pigmentation on the gut and gonads.

The oral siphon has six large, petal-like lobes above a strong sphincter (Fig. 60A). The cloacal opening is wide. The branchial sac has 10 elongated stigmata on each side in the first row. The retractor muscle is shorter than the thorax, and

issues from the posterior part of the thorax (Fig. 60A).

The abdomen is folded under the thorax. The two testis lobes (Fig. 60B) are pressed against each other and against the gut loop. The ovary has the usual place against the testis. The eggs remain in the abdomen, and even advanced larvae with a developed tail and buds remain included in the abdomen against the digestive loop. The larvae (Fig. 60C) measure 0.75 mm for the trunk. They are made opaque by an abundance of round white cells distributed throughout the larval body wall except at the base of the tail and the tip of the adhesive papillae. The adhesive papillae have narrow brown stems. They are encircled by eight or more often 10 short ampullae.

REMARKS

This species has some characters in common with *Diplosoma versicolor* Monniot F., 1994: brown pigment, large oral lobes, a retractor muscle, and two testis lobes. It differs in the shape of the colony, and the size and internal structure of the larva.

Diplosoma pannosum n. sp. (Figs 61; 121E)

TYPE MATERIAL. — **Philippines**. Cebu Straits, Cabilao Island, cave, 9°53.39'N, 123°45.45'E, 10 m, 15.IV.1997 (MNHN A2 DIP.A 145).

ETYMOLOGY. — From the Latin *pannosus*: in rags.

OTHER MATERIAL EXAMINED. — **Philippines**. Cebu, E Mactan Island, overhang, 10°15.47'N, 123°59.08'E, 30 m, 14.IV.1997 (MNHN A2 DIP.A 146).

DESCRIPTION

The colonies, 20 to 30 cm across and 5 to 10 mm thick, are encrusting. Inflated underwater, the living colonies are billowy, brown and translucent, with darker patches surrounded by clear spots corresponding to the zooids' apertures (Fig. 121E). When removed from the substrate they tear to shreds (giving the species its name), and they lose their shape. Large, tubular common cloacal siphons have a transparent tunic.

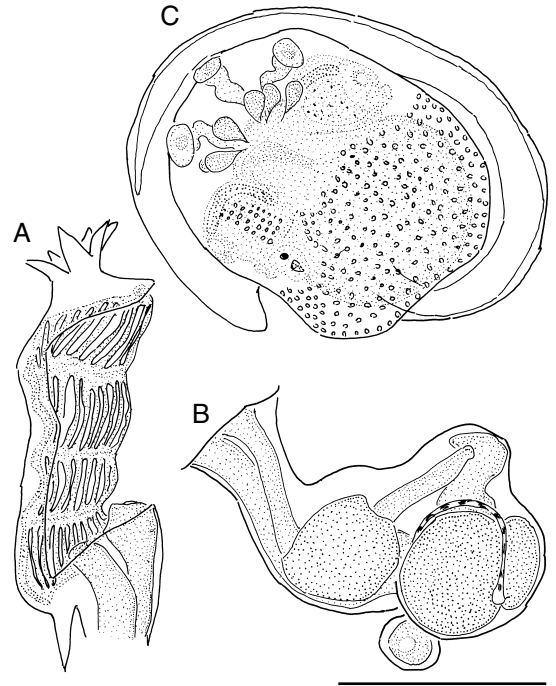


FIG. 60. — *Diplosoma marsupiale* n. sp.; A, thorax; B, abdomen; C, larva. Scale bar: 0.5 mm.

The zooids are gathered in groups in gelatinous cores of tunic separated by wide channels. The superficial and basal sheets of tunic have a firmer consistency than intermediate levels. Brown pigment cells are scattered throughout the tunic, but more abundant around the zooids. The body wall of the zooids is devoid of pigment, but some is present in the larvae. The thoraces are elongated with a narrow oral siphon fringed by six small lobes (Fig. 61A). The cloacal aperture is large. The branchial stigmata could not be counted. The retractor muscle is absent and the waist is short. The abdomen (Fig. 61B, C) is folded under the thorax, and the single-lobed testis protrudes below the gut loop. The sperm duct arises from the posterior part of the testis, passes over it and then follows the rectum. Its proximal part is inflated (Fig. 61B, C). The oocytes develop in a pouch protruding from the abdominal body wall. The larvae (Fig. 61D) develop in the basal layer of the colony. They are oval with a tail equal in length to the trunk. The three short, stout

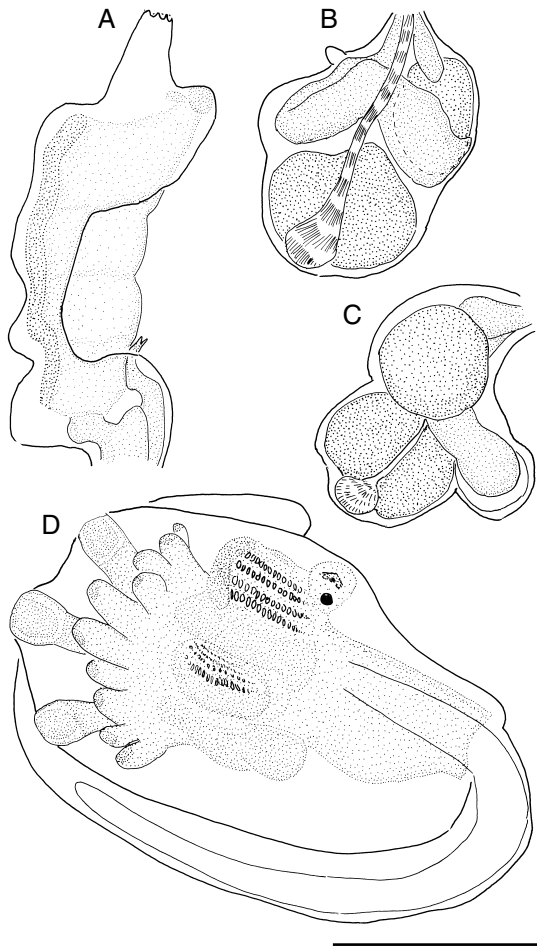


FIG. 61. — *Diplosoma pannosum* n. sp.: A, thorax; B, C, abdomen; D, larva. Scale bar: 0.5 mm.

adhesive papillae are encircled by about 20 clear ampullae that have dense tips. The sensory vesicles lie in a protrusion of the larval thorax where four rows of stigmata already appear. A bud grows on each side of the larva. The larva measures 1.25 mm.

REMARKS

Among the *Diplosoma* species with a single testis follicle, *D. pannosum* n. sp. differs from *Diplosoma ata* Monniot C. & Monniot F., 1987 in the absence of retractor muscle and more numerous larval ampullae. It differs from

Diplosoma redika Monniot F., 1994 in its larval structure.

Diplosoma handi Eldredge, 1967, from the Caroline Islands, is described as making colonies with a tough, thick, solid tunic, containing symbiotic algae in cloacal channels, and having zooids with a retractor muscle.

Diplosoma hiatti Eldredge, 1967, from Eniwetok, has zooids with a retractor muscle; the zooids are arranged around a single common cloacal aperture per colony.

Diplosoma pavonia

Monniot C. & Monniot F., 1987
(Figs 62; 121F)

Diplosoma pavonia Monniot C. & Monniot F., 1987: 60, fig. 21. Type locality: Solomon Islands.

MATERIAL EXAMINED. — Indonesia. N Sulawesi, West of Manado, 1°23.52'N, 124°32.64'E, 5 m, 14.IV.1993 (MNHN A2 DIP.A 144).

DESCRIPTION

The colonies are dark green, growing on dead corals (Fig. 121F). The common cloacal cavity is filled with symbiotic algae. The plate-like colony is attached to the coral by a short, narrow peduncle. The colony surface is flat with a central common cloacal aperture. The tunic is hard and resistant. The zooids have a long oral siphon, often curved, as in the type specimen, with six small lobes. The cloacal siphon is large but the body wall covers the first and fourth rows of stigmata. The retractor muscle is inserted very posteriorly on the oesophageal peduncle. The abdomen has the common shape of the genus. There are two voluminous testis follicles. The sperm duct is straight. The ovary, with a very large oocyte, lies on the side of the testis.

The larvae are large, 1.1 mm in diameter for the trunk (Fig. 62). They have many adhesive papillae in a line, some of them on bifurcated stems (Fig. 62), and two pairs of digitiform ampullae. The larvae are gemmiparous. A very large "rastrum" in the shape of two wings occurs at the base of the tail. Many larvae in

the colony had degenerated, with only the adhesive papillae and sensory organs remaining in their bodies.

REMARKS

This species is recorded again here for the first time.

Diplosoma redika Monniot F., 1994
(Figs 63; 122A)

Diplosoma redika Monniot F., 1994: 7, fig. 3. Type locality: New Caledonia.

MATERIAL EXAMINED. — **Philippines**. Mindanao, Davao, Pakiputan Strait, 7°07.36'N, 125°40.11'E, 33 m, 3.IV.1996 (MNHN A2 DIP.A 134). — Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 7 m, 18.IV.1997 (MNHN A2 DIP.A 143).

DESCRIPTION

The colonies are very thin and soft, transparent (Fig. 122A), in large gelatinous sheets encrusting calcareous pebbles. In life, the common cloacal apertures are atop erect small chimneys on colonies that are 5 to 10 mm thick underwater, but reduced to 1 mm thick when fixed. The zooids are colourless, hardly visible as pale flecks in the vitreous tunic, which often falls apart into mucous strings.

The oral siphon is narrow with short lobes. The cloacal aperture is wide. The number of stigmata could not be counted in the very retracted zooids. There is no retractor muscle (Fig. 63A).

The abdomen is folded under the thorax. The gut loop is narrow, and a single testis follicle protrudes from its exterior side (Fig. 63A, B). The sperm duct is enlarged along the testis, where it makes a groove. The ovary is located against the testis, but the maturing oocytes enter a pedunculate pouch of the body wall that rapidly isolates them from the mother zooid (Fig. 63B).

Numerous small larvae (Fig. 63C) lie in the basal layer of the colony. They measure 0.5 mm in diameter. They have three urn-shaped adhesive papillae on thin stems and four pairs of well-separated clavate ampullae. There is one bud on each side of the larval body.

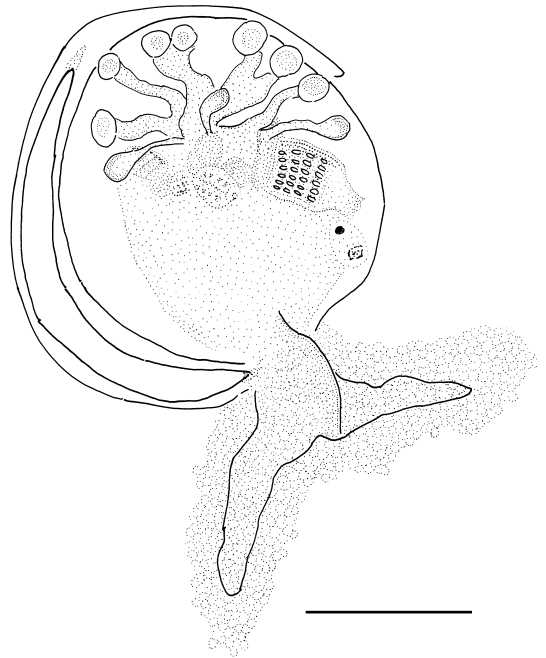


FIG. 62. — *Diplosoma pavonia* Monniot C. & Monniot F., 1987, larva. Scale bar: 0.5 mm.

REMARKS

This species, previously described from New Caledonia, is characterised by its colourless, translucent, gelatinous colonies, a single testis follicle, and a larva with four well-separated ampullae on each side of the adhesive papillae. The distribution of this species may be wide but its fluid consistency excludes any collection except by SCUBA and so may have excluded as well wider records from the tropical western Pacific.

Diplosoma simile (Sluiter, 1909)

Leptoclinum simile Sluiter, 1909: 77. Type locality: Indonesia.

Diplosoma similis – Monniot F. & Monniot C. 1996: 170, Indonesia.

MATERIAL EXAMINED. — **Palau**. Ngiwal, 7°31.43'N, 134°37.66'E, 1 m, 8.V.1996 (MNHN A2 DIP.A 141). — Koror, Ngermeumangel Island, E side, 7°19.60'N, 134°30.84'E, 1 m, 27.XI.1996 (MNHN A2 DIP.A 140).

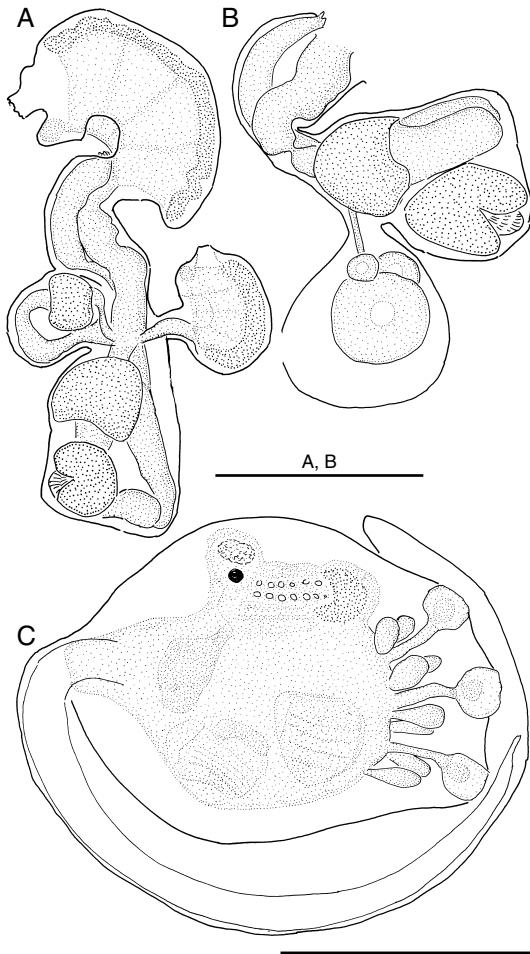


FIG. 63. — *Diplosoma redika* Monniot F., 1994; **A**, zooid; **B**, gonads; **C**, larva. Scale bars: A, B, 0.5 mm; C, 0.3 mm.

***Diplosoma unitestis* n. sp.**
(Fig. 64A-C)

TYPE MATERIAL. — Palau. Koror, West Uchelbeluu Reef, Short Dropoff, cave, 7°15.96'N, 134°31.28'E, 12 m, 28.VIII.1997 (MNHN A2 DIP.A 157).

ETYMOLOGY. — From the Latin *unus*: one and *testis*: testis.

DESCRIPTION

The colonies are very soft cushions about 1 cm thick when fixed. They probably were much inflated in life. They are colourless in formalin with a transparent tunic that allows one to see the zooids and embryos.

The zooids have a small oral siphon with six pointed lobes and a large cloacal aperture without a languet, uncovering most of the branchial sac (Fig. 64A). There are eight stigmata per side in the three first rows and six in the last row. There is no retractor muscle.

The abdomen is folded under the thorax (Fig. 64A, B). The digestive loop is wide and in its centre is a single spherical testis lobe. At its beginning the sperm duct moves well away from the lobe (Fig. 64A, B) and then it follows the rectum. The ovary is isolated into a pouch of the body wall below the abdomen (Fig. 64A, B). There are several oocytes maturing at the same time. A digitiform vascular appendage protrudes from the centre of the gut loop and penetrates the tunic next to the ovary (Fig. 64A, B).

The larvae (Fig. 64C) are incubated in large numbers in the basal layer of the colony, but few have reached full development in our specimen. They have a small size (0.4 mm in diameter) and are not gemmiparous. They have three adhesive papillae and one pair of lateral ampullae on each side.

REMARKS

Few species of *Diplosoma* have only one testis follicle. Among them are *D. ata* Monniot C. & Monniot F., 1987, *Diplosoma multipapillata* Kott, 1980, *D. redika* Monniot F., 1994: these have gemmiparous larvae. The European *Diplosoma singulare* Lafargue, 1968 has more lateral ampullae in the larva. *D. handi* Eldredge, 1967 and *D. hiatti* Eldredge, 1967 and *Diplosoma siphoniata* Romanov, 1977 are not sufficiently described to be compared.

***Diplosoma versicolor* Monniot F., 1994**
(Figs 64D; 122B)

Diplosoma versicolor Monniot F., 1994: 9, fig. 4. Type locality: New Caledonia.

MATERIAL EXAMINED. — Philippines. Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 7 m, 18.IV.1997 (MNHN A2 DIP.A 147).

Federated States of Micronesia. Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm growing on nylon

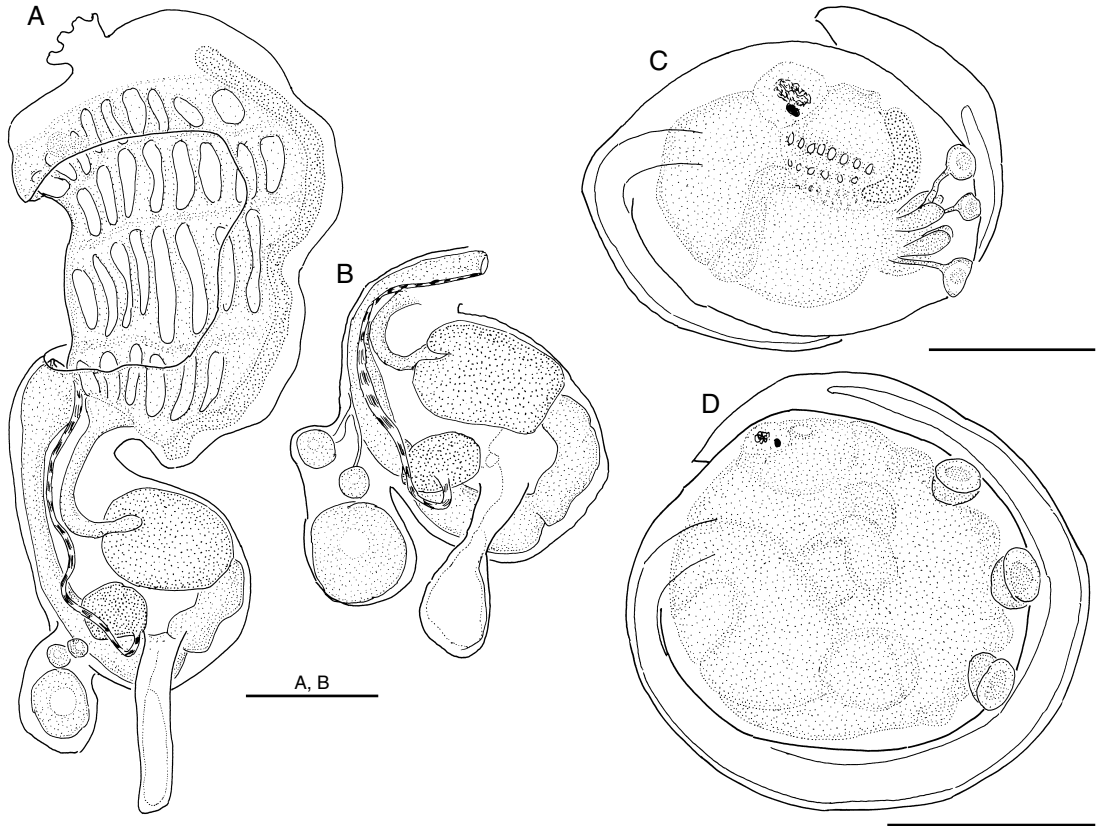


FIG. 64. — A-C, *Diplosoma unitestis* n. sp.; A, zoid; B, abdomen; C, larva; D, *Diplosoma versicolor* Monniot F., 1994, larva. Scale bars: A-C, 0.25 mm; D, 0.5 mm.

line, 6°57.68'N, 158°17.85'E, 15.X.1996 (MNHN A2 DIP.A 142).

DESCRIPTION

The colonies of this species are thick, with very few common cloacal openings. The tunic is opaque with a variable design in well-delimited brown and pure white patches (Fig. 122B). The zooids are grouped in cores of tunic in a wide common cloacal cavity.

The zooids have a long thorax and a brown body wall. There are at least 10 stigmata in a half row. The retractor muscle is located at the base of the thorax. The large abdomen encloses a voluminous stomach. The testis is usually made of two follicles, but in the same colony there are three testis follicles in some zooids.

The larvae are large, round, and deeply coloured (Fig. 64D). The trunk is 1 mm in diameter. The three short and wide adhesive papillae are well-separated. At the base of the papillae, four pairs of club-shaped ampullae are barely visible through the opaque body wall.

REMARKS

A pontomid shrimp was sheltered in the wide cloacal cavity of one colony. Parasitic copepods inhabit the tunic. This species was described from New Caledonia with the same colony shape and superficial design. The Philippines colonies allow us to describe the larvae of this species, which were absent from the immature New Caledonian specimens.

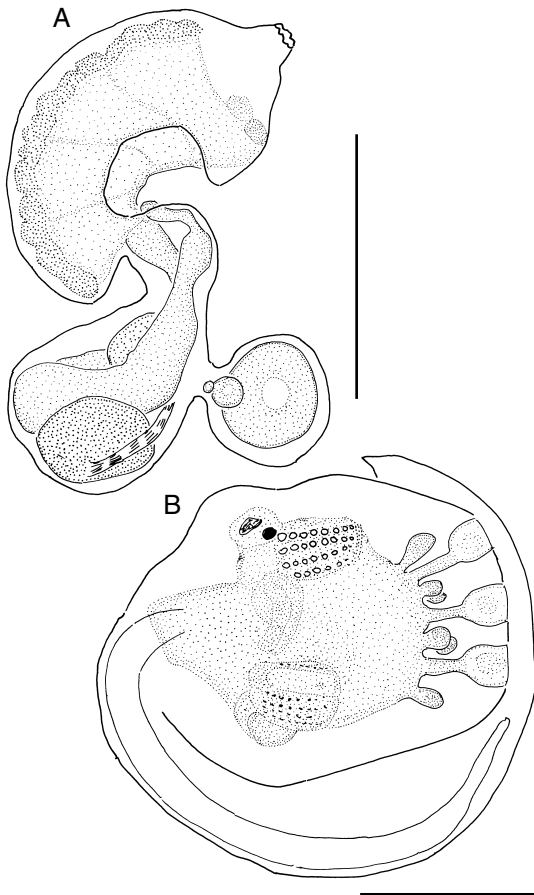


FIG. 65. — *Lissoclinum abdominale* Monniot F., 1983; **A**, zoid; **B**, larva. Scale bars: A, 0.5 mm; B, 0.25 mm.

Genus *Lissoclinum* Verrill, 1871

Lissoclinum abdominale Monniot F., 1983
(Figs 65; 122C)

Lissoclinum abdominale Monniot F., 1983: 33, fig. 14.
Type locality: Guadeloupe; 1992: 566, New Caledonia.

MATERIAL EXAMINED. — **Papua New Guinea**. Milne Bay Province, Reef SE of Drawari Island, 10°18.03'S, 151°03.94'E, 16 m, 6.VI.1998 (Sample: CRRF).

DESCRIPTION

As the type of the species is, these colonies are mucous, transparent, and encrust all kinds of substrates (Fig. 122C). They disintegrate very

easily when touched. The spicules are concentrated in two spots, one at the top of the endostyle and another on the abdomen at its contact with the thorax. The small zooids are colourless, but the spicules give them a spotted white aspect. There are six small oral lobes (Fig. 65A). The thorax is about 0.5 mm in length. The cloacal aperture is wide but often narrowed by the thoracic musculature (Fig. 65A). There is no cloacal languet. We have not found lateral thoracic organs or a retractor muscle.

The abdomen is folded under the thorax, with the usual shape of the gut loop. The single testis lobe lies in the middle of the gut loop but the ovary protrudes to the side (Fig. 65A).

The larvae (Fig. 65B) are numerous in the mucous basal layer of the colonies. They have three adhesive papillae on long peduncles and four pairs of digitiform ampullae. There is one bud on each side of the vitellus mass. The larvae are 0.55 mm in length, and the tail is wound in half a turn around the trunk.

The spicules are small balls of numerous needles that are not regularly arranged.

REMARKS

This Atlantic species was collected, too, in New Caledonia (Monniot F. 1992), so its geographical range is wide. It is surprising to find so fragile a species in such far-removed places, but no character or combination of them allows a separation of these *Lissoclinum* Verrill, 1871 specimens into separate species.

Lissoclinum badium

Monniot F. & Monniot C., 1996

Lissoclinum badium Monniot F. & Monniot C., 1996: 170, figs 19A, B; 20A, pl. 3E. Type locality: western Pacific.

MATERIAL EXAMINED. — **Palau**. Koror, Lighthouse Channel, 7°17.03'N, 134°27.82'E, 10 m, 20.V.1994 (MNHN A2 LIS 128). — Kayangel Channel, 8°02.35'N, 134°41.60'E, 12 m, 12.VII.1996 (MNHN A2 LIS 151).

Papua New Guinea. Milne Bay Province, East Cape, Boia Boia Waga Island, 10°12.26'S, 150°44.75'E, 7 m, 27.V.1998 (MNHN A2 LIS 158).

Lissoclinum bistratum (Sluiter, 1905)

Didemnum bistratum Sluiter, 1905: 103. Type locality: Somalia.

Lissoclinum bistratum – Monniot F. 1992: 566, New Caledonia.

Lissoclinum voeltzkowi (Michaelsen, 1920) – Monniot F. & Monniot C. 1996: 175, Palau.

MATERIAL EXAMINED. — **Indonesia.** Tawata Island, 20 m, coll. Erhardt (MNHN A2 LIS 160).

Palau. Koror, Ngerchelangel, 7°19.27'N, 134°29.32'E, 10 m, 3.IX.1996 (MNHN A2 LIS 147).

Tonga. Tongatapu, Tufaka Island, 21°03.83'S, 175°15.42'W, 2 m, 19.XI.1997 (MNHN A2 LIS 155).

Fiji. Coll. Ireland (MNHN A2 LIS 113-114).

Yemen. Socotra Island, coll. Monniot (MNHN A2 LIS 164).

Tanzania. Pemba Island, 5°09.20'S, 39°37.88'E, 10 m, coll. Monniot (MNHN A2 LIS 143).

Mozambique. Ibo Island, 2-10 m, coll. Monniot (MNHN A2 LIS 140-142).

Comoros. Mayotte Island, 15 m, coll. Akinin (MNHN A2 LIS 139).

Madagascar. Nosy-Be, 12-15 m, coll. Laboute (MNHN A2 LIS 112).

South Africa. KwaZulu Natal, Sodwana Bay, 19 m, coll. Schleyer (MNHN A2 LIS 136).

REMARKS

Green flat cushions of *Lissoclinum* colonies, containing abundant symbiotic algae in their common cloacal cavity, have been collected in many stations, as well in the western Pacific Ocean and the Indian Ocean. All colonies have similar zooids and larvae. Differences appear only in the shape and size of spicules. The presence of brown pigment cells in the tunic is variable.

We have examined the type specimens of *Lissoclinum bistratum* (Sluiter, 1905), MNHN A2 LIS 24 and *Lissoclinum timorensis* (Sluiter, 1909) ZMA TU 482 and 1274. They differ only in the shape of spicules. Both shapes of spicules, and intermediate ones, were found either in the Pacific or Indian colonies that we studied, sometimes in the same locality. The anatomical characters of all these specimens are constant. In Michaelsen's (1920) description, *L. voeltzkowi* differs from *L. bistratum* in lateral organs protruding into the tunic instead of being internal. But examining the type of *L. bistratum*, the

lateral thoracic organs protrude externally. Michaelsen's species is said to be brown, Sluiter did not specify the color in life of *L. bistratum*.

Kott (1998) synonymized *L. voeltzkowi* with *L. timorensis*, without any explanation.

Considering the large variability of the spicules in the same geographical area, the absence of distinctive anatomical characters in the zooids and larvae, and the similar structure of the colonies, we propose to gather all the material described as *L. voeltzkowi* or *L. timorensis* in a single species *L. bistratum* (Sluiter, 1905) which has priority.

Nevertheless, the chemical differences found by chemists in populations of *L. bistratum* and *L. voeltzkowi* in New Caledonia remain puzzling, but they may be due to different symbionts.

Lissoclinum fragile (Van Name, 1902)

Diplosomoides fragile Van Name, 1902. Type locality: Bermuda.

Lissoclinum fragile – Monniot F. 1992: 570, fig. 3A, New Caledonia.

MATERIAL EXAMINED. — **Mariana Islands.** Guam, Apra Harbour, off Buoys, 0-3 m, 12.VI.1998 (MNHN A2 LIS 161).

Lissoclinum guinense n. sp.
(Figs 66; 67A; 122D)

TYPE MATERIAL. — **Papua New Guinea.** Cape Rodney Pass, 10°15.66'S, 148°22.27'E, 31 m, 11.VI.1998 (MNHN A2 LIS 152).

ETYMOLOGY. — From New Guinea.

DESCRIPTION

Inflated underwater (Fig. 122D), the colonies become flat encrusting sheets when fixed. They are colourless with a cloudy aspect due to irregularly distributed small spicules. The wide common cloacal apertures (Fig. 122D) correspond to an extensive common cloacal cavity.

The zooids are small and colourless but the eggs and larvae have a brown pigment in formalin preservative. The oral siphon is short and narrow with six pointed lobes (Fig. 66A). The cloacal aperture is narrowed by a strong thoracic musculature. There is no cloacal languet. Lateral thoracic

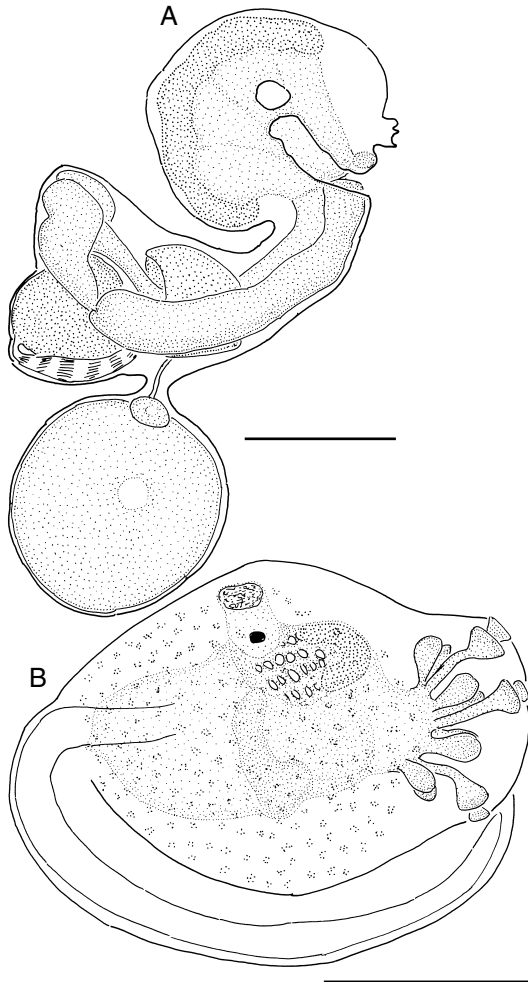


FIG. 66. — *Lissoclinum guinense* n. sp.; **A**, zoid; **B**, larva. Scale bars: 0.25 mm.

organs were not clearly observed. There is no retractor muscle.

The abdomen is folded under the thorax and the waist is short (Fig. 66A). The gut has the usual compartments. The single testis follicle lies beneath the gut loop. The sperm duct is straight. The ovary is appended in a pouch attached anteriorly to the stomach and contains one large egg (Fig. 66A). The larvae (Fig. 66B) are incubated in the basal layer of the colony. The eggs and the posterior half of larvae contain brown droplets, probably pigment cells.

The larvae are small, 0.55 mm for the trunk. They have three anterior adhesive papillae and four pairs of intercalated ampullae. The larval gut is posterior to a large vitellus vesicle. There are no buds.

The spicules (Fig. 67A) have generally four stellate branches made of needles. They measure 60 to 70 μ m. They are very similar to those of *Lissoclinum verrilli* (Van Name, 1902).

REMARKS

By numerous characters this species is closely allied to the Polynesian *Lissoclinum tubeiavae* Monniot C. & Monniot F., 1987. The latter has larger zooids and much larger spicules, and its larvae have no pigment. But both species share the absence of a cloacal languet, the absence of a retractor muscle, the shape of the ovary, and a non-gemmiparous larva with four pairs of anterior ampullae.

Lissoclinum verrilli has the same shape of spicules, but its larvae are gemmiparous. *Lissoclinum triangulum* Sluiter, 1909 has different spicules and a larva with six pairs of larval ampullae.

Lissoclinum patella (Gottschaldt, 1898)

Didemnoides patella Gottschaldt, 1898: 651. Type locality: Indonesia.

Lissoclinum patella – Monniot F. & Monniot C. 1996: 174, Palau.

MATERIAL EXAMINED. — Palau. Koror, Ngermechuangel, 7°19.13'N, 134°30.40'E, 1 m, 8.VII.1994 (MNHN A2 LIS 129).

Philippines. NE Panay, Bayas Island off Estancia town, 11°26.50'N, 123°12.00'E, 1 m, 28.IV.1995 (MNHN A2 LIS 131).

Papua New Guinea. Milne Bay Province, East Cape, Boia Boia Waga Island, 10°12.26'S, 150°44.75'E, 10 m, 27.V.1998 (MNHN A2 LIS 157).

?*Lissoclinum taratara*

Monniot C. & Monniot F., 1987 (Fig. 122E)

Lissoclinum taratara Monniot C. & Monniot F., 1987: 52, fig. 18A-E, pl. IVA. Type locality: Polynesia.

MATERIAL EXAMINED. — Papua New Guinea. Coral Sea, eastern Fields, 10°02.22'S, 145°33.01'E, 12 m, 14.VI.1998 (MNHN A2 LIS 159).

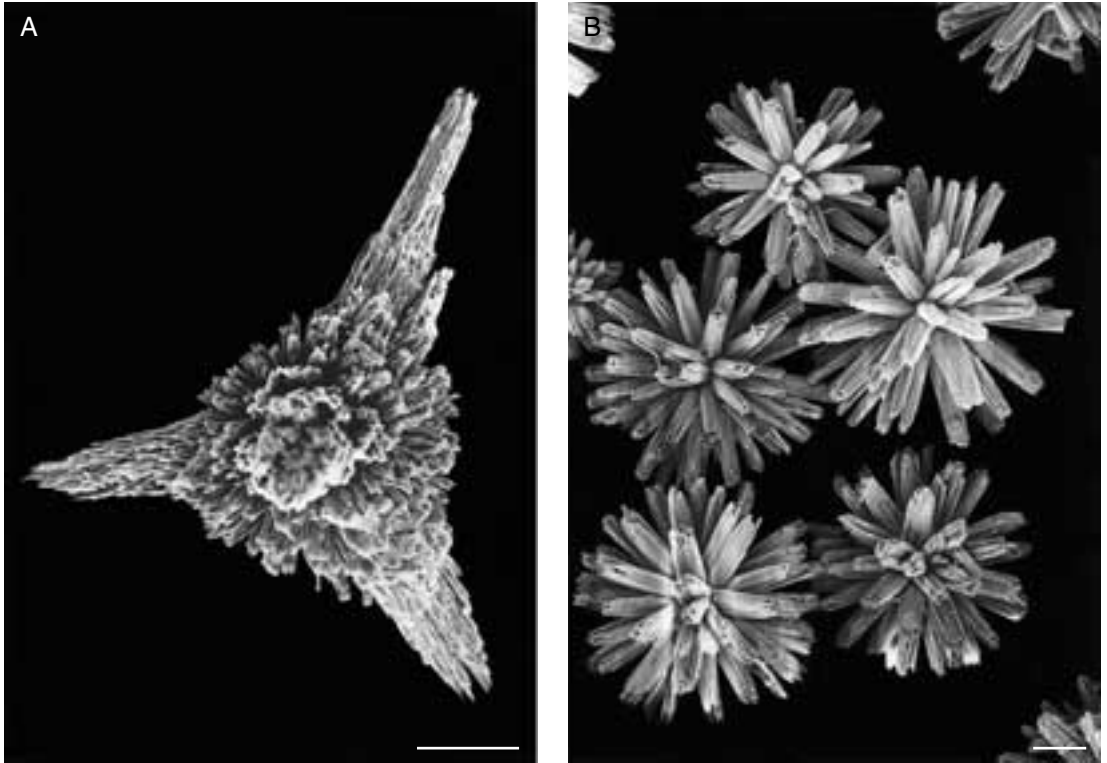


FIG. 67. — Spicules; **A**, *Lissoclinum guinense* n. sp.; **B**, *Lissoclinum textile* n. sp. Scale bars: 10 μ m.

DESCRIPTION

The colony is very soft, even billowy in life, and of a pale yellow (Fig. 122E). The zooids are in small groups separated by a wide common cloacal cavity. The tunic is glassy. The spicules are sparse except around the zooids, where they form capsules. The shape of the spicules, with long pointed rays of unequal length, is characteristic.

The zooids have a short oral siphon. The lateral thoracic organs are placed above the second transverse vessel. The abdomen is folded under the thorax. There is a single testis follicle and a straight sperm duct. No larvae were present in the colony studied.

REMARKS

The colonies' fragile consistency and the anatomical characters of the zooids are not sufficient to ascertain the identity of this *Lisso-*

clinum species. Here the spicules have a characteristic shape and size, but in the absence of larvae either in the type or here, the identification remains problematic.

Lissoclinum textile n. sp.
(Figs 67B; 68; 122F)

TYPE MATERIAL. — Papua New Guinea. Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 12 m, 1.VI.1998 (MNHN A2 LIS 163).

ETYMOLOGY. — From the Latin *textile*: cloth.

DESCRIPTION

The thin white crusts have a lobed outline, and a smooth surface with a design of brown lines drawing polygonal meshes (Fig. 122F) (hence the species name). The brown pigment cells are

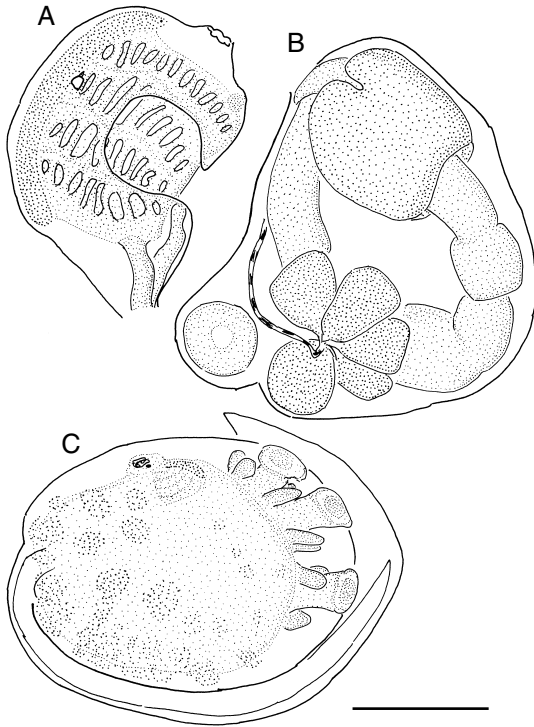


FIG. 68. — *Lissoclinum textile* n. sp.; **A**, thorax; **B**, abdomen; **C**, larva. Scale bar: A, B, 0.25 mm; C, 0.5 mm.

distributed exclusively in the surface layer above the common cloacal channels; the zooids line each side of the channels and are absent from the centre of the meshes. The whole tunic is filled with spicules but the colonies remain soft. The zooids, which have their abdomens folded under the thorax, occupy only the upper half of the colony's thickness of the colony. The oral siphon is short and narrow (Fig. 68A). The cloacal aperture is moderately large, without a languet. The round lateral thoracic organs form cups, at the level of the second row of stigmata, near the endostyle. The branchial sac has a square shape with 12 stigmata in the first half row and 10 in the fourth half row. There is no retractor muscle. The abdomen (Fig. 68B) is difficult to find as it is embedded in a body wall filled with reserve cells. The gut loop is flat with neatly separated compartments (Fig. 68B). There are up to five well-separated testis follicles in a rosette, their

ducts joining in a straight common sperm duct. The ovary lies against the testis.

Only one larva was found in the three colonies examined, located in a cloacal channel and protruding at the colony surface. It is large, 1.3 mm for the trunk (Fig. 68C). There are three adhesive papillae, and five ampullae on each side. The larval body wall is filled with reserve cells. An ocellus and otolith are present.

The stellate spicules (Fig. 67B), 80 μ m in diameter, are made of numerous thin needles.

REMARKS

Lissoclinum species having several testis follicles are not common. *L. textile* n. sp. is closely allied to the New Caledonian species *L. polyorchis* Monniot F., 1992, with the same number of stigmata, no cloacal languet, no retractor muscle, and several testis lobes. But *Lissoclinum polyorchis* has a large cloacal opening, only four pairs of ampullae alongside the larval adhesive papillae, and its spicules are different in shape. As well, the colonies in that species lack the surface design with brown meshes characteristic of *L. textile*, and the disposition of the zooids in the colony is different.

Genus *Atriolum* Kott, 1983

Atriolum robustum Kott, 1983 (Fig. 123A)

Atriolum robustum Kott, 1983: 15, figs 1-4. Type locality: Northern Australia. — Millar 1988: 830, fig. 3, Madagascar. — Lafargue & Vasseur 1989: 61, fig. 2, Mayotte, Mauritius. — Monniot F. 1990b: 676, fig. 2, pl. IB, New Caledonia.

MATERIAL EXAMINED. — Papua New Guinea, Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 7 m, 1.VI.1998 (MNHN A2 ATR 15).

REMARKS

The colonies are made of several urn-shaped lobes on a common base. The colour is a mixture of green, pink, and light brown with white rims of the large common cloacal apertures (Fig. 123A). Symbiotic algae are present in the tunic. All char-

acters agree with previous descriptions. No larvae were found in this material.

The distribution of this species is wide in both the western Pacific Ocean and in the Indian Ocean.

Genus *Leptoclinides* Bjerkan, 1905

Leptoclinides dubius (Sluiter, 1909)

Polysyncraton dubium Sluiter, 1909: 69. Type locality: Indonesia.

Leptoclinides dubius – Monniot F. & Monniot C. 1996: 176, pl 3H, western Pacific.

MATERIAL EXAMINED. — **Papua New Guinea.** Louisiades, Calvados Island, Brooker Channel, 11°03.09'S, 152°28.62'E, 12 m (Sample: CRRF).

Leptoclinides madara Tokioka, 1953
(Figs 69; 70; 123B)

Leptoclinides madara Tokioka, 1953: 200, pl. 1, fig. 2; pl. 23, figs 1-6. Type locality: Sagami Bay. — Nishikawa 1990: 116, Japan sea.

MATERIAL EXAMINED. — **Palau.** Babeldaob, Ibobang, 7°30.58'N, 134°29.66'E, 10 m, 11.VI.1996 (MNHN A2 LEP 73).

Papua New Guinea. New Ireland, S Coast, outside Kalili Harbour, 3°26.62'S, 151°56.00'E, 15 m, 11.IV.1993 (MNHN A2 LEP 72). — Milne Bay Province, China Straits, 10°34.50'S, 150°40.73'E, 93 m, 10.VI.1998 (Sample: CRRF).

Philippines. Bohol Sea, Balicasag Island SW of Bohol, 9°31.26'N, 123°41.05'E, 13 m, 16.IV.1997 (MNHN A2 LEP 74). — Bohol Sea, Balicasag Island SW of Bohol, 9°31.23'N, 123°40.98'E, 22.IV.1997 (MNHN A2 LEP 76).

DESCRIPTION

The colonies are hard crusts, 5-10 mm thick, irregular in outline and variably pigmented. They have large white and orange patches and irregular black-green specks (Fig. 123B). The proportions of these colours are highly variable. The pigments are restricted to the surface layer of the colonies. The zooids are perpendicular to the colony surface.

Both siphons are long, with strong sphincters and without lobes at their rim (Fig. 69A). The thoracic musculature is longitudinal with eight to

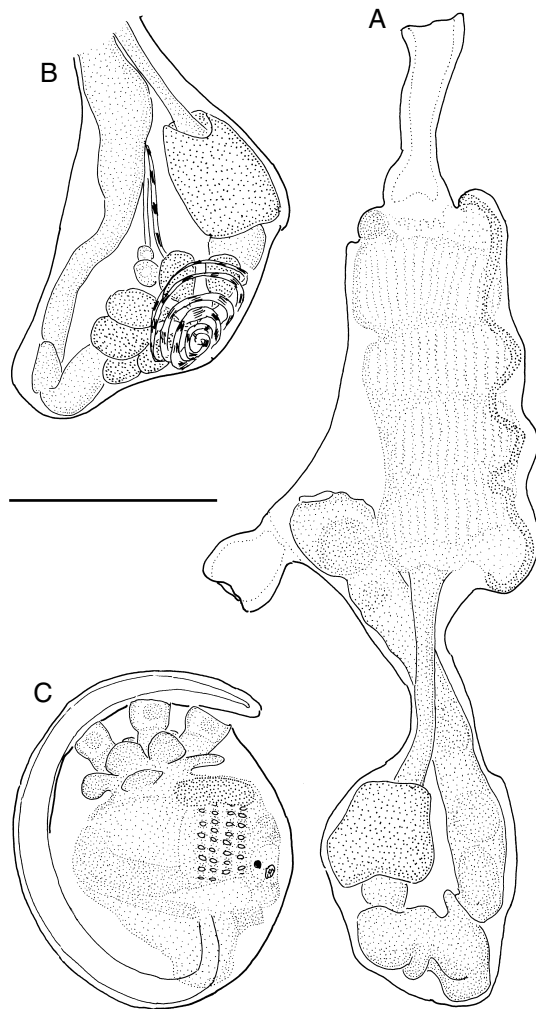


FIG. 69. — *Leptoclinides madara* Tokioka, 1953; **A**, zooid; **B**, gonads; **C**, larva. Scale bar: 0.5 mm.

10 well-spaced bundles. The branchial sac has numerous long stigmata, about 16 in the two first half rows and 15 in the two last half rows. There is no retractor muscle. The lateral thoracic organs are large, in cups at the level of the third transverse vessel. The abdomen is not folded under the thorax (Fig. 69A). It has an elongate shape; the oesophagus is long, and the mid-intestine is horizontal in contrast to the vertical foregut and hindgut. The testis follicles (Fig. 69B) are arranged in a rosette of three to six follicles with

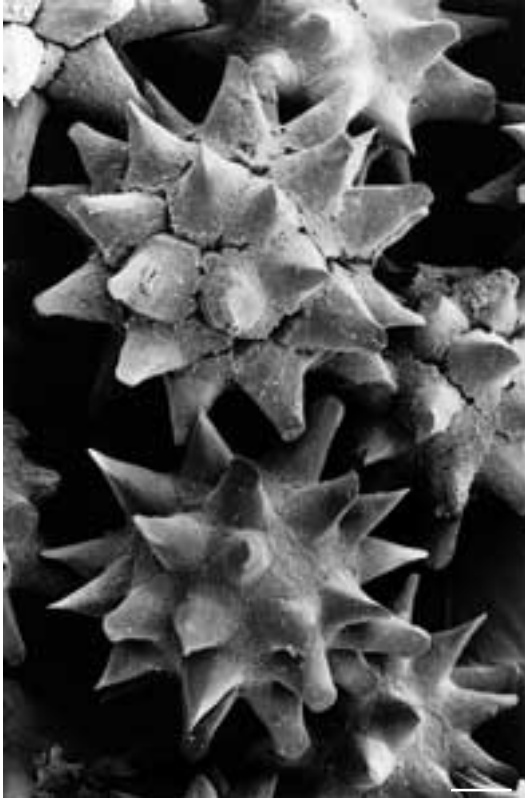


FIG. 70. — *Leptoclinides madara* Tokioka, 1953, spicules. Scale bar: 10 μ m.

an average of four. They are covered by five to six turns of the sperm duct.

Larvae were present only in a colony from Papua New Guinea. They measure 0.75 mm for the trunk (Fig. 69C). They have three anterior adhesive papillae, two pairs of ampullae between them, and one dorsal and one ventral ampulla. On the left side only is an odd anterior protrusion at the base of the ampullae.

The spicules are large and stellate. The rays have chisel-like points; the spicules measure 75 μ m for the largest (Fig. 70).

REMARKS

The specimens correspond well to previous descriptions of the species' colour and the anatomical characters. All *Leptoclinides* species are so similar in their zooids' characters that it is dif-

ficult to decide if the present specimens belong to Tokioka's species, but the colour pattern seems characteristic.

L. madara is widely distributed in the western tropical Pacific Ocean.

Leptoclinides oscitans

Monniot F. & Monniot C., 1996

Leptoclinides oscitans Monniot F. & Monniot C., 1996: 177, figs 22; 24A, pl. 4A. Type locality: Indonesia.

MATERIAL EXAMINED. — **Palau.** KB Channel, Airai side South of KB Bridge, 7°21.03'N, 134°30.95'E, 10 m, 2.VI.1994 (MNHN A2 LEP 54). — Wonder Channel, 7°10.83'N, 134°21.67'E, 10 m, 30.VIII.1996 (MNHN A2 LEP 65). — Ngemelis, Bailechesengel Island, Big Drop Off, 7°06.22'N, 134°15.06'E, 20 m, 26.XI.1996 (MNHN A2 LEP 67).

Philippines. Mindanao, Davao, N side Talikud Island, Angel Cove Wall, 6°57.72'N, 125°40.94'E, 7 m, 27.III.1996 (MNHN A2 LEP 57).

Leptoclinides reticulatus (Sluiter, 1909)

Didemnum reticulatum Sluiter, 1909: 60. Type locality: Indonesia.

Leptoclinides reticulatus — Monniot F. & Monniot C. 1996: 178, figs 23; 24B, pl. 4B, Palau.

MATERIAL EXAMINED. — **Indonesia.** N Sulawesi, West of Manado, 1°23.52'N, 124°32.64'E, 10 m, 14.V.1993 (MNHN A2 LEP 77).

Palau. Koror, Ngederrak Reef along Ngel Channel, seagrass bed, 7°17.90'N, 134°28.34'E, 1 m, 27.XI.1996 (MNHN A2 LEP 78).

Leptoclinides subviridis (Sluiter, 1909)

(Figs 71; 123C)

Leptoclinium subviridis Sluiter, 1909: 81, pl. IV, fig. 9. Type locality: Banda Sea.

MATERIAL EXAMINED. — **Philippines.** Mindanao, Davao, SW of Samal Island, W side of Talikud Island, 6°56.11'N, 125°40.46'E, 3 m, 31.III.1996 (MNHN A2 LEP 82).

DESCRIPTION

The colonies were not abundant but they were found in several places. They form low cushions of a rubbery consistency, 1 cm thick and

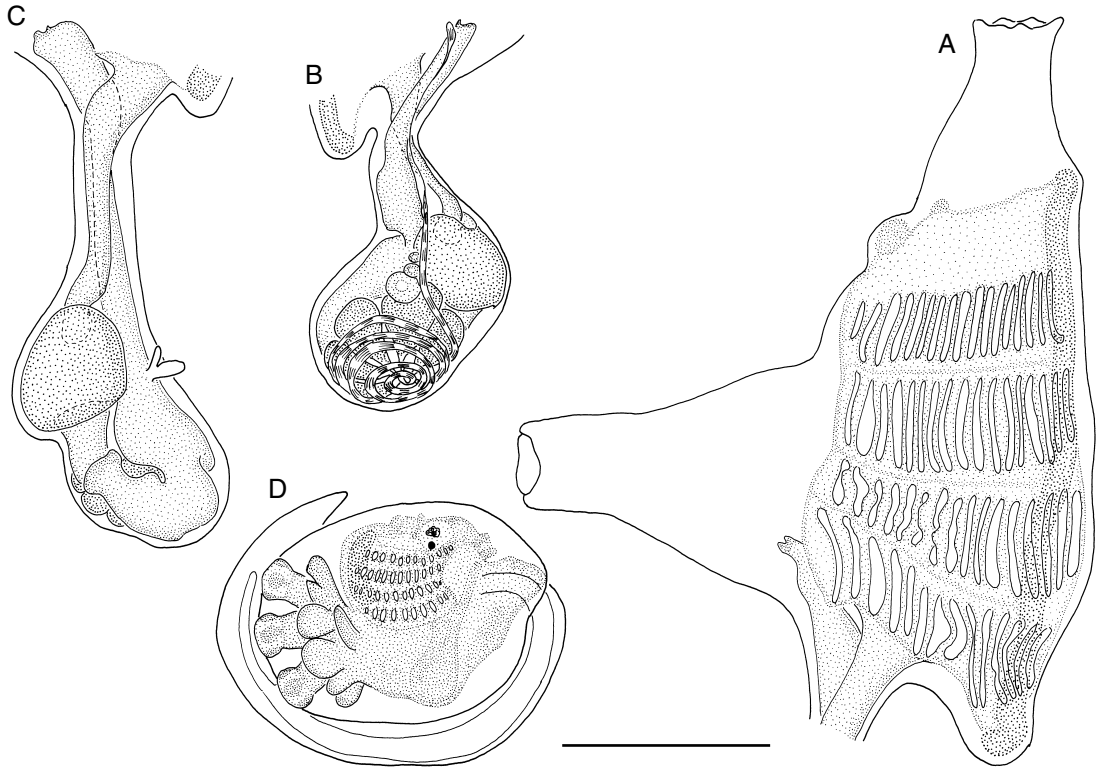


FIG. 71. — *Leptoclinides subviridis* (Sluiter, 1909); A, thorax; B, C, abdomens; D, larva. Scale bar: 0.5 mm.

5 to 8 cm across. The surface of the colony is raised in convoluted ridges between hollows and furrows into which the oral apertures open (Fig. 123C). This shape reminds one of the didemnid *Lissoclinum patella* (Gottschaldt, 1898). The colour is pale grey, slightly translucent, with dark spots that are probably symbiotic organisms gathered in balls in the surface layer of the colony. Rare elongated and dendritic pigment cells are scattered in the tunic. No trace of spicules could be found in any part of the vacuolated tunic.

The common cloacal cavity is large, interrupted only by some pillars of tunic uniting the upper part of the colony, which contains the zooids and larvae, to the basal layer. This wide cavity opens at the colony surface by a few wide holes.

The zooids have a large thorax (Fig. 71A) and a much smaller abdomen (Fig. 71B, C), either

folded under the thorax or in a straight line according to the zooid distribution in the colony. The oral siphon has occasionally six undulations but no true lobes, and a weak sphincter. There are a dozen irregular oral tentacles. The cloacal tube is long and wide with a plain edge. The thoracic musculature is weak with about 15 very thin, regularly spaced longitudinal fibres. Fourteen to 16 elongated stigmata constitute the first branchial half row. The lateral thoracic organs and a retractor muscle are absent.

The waist is narrow. The gut makes a closed loop (Fig. 71B, C). The only well-marked compartment is the stomach. The anus opens next to the oesophagus entrance. The testis is made of a flat rosette of six to eight lobes applied to the gut loop, and the sperm duct is coiled in five to six turns above it (Fig. 71B). The ovary lies against the testis, and also on the stomach.

The larvae (Fig. 71D) develop in the tunic close to the abdomens. They are almost spherical with an already well-developed branchial sac. The three adhesive papillae are stout and short (Fig. 71D). Beside them are four pairs of ampullae or sometimes six pairs resulting from a division at an advanced stage. The larvae are not gemmiparous.

REMARKS

This species differs from any other *Leptoclinides* in its total absence of spicules and lateral thoracic organs, a colony whose surface is raised in ridges, and a spacious basal common cloacal cavity opening at the colony surface by wide holes. The presence of symbiotic cells is also characteristic. These samples correspond well to the type specimen (ZMA TU 595 from Banda Sea), which has the same zooid anatomy, a vascular tunic without spicules, and a thick colony. The type colony lacks larvae.

Leptoclinides sulawesii

Monniot F. & Monniot C., 1996

Leptoclinides sulawesii Monniot F. & Monniot C., 1996: 180, figs 24C; 25A, C, pl. 4C. Type locality: Micronesia.

MATERIAL EXAMINED. — **Philippines.** Mindanao, Davao, N side Talikud Island, Angel Cove Wall, 6°57.72'N, 125°40.94'E, 8 m, 27.III.1996 (MNHN A2 LEP 55).

Palau. West Babeldaob, Ibobang, 7°30.58'N, 134°29.66'E, 7 m, 10.VI.1996 (MNHN A2 LEP 64). — Wonder Channel, 7°10.83'N, 134°21.67'E, 12 m, 10.VII.1996 (MNHN A2 LEP 68).

Federated States of Micronesia. Pohnpei, Arau Channel, 6°93.75'N, 158°32.15'E, 10 m, 14.X.1996 (MNHN A2 LEP 63).

Order PHLEBOBRANCHIA

Family DIAZONIDAE Seeliger, 1906

Genus *Diazona* Savigny, 1816

Diazona angulata

Monniot F. & Monniot C., 1996

Diazona angulata Monniot F. & Monniot C., 1996: 217, fig. 39A-D, pl. 7B. Type locality: Philippines.

MATERIAL EXAMINED. — **Philippines.** Cebu, E Mactan Island, cave, 10°15.62'N, 123°59.11'E, 30 m, 13.IV.1997 (MNHN P1 DIA 34). — SW Bohol, Panglao Island, overhang, 9°37.14'N, 123°46.48'E, 23 m, 21.IV.1997 (MNHN P1 DIA 33). — Bohol Sea, Balicasag Island SW of Bohol, 9°31.02'N, 123°40.83'E, 15.IV.1997 (MNHN P1 DIA 36). — Cebu, E Mactan Island, overhang, 10°15.62'N, 123°59.11'E, 10 m, 14.IV.1997 (MNHN P1 DIA 37).

DESCRIPTION

By its internal morphology this species is very close to *D. chinensis*. It is characterised by a hard tunic and zooids partly protruding at the colony surface. The oesophago-rectal peduncle is longer than in *D. chinensis*.

Diazona chinensis (Tokioka, 1955)

Syndiazona chinensis Tokioka, 1955: 48, pl. 11a-c, fig. 1. Type locality: China Sea.

Synonymy and distribution: see *Diazona chinensis* — Monniot F. & Monniot C. 1996; 220, fig. 40, pl. 7D, Indonesia and Philippines.

MATERIAL EXAMINED. — **Indonesia.** N Sulawesi, Tg Torowitan, overhang, 1°45.10'N, 124°58.87'E, 55 m, 21.V.1993 (MNHN P1 DIA 44).

Philippines. Mindanao, Davao, N side Talikud Island, Angel Cove Wall, overhang, 6°57.72'N, 125°40.94'E, 18 m, 27.III.1996 (MNHN P1 DIA 31). — Mindanao, Davao, off NE Samal Island, SW Ligit (Big Cruz) Island, 7°09.63'N, 125°47.05'E, 18 m, 30.III.1996 (MNHN P1 DIA 32).

Vanuatu. 16°36.05'S, 167°29.9'E, 40-55 m (MNHN P1 DIA 30).

REMARKS

This species is always massive.

Diazona formosa

Monniot F. & Monniot C., 1996

(Fig. 123D)

Diazona formosa Monniot F. & Monniot C., 1996: 222, fig. 41, pl. 7E. Type locality: Indonesia.

MATERIAL EXAMINED. — **Philippines.** West Luzon, Zambales near Masinloc town, Luan Island, 15°29.96'N, 119°54.41'E, 20 m, 2.V.1995 (MNHN P1 DIA 29). — Cebu, E Mactan Island, wall, 10°15.62'N, 123°59.11'E, 60 m, 18.II.1994 (MNHN P1 DIA 1). — Bohol Sea, Camiguin Island, N side of

White Island, offshore sand cay, 9°15.87'N, 124°39.32'E, 18.IV.1997 (MNHN P1 DIA 40). — Bohol Sea, Camiguin Island, W side of White Island, offshore sand cay, 9°15.38'N, 124°30.12'E, 19.IV.1997 (MNHN P1 DIA 45).

REMARKS

These colonies have the same structure as the type colony, and the zooids are exactly similar. There are some differences in the pigment distribution. In the present specimen the lobes of the siphons are marked with six large white patches on the oral siphon and six smaller patches on the cloacal siphon (Fig. 123D). There is no pigment accumulation above the neural ganglion or the tip of the endostyle. Some of the transverse branchial vessels are pigmented, as are the dermato-branchial trabeculae. When fixed in formalin, all colours disappear.

Diazona fungia n. sp.
(Figs 72; 123E)

TYPE MATERIAL. — Fiji, Somosomo Straits, wall, 16°47.88'S, 179°54.09'E, 53 m, 3.XI.1996 (MNHN P1 DIA 46).

ETYMOLOGY. — From the Latin *fungus*: mushroom.

DESCRIPTION

The colonies are massive, pedunculate, and look like mushrooms (hence the species name). The “heads” measure 3 to 4 cm in diameter, the peduncle 2 to 3 cm in diameter and 4 to 5 cm in length. In life the colonies are white (Fig. 123E) and the pigment is diffuse. There are no circles around the siphonal apertures, which protrude very slightly in a transparent tunic. When formalin-fixed the colour turns yellow-grey. There are some encrusting bryozoans at the base of the colony. The zooids are located in the “head” of the colony, the base of the abdomens being sometimes slightly included in the peduncle. The tunic is harder on the peduncle and contains only the vascular processes. The tunic is soft around the thoraces, a little more resistant around the abdomens. A ring of fibrous and more resistant tunic encircles the top-part of the oesophago-rectal area. The thorax and abdomen are equal in

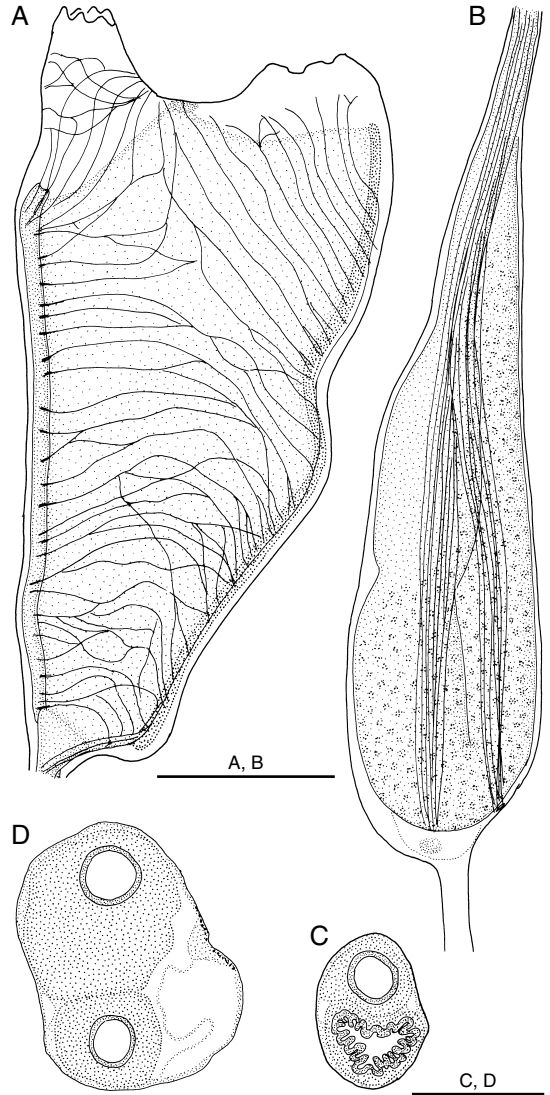


FIG. 72. — *Diazona fungia* n. sp.; A, musculature of the thorax; B, abdomen; C, section at the stomach level; D, section at the heart level. Scale bars: A, B, 2 mm; C, D, 1 mm.

length. A long vascular process extends from the abdomen. The oral siphon is terminal with six flat lobes. The cloacal siphon is longer with six sharp lobes (Fig. 72A). The muscles (Fig. 72A) are gathered in bundles starting from the dorsal side of the body. These branch along the endostyle and constitute the muscles extending along the abdomen. The siphonal

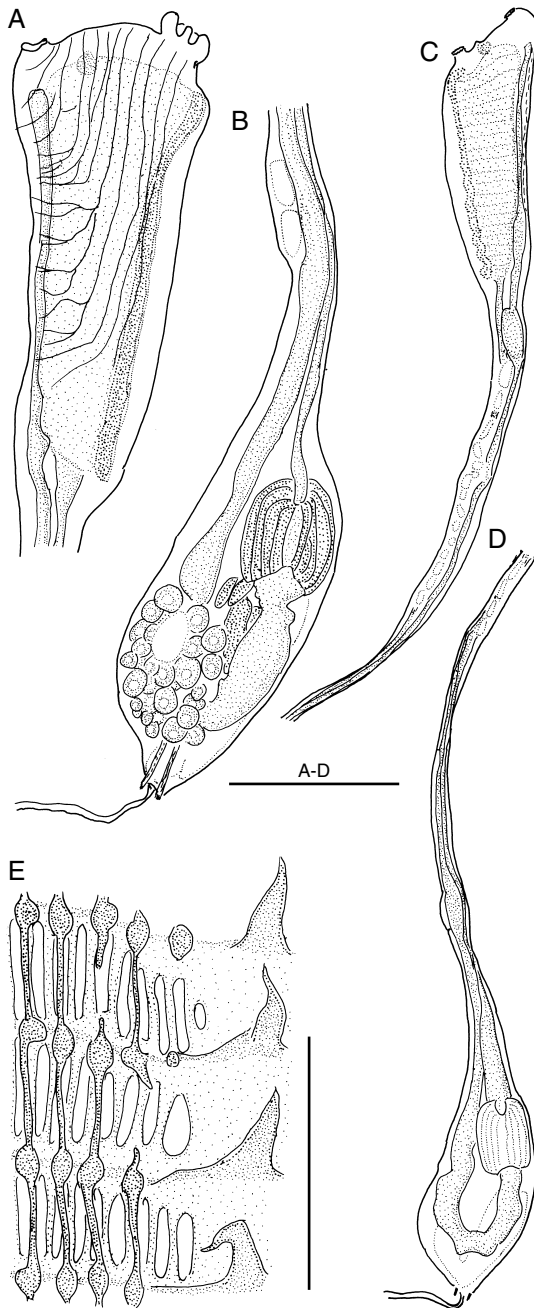


FIG. 73. — *Diazona pedunculata* n. sp.; **A**, musculature of the thorax; **B**, abdomen; **C**, **D**, both part of a zooid; **E**, part of the branchial sac. Scale bars: A, B, 1 mm; C, D, 2 mm; E, 0.3 mm.

musculature becomes oblique in the anterior third of the thorax. On the abdomen, the muscle fibres are spaced well apart before converging into two bundles along the stomach and ending without protrusions at the base of the intestine (Fig. 72B).

There are 12 oral tentacles in two orders and some smaller ones intercalated. They are planted on a crest that makes large undulations to connect the base of the largest tentacles. The prepharyngeal band has only one blade and is deeply curved dorsally. The dorsal tubercle is round, close to a diffuse neural gland. The dorsal languets are long and generally correspond to each transverse vessel, but exceptionally there is only one languet per two vessels.

The branchial sac is cylindrical, slightly narrowed in its posterior part. There are 50 to 55 rows of stigmata and about 35 longitudinal vessels on each side, most of them complete. The branchial tissue is flat; the meshes are elongated with only two stigmata apiece.

The gut is embedded in an opaque tissue layer of irregular thickness in different zooids (Fig. 72C, D), obscuring the different parts of the gut. In section, the stomach has deep grooves (Fig. 72C). The rectum is long and opens by a bilobed anus at the base of the cloacal siphon. No zooids in these specimens have mature gonads. The sperm duct runs along the rectum and opens at a short distance behind the anus.

REMARKS

This species differs from all other *Diazona* in the shape of the colony. The musculature has principally transverse fibres as does *Diazona textura*, but in the latter they ramify in the ventral part of the body. *D. fungia* n. sp. differs from *D. pedunculata* n. sp. in the size of the zooids, the length of the abdomen, and the thoracic musculature.

Diazona pedunculata n. sp.
(Figs 73; 123F)

TYPE MATERIAL. — Papua New Guinea. South coast, Coutance Island on barrier reef, overhang, 10°13.80'S, 148°06.87'E, 33 m, 13.VI.1998 (MNHN P1 DIA 48).

ETYMOLOGY. — From the Latin *pedunculus*: peduncle.

OTHER MATERIAL EXAMINED. — **Papua New Guinea.** South coast, 100 miles SE of Port Moresby, Cape Rodney Pass, 10°15.66'S, 148°22.27'E, 25 m, 11.VI.1998 (Sample: CRRF).

DESCRIPTION

The pedunculate colonies are as long as 10 cm. The peduncle, about 1 cm in diameter, is rather hard at the surface and carries some epibionts. It is divided into two or three branches each ending in a very soft and clear inflated head. The siphons, circled with a white pigment (Fig. 123F), do not show any special pattern at the colony surface. There is no sand at all in the tunic.

The zooids are extremely long (Fig. 73C, D). The thorax measures 3 mm in length in the less contracted zooids, while the abdomen reaches 25 mm. The oral siphon has six flat lobes; it is well apart from the cloacal aperture. The thoracic musculature (Fig. 73A) is regularly arranged with straight, parallel longitudinal bundles issuing from the oral siphon, then curving at their posterior ends to reach the medio-dorsal line. The shortest bundles are those arising nearest to the cloacal siphon, and the more ventral muscles are progressively longer. There is no muscle on the ventral line. The musculature is thin on the abdomen, ending grouped in two weak bundles at the abdominal extremity (Fig. 73B). They do not penetrate into the very long and thin vascular process that extends into the peduncle of the colony.

The branchial sac has about 22 rows of stigmata. The longitudinal vessels are generally complete (Fig. 73E) and bear short papillae. There are one to two elongated stigmata in a mesh. The stigmata rows are interrupted dorsally. The dorsal lamina is made of long, sharp languets. It is not displaced on the left side of the body.

The abdomen is particularly long and very thin (Fig. 73C, D), except at the posterior extremity, where it is inflated to contain the stomach and the gonads (Fig. 73B). The wall of the barrel-shaped stomach has uninterrupted folds.

The intestine does not show individualised compartments.

The gonads comprise a few testicular follicles inside the gut loop behind the stomach and an ovary with numerous oocytes placed against the testis (Fig. 73B). Many gonadal lobules or "pseudo-oocytes" are accumulated at the base of the ascending limb of the gut and make a line along the rectum. The sperm duct follows the rectum and extends beyond the anus to open at the base of the cloacal siphon.

REMARKS

D. pedunculata n. sp. differs from all other described *Diazona* except *D. fungia* n. sp. in its pedunculate colony. It differs from *D. fungia* n. sp. in the colony shape, smaller zooids, a much longer abdomen, and a different thoracic musculature.

Diazona tenera

Monniot F. & Monniot C., 1996
(Fig. 124A)

Diazona tenera Monniot F. & Monniot C., 1996: 226, fig. 42D-G, pl. 7G. Type locality: Indonesia.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 12 m, 18.IV.1997 (MNHN P1 DIA 47). — Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 12 m, 18.IV.1997 (MNHN P1 DIA 42). — SW Bohol, Panglao Island, 9°32.27'N, 123°43.54'E, 15 m, 21.IV.1997 (MNHN P1 DIA 39).

REMARKS

This species (Fig. 124A), described from Indonesia, is probably present in the whole western Pacific Ocean.

Diazona textura

Monniot C., 1987
(Figs 74; 124B)

Diazona textura Monniot C., 1987a: 4, fig. 1. Type locality: New Caledonia. — Monniot C. & Monniot F. 1991: 379, fig. 14, New Caledonia.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Chuuk Lagoon outer reef, oceanside Onang Island, 7°13.46'N, 151°37.78'E, 40 m, 18.III.1992 (MNHN P1 DIA 38).

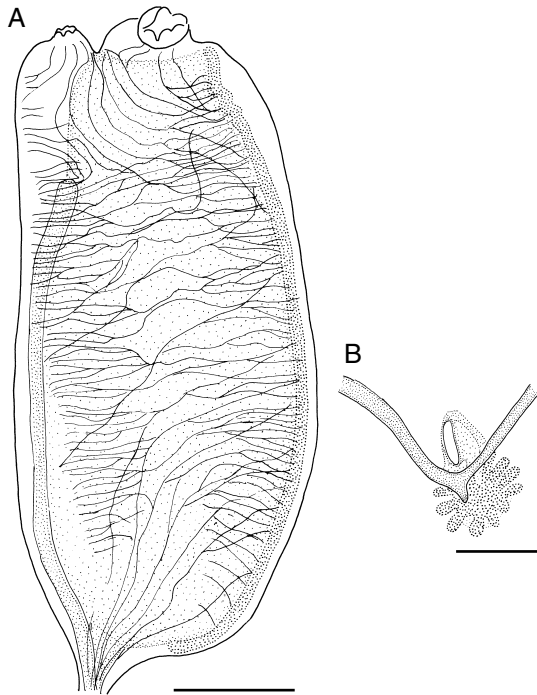


FIG. 74. — *Diazona textura* Monniot C., 1987; **A**, musculature; **B**, dorsal tubercle. Scale bars: A, 2 mm; B, 0.2 mm.

DESCRIPTION

In life this species looks like *D. tenera*, in that it has the same transparency with white pigment stripes (Fig. 124B). But here the endostyle is a neat line. The prepharyngeal band and some of the transverse vessels have a less obvious pigmentation. The siphons have six white spots. The diffuse white colour of the branchial sac in *D. tenera* is absent in *D. textura*.

The colonies are in the shape of cushions. Each zooid protrudes slightly at the colony surface, which is free of epibionts. When fixed, the tunic is soft and transparent with some thin and poorly ramified sinuses. The thoraces are perpendicular to the colony surface and reach 1 cm when relaxed. The abdomens are as long as the thoraces. According to the colony thickness, the abdomens are in the long axis of the thoraces or else lying against the lower colony surface. The oesophago-rectal peduncle takes half of the total length of the abdomen.

We have not seen any vascular post-abdominal process.

The musculature is characteristic (Fig. 74A). It is mainly constituted of transverse fibres extending from the endostyle to the dorsal lamina, gathered in the median part of the thoracic wall into a reduced number of bundles. The musculature issuing from the siphons does not extend beyond the anterior third of the thorax; fibres coming from the ventral posterior half of the thorax make the muscular bundles running down the abdomen. These bundles end in two anchoring masses on the left side at the base of the abdomen. The siphons have six lobes. The long and curved oral tentacles have joined bases and are planted anteriorly in the oral siphon. The prepharyngeal band is made of a single blade; it forms a deep dorsal V. The dorsal tubercle is an antero-posterior slit (Fig. 74B). The round neural ganglion is close to the dorsal tubercle. The neural gland forms radiating lobes (Fig. 74B). The dorsal lamina has sharp languets clearly displaced to the left side. There is a large unperforated space on the right side of the dorsal lamina.

The branchial sac has about 35 rows of stigmata and 20 to 25 longitudinal vessels on each side. There is a line of T-shaped papillae on each side of the dorsal lamina. The meshes are elongated and contain three stigmata.

The stomach is elongate with numerous internal folds. The gonads were not developed in the zooids of this collection.

REMARKS

The specimens dredged previously in the south of New Caledonia were not in as good condition as the Chuuk specimens. The musculature in the former is mainly transverse and less developed dorsally than in the present collection, but all other characters are identical.

D. textura is easily distinguished from all the *Diazona* from the western Pacific. The only other species with a mainly transverse musculature is *Diazona labyrinthea* Monniot F. & Monniot C., 1996, which has a hard, massive colony with a peculiar structure.

Genus *Rhopalaea* Philippi, 1843

REMARKS

This genus units phlebobranch species, solitary or colonial, with the gut located under the branchial sac. It is closely allied to the genus *Diazona*, in which all species are colonial and have at least the abdomen included in a common tunic. *Rhopalaea* species are known in all warm and temperate seas, from shallow waters to the bathyal area. Their mode of budding is not completely known. In some solitary species a regeneration of the thorax starting from the abdomen has been demonstrated (*R. cloneyi* Vasquez & Young, 1996). In other species the regeneration has not been directly observed but can be supposed, as some specimens have rings of hard tunic around the abdominal region which correspond to the successive accumulation of tunics from regressed thoraces; examples of the latter are *R. neapolitana* Philippi, 1843 and *Rhopalaea perlucida* Monniot C., 1997. Colony formation has been observed two times by Millar (1975) in *Rhopalaea fusca* (*R. crassa*), where buds arise from vascular ampullae, and in *R. piru* Monniot C. & Monniot F., 1987. In the latter case, there is a multiple regeneration phenomenon.

The first descriptions of *Rhopalaea* were established from badly preserved specimens, often not complete. All the *Rhopalaea* have the same kind of thorax, and the gut and gonads are embedded in an opaque tissue, characters which were unavailable to the authors to distinguish the species. The type specimens and those from old collections are in poor condition, and the criteria now used to distinguish the species in this genus cannot be seen in them. In these circumstances, it is understandable that some authors have concluded that there might be only one species in the genus: "the information that is presently available suggests that *R. neapolitana*, *R. crassa*, *R. birkelandi* and *R. abdominalis* could represent populations of a single diverse circumglobal species" (Kott & Goodbody 1982: 510). In that publication the name *R. crassa* covers all described species from the western Pacific Ocean. The last descriptions of *R. crassa* from Kott & Goodbody

(1982), Nishikawa (1991), and Kott (1992b) are difficult to work with, as characters of several species are mixed up.

For some years the species of *Rhopalaea* have been collected in excellent condition and photographed *in situ*. Precise descriptions have been made and have shown that morphological differences exist between the species. The genus is diversified but few species are yet identified. The large variety of shapes and colours is well-illustrated by Gosliner, Behrens & Williams (1996: 293) in "Coral Reef Animals of the Indo Pacific". In the five photographs we recognise *Rhopalaea fusca* and *Rhopalaea circula* n. sp. The three others have distinctly different appearances and probably belong to other species, but they were not collected. It is also probable that the species figured in Kott (1990: pl. 1b, c), which has the extremity of the sperm duct marked with a yellow point, is undescribed.

Rhopalaea circula n. sp.
(Figs 75; 124C)

TYPE MATERIAL. — **Federated States of Micronesia.** Pohnpei, NE lagoon, Tehpehk Island, bath sponge farm, growing on nylon lines, 6°57.27'N, 158°19.57'E, 8 m, 15.X.1996 (MNHN P1 RHO.A 23).

ETYMOLOGY. — From the Latin *circulus*: circle.

OTHER MATERIAL EXAMINED. — **Palau.** Koror, Ngerikuul Pass, wall, 7°19.22'N, 134°29.24'E, 7 m, 17.VI.1994 (MNHN P1 RHO.A 16). — Koror, Malakal Harbour, rock island near Ngerchaol Island, 7°20.04'N, 134°27.27'E, 16.VII.1993 (Sample: CRRF).

Papua New Guinea. Milne Bay Province, N side of E Cape, Hiliwau, 10°15.65'S, 150°42.75'E, 18 m, 28.V.1998 (Sample: CRRF). — Milne Bay Province, Reef SE of Drawari Island, 10°18.03'S, 151°03.94'E, 16 m, 6.VI.1998 (Sample: CRRF). — Milne Bay Province, Samarai Island, 10°36.98'S, 150°39.77'E, 9 m, 10.VI.1998 (Sample: CRRF).

Mariana Islands. Guam, Apra Harbour, Jade Shoals, 6-18 m, 5.VI.1997, coll. Paulay (MNHN P1 RHO.A 30).

DESCRIPTION

The zooids are in "bushes" united at their base by a mass of tunic containing numerous vascular

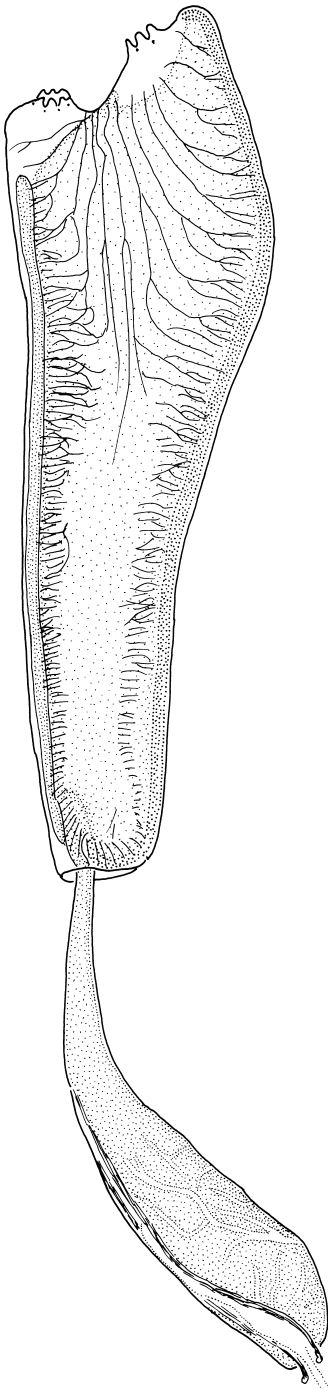


FIG. 75. — *Rhopalaea circula* n. sp., zooid. Scale bar: 1 cm.

ampullae (Fig. 124C). A bush is made of large and small zooids. It is possible to separate some of the zooids, but for others the tunic is fused and a connection exists with the vascular ampullae. In life this species is transparent bluish, and with some rings of a deep blue (Fig. 124C) (hence the species name). It is possible to see the musculature through this transparency. All pigments disappear after fixation in formalin. The oral siphon is terminal. The cloacal siphon is smaller and lateral. The six lobes of the siphons are not visible in life. There is a pigment spot between each lobe of both siphons. On the thorax the tunic is thin, soft and naked. Around the abdomen it is hard, often constituted of successive rings, and covered with epibionts. Filamentous algae are partially included into the tunic. The abdomen lies within a fibrous tissue that is difficult to tear; the abdomen is narrow at its upper end, and the base of the long thorax covers it in a circular fold. The oesophagus entrance is located clearly above this fold and not at the posterior extremity of the branchial sac.

The thoracic musculature (Fig. 75) is made of a few longitudinal bundles, about seven issuing from the oral siphon and six from the intersiphonal space. They are prominent on the anterior part of the thorax and become inconspicuous posteriorly, ramifying and ending perpendicular to the dorsal lamina and medio-ventral line. Some muscles extend onto the abdomen in two bundles on each side of the heart. They terminate abruptly below the posterior abdominal extremity. There are about 40 oral tentacles in three or four orders at increasing distance from a high crest, the largest of them making basal ribs. The prepharyngeal band has a single blade. It makes a slight dorsal curve. The dorsal tubercle protrudes and has an antero-posterior slit. The dorsal lamina consists of sharp languets inserted on one per two to five transverse vessels. In the posterior part of the thorax the endostyle turns up to reach the oesophagus entrance.

The branchial sac is conical. We counted up to 180 transverse vessels and about 60 longitudinal vessels per side in the anterior part and only 30 longitudinal vessels per side at the oesophagus

entrance. There are about 30 transverse vessels posteriorly of the oesophagus entrance. The sinuses are held on flat, high papillae. The elongated meshes contain one to three stigmata.

The internal anatomy of the abdomen is not visible, as it is embedded in an opaque tissue. The stomach is at the bottom of the gut loop. It bears a network of blood sinuses. The rectum is long, attached to the dorsal lamina; it ends at the level of the 50th stigmata row which is at the base of the cloacal siphon, with an anus that has a thick, plain rim. The oviduct opens in a small flat papilla; the sperm duct extends beyond the anus with an elongated papilla. The gonads could not be seen.

REMARKS

This species is close to *R. tenuis* (Sluiter, 1904) *sensu* Kott (1990) as indicated by the presence of muscles on the abdomen. But other characters indicate a different species: a small size, yellow lines on the siphons, the thoracic muscles (*R. tenuis* “has about 20 fine longitudinal muscles, about half from the branchial siphon and half from the atrial siphon” Kott writes [1990: 30]), and only 60 rows of stigmata and 12 longitudinal sinuses per side.

The Japanese species *R. macrothorax* Tokioka, 1953 has a soft and transparent thin tunic on the thorax, 150 rows of stigmata, similar muscles (Nishikawa 1991, revision), ocelli between the oral lobes, and a thickened rim of the anus. It looks much like *R. circula*.

Rhopalaea crassa (Herdman, 1880)
(Figs 76; 124D)

Ecteinascidia crassa Herdman, 1880: 723; 1882: 240, pl. 36, figs 12-14. Type locality: Kii Islands.

Rhopalaea crassa (part) – Kott 1990: 26, specimens with hard tunic.

Rhopalaea crassa – Monniot C. 1997b: 558, fig. 1A-C, Mozambique.

MATERIAL EXAMINED. — **Philippines.** Mindanao, Davao, off NE Samal Island, SW Ligit (Big Cruz) Island, 7°09.63'N, 125°47.05'E, 10 m, 30.III.1996 (MNHN P1 RHO.A 25). — Cebu, E Mactan Island, cave, 10°15.62'N, 123°59.11'E, 25 m, 15.II.1994 (MNHN P1 RHO.A 17).

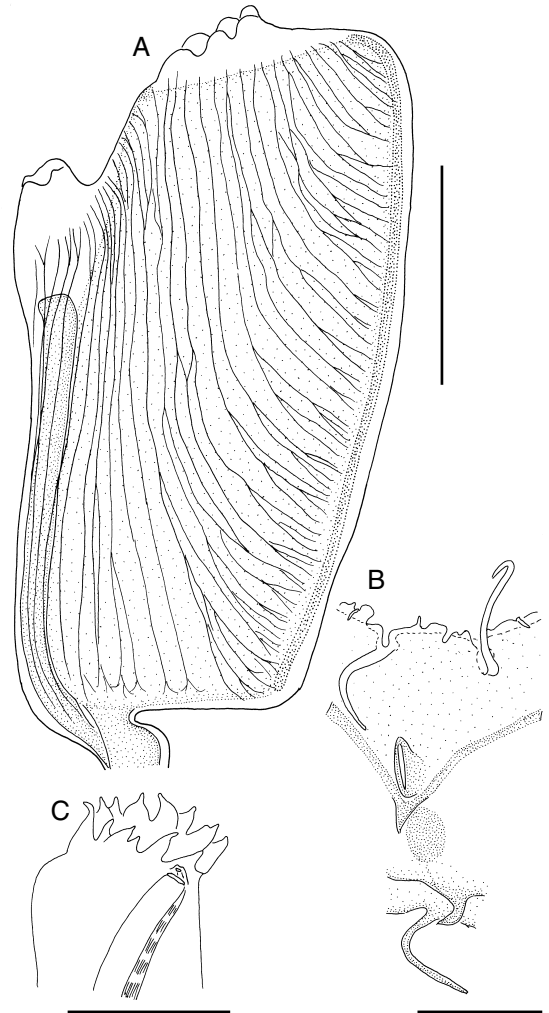


Fig. 76. — *Rhopalaea crassa* (Herdman, 1880); **A**, musculature; **B**, dorsal area; **C**, anus and genital papillae. Scale bars: A, 1 cm; B, 1 mm; C, 2 mm.

Papua New Guinea. Milne Bay Province, Fringing reef west of China Straits, Kuiu Bay, 10°35.17'S, 150°39.08'E, 16 m, 10.VI.1998 (Sample: CRRF).

Mariana Islands. Guam, Apra Harbour, Jade Shoals, 6-18 m, 5.VI.1997 (MNHN P1 RHO.A 29).

DESCRIPTION

This species, always solitary (Fig. 124D), lives most often with the abdomen dug into crevices or between coral branches so that only its cylindrical thorax emerges from the substrate. The

tunic is hard, opaque, 2 to 5 mm thick. The siphons are simple round holes or with six low lobes. The colour of the tunic varies from yellow-green to orange-yellow. It generally has no epibionts. The colour fades in alcohol or formalin, but traces of yellow always remain.

If the specimens were expanded when fixed, the body wall is thin and transparent and the musculature appears oblique (Fig. 76A). About 20 muscle bundles coming from the oral siphon are ramified at their contact with the endostyle. The muscles arising between the siphons end at the bottom of the branchial sac. Those coming from the cloacal siphon remain parallel and make parallel bundles on the abdomen. (In the specimens of this collection, the base of the abdomen was not collected, so it is not possible to specify to what level these bundles extend). The oral siphon has six lobes which only appear when the siphon is contracted. The largest oral tentacles (about 12) are not much longer than the distance between them. Between each of them, there are one or two much shorter ones at the top of a high crest. The largest tentacles are planted behind the crest but linked to it by their base (Fig. 76B). The prepharyngeal band has a single high blade distinctly curved in a dorsal V (Fig. 76B). The dorsal tubercle is protruding, and opens in a vertical slit (Fig. 76B). The circular neural ganglion lies against the dorsal tubercle. The dorsal lamina begins only at the level of the fifth transverse vessel. It is made of languets as long as eight to 10 rows of stigmata. They arise from one of each two transverse vessels.

The branchial sac is thin and flat. We counted 105 rows of stigmata and 70 longitudinal vessels on each side. The laterally flattened papillae are as high as a row of stigmata. They do not exceed the level of the longitudinal vessels. There is an average of four stigmata in a mesh.

No detail of the abdomen is visible externally, as it is wrapped in an opaque tissue. The bottom of the gut loop is missing in these specimens. The rectum is long, follows the dorsal lamina to which it is attached, and ends in an anus with many triangular lobes (Fig. 76C). The oviduct and sperm duct open by small papillae at a short distance behind the anus.

REMARKS

We use the name *R. crassa* even though Herdman's description (1882) is very insufficient. It mentions a tunic that is "very strong, cartilaginous and very thick" and says the colour in alcohol is "warm grey, slightly yellowish in places" (p. 240). *Ecteinascidia* (?*Rhopalopsis*) *solida* Herdman, 1906 from Sri Lanka may belong to this species.

Rhopalaea fusca (Herdman, 1880) (Figs 77; 124E)

Ecteinascidia fusca Herdman, 1880: 723; 1882: 241, pl. 36, figs 7-11. Type locality: Banda Sea.

Rhopalopsis fusca – Sluiter 1904: 13, pl. 2, fig. 6, Indonesia, numerous localities.

?*Rhopalopsis crassa* – Van Name 1918: 126, pl. 23, figs 14; 82-84, Philippines.

?*Rhopalaea crassa* – Millar 1975: 242, fig. 44, Philippines and Japan.

MATERIAL EXAMINED. — **Philippines.** Sulu Sea, SE of Puerto Princessa, Jessie Beazley Reef, 9°02.73'N, 119°48.77'E, 8 m, 19.IV.1995 (MNHN P1 RHO.A 27). — Bohol Sea, Camiguin Island, 9°13.73'N, 124°38.56'E, 7 m, 19.IV.1997 (MNHN RHO.A 26). **Indonesia.** N Sulawesi, West of Manado, 1°27.07'N, 124°44.59'E, 10 m, 7.V.1993 (MNHN RHO.A 14).

DESCRIPTION

In this species the zooids are either isolated or grouped in small bushy clumps. The colour is characteristic and concentrated in the tunic. The thoraces are of an intense blue (Fig. 124E), while the siphons are rimmed with a thin orange line and an irregular blackish band. The specimens of this collection were living in a complex mass of sponges, alcyonids, and didemnid ascidians. The abdominal part of the body is encircled by vascular processes containing blood ampullae that remain blue in fixatives while the body becomes colourless and transparent. In specimens making a bush, the vascular processes of the different individuals form a common mass with numerous blood ampullae. It is impossible to separate the zooids without tearing the tunic. The thorax length reaches 4 cm, the abdomen length 1.5 cm. The thoracic tunic is firm and thick. Around the abdomen it is thick and covered with epibionts.

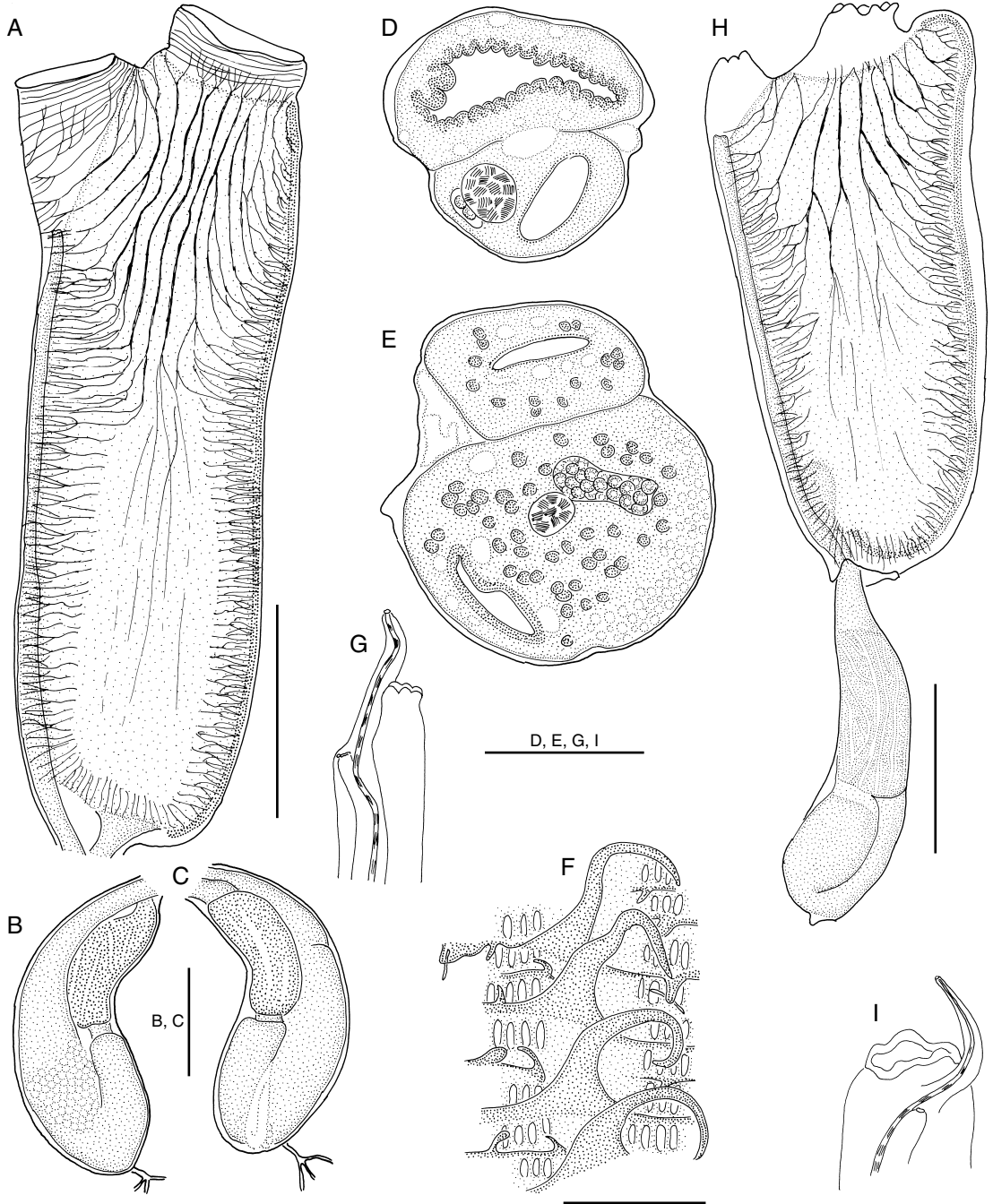


FIG. 77. — *Rhopalaea fusca* (Herdman, 1880); **A**, thorax from a Philippines specimen; **B**, **C**, gut of the specimen **A**; **D**, section at the stomach level; **E**, section at the gonad level; **F**, part of the dorsal lamina; **G**, genital papillae of the specimen **A**; **H**, thorax of another Philippines specimen; **I**, genital papillae of specimen **A**. Scale bars: **A**, **H**, 1 cm; **B**, **C**, 5 mm; **D**, **E**, **G**, **I**, 2 mm; **F**, 1 mm.

The anterior part of the oesophageal peduncle is encircled by a ring of harder tunic around which the base of the thorax makes a fold to produce a collar (Fig. 77H).

The musculature (Fig. 77A, H) is characteristic. In the anterior half of the thorax, it comprises eight to 10 bundles issuing from the oral siphon and three to five bundles coming from the space between the siphons. Well-separated anteriorly, they part and ramify to form fibres perpendicular to the body axis. These fibres do not reach the dorsal lamina or the endostyle. In the posterior half of the thorax, the longitudinal fibres become thin and disappear as the transverse fibres become preponderant. The muscles do not extend onto the abdomen.

In living or relaxed specimens, the siphons are not lobed (Fig. 77A) but six lobes appear with contraction (Fig. 77H). The oral tentacles, 24 in three orders, stand well apart from each other. Those of the first two orders are long and may even extend out of the siphon. They are somewhat withdrawn behind those of third order.

Smaller crests than in other species link the bases of the large oral tentacles. The prepharyngeal band has a single thick crest. It makes a dorsal V. The dorsal tubercle is a simple slit. The globular neural ganglion is under the dorsal tubercle. The dorsal lamina is made of large flat languets corresponding to one of two transverse vessels (Fig. 77F). On the left side, the transverse vessels that do not correspond to a large rapheal papilla generally end by a small digitation.

The branchial sac is cylindrical, thin and regular. We counted more than 110 rows of stigmata with up to 60 longitudinal vessels on each side. Most of the longitudinal vessels are complete. The branchial papillae are large and transversally flattened. There are three to five long stigmata per mesh. There are no parastigmatic vessels and the tissue is flat.

The gut is below the branchial sac (Fig. 77H). The short oesophagus opens into an elongate stomach whose internal wall has numerous folds (Fig. 77D). The stomach stripes that can be observed externally have no correspondence with the internal folds of the stomach but rather are large blood sinuses (Fig. 77H). There is a well-

defined, short post-stomach. The intestine is totally embedded in a mass of spongy tissue, which contains the testes (Fig. 77E). The ovary, more external, covers a part of the right side of the intestine. The rectum is long with a transparent wall. The lobed anus opens at the base of the cloacal siphon at the level of the 35th stigmata row. The genital ducts accompany the rectum. The oviduct opens below the anus, but the sperm duct is prolonged by a papilla (Fig. 77G, I) with a length of at least four rows of stigmata. This papilla is attached to the dorsal lamina.

REMARKS

An erect form with a cylindrical thorax and a firm tunic is typical, according to Herdman's figure (1882) and also clearer with the blue colour in Sluiter's figure (1904). This spectacular species is one of the most photographed ascidians in guides to the Indo-Pacific fauna.

Rhopalaea respiciens Monniot C., 1991 (Fig. 124F)

Rhopalaea respiciens Monniot C., 1991a: 494, fig. 2. Type locality: New Caledonia.

MATERIAL EXAMINED. — Papua New Guinea. Milne Bay, Alotau, 10°19.30'S, 150°27.68'E, 12 m, 9.VI.1998 (Sample: CRRF). — Milne Bay Province, Samarai Island, 10°36.98'S, 150°39.77'E, 9 m, 10.VI.1998 (Sample: CRRF).

DESCRIPTION

The species has a thorax that is distinctly larger than the abdomen. The gut loop is short with the stomach located close to the bottom of the loop. The ovary is massive, partly under the digestive tract. The zooids are isolated from their base. The body is bluish with a brown collar around the oral siphon (Fig. 124F) — a characteristic pigmentation.

Family CIONIDAE Lahille, 1887
Genus *Ciona* Fleming, 1822

Ciona hoshinoi Monniot C., 1991

Ciona hoshinoi Monniot C., 1991a: 492, fig. 1. Type locality: New Caledonia.

MATERIAL EXAMINED. — **Palau.** Koror, West Uchelbeluu Reef, 7°15.96'N, 134°31.28'E, 90 m, 12.V.1997 (Sample: CRRF).

REMARKS

This species was only known from a single specimen from New Caledonia. The new specimen, 1.5 cm long, is extremely contracted. All characters correspond well to the original description.

Family PEROPHORIDAE Giard, 1872

Genus *Perophora* Wiegmann, 1835

Perophora modificata Kott, 1985
(Fig. 125A)

Perophora modificata Kott, 1985: 104, fig. 45, pl. IIg. Type locality: Queensland. Distribution: see Monniot C. 1997b: 562.

MATERIAL EXAMINED. — **Palau.** KB Channel, 7°19.24'N, 134°31.28'E, 20 m, 14.V.1994 (MNHN P2 PER 65).

REMARKS

This species (Fig. 125A) is well-characterised by its musculature, digestive tract, and gonads. Here, it has a pale yellow colour, which is uncommon. The species has a wide distribution from Mozambique to Australia, New Caledonia, the Philippines, and now Palau.

Perophora namei
Hartmeyer & Michaelsen, 1928
(Fig. 125B)

Perophora namei Hartmeyer & Michaelsen, 1928: 270. Type locality: Philippines. Synonymy and distribution: see Kott 1985: 108, fig. 47b, c.

MATERIAL EXAMINED. — **Philippines.** Palawan, Honda Bay, Fondeado Island, 9°55.75'N, 118°54.93'E, 20 m, 25.IV.1995 (MNHN P2 PER 54).

Papua New Guinea. Louisiade Archipelago, Deboyne Lagoon, Nivani Island, 10°47.46'S, 152°23.08'E, 12 m, 30.V.1998 (MNHN P2 PER 68).

REMARKS

The zooids of this very characteristic species (Fig. 125B) are not mature in the colonies of this collection.

Genus *Ecteinascidia* Herdman, 1880

Ecteinascidia bandaensis Millar, 1975
(Figs 78; 125C)

Ecteinascidia bandaensis Millar, 1975: 268, fig. 49. Type locality: Banda Sea.

Ecteinascidia jacerens – Monniot C. 1997b: 564 fig 3A-B, Mozambique and Madagascar.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Camiguin Island, N side of White Island, offshore sand cay, 9°15.87'N, 124°39.32'E, 19.IV.1997 (MNHN P2 ECT 84).

DESCRIPTION

In life this species is opaque. In this collection as in Mozambique and Madagascar, the tunic is white with a red ring around each siphon linked by a red median line (Fig. 125C) between them. Inside the rings the siphonal lobes appear as white spots. This species has been briefly described by Millar (1975) and Monniot C. (1997b). Some further details are given here. The musculature is oblique (Fig. 78A, B). There are about 20 oral tentacles along a wavy crest and some very small ones irregularly distributed. The prepharyngeal band is circular, made of two unequal blades, the posterior one higher. The dorsal tubercle is urn-shaped, opening by a round hole hidden in a fold of the anterior blade of the prepharyngeal band. The posterior blade of the band makes a short papilla.

The dorsal lamina is made of sharp languets, independent of each other right from their base. The branchial sac has 16 rows of stigmata and about 23 longitudinal vessels per side. The branchial meshes are elongated, with an average of two stigmata each.

The stomach is globular and asymmetrical, linked to the intestine by a protruding ring. The intestine begins with four well-pronounced caeca. The bilobed anus has the shape of pursued lips with a large slit. The massive gonads occupy all the space between the two limbs of the gut. The ovary, poorly developed in these specimens, is encircled by numerous testis follicles, which may spill onto the internal and external sides of the gut (Fig. 78C, D).

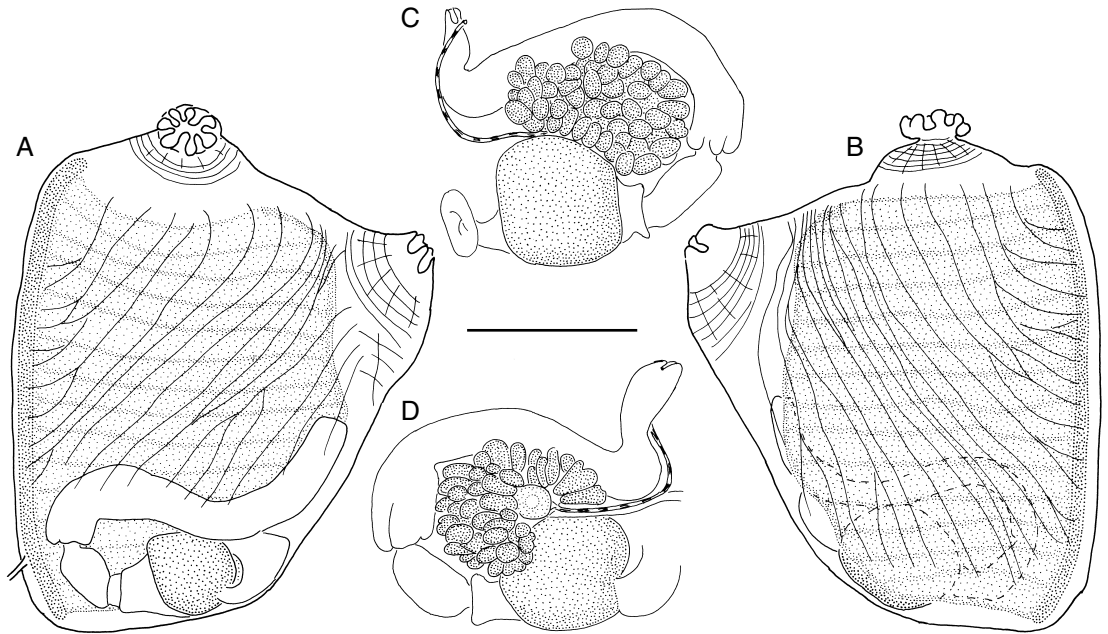


FIG. 78. — *Ecteinascidia bandaensis* Millar, 1975; **A, B**, left and right sides of a zooid; **C, D**, left and right sides of the gut loop. Scale bar: 1 mm.

The sperm duct opens by a papilla against the anus, and the oviduct runs to its right side. We have not found larvae.

This species has been confused with *E. jacerens* Tokioka, 1954, which has an oblique musculature but one that makes a plexus between the siphons.

Ecteinascidia remanea n. sp.
(Fig. 79)

TYPE MATERIAL. — Palau. Shrimp Lake, marine lake on E side Ngeruktabel Island, Ngeremdiu, mangrove roots/carbonate rock, 7°15.27'N, 134°26.68'E, 1 m, 26.XII.1994 (MNHN P2 ECT 83).

ETYMOLOGY. — From the Latin *remaneo*: to remain.

DESCRIPTION

The specimens were attached to mangrove roots along with colonies of *Eudistoma viride*. The colony is a dense mass of zooids, stolons, and buds, compact enough to shelter Modiolidae molluscs, which usually are incorporated into the

tunic of solitary ascidians. The stolons arise from the posterior three quarter, of the body length. They are ramified and fixed on the tunic of other adult zooids giving the colony the aspect of a tangled ball. The colour in life is not known. In formalin the zooids are transparent, and the blood sinuses and stolons are whitish.

The musculature consists of transverse fibres on each side of the cloacal siphon (Fig. 79A, B). The muscles are anastomosed and sometimes make a plexus. They extend more ventrally on the left side than on the right side of the body. There is no relation between the musculature of the oral siphon and the lateral musculature; these elements are separated by a large space. Even when contracted, the siphons are long; they possess eight lobes. We counted about 40 thin oral tentacles on a circle, in three or four orders of size, their bases joined. The prepharyngeal band has two high sides. The anterior one seems less developed but is distorted by numerous parasitic protozoans. The neural ganglion is round and protrudes into the branchial cavity. The neural gland channel begins at the pos-

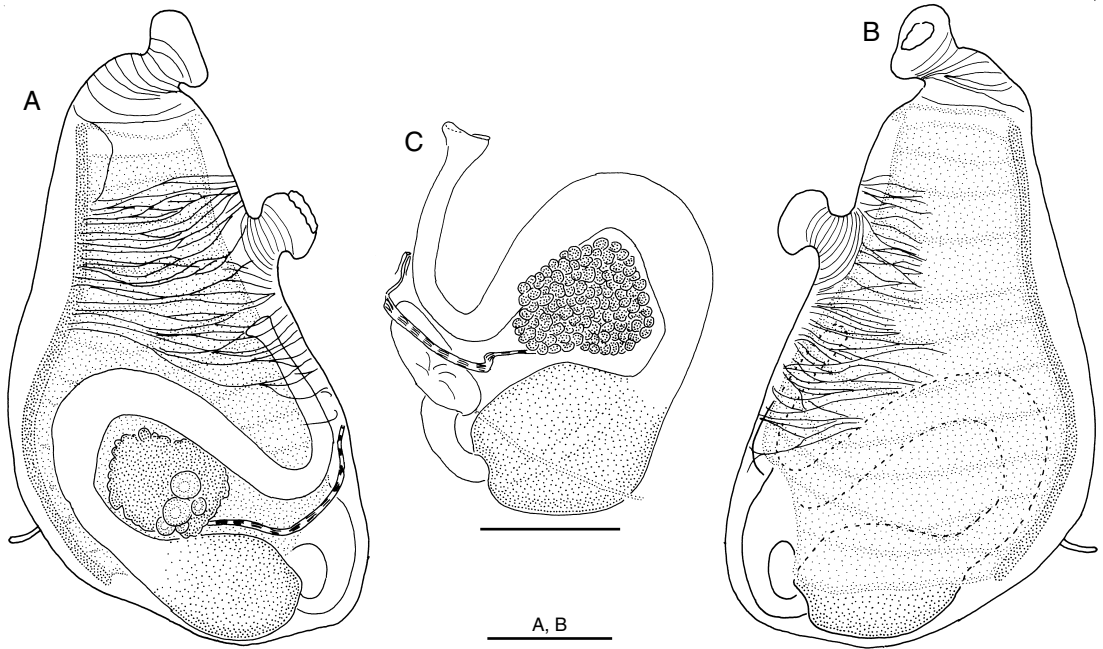


FIG. 79. — *Ecteinascidia remanea* n. sp.; **A, B**, left and right sides of a zooid; **C**, internal side of the gut loop. Scale bars: 1 mm.

terior pole of the ganglion. It is wide and opens by a circular hole ahead of the prepharyngeal band. Anterior to the neural ganglion, the posterior side of the prepharyngeal band makes a large languet that is as long as the stigmata. This languet is linked to the rapheal papillae.

The branchial sac has 10 to 12 rows of stigmata. The first and last row are not complete and some stigmata extend over two rows. There are seven or eight rapheal languets (the two last ones are missing). A membrane half their height links them. There is some distance between the prepharyngeal band and the first row of stigmata. We counted 10 to 12 T-shaped papillae on each transverse vessel on each side of the body. We have not found junctions of these papillae to form longitudinal vessels.

The gut curves in a double loop. The anus and the top of the loop reach the same level (Fig. 79A) at the fifth or sixth transverse vessel. The globular stomach progressively narrows to form the intestine without constriction or post-stomach. The typhlosole is the only groove to be

seen on the internal side on the stomach. The rectum ends in an enlarged anus (Fig. 79C).

The ovary contains only a few eggs and can only be seen from the external side of the body (Fig. 79A). The testis is a mass of very small acini totally covering the ovary on the internal side (Fig. 79C). The sperm duct opens in the right cloacal cavity three stigmata rows posteriorly to the anus. This disposition merits the species name *remanea*. Only embryos at a morula stage were present in the cloacal cavity.

REMARKS

While the disposition of its musculature recalls that of *Ecteinascidia styeloides* (Traustedt, 1882) and *Ecteinascidia nexa* Sluiter, 1904, the new species is characterised by three traits that are uncommon in the Perophoridae and until now have never been encountered together in the same species: a branchial sac devoid of longitudinal vessels having only T-shaped papillae, a stomach without a pyloric constriction, and a sperm duct opening posterior to the anus.

Family ASCIDIIDAE Herdman, 1882

Genus *Ascidia* Linné, 1767*Ascidia archaia* Sluiter, 1890

Ascidia archaia Sluiter, 1890: 346, figs 21-23. Type locality: Indonesia. Synonymy: see Monniot C. & Monniot F. 1987: 92, fig. 34, Polynesia. — Monniot C. 1987a: 7, New Caledonia.

MATERIAL EXAMINED. — Palau. Koror, Malakal Harbour, Buoy #1, 7°19.88'N, 134°27.50'E, 1 m, 28.I.1998 (MNHN P5 ASC.A 315).

REMARKS

This species is common in fouling communities of tropical Indo-Pacific and Atlantic coasts.

Ascidia gemmata Sluiter, 1895 *s.l.*
(Figs 80; 125D)

Ascidia gemmata Sluiter, 1895: 177, pl. 9, figs 7-9. Type locality: Indonesia. — Tokioka 1950: 131, fig. 11, pl. 9; fig. 2, Palau; 1952: 103, fig. 169, Port Moresby; 1967: 140, fig. 51, Mariana, Carolina and Wake Islands. — Nishikawa 1984: 126, Micronesia; 1986: 52, Micronesia; 1991: 142, fig. 14, Japan Sea.

?*Ascidia gemmata* – Hartmeyer & Michaelsen 1928: 292, fig. 8, NW Australia. — Kott 1985: 37, fig. 10e-i, Australia. — Monniot C. 1991a: 507, fig. 7, New Caledonia.

MATERIAL EXAMINED. — Palau. Coll. Faulkner (MNHN P5 ASC.A 297). — Mecherchar, Jellyfish Lake, marine lake, on mangrove roots, 7°09.83'N, 134°22.50'E, 1 m, 8.VI.1994 (MNHN P5 ASC.A 296).

DESCRIPTION

The largest individual measures 4 × 2.5 × 1 cm. It was erect and attached by 2/3 of its left side. The oral siphon is terminal. The cloacal siphon is in the middle of the body, displaced to the right side in one specimen, directed backwards in the others (Fig. 80A, B). Both siphons are wide. We counted eight low lobes on the oral aperture and six to eight on the cloacal siphon. The tunic is devoid of epibionts. In life this species is pinkish (Fig. 125D). The colour is concentrated in the body wall, in more numerous patches dorsally. The oral siphon has eight darker stripes and the

cloacal lobes have white spots. When fixed in formalin the tunic is translucent and has a solid consistency. It contains a network of anastomosed blood vessels ending in small ampullae just under the surface, corresponding to small surface papillae. Numerous cells fill the vascular network.

The musculature, made up of thin fibres, makes a complete network on the right side (Fig. 80B) but only covers the anterior part of the body on the left side (Fig. 80A, F). There is a large oral velum that is easily removed. There are about 60 oral tentacles, shorter than the oral siphon. They are planted at the same level around a circle at the base of a protruding crest, in three orders of size. Some very small ones are more numerous ventrally. The prepharyngeal band has two equally high rims. The dorsal curve is only slightly marked (Fig. 80E). The prepharyngeal area has small papillae. The dorsal tubercle is small, only slightly protruding, and with a U-shaped slit (Fig. 80E). The neural ganglion is distant from the dorsal tubercle by four to five times its length; for a specimen 4 cm in length, this distance corresponds to 7 mm. The dorsal lamina is doubled for half the distance between the dorsal tubercle and the ganglion. In its middle length, it consists of a high blade with ribs on each side ending in long teeth. At the oesophagus entrance, it is abruptly lowered and transformed into a low crest extending down to the bottom of the branchial sac. In one specimen it is reduced to just the languets. On the right side, at the oesophagus entrance, the branchial papillae close to the dorsal lamina are twice the height of papillae elsewhere but are not linked by a lamina.

The branchial tissue is pleated. It extends slightly beyond the base of the intestinal loop. At the level of the top of the intestinal loop there are about 40 longitudinal vessels on the left side and a few more (46) on the right side. The papillae are large, antero-posteriorly flattened without lateral protrusions. The branchial meshes are transversally elongated with eight to 12 stigmata each. There are no parastigmatic vessels and no intermediate papillae.

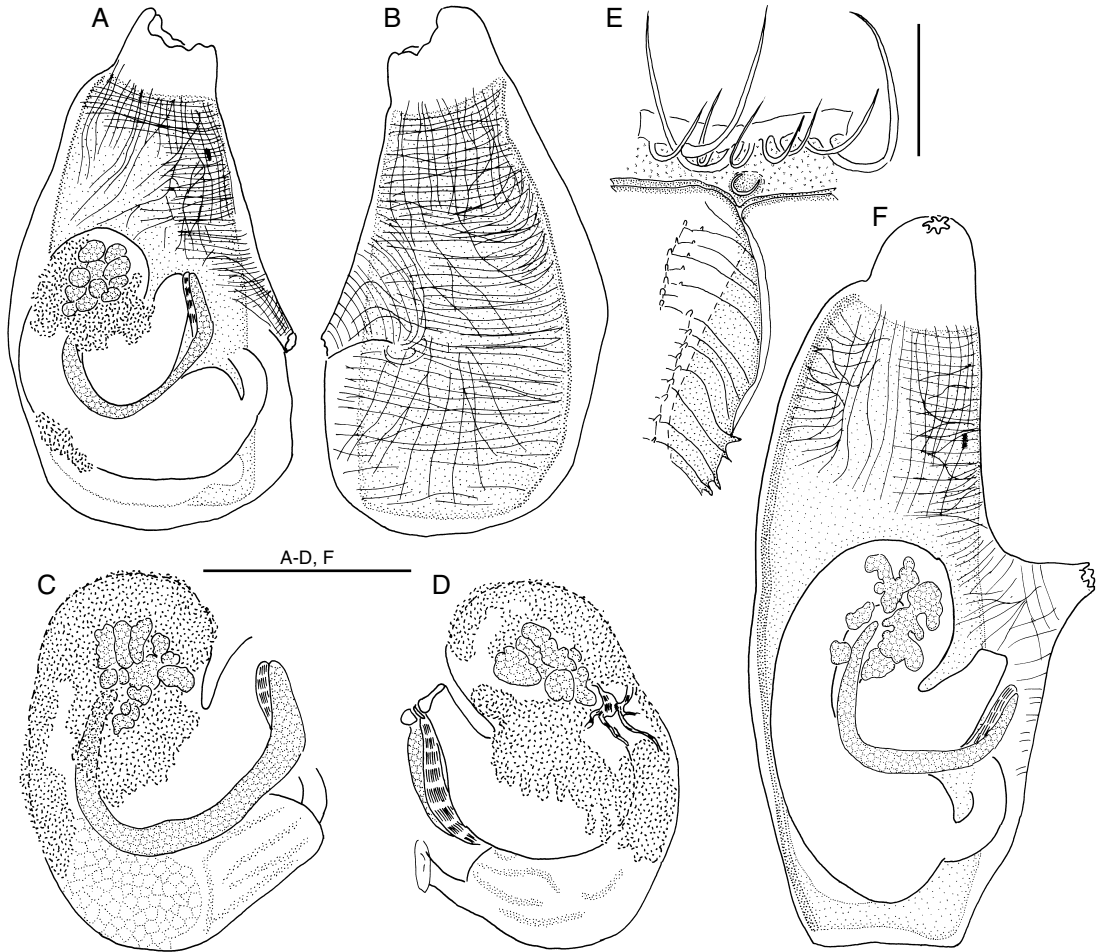


FIG. 80. — *Ascidia gemmata* Sluiter, 1895 s.l.; **A, B**, left and right sides of the body; **C, D**, both sides of the gut; **E**, dorsal area; **F**, left side of the largest specimen. Scale bars: A-D, F, 1 cm; E, 2 mm.

The massive gut, with a thin and transparent wall, makes a double closed loop (Fig. 80C, D). The stomach has irregular internal folds. The posterior intestine is dilated. The anus has a plain rim.

The ovary is massive, exclusively located in the primary intestinal loop. The testis spreads in a thin layer on the intestine (Fig. 80C, D). The genital ducts follow the rectum and open in slits beside the anus. The female aperture is wide. Large renal accumulation vesicles lie in the posterior part of the intestinal loop, particularly obvious on the external side (Fig. 80C). The voluminous heart does not contain inclusions.

REMARKS

The specimens in this collection certainly correspond to what Tokioka (1950) described from the Palau Islands under the name *Ascidia gemmata*. The only difference with our sample is the clearly posterior position of the cloacal siphon in Tokioka's specimens. The shape of the gut is the same with a marked enlargement of the posterior intestine and a short rectum opening well below the top of the intestinal loop. Tokioka and Nishikawa both figured variable dorsal tubercles, often with multiple openings, but this is not the case in our specimens.

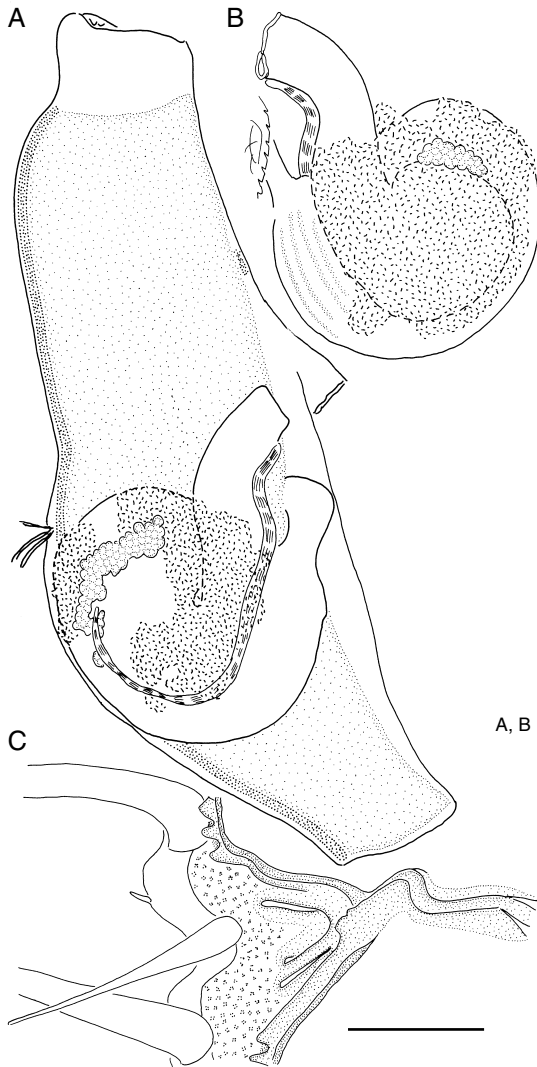


FIG. 81. — *Ascidia ornata* n. sp.; **A**, left side of the body; **B**, internal side of the gut loop; **C**, dorsal tubercle. Scale bars: A, B, 1 cm; C, 1 mm.

Several authors have described *A. gemmata*, and the descriptions vary. All mention a posterior cloacal siphon opening backwards, but the gut shape varies. Sluiter (1895) depicts the gut with an enlarged intestine and a short rectum. Tokioka describes the same shape (1950) at Palau, (1952) in New Guinea, and (1967) in the Mariana, Carolina and Wake Islands. Nishikawa (1991) shows a short rectum for the Japanese

specimens. In Australia, Hartmeyer & Michaelsen (1928) figure a longer rectum without dilation. This same appearance is reported by Kott (1985) in Australia and Monniot C. (1991a) in New Caledonia. In the Australian and Caledonian specimens, the ovary projects out of the primary gut loop. These specimens perhaps represent a distinct species, but the variability of *A. gemmata* is not sufficiently known to say so.

Ascidia ornata n. sp.
(Figs 81; 125E)

TYPE MATERIAL. — **Philippines**. Bohol Sea, Balicasag Island, SW of Bohol, 9°31.26'N, 123°41.05'E, 13 m, 16.IV.1997 (MNHN P5 ASC.A 298).

ETYMOLOGY. — From the Latin *ornatus*: ornate.

OTHER MATERIAL EXAMINED. — **Philippines**. Bohol Sea, Camiguin Island, W side of White island, off-shore sand cay, 9°15.38'N, 124°39.12'E, 18 m, 19.IV.1997 (Sample: CRRF). — SW Bohol, Panglao Island, 9°32.27'N, 123°43.54'E, 20 m, 21.IV.1997 (Sample: CRRF).

DESCRIPTION

The type specimen, 7 × 4 cm in size, was attached by its left side to the ceiling of a cave. The tunic is mammillated, transparent and without epibionts (Fig. 125E). It contains a network of dichotomously branching blood vessels making small ampullae just under the tunic surface, but these are not reflected on the surface by papillae. The siphons are far apart and slightly protruding. There are about 20 lobes on the oral siphon. They are round, not dentate, but a white pigment line gives them a sharp appearance. In both siphons the velum has a network of white pigment. The whole body wall is reddish; the siphons and the tentacles are the most coloured. The other specimens are somewhat different. One of them is transparent without lines on the siphon lobes and has a yellow velum. Another has white lines on the siphons, and its vascular ampullae are white, giving it a spotted look, but its velum is not visible. This appearance accounts for the species name. All pigments disappear in fixatives.

The body wall is thin and the musculature is weak. On the right side the muscles cover the

whole body in a loose network. On the left side there are only some longitudinal fibres, while the transverse musculature is only present in the dorsal part, anterior to the gut.

There are about 30 long, cylindrical oral tentacles irregularly arranged. In life they are red. They are planted on a crest where some very small ones are intercalated. The prepharyngeal area is narrow, covered by small papillae. The prepharyngeal band has two unequal blades, the anterior one is high and wavy. The dorsal curve is filled by a flat dorsal tubercle (Fig. 81C). It has two openings in the type specimen (Fig. 81C) but only one in other specimens. The neural ganglion is far from the dorsal tubercle, at 3/5 of the inter-siphonal distance. There are no accessory openings of the neural gland or its channel. The dorsal lamina is high and double down to the neural ganglion, then becomes a thin blade without teeth, and then farther posteriorly it has thin teeth that correspond to its ribs. It is prolonged without change below the oesophagus entrance. On the right side of the dorsal lamina, the branchial papillae are elongated.

The oesophagus entrance is 3/5 the way down the branchial sac which is prolonged beneath the gut. The branchial tissue is thin, slightly pleated. The meshes contain six to 10 stigmata each. The papillae are large and flat. There are no intermediate papillae. The gut is massive (Fig. 81A, B) with an uncommon shape. The anus is anterior to the top of the gut loop, which is at the level of the oesophagus entrance. The stomach is almost longitudinal; its thin wall reveals its internal glandular ridges. The ascending limb of the intestine is narrow and the descending limb dilated. The rectum is large. The gaping anus has a rolled, plain rim. The shape of the gut does not correspond to that of any other *Ascidia* species of the western Pacific.

Ascidia sydneiensis Stimpson, 1855
(Figs 82; 125F)

Ascidia sydneiensis Stimpson, 1855: 387. Type locality: Australia, Port Jackson.

MATERIAL EXAMINED. — **Palau.** Southwest Islands, Sonsoral, 5°20.88'N, 132°13.80'E, 9 m, 24.VII.1995.

— Koror, West Uchelbeluu Reef, 7°16.41'N, 134°31.43'E, 31 m, 9.V.1997. — Koror, West Uchelbeluu Reef, 7°15.96'N, 134°31.28'E, 112 m, 15.IX.1998 (Samples: CRRF).

Papua New Guinea. Milne Bay Province, N side of East Cape, Hiliwau, 10°15.65'S, 150°42.75'E, 3 m, 27.V.1998 (Sample: CRRF).

Tonga. Vava'u dock, 18°40.62'S, 174°01.70'W, 1 m (MNHN P5 ASC.A 311).

REMARKS

This very common species (Figs 82; 125F) is widely distributed. Its shape and consistency are highly variable and depend on the habitat. Generally, more stout forms are found in polluted areas, such as harbours, that are rich in organic matter.

A. sydneiensis from the Pacific Ocean is very closely allied to *Ascidia canaliculata* Heller, 1878 from the Atlantic Ocean and South Africa, in which dorsal tubercle openings are in a double spiral. Both species are vicariant.

Genus *Phallusia* Savigny, 1816

Phallusia julinea Sluiter, 1919

Phallusia julinea Sluiter, 1919: 7. Type locality: Java. — Kott 1985: 64, fig. 25, pl. 1F, Australia. — Nishikawa 1986: 70, fig. 11B, C, Salomon Island.

MATERIAL EXAMINED. — **Mariana Islands.** Guam, Apra Harbour, Jade Shoals, 6-18 m, 5.VI.1997 (MNHN P5 PHA 94).

?*Phallusia obesa* (Herdman, 1880)
(Figs 83; 126A)

Pachylaena obesa Herdman, 1880: 462. Type locality: Australia, Victoria.

Phallusia obesa — Traustedt 1885: 16.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Yap, Colonia, main wharf, 9°30.91'N, 138°07.57'E, 10 m, 4.VI.1996 (MNHN P5 PHA 86).

DESCRIPTION

The specimens are of large size, more than 10 cm in length. Their shape is variable and depends on the disposition on the substrate. One specimen is

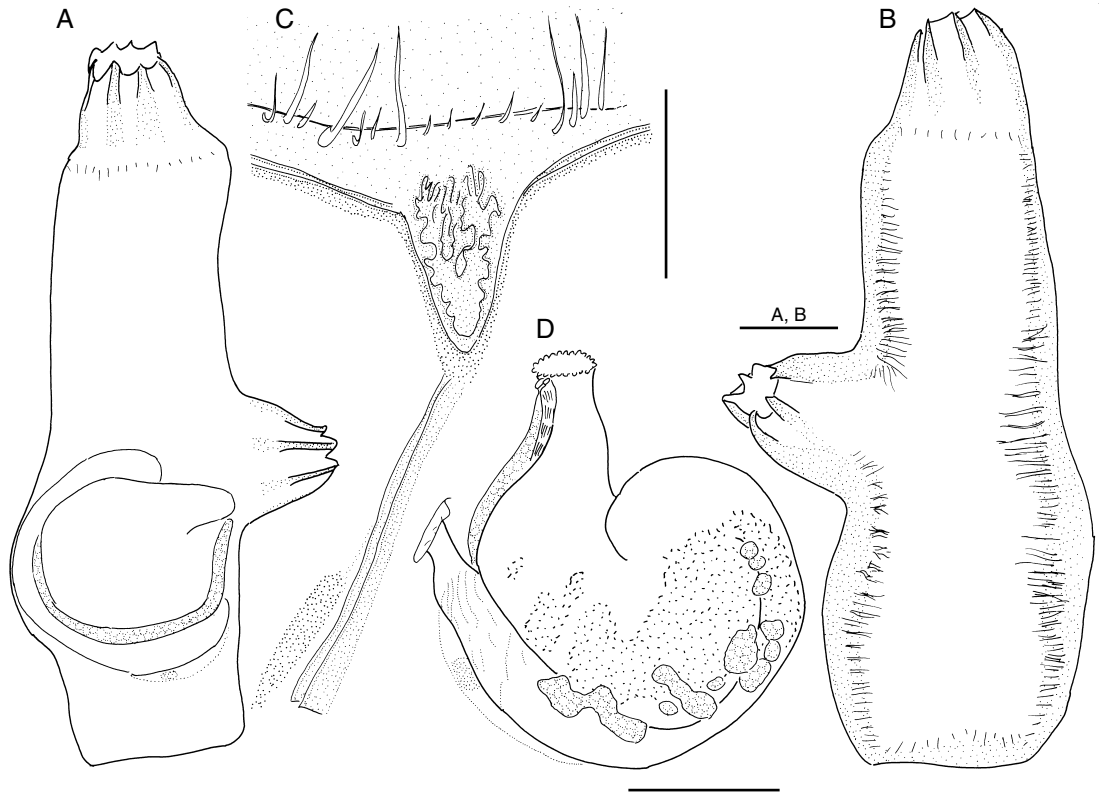


FIG. 82. — *Ascidia sydneyensis* Stimpson, 1855; **A, B**, left and right sides of the body; **C**, neural area; **D**, internal side of the gut loop. Scale bars: A-C, 1 cm; D, 2.5 mm.

particularly elongated (Fig. 126A), with the cloacal siphon slightly anterior to the mid-length of the body. This ascidian was attached by a large part of its ventral side. The other specimens have the siphons nearer to each other and were attached by the left posterior side.

The tunic is bare with a few tubercles. The siphons are protruding and tubercular. The surface of the tunic is covered with very small papillae, which correspond to the ampullar extremities of the branches of blood sinuses in the tunic. The tunic is up to 1 cm thick and stiff. The grey tunic becomes light brown when preserved in formalin. There are 12 lobes on the oral siphon and eight on the cloacal siphon; they have patches of pigment. Their size is variable. The musculature is weak, in a loose network on the right body side and in just the anterior part of the left side.

About 40 short oral tentacles in three to four orders of size are planted on a high crest. The prepharyngeal area is particularly narrow, covered with small papillae. It is necessary to lift the crest with the tentacles to observe the prepharyngeal band. The band has two protruding parallel and unequal sides, with the anterior edge high and thin and the posterior edge thicker. The dorsal tubercle has a U-shaped slit with slightly rolled horns and occupies the whole dorsal curve of the prepharyngeal band (Fig. 83B). The neural ganglion is far from the dorsal tubercle, at the base of the cloacal siphon. No accessory opening was found in the specimens of this collection.

The dorsal lamina begins with a double blade down to the neural ganglion and continues as a high blade with a dentate rim.

The branchial sac extends well beneath the gut. The branchial papillae are stout. The square meshes contain six to eight stigmata. There are no parastigmatic vessels and no intermediate papillae. The branchial tissue is only slightly pleated.

The gut is massive, the secondary loop well-marked, and the rectum is applied against the proximal intestine (Fig. 83A). The posterior intestine is only slightly dilated. The anus opens a little anteriorly to the top of the gut loop. It seems cut obliquely with regard to the rectum. Its rim, underlined by an accumulation of blood cells, has low lobes.

The ovary is made of thick tubules grouped in a mass restricted to the primary intestinal loop. The oviduct opens with the sperm duct beside the anus. A poorly developed testis spreads on the intestine; but the sperm duct is full.

REMARKS

We hesitated to identify these specimens as *Phallusia obesa*. The presence of accessory openings of the neural gland channel, which is the only character separating the genus *Phallusia* from *Ascidia*, was not detected. But by other characters such as the thickness and stiffness of the tunic, a weak musculature, the narrow prepharyngeal area, the disposition of the neural ganglion, and the shape of the gut, this species is closely allied to the *Phallusia* species of the tropical Pacific Ocean.

The absence or presence of accessory openings of the neural gland channel is not a stable character. In *Phallusia mammillata* (Cuvier, 1815), *Phallusia nigra* Savigny, 1816, and *P. julinea* Sluiter, 1919, several authors have noted that these openings appear late during growth. In *Phallusia julinea*, even adult specimens without accessory openings have been noted by Tokioka (1961) and Kott (1964, 1985). Monniot C. (1987a) described a whole population from New Caledonia without accessory openings. Conversely, some *Ascidia* species exceptionally may have accessory openings (*Ascidia melanostoma* in Monniot C. & Monniot F. 1987).

The distinctions between the *Phallusia* species of the Pacific Ocean are not clear. *P. julinea* Sluiter,

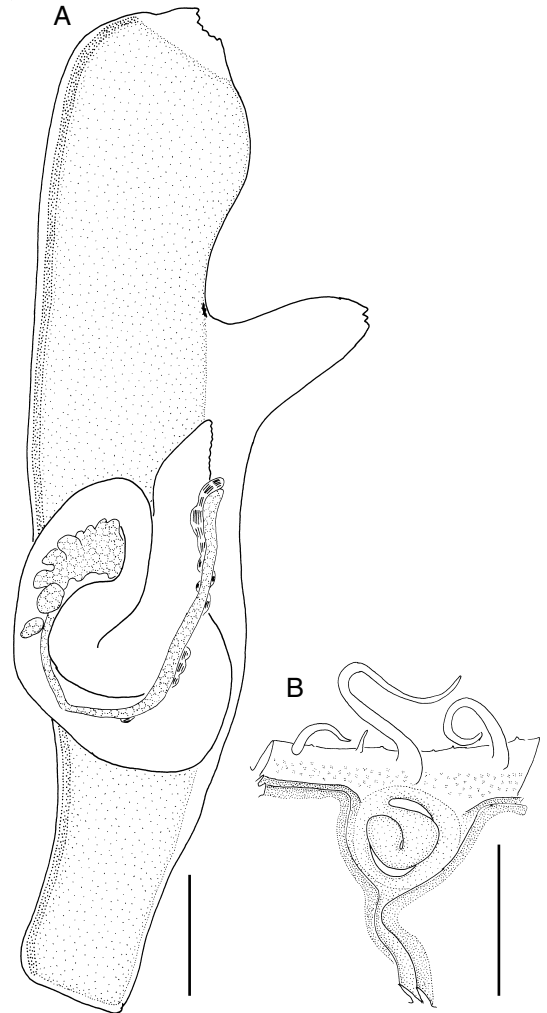


FIG. 83. — ?*Phallusia obesa* (Herdman, 1880); **A**, left side of the body; **B**, dorsal tubercle. Scale bars: A, 1 cm; B, 2 mm.

1919 is well-characterised by a superficial dilation of the tunic vessels filled with gold yellow granules and a very pronounced widening of the rectum. *Phallusia barbarica* Kott, 1985 has a tunic partially covered with sand and debris, and its anus lies posterior to the top of the gut loop. *Phallusia millari* Kott, 1985 has siphons that are notably closer together, an anus with lobes, and a non-dilated intestine. *Phallusia arabica* Savigny, 1816 and *Ph. obesa* (Herdman, 1880) lack distinct identifying characters. For Kott (1985) the

disposition of its siphons distinguishes that species. We believe that *P. arabica* lives hidden in crevices with only its siphons apparent while *Ph. obesa* lives exposed on the rocky surface. The specimen figured by Herdman (1882) and Hartmeyer & Michaelsen (1928) and the picture in Kott (1985) attest to this. This difference may reflect chemical defences in *Ph. obesa*, as shown in *P. mammillata* and *P. nigra*, which live exposed at the substrate surface.

The samples from Yap look like the photograph in Kott (1985: pl. 1, fig. 6). *Ph. obesa* has close relations to *Ascidia kreaagra* Sluiter, 1895, *sensu* Nishikawa (1986), from the Solomon Islands, as suggested by the tunic, the position of the neural ganglion, and the gut shape. But the size is very different, as the type of *A. kreaagra* measures 23 mm and the largest Nishikawa's specimen is only 62 mm long including a very long oral siphon.

Phallusia philippinensis Millar, 1975
(Figs 84; 126B)

Phallusia philippinensis Millar, 1975: 275, fig. 55, Philippines and Banda Sea.

?*Phallusia depressiuscula* – Van Name 1918: 116, pl. 27, figs 10-13.

Phallusia depressiuscula – Tokioka 1970: 87, fig. 4 (15-22), Philippines.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 18.IV.1997 (MNHN P5 PHA 87).

Palau. Koror, Malakal Harbour, rock islands near Ngerchaol, on boat hull, 7°20.37'N, 134°22.02'E, 3 m, 14.VIII.1997 (MNHN P5 PHA 92).

DESCRIPTION

The specimen from the Philippines, 4.2 × 2.2 cm was attached to coarse sediment by half of the left side. The distance between the siphons is 2 cm. The siphons are erect with grooves. The tunic is bare except for some kamptozoans growing on the siphons and in the grooves of the tunic. In life the species is black (Fig. 126B), and it becomes dark brown when preserved in formalin. The thick cartilaginous tunic contains a network of whitish vessels. The extremities of these vessels make ampullae filled with clear granules. They

protrude slightly at the tunic surface but do not constitute papillae. These ampullae are not ramified as they are in *P. julinea*. Black granules lie in the tunic between the ampullae.

The body wall is brown. The strong musculature exteriorly forms anastomosed longitudinal bundles, and internally is a continuous layer of circular fibres. The muscles are reduced on the posterior part of the right side, and on the left side they are limited to the region anterior to the gut (Fig. 84A, C).

The oral siphon has eight cone-shaped lobes exteriorly prolonged by eight crests. There are no ocelli.

About 55 oral tentacles in four orders have almost joined bases. The prepharyngeal area is entirely covered with papillae. The prepharyngeal band has two blades, the anterior of which is covered with papillae similar to that of the prepharyngeal area (Fig. 84D). The dorsal tubercle is small, its slit C-shaped, and lies in a small indentation of the prepharyngeal band. The neural ganglion lies at the base of the cloacal siphon. The channel of the neural gland has numerous accessory apertures along its whole length. The dorsal lamina has two blades as far as the neural ganglion; posteriorly it forms a blade of medium size with teeth corresponding to one per every two transverse vessels. It disappears at the oesophagus entrance, replaced by long papillae corresponding to one per each two vessels. On the right side, starting from the oesophagus entrance extends a row of triangular papillae.

The branchial sac has an equal width on each side. There are large main papillae and small buttons corresponding to intermediate papillae. The branchial tissue is pleated.

The gut is massive (Fig. 84A, B) and wrapped in an opaque tissue filled with blood lacunae. It is covered with small papillae. Externally some lines appear on the stomach corresponding to blood lacunae. The posterior intestine is slightly thickened. The gaping anus has a rolled rim. The ovary in packed lobules occupies the top of the gut loop. The testis lies along the intestine, and externally it can be seen only in the secondary gut loop. Eggs were found in the cloacal cavity.

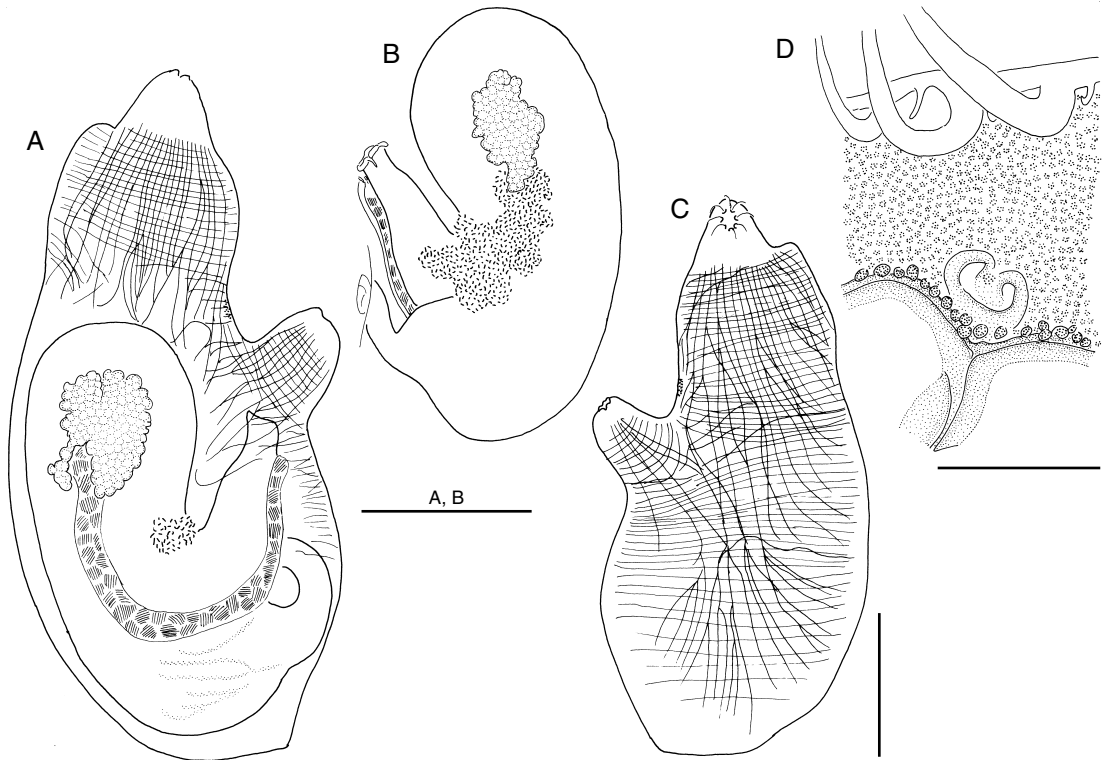


FIG. 84. — *Phallusia philippinensis* Millar, 1975; **A**, left side of the body; **B**, internal side of the gut loop; **C**, right side of the body; **D**, dorsal tubercle. Scale bars: A-C, 1 cm; D, 0.5 mm.

REMARKS

This species is closely allied with *P. nigra* Savigny, 1816. It differs in the shape of the siphons, the more translucent tunic and the presence of minute papillae between the main papillae on the branchial vessels.

Phallusia sp.
(Figs 85; 126C)

MATERIAL EXAMINED. — **Tonga**. Vava'u, sunken wreck Glen McWilliam near Neiafu, 18°40.25'S, 173°59.45'W, 18 m, 11.XI.1997 (MNHN P5 PHA 95).

DESCRIPTION

This large size specimen (10 cm) was found inside clumps of calcareous algae on a sunken wreck. The individual is attached by two third of its left side. Though hidden in the algae, this animal

has a tunic devoid of epibionts. It is white and hard (Fig. 126C). The siphons are far apart. The long oral siphon has a dozen flat lobes with patches of white pigment. The siphons are grooved and interiorly they have lines of white pigment prolonged as far as the circle of oral tentacles. All pigmentation disappears after formalin preservation. The thick, stiff tunic contains a network of blood vessels ending in small papillae at the surface, but there are no vascular ampullae as there are in other *Phallusia* species. The body is elongated and its siphons are far apart (Fig. 85A, B). The body wall is thin. The weak musculature is made of a regular network of thin bundles covering the whole right side of the body and the anterior part of the left side. The oral tentacle ring is far down at the base of the siphon. There are about 45 tentacles of very different sizes, not distributed in regular orders. The prepharyngeal band has two

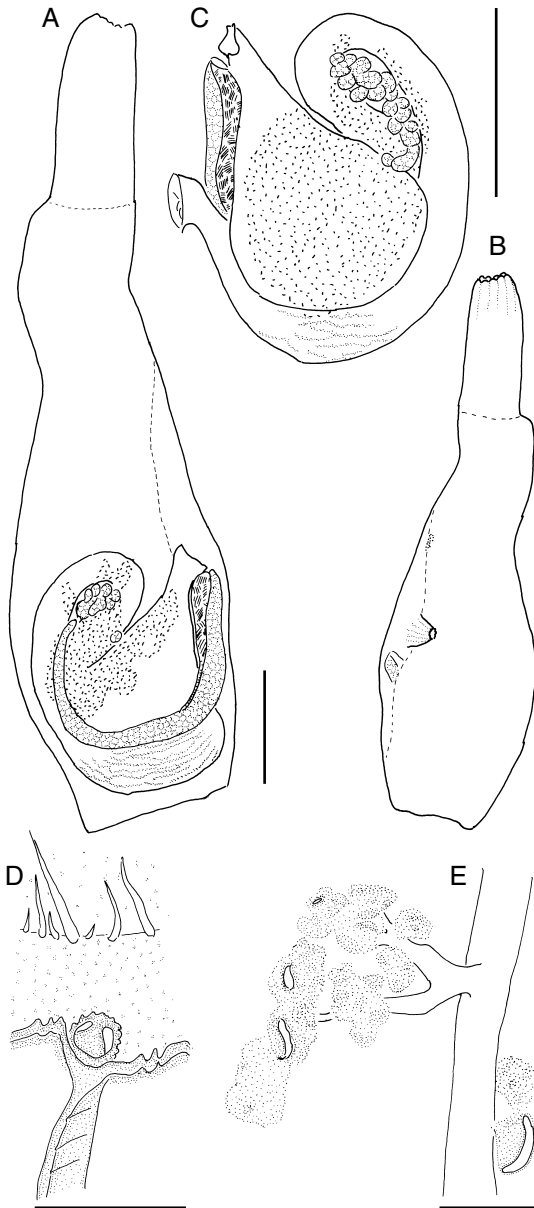


FIG. 85. — *Phallusia* sp.; **A, B**, left and right sides of the body; **C**, internal side of the gut; **D**, dorsal tubercle; **E**, accessory openings of the neural gland. Scale bars: A-C, 1 cm; D, E, 2 mm.

equal slightly folded blades. The neural ganglion is very posterior. The neural gland channel has some accessory apertures (Fig. 85E); it opens through a small dorsal tubercle slit in the shape of a C that is open anteriorly (Fig. 85D).

The whole prepharyngeal area and the dorsal tubercle are covered with small papillae. These are also present less numerously on the internal surface of the oral siphon.

The dorsal lamina is double as far as the neural ganglion. In this anterior region, the right side is even but the left blade is dentate. In its middle part the dorsal lamina has irregular teeth and is moderately high, and after the oesophagus entrance it becomes progressively lower. On the right side is a row of papillae joined posteriorly in a right dorsal lamina identical to that of the left side.

The branchial tissue is well-plicated and passes beyond the gut. There are about 60 regularly spaced longitudinal vessels on each side. The branchial meshes are square. The papillae are high with lateral extensions. There are no intermediate papillae.

The gut is located in the posterior part of the body (Fig. 85A). The stomach has irregular ridges. The rectum is dilated even when the gut is empty (Fig. 85C). The anus has two lobes.

The ovary is more developed on the internal side of the gut (Fig. 85C), with a mass of small lobes, few of which are visible externally (Fig. 85A). The testis lobes cover a large part of the gut. The gonoducts end in a common papilla beside the anus. This papilla remains orange even after preservation in formalin.

About 20 fish larvae occupied the posterior part of the cloacal cavity on the left side.

REMARKS

This species is placed in the genus *Phallusia* Svigny, 1816 according to the presence of some accessory openings on the neural gland channel.

Family PLURELLIDAE Kott, 1973

Genus *Plurella* Kott, 1973

Plurella kottae

Monniot F. & Monniot C., 1996

Plurella kottae Monniot F. & Monniot C., 1996: 235, and several new species are detailed in a separate publication (Monniot F. & Monniot C. 2000).

Order STOLIDOBRANCHIA
 Family STYELIDAE Sluiter, 1895
 Genus *Botryllus* Gaertner, 1774

Botryllus niger (Herdman, 1886)

Botrylloides nigrum Herdman, 1886: 50, pl. 1, fig. 8; pl. 3, figs 19; 20. Type locality: Bermuda.

Botryllus niger – Michaelsen 1919b: 105.

MATERIAL EXAMINED. — **Mariana Islands.** Guam, Apra Harbour, off Buoys, 0-3 m, 12.VI.1998 (MNHN S1 BOT.B 189).

Botryllus perspicuus (Herdman, 1886)
 (Fig. 126D)

Botrylloides perspicuum Herdman, 1886: 45. Type locality: Philippines. — Sluiter 1904: 101. — Kott & Goodbody 1982: 532, Hong Kong. — Kott 1985: 278 part, except the synonymy and, pl. VIe, Australia. — Sanamyan & Sanamyan 1999: 1860, Tasmania, 160-170 m.

Botryllus firmus Monniot F. & Monniot C., 1996: 238, fig. 48, pl. 8C, D, Indonesia and Papua New Guinea.

MATERIAL EXAMINED. — **Papua New Guinea.** Louisiade Archipelago, Calvados Island Chain, Brooker Channel, overhang, 11°03.09'S, 152°28.62'E, 7 m, 1.VI.1998 (MNHN S1 BOT.B 192). — Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 12 m, 1.VI.1998 (MNHN S1 BOT.B 193). — Milne Bay Province, Reef SE of Drawari Island, 10°18.03'S, 151°03.94'E, 12 m, 6.VI.1998 (Sample: CRRF). — South coast, Coutance Island on barrier reef, 10°13.80'S, 148°06.87'E, 31 m, 13.VI.1998 (MNHN S1 BOT.B 191). — Coral Sea, Eastern Fields, 10°09.35'S, 145°33.92'E, 19 m, 15.VI.1998 (MNHN S1 BOT.B 195). — Milne Bay Province, East Cape, Boia Boia Waga Island, 10°12.26'S, 150°44.75'E, 19 m, 27.V.1998 (Sample: CRRF).

DESCRIPTION

The colonies are very variable in life. They are thick crusts of a firm consistency in which the zooids form a design in meandriform ladders (Fig. 126D). The colour is extremely variable: pale yellow, cream with brown apertures, pink, green, and even red. When preserved in formalin the colonies become translucent with brown circles around the oral siphons. Between the zooid systems the tunic appears spotted, and this pigmentation persists after preservation. When

fixed, the surface above the double rows of zooids is depressed. This variability caused an erroneous identification by Monniot F. & Monniot C. (1996) as *B. firmus*, which can now be corrected from the study of new material. All anatomical characters in the present collection correspond well to the description given by Monniot F. & Monniot C. (1996: fig. 48). The nourishing zooids may have small testes or not. Buds of the first order carry well-developed testes but no ovaries. The ovaries are found only in buds of the second order. Most of the second order buds regress before reaching full maturity.

Botryllus tuberatus Ritter & Forsyth, 1917

Botryllus tuberatus Ritter & Forsyth, 1917: 461. Type locality: California. Synonymy: see Monniot C. & Monniot F. 1987: 104, Polynesia.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Camiguin Island, 9°14.71'N, 124°39.61'E, 10 m, 17.IV.1997 (MNHN S1 BOT.B 159).

DESCRIPTION

This species is black with small, round systems. It has been collected on *Ulva reticulata*. This very common ascidian is distributed worldwide.

Botryllus tyreus (Herdman, 1886)
 (Figs 86; 126E)

Botrylloides tyreum Herdman, 1886: 344. Type locality: Philippines. Synonymy: see Monniot C. & Monniot F. 1987: 104, fig. 39D-H, Polynesia.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Yap, Colonia, main wharf, 9°30.91'N, 138°07.57'E, 7 m, 4.VI.1996 (MNHN S1 BOT.B 160).

DESCRIPTION

The colonies are massive, lobed, 3 to 4 mm thick. The common cloacal apertures are raised in short chimneys at the junction of several cloacal channels, and this gives the colony a spongy appearance. In life the colonies are beige (Fig. 126E); there are darker rings around the oral siphons, while the surface above the cloacal channels is almost white. In formalin preservative the tunic becomes transparent, with reddish zooids and clear vascular ampullae at the periphery of the

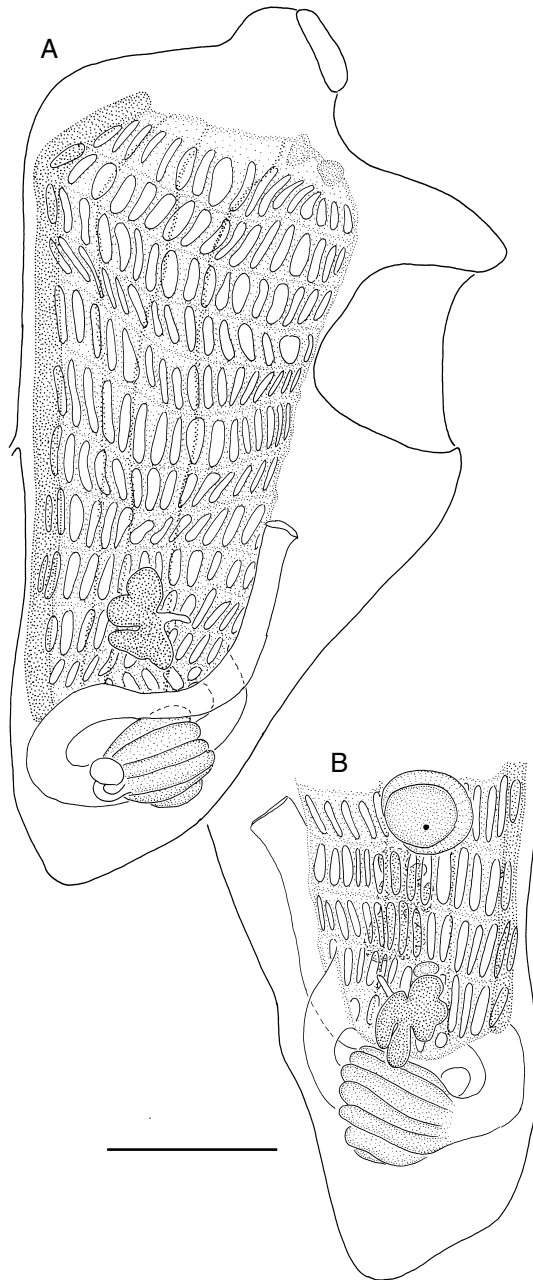


FIG. 86. — *Botryllus tyreus* (Herdman, 1886); A, left side of a zooid; B, right gonad. Scale bar: 0.5 mm.

colony. The buds develop deep in the colony, below the nourishing zooids, and they part very early from the mother zooid.

The cloacal siphon has no languet (Fig. 86A). Its size is small compared to that of other *Botryllus* species, and it sometimes forms a tube. Its rim is even. There are 12 stout oral tentacles of three orders; the longest may extend through the siphon. The prepharyngeal band, in a circle, has a single crest. The dorsal tubercle has a circular opening. The branchial sac has 12 to 13 rows of stigmata on each side (Fig. 86A). The second row is entire and reaches the dorsal lamina. The last row is irregular. The formula on the left side is:

E. 4 V 2-3 V 2-3 V 2 V 6-7 D.L.

The oesophagus is perpendicular to the two last stigmata rows. The stomach is wider in its cardiac part than at its pyloric end. There are about 12 entire protruding stomach folds, which are not dilated anteriorly. The caecum is an inflated ampulla on a long peduncle. The pyloric gland is poorly developed and does not narrow the intestine; its channel opens at the base of the peduncle of the caecum. The long rectum opens at the level of the eighth row of stigmata by an anus with a plain rim. In the nourishing zooids there is a testis on each side (Fig. 86), made of only a few lobes (up to six), located at the level of the two last stigmata rows on the right side, and at the same level or one or two rows ahead on the left side. In some zooids we have found a small larva, 220 μ m in diameter and with only one sensory organ, in the right cloacal cavity at the level of the anus. The larva does not distend the body wall. In one of the incubating individuals an oocyte was present anterior to the right side testis.

The first order buds have functional testes. We have not found oocytes in the first order buds, but second order buds have a lateral mass of large undifferentiated cells on each side.

Genus *Eusynstyela* Michaelsen, 1904

Eusynstyela hartmeyeri Michaelsen, 1904
(Fig. 126F)

Eusynstyela hartmeyeri Michaelsen, 1904: 38, 114, pl. 1, fig. 1, Red Sea and Mozambique. — Monniot C. & Monniot F. 1997: 1639, Bahrain.

Polyandrocarpa violacea Sluiter, 1905: 10, pl. 1, fig. 3.

Eusynstyela aliena Monniot C., 1991b: 18, fig. 6, New Caledonia.

MATERIAL EXAMINED. — **Hong Kong.** SE Hong Kong Island, Swire Marine Lab, 22°12.53'N, 114°15.66'E, 5 m, 12.X.1994 (MNHN S1 EUS 18).

DESCRIPTION

This species (Fig. 126F) makes thick crusts, with the zooids totally included in a common tunic. It was described from the Indian Ocean and Noumea Harbour. It is characterised by elongated polycarps, erect in the cloacal cavity, with two testes of equal length. The stomach is elongated with a small, uncurved caecum.

REMARKS

Monniot C. (1991b) suggested that this species was imported into Noumea Harbour and that diverse populations described by previous authors from oyster cultures or mangroves may also belong to this species. The new collection from Hong Kong Harbour reinforces this hypothesis. Monniot C. & Monniot F. (1997: 1639) have considered the possible relationship between *E. aliena* and *E. hartmeyeri* Michaelsen, 1904 from the Red Sea and Arabian Gulf, both species that also make thick forms. The specimens of the present collection correspond perfectly to those from Noumea and the Indian Ocean. The synonymy of *E. aliena* and *E. hartmeyeri* is established here.

Eusynstyela latericius (Sluiter, 1904) (Fig. 127A)

Gynandrocampa latericius Sluiter, 1904: 94, pl. 15, figs 8-11. Type locality: Indonesia. Synonymy and distribution: see Monniot C. 1991b: 14. — Monniot F. & Monniot C. 1996: 241, figs 49B-D; 50, pl. 8F, Indonesia.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 7 m, 18.IV.1997 (MNHN S1 EUS 20). — Bohol Sea, Camiguin Island, 9°12.89'N, 124°38.03'E, 25 m, 18.IV.1997 (MNHN S1 EUS 21).

Papua New Guinea. Madang barrier reef pass N of Pig (Tab) Island, Rash Pass, 5°09.27'S, 145°49.82'E, 30 m, 22.XI.1993 (MNHN S1 EUS 22).

Indonesia. N Sulawesi, West of Manado, 1°23.52'N, 124°32.64'E, 6 m, 14.V.1993 (MNHN S1 EUS 15).

Fiji. SW Taveuni Island, 16°54.48'S, 179°55.30'E, 12 m, 2.XI.1996 (MNHN S1 EUS 19).

Mariana Islands. Guam, fore reef of Merizo Channel, 5 m, 19.IX.1997 (MNHN S1 EUS 26).

DESCRIPTION

The colonies form thin crusts. The tunic is thin and the zooids can be easily seen. The colour of the colonies may vary according to the extension of the lightest patches between the siphons (Fig. 127A). The species is characterised by a short globular stomach with a small caecum and round gonads lying on the body wall. According to the stage of development, the gonads are distributed along one row or two rows, or are sometimes irregular as in the type specimen. The dissection of this species is made difficult by elastic filaments uniting the tunic and the body wall.

REMARKS

This species is distributed throughout the tropical western Pacific Ocean.

Genus *Symplegma* Herdman, 1886

Symplegma brakenhielmi (Michaelsen, 1904)

Diandrocampa brakenhielmi Michaelsen, 1904: 50. Type locality: Mexico gulf.

Symplegma brakenhielmi — Monniot C. & Monniot F. 1997: 1636, fig. 7A, C, all oceans.

MATERIAL EXAMINED. — **Mariana Islands.** Guam, Apra Harbour, off Buoy, 0-3 m, 12.VI.1998 (MNHN S1 SYM 73).

Symplegma rubra Monniot C., 1972 (Figs 87; 127B, C)

Symplegma rubra Monniot C., 1972: 622, figs 2E, F; 3. Type locality: Bermuda. Synonymy and distribution: see Monniot F. & Monniot C. 1997: 26, fig. 15, pl. 3B, C, Zanzibar, Mozambique.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Yap, Colonia, main wharf, 9°30.91'N, 138°07.57'E, 10 m, 7.VIII.1995.

Palau. KB Channel, Airai side South of KB Bridge, 7°21.03'N, 134°30.95'E, 33 m, 12.VII.1993 (MNHN S1 SYM 66). — Koror, Malakal Harbour, Buoy #5, 7°19.16'N, 134°27.18'E. — Koror, Malakal

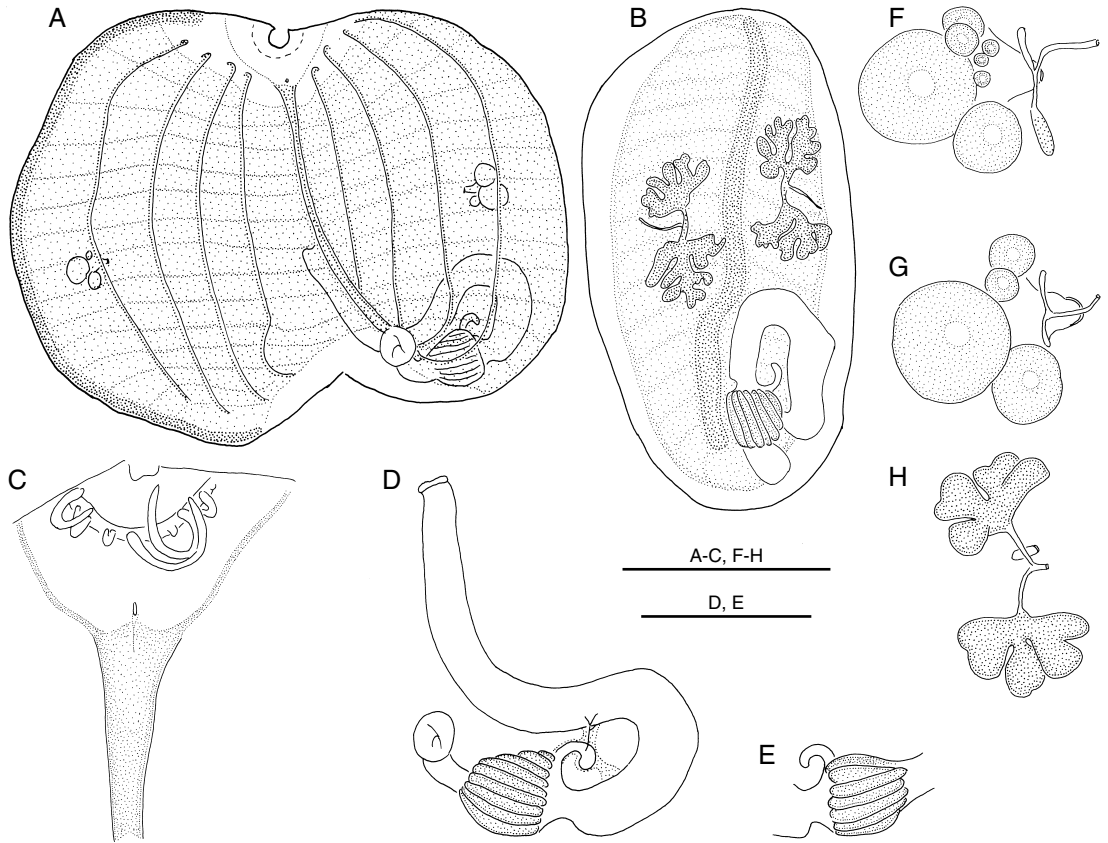


FIG. 87. — *Symplegma rubra* Monniot C., 1972; **A**, female zooid ventrally opened; **B**, ventral side of a male zooid; **C**, anterior dorsal area; **D**, detail of the gut; **E**, external side of the stomach; **F-H**, successive development stages of the gonads. Scale bars: A, B, 2 mm; C, F-H, 0.5 mm; D, E, 1 mm.

Harbour, on buoy chain, 8 m, 7.VIII.1995. — Koror, West Malakal Harbour mouth, 7°20.37'N, 134°25.78'E, 34 m, 25.VIII.1997 (Samples: CRRF). **Indonesia**. Banta Island, 22 m, 1998, coll. Erhardt (MNHN S1 SYM 71).

DESCRIPTION

The distribution of this species now includes the three oceans. There is a large colour diversity in the Indo-Pacific region (Fig. 127B, C), while in the Atlantic it is pink or red. The disposition of the pigment ring linking both siphons is characteristic. The colonies collected at Yap Island are encrusting and 5 mm thick. The zooids lie oblique to the surface and not flattened as they are in most other species of *Symplegma*. The

zooids are in contact with the basal layer of the colony only by the posterior part of their ventral side. In life the zooids are opaque; at Yap this is due to a white pigment uniformly distributed in the body wall, while at Palau they are pink. All colours disappear after formalin fixation.

There are 12 oral tentacles in two orders, well forward in the siphon, and sometimes small buttons between them. The prepharyngeal band has a single circular crest without a dorsal curve (Fig. 87C). The dorsal tubercle is very small with a round or oval opening. The rim of the hole does not stain as it usually does. The dorsal lamina has two low parallel blades.

The branchial sac has four longitudinal vessels on each side. The first two on the left join the dorsal

lamina at the level of the tenth and twelfth rows of stigmata (Fig. 87A). The longitudinal vessels are prolonged anteriorly beyond the branchial perforations. We counted 14 rows of large stigmata; the second row does not reach the dorsal lamina. At the level of the sixth row, the formula is:

R.E. 8 v 7 v 7 v 7 v 8 D.L. 5 v 7 v 6 v 7 v 7 E.L.

On the right side the first vessel parts from the dorsal lamina posteriorly and about 12 stigmata lie between them.

Some differences between the Atlantic, Mozambican, and Pacific samples concern the gut. In the present collection the gut (Fig. 87A, B) is limited to the posterior third of the left side, while in Africa and North America it is larger, reaching half or even three fifth of the left side. The stomach has 14 folds, decreasing in length on its internal side toward the caecum. The pyloric caecum is long and curved (Fig. 87D, E); it is linked to the intestine by two strips of tissue variably positioned according to the colonies. The long rectum ends in a gaping anus without lobes, or one with four low lobes when contracted. The gonads lie at the level of the sixth and seventh rows of stigmata on the left side and the seventh and eighth rows on the right (Fig. 87A). This near-symmetry may reflect a short gut; in African specimens there is a difference of two rows of stigmata, but on the left side in them the gonad may well be pushed anteriorly by the larger gut. The male and female parts of the gonads are not simultaneously mature. When the oocytes are developed the male part is rudimentary (Fig. 87F, G) and during the male phase only the female papilla persists (Fig. 87H). It appears that the zooids are first female, as no oocyte remains in the traces of ovary during the male phase. In Caribbean and African populations, as in *Symplegma alterna* Monniot C., 1988 from New Caledonia, which also shows sequential hermaphroditism, the rudimentary ovary contains numerous small oocytes during the male phase, and this may indicate a protandric activity.

REMARKS

Taking into account the characteristic aspect of the living colonies, we believe that there is a sin-

gle cosmopolitan species. The diversity of colour in the Indo-Pacific populations compared to the uniformity of colour in the Atlantic Ocean may mean that the latter are immigrant populations, as they are mostly found in harbours.

Genus *Stolonica* Lacaze-Duthiers & Delage, 1892

Stolonica bigyna n. sp.

(Figs 88; 127D)

TYPE MATERIAL. — Fiji. Lau Group, Weilagilala Atoll, lagoon channel, 16°46.48'S, 179°07.46'E, 10 m, 30.IX.1996 (MNHN S1 STO 20).

ETYMOLOGY. — From the Greek *gune*: woman.

DESCRIPTION

This species makes plates of closely packed zooids that are separated from their base. The colour is a deep red (Fig. 127D). Each siphon has six white spots. The colour, essentially concentrated in the tunic, fades in formalin preservative. The zooid's body wall is yellowish. The zooids are linked by stolons. There is some weakly attached sand on the tunic. The tunic is thin and contains large clear vesicles. The musculature is thin and regular.

There are 12 large, stout oral tentacles of two orders. The prepharyngeal band has a single thick crest. The dorsal curve is not deep. The protruding dorsal tubercle opens in an antero-posterior slit. The dorsal lamina is high with a double crest. The branchial sac has three folds on each side. The formula is:

R.E. 5 7.3.7 3 7 1 to 5 D.L. 0 7 4 8 2 7 3 E.L.

The longitudinal vessels between folds one and two on each side are slightly higher, but, in contrast to other species of this genus, there is not a double-sized vessel, which would represent a second, regressed fold. Several vessels are intercalated in the widened space between the first fold on the right side and the dorsal lamina; they generally begin close to the dorsal lamina, but sometimes lie close to the first fold. The branchial meshes are long and contain three to four stigmata between folds, cut by a parastigmatic vessel. We counted generally two stigmata per mesh on

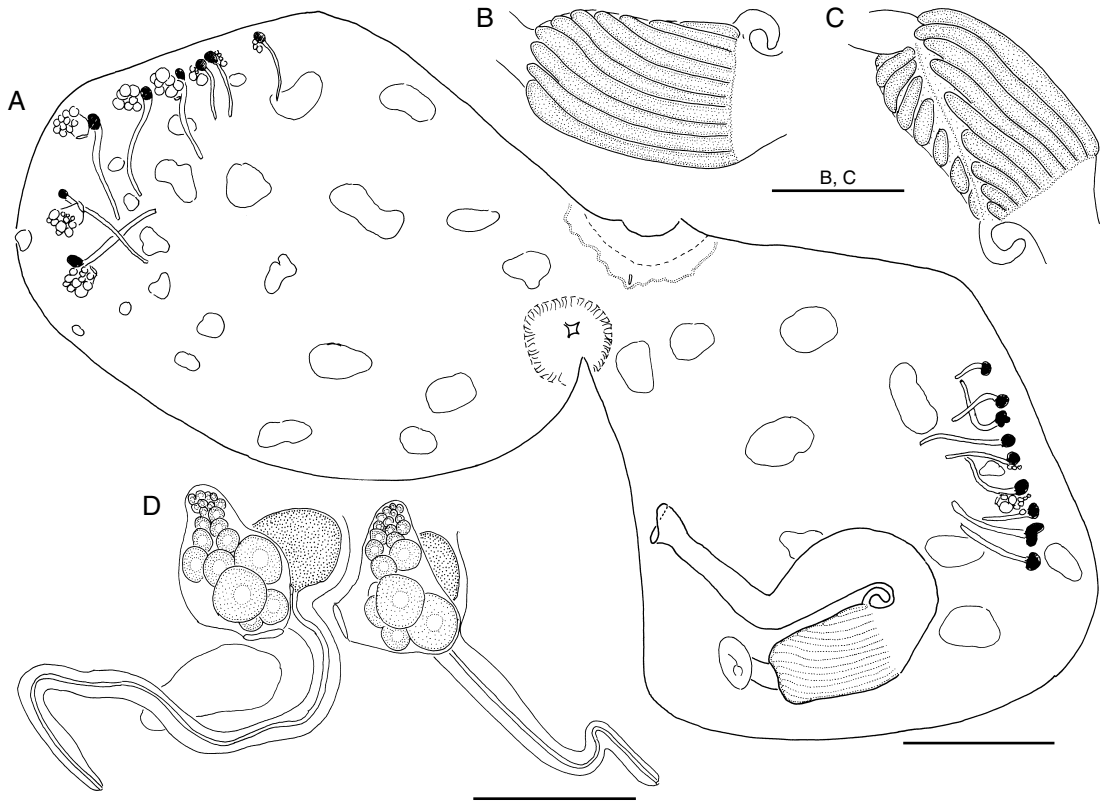


FIG. 88. — *Stolonica bigyna* n. sp.; **A**, specimen opened along the ventral side; **B**, **C**, both sides of the stomach; **D**, gonads. Scale bars: A, 2 mm; B, C, 1 mm; D, 0.5 mm.

the folds. On each side of the dorsal lamina, the meshes may contain six to seven stigmata.

The stomach has 21 distinct folds interrupted at the level of the typhlosole (Fig. 88B, C). The caecum is hook-shaped. The pyloric gland is clearly visible on the whole enlarged part of the intestine. The pyloric channel is independent from the caecum. The slightly enlarged anus has a smooth rim.

The gonads lie along a line on each side of the endostyle in the posterior half of the body (Fig. 88A). There are eight to ten testes per side, spherical or slightly lobed, each with a very long sperm duct. An ovary is coupled to each testis on the left side, and coupled to two to four testes on the right side in the middle of the row. Most of the ovaries on the left are well-developed (Fig. 88D); this is not the case on the right side,

but in all the specimens studied there are at least rudimentary ovaries. The ovaries contain numerous oocytes, the smallest of which are ventral. The specimens in this collection had not reached complete sexual maturity and were not incubatory. Endocarps are scattered on the body wall. The base of the cloacal siphon is encircled by small tentacles.

REMARKS

The genus *Stolonica* Hartmeyer, 1903 *s.s.* seems very homogeneous, with a branchial sac reduced to three complete folds and hermaphroditic gonads comprising a massive ovary and a single testis opening by a long sperm duct. The male or hermaphroditic gonads of the closely related genera *Amphicarpa* and *Distomus* have a very different aspect. Until now, there has not been any *Stolonica* species described with hermaphroditic gonads on

the left side. The disposition of hermaphroditic and female gonads has been the most reliable character to distinguish the genera *Stolonica* (ovaries on the right) and *Amphicarpa* (ovaries on both sides). Our new species possesses ovaries on both sides, but all other characters closely ally it to the other *Stolonica* species. *S. bigyna* n. sp. in life has exactly the same appearance as the Coral Sea species *Stolonica variata* Monniot C., Monniot F. & Laboute P. (1991: 212), but the two species differ in the elongate and lobed testes and the ovaries with few oocytes in *S. variata*.

Stolonica limbata

Monniot F. & Monniot C., 1996

Stolonica limbata Monniot F. & Monniot C., 1996: 245, fig. 51, pl. 8G. Type locality: Palau.

MATERIAL EXAMINED. — Papua New Guinea. Louisiade Archipelago, Tagula Island, Yuma Pass, 11°22.14'S, 153°20.99'E, 12 m (Sample: CRRF).

Genus *Seriocarpa* Diehl, 1969

Seriocarpa tongae n. sp.

(Figs 89; 127E)

TYPE MATERIAL. — Tonga. Vava'u, Fotula, small rock off West coast of Vava'u, cave, 18°38.92'S, 174°04.12'W, 33 m, 16.XI.1997 (MNH S1 SER 8).

ETYMOLOGY. — Named after Tonga, the type locality.

DESCRIPTION

The individuals were grouped in patches, loosely attached to the substratum. Even when the bodies are close together, we have not found any anatomical link between them. The bodies are covered with hair-like extensions of the tunic and are coated with sand and diverse epibionts (Fig. 127E). Both siphons, far apart, are red. When removed from the tunic, the body is elongated with the siphons widely spaced (Fig. 89A). There is a mid-ventral keel between two parallel grooves in the body, which are filled with tunic, and which contain the gonads (Fig. 89B). The body wall is thin. The musculature comprises crossed longitudinal and transverse fibres on the

siphons, but there is only transverse musculature, made of thin but dense fibres, in the remainder of the body wall.

There are about 20 long oral tentacles in two orders of size, irregular, with some small buttons between them. The prepharyngeal band is indented dorsally in a deep V. The dorsal tubercle is round; its opening is a vertical or transverse slit.

The dorsal lamina is a long, high membrane with a plain edge.

The branchial sac has four high folds on each side, on which the vessels are pressed together. One of the formulae is:

R.E. 1 7 7 9 5 7 6 9 3 D.L. 2 9 7 8 6 9 6 9 ? E.L.

There are no parastigmatic vessels.

The gut is small, and lies very posterior in a closed loop (Fig. 89A). The oesophagus is very short. The stomach is elongated with a dozen uninterrupted deep folds. No caecum was found. The anus has numerous small lobes.

The gonads are numerous, included in parallel rods of tunic penetrating into the body wall on each side of the endostyle (Fig. 89B). The polycarps are not in a line, but rather in two longitudinal series with up to 30 gonads on the right side and a few less on the left. Each polycarp is enclosed in a capsule of tunic, and only the genital ducts open into the cloacal cavity (Fig. 89C, D). Each gonad consists of a round ovary accompanied by a single male follicle. The sperm duct is inflated into an ampulla, then narrows before it opens close to the female papilla (Fig. 89C, D).

Numerous endocarps are scattered over the whole internal side of the body wall.

We have not found cloacal tentacles at the base of the cloacal siphon.

REMARKS

S. tongae n. sp. is the fifth species described in the genus.

Seriocarpa benthedii Monniot C. & Monniot F., 1985 is very different from all others. It is a very small deep sea species with few gonads and only three rows of stigmata.

Seriocarpa cristata Millar, 1975 from Kei Island is the most closely allied to our species, with a similar size, gut, and branchial sac, but its gonads are less

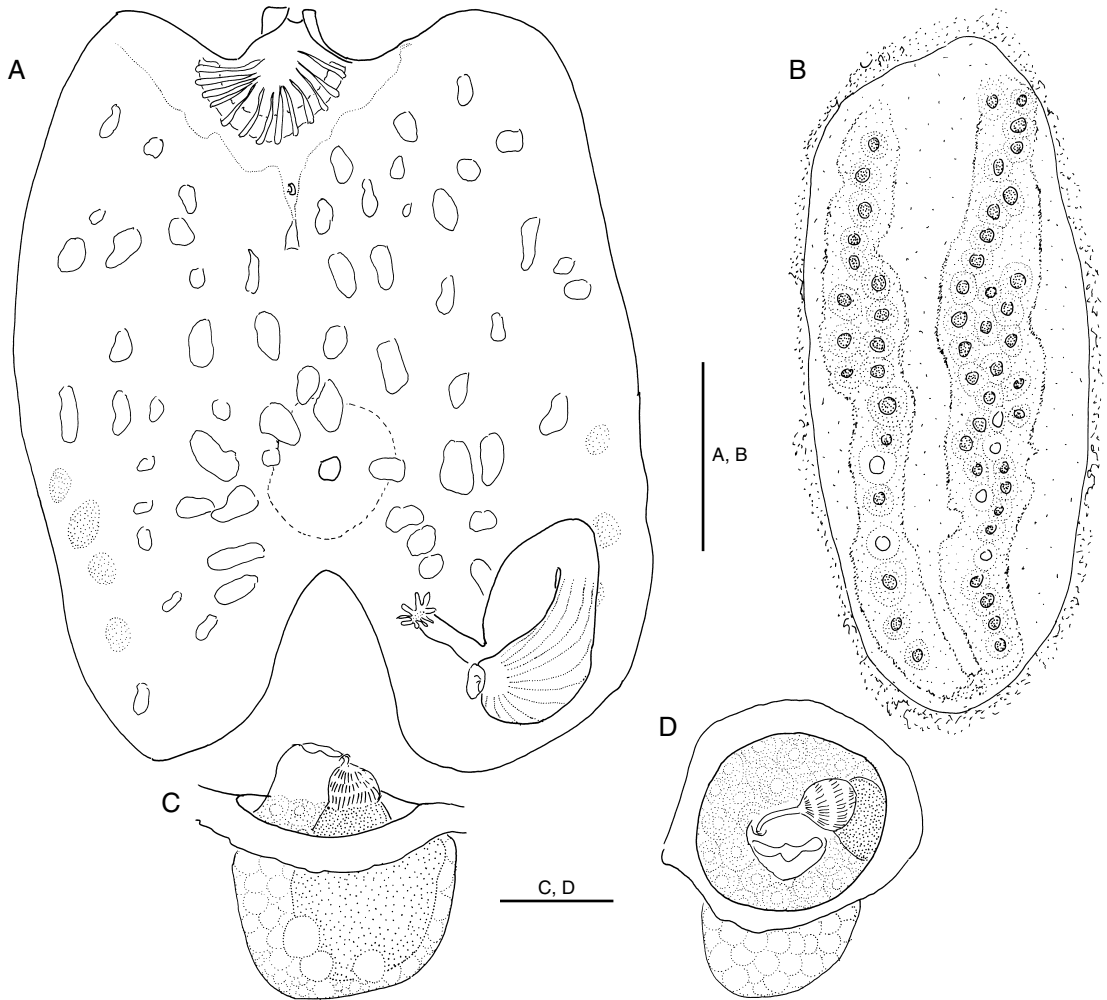


FIG. 89. — *Sericarpa tongae* n. sp.; **A**, specimen ventrally opened; **B**, external view of the ventral side; **C**, lateral view of a gonad; **D**, internal view of a gonad. Scale bars: A, B, 0.5 cm; C, D, 0.5 mm.

numerous and lie in a single line on each side of the endostyle.

Sericarpa littoralis Millar, 1975 from Singapore has many more oral tentacles, more longitudinal vessels on the branchial folds, a short stomach, and gonads that are differently included in the tunic.

Sericarpa rhizoides Diehl, 1969 has a wide distribution in the Atlantic Ocean, the Mediterranean Sea and the Pacific Ocean. It has a single mid-ventral rod of tunic penetrating into the body wall and containing a double row of gonads. The

tunic has stout root-like extensions instead of fine hairs. Its colonial nature has been demonstrated.

Genus *Polyandrocarpa* Michaelsen, 1904

Polyandrocarpa polypora n. sp.
(Figs 90; 127F)

TYPE MATERIAL. — Fiji. Viti Levu, Beqa Passage, Shark Reef, crevice 20 m, 18°16.48'S, 178°00.27'E, 19.X.1996 (MNHN S1 POLA 43).

ETYMOLOGY. — From the Greek *poly*: numerous and *poros*: hole.

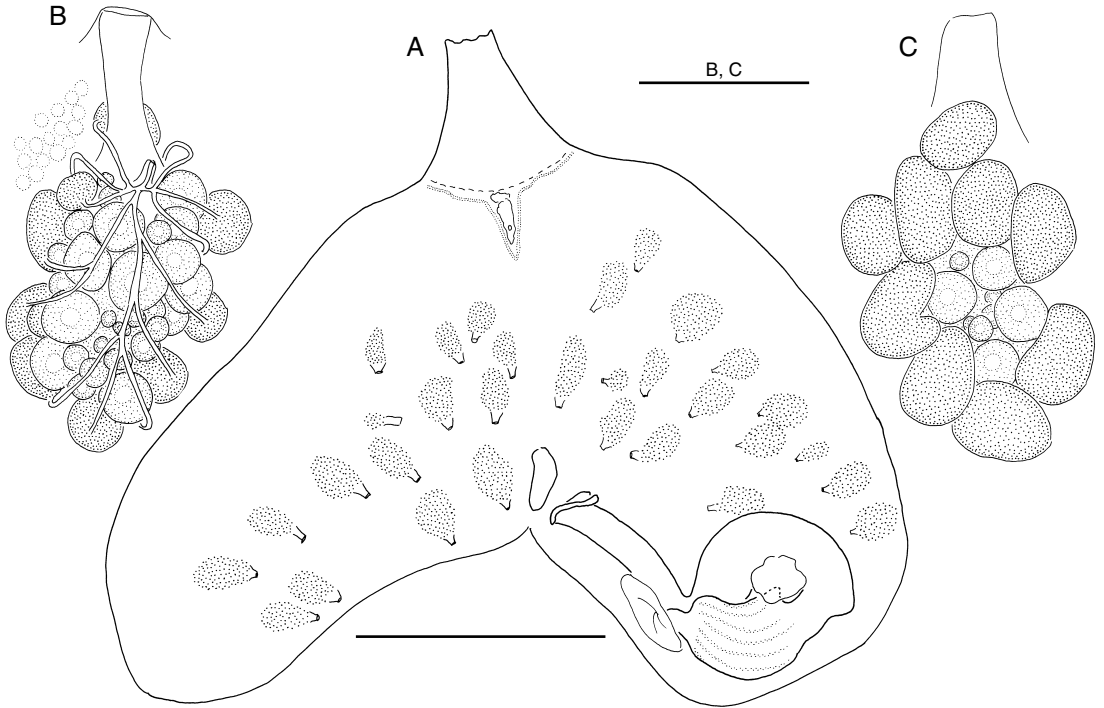


FIG. 90. — *Polyandrocarpa polypora* n. sp.; **A**, specimen ventrally opened; **B**, **C**, both sides of a polycarp. Scale bars: **A**, 5 mm; **B**, **C**, 0.5 mm.

OTHER MATERIAL EXAMINED. — **Tonga**. Vava'u, Swallow Cave, NW end of Kapa Island, on rock wall, 18°40.93'S, 174°02.85'W, 10 m, 8.XI.1997 (MNHN S1 POL.A 44). — W Tongatapu, on reef, 27 m, 21°03.83'S, 175°19.98'W, 10 m, 18.XI.1997 (MNHN S1 POL.A 45).

DESCRIPTION

This species forms globular colonies that reach 6 cm across, on peduncles 2 to 3 cm thick and 6 cm high. The siphons are oval or circular in life. They are light beige exteriorly and white interiorly. The colony is naked; the sand particles in the photo (Fig. 127F) do not adhere to the tunic. When preserved in formalin the colony becomes entirely black. The siphons are placed without special order in the colony (hence the species name). In each zooid they are at least 1 cm apart. When two siphons are close together, they belong to two different zooids.

The contracted zooids measure at least 1.5 cm. They are enclosed in a tunic capsule and are linked to the

common tunic by several blood sinuses. The capsules are hollowed out entirely within the common tunic; to reach the colony surface the oral siphon is 3 to 5 mm long and the cloacal siphon 5 to 7 mm long. The centre of the colony and the peduncle are filled with a black tunic that is both fibrous and gelatinous, crossed by blood sinuses. Among the zooids there are some closed cavities containing cell masses that we interpret as degenerated zooids. No bud was found. The body wall is opaque. Its external layer contains the muscles, its thick internal layer contains clear vesicles. The oral tentacles number about 20 in two or three orders of size, inserted at the base of the long oral siphon, close to the branchial sac. They are curved internally in contracted specimens. The prepharyngeal band has a single thick crest and is deeply indented dorsally. The dorsal tubercle opens by a simple hole in the middle of protruding tissue that contains numerous granules. The dorsal lamina is low, its height only increasing at its mid-length.

The branchial sac has four folds on each side; R.E. 8 6 3 6 2 7 2 8 1–0 D.L. 0 8 3 7 3 6 3 6 7 E.L. In the anterior and middle parts of the branchial sac, the first vessel on the right side is equidistant between the dorsal lamina and the first fold. Posteriorly it parts from the dorsal lamina and draws nearer to the first fold. The longitudinal vessels are high. The branchial meshes contain an average of six stigmata between the folds and two to four on the folds. In the ventral part of the branchial sac, the stigmata are usually cut by parastigmatic vessels. The transverse vessels contain numerous muscular fibres. The gut (Fig. 90A), a closed loop, lies very posterior. The stomach is wide with obvious folds. There is no true caecum but rather just a small button in its place. The irregular intestine ends near the cloacal siphon by an indented anus with a rolled rim. The gonads (Fig. 90A, B) are included in the internal layer of the body wall and covered by a continuous layer of clear granules. They are composed of a central ovary encircled by a crown of round testes. The central part of the ovary is in contact with the external layer of the body wall (Fig. 90C). The testis lobes send out sperm ducts, which join to form a papilla opening far from the oviduct (Fig. 90B). In one of the polycarps we have found two papillae joined by a channel.

In the most mature colony the polycarps were scattered without order on the whole internal side of the body wall (Fig. 90A). We counted about 15 on each side, some of them very small and at the beginning of their development. In other colonies we have found less than 10 polycarps, mostly developed on the ventral side; in some cases they seem to lie in a line.

In one young specimen we found incompletely developed polycarps comprising an oviduct and one or two testis lobes, but these rudiments were few. It may be possible that new polycarps keep appearing during the growth of the zooid.

There is a single endocarp in the intestinal loop (Fig. 90A). We have not found cloacal tentacles; in their place is a circle of mere protruding buttons.

REMARKS

This species is unique among *Polyandrocarpa* in forming a colony with a well-defined form,

including a differentiated peduncle, a rare structure among stolidobranchs, comparable only to the South African species *Gynandrocarpa lacerta* (Herdman, 1886) (see Monniot C. *et al.* in press). Another *Polyandrocarpa*, *P. watsonia* Kott, 1985, has a different form: "The colony forms a thick, curved upright lamella, slightly convex on one side and concave on the other, with a long, curved upper outer border and a shorter basal edge by which it is fixed" (Kott 1985: 225). The zooid of *P. watsonia* is very different from that of *P. polypora*. As suggested by Kott (1985), the genus *Polyandrocarpa* is certainly polyphyletic. It artificially groups disparate species and cladistic lineages encountered in the genus *Polycarpa*. These include particularly species having endocarps scattered around the gonads, species without any endocarps, and, as with *P. polypora*, species with a single endocarp in the gut loop and gonads included in the body wall and covered with vesicles. This last lineage of *Polycarpa* is mostly diversified in the Indo-Pacific region.

Genus *Polycarpa* Heller, 1877

Polycarpa argentata (Sluiter, 1890)
(Fig. 128A)

Styela argentata Sluiter, 1890: 340. Type locality: Indonesia.

Synonymy and distribution: see *Polycarpa argentata* – Monniot F. & Monniot C. 1996: 247, fig. 52, pl. 8H.

Polycarpa iwayamae Tokioka, 1970: 97, fig. 8.

MATERIAL EXAMINED. — **Palau.** Koror, Ngeteklul Island (Kaibakku Island), tunnel into Marine Lake, 7°19.47'N, 134°29.42'E, 10 m, 1.XI.1995 (MNHN S1 POL.B 360).

Philippines. Bohol Sea, Balicasag Island SW of Bohol, 9°31.02'N, 123°40.83'E, 15.IV.1997 (MNHN S1 POL.B 378).

REMARKS

This species (Fig. 128A), present in many parts of the western tropical Pacific and western Australia, is now recorded in the Philippines. It was also collected far from this region at Ibo Island, Mozambique. Tokioka (1970) described

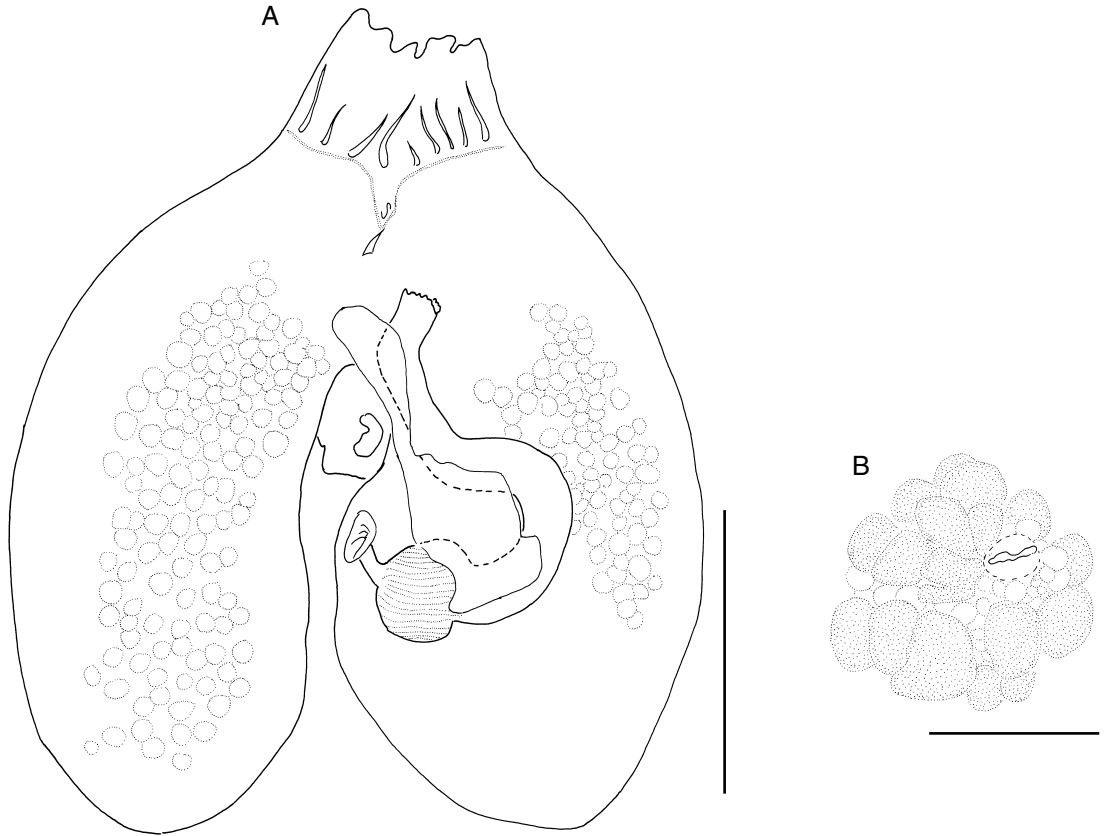


FIG. 91. — *Polycarpa camptos* n. sp.; **A**, specimen ventrally opened; **B**, polycarp. Scale bars: A, 1 cm; B, 1 mm.

Polycarpa iwayamae, which has an external appearance very like that of *P. argentata*. Its internal anatomy does not present enough distinctive characteristics to justify a different species.

Polycarpa camptos n. sp.
(Figs 91; 128B)

TYPE MATERIAL. — Papua New Guinea. Louisiade Archipelago, Deboyne Lagoon, Nivani Island, 10°47.46'S, 152°23.08'E, 12 m, 30.V.1998 (MNHN S1 POL.B 422).

ETYMOLOGY. — From the Greek *camptos*: flexible.

DESCRIPTION

The specimen is 8 × 4 cm, erect, with a cream-coloured, wrinkled tunic (Fig. 128B covered by a

black didemnid). In formalin the tunic turns light brown and the siphons a darker brown. The tunic is soft and flexible (hence the species name) and generally without epibionts. The siphons are close together.

The body wall is brown and thin. There are no vesicles in the thickness of the body wall. There are a dozen oral tentacles of irregular length. The prepharyngeal band is deeply indented dorsally, but not prolonged in a groove (Fig. 91A). The dorsal tubercle is small with a S-shaped aperture. The dorsal lamina begins at the point of the dorsal V, and its height increases gradually down to the oesophagus. At this level it is abruptly cut. The first branchial fold on the right side is doubled. The formula on the right side is:

R.E. ? 8 5 10 7 13 8 17 1 + 4 D.L.

In the space between the first fold and the dorsal lamina, four longitudinal vessels are grouped in a pseudo-fold. The folds are high but do not overlap each other. On the right side we counted about 30 stigmata between the dorsal lamina and the first vessel, but only 15 on the left side.

The digestive tract forms an open loop (Fig. 91A). The oesophagus is short and narrow. The stomach is spherical with numerous thin folds. There is no caecum. The rectum is attached to the body wall only along the dorsal lamina. The anus has two dentate lobes.

There is only one large endocarp, located inside the gut loop, which links the intestine to the stomach.

The gonads are very numerous on the both sides of the body (Fig. 91A) with about 130 polycarps on the right side and 74 on the left side. There are no polycarps on the posterior part of the body wall below the stomach and the gut loop. Each polycarp is round (Fig. 91B), not protruding but rather included in the transparent body wall. The testis lobes are internal to the ovary. The gonoducts are short. We have not seen cloacal tentacles.

REMARKS

This species differs from many *Polycarpa* in its elongate and erect shape and the very numerous and flat, round polycarps with short ducts, and in consistency of its tunic.

Polycarpa captiosa (Sluiter, 1885) (Figs 92; 128C)

Styela captiosa Sluiter, 1885: 202, pl. 9, figs 4-7. Type locality: Indonesia.

Polycarpa captiosa – Monniot F. & Monniot C. 1996: 249, fig. 53, pl. 9A, Palau, and synonymy.

MATERIAL EXAMINED. — **Philippines.** Mindanao, Davao, N side Talikud Island, Angel Cove, 6°57.59'N, 125°40.76'E, 27.III.1996 (MNHN S1 POL.B 362). — NE Panay Island, Bayas Island off coast of Estancia town, 11°26.50'N, 123°12.00'E, 28.IV.1995 (MNHN S1 POL.B 340). — SW Bohol, Planglao Island, 9°32.27'N, 123°43.54'E, 12 m, 21.IV.1997 (MNHN S1 POL.B 377).

DESCRIPTION

The different specimens are from 8 to 12 cm long. They are erect with the siphons at 45°. The tunic is tough, tuberculated, and covered with varied epibionts. The siphons have a red tint (Fig. 128C). The internal characteristics are the same as described in Monniot F. & Monniot C. (1996). The dorsal tubercle has numerous irregular openings. The polycarps are oval, protruding, and arranged in an irregular line on each side of the body (Fig. 92). The gut forms a double loop (Fig. 92), very loosely attached to the body wall when it is not eviscerated.

REMARKS

This species differs from *Polycarpa papillata* (Sluiter, 1885) and *Polycarpa reviviscens* n. sp. in the arrangement of gonads and the multiple openings of the dorsal tubercle.

The distribution covers a large part of the tropical western Pacific Ocean.

Polycarpa cryptocarpa (Sluiter, 1885) (Figs 93; 128D)

Styela cryptocarpa Sluiter, 1885: 210. Type locality: Billiton Island. Synonymy: see Monniot C. 1987b: 281, fig. 2. — Monniot F. & Monniot C. 1996: 251, pl. 9C.

MATERIAL EXAMINED. — **Maldives.** N Male Atoll, Feydhoo Findhu Island, 4°12.94'N, 73°29.04'E, 2 m, 23.IX.1997 (MNHN S1 POL.B 390). — S Male Atoll, oceanside North reef, 4°07.54'N, 73°30.55'E, 10 m, 24.IX.1997 (MNHN S1 POL.B 389).

Tonga. Vava'u, Hunga Island Lagoon, 18°42.25'S, 174°07.72'W, 2 m, 9.XI.1997 (MNHN S1 POL.B 388).

DESCRIPTION

The newly collected specimens allow us to complement the description given by Monniot C. (1987b) for New Caledonian specimens. The colour of the tunic in life is rather variable, and the internal side of the siphons is either completely white (Fig. 128D) or spotted with white. The oral tentacles are of two or three orders of size. The dorsal tubercle is protruding, occupying the total space between the dorsal V and the tentacle ring. Its openings are multiple, curved, or merely in a C (Fig. 93B, D).



FIG. 92. — *Polycarpa captiosa* (Sluiter, 1885). Scale bar: 1 cm.

The gut forms a closed loop (Fig. 93A, C). The secondary curve is always present. The stomach is only slightly enlarged. The anus has a rolled edge

with numerous lobes (Fig. 93A, C). There are two or three large endocarps in the intestinal loop (Fig. 93A, C). The polycarps are numerous on

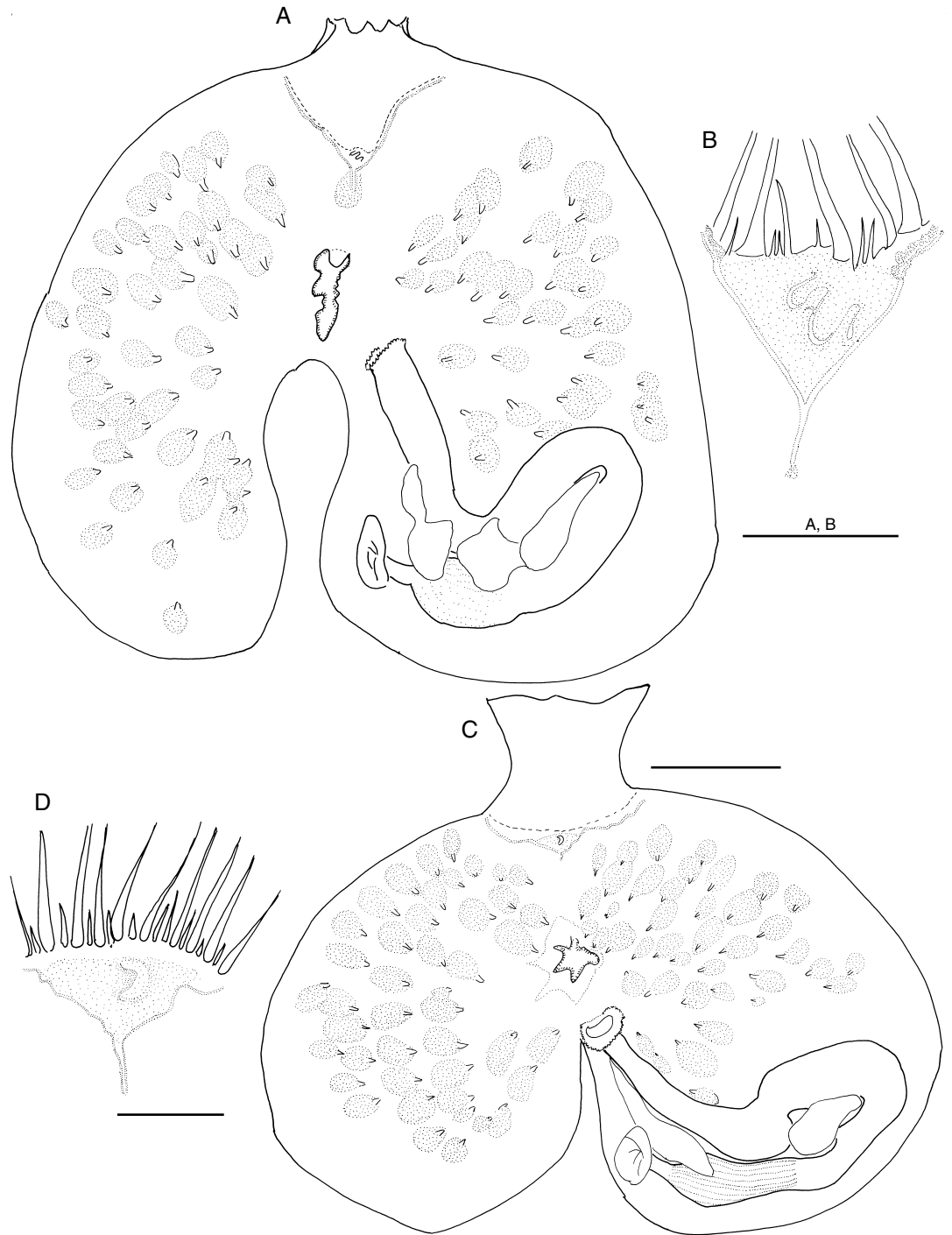


FIG. 93. — *Polycarpa cryptocarpa* (Sluiter, 1885); **A, B**, specimen from Tonga; **C, D**, specimen from Maldives. Scale bars: A, 1 cm; B, D, 2 mm; C, 5 mm.

each side, covering the whole internal side of the body wall (Fig. 93A, C). They are round, included in the thickness of the body wall and have protruding gonoducts. There are no endocarps between them. There is a ring of small cloacal tentacles.

REMARKS

The distribution of this species is very wide in the whole western Pacific Ocean and the tropical Indian Ocean.

Polycarpa nigerrima n. sp.
(Fig. 128E)

Polycarpa nigricans – Monniot C. 1987b: 286, fig. 5, New Caledonia. — Monniot C., Monniot F. & Laboute P. 1991: 217. — Monniot F. & Monniot C. 1996: 258. — Kott 1985 part, pl. 3f.

TYPE MATERIAL. — New Caledonia. Barrier reef, coll. Monniot (MNHN S1 POL.B 424).

ETYMOLOGY. — From the Latin *niger*: black.

OTHER MATERIAL EXAMINED. — Papua New Guinea. Coral Sea, Eastern Fields, 10°01.02'S, 145°38.66'E, 9 m, 14.VI.1998 (Sample: CRRF).

DESCRIPTION

The specimens, arrayed in clusters, are joined at their base. They are entirely black except for a pale line at the rim of the siphons (Fig. 128E). They are 2 cm in length and carry some epibionts. The black tunic is firm and thick. The dark brown body wall is also thick. The oral tentacles, regularly alternated in three orders of size, lie far forward in the oral siphon. The dorsal tubercle lies in the V of the prepharyngeal band, its aperture making a C opened on the right side. The dorsal lamina is very long. The branchial sac is dark brown; it has four well-spaced folds. The gut has a posterior position. It forms a closed loop in which there are two endocarps. The pyloric caecum is very small. The anus has numerous round, thick lobes. The gonads are included in the thickness of the body wall, and only the genital papillae poke out, but the polycarps make swellings on the internal body wall. There is a cloacal velum with a ring of thin cloacal tentacles.

REMARKS

In 1996, Monniot F. & Monniot C. pointed out that there were several species confused under the name *Polycarpa nigricans*. They isolated one species under the name *Polycarpa tokiokai* Monniot F. & Monniot C., 1996, from *Polycarpa nigricans* Heller, 1878 *s.s.*, the latter now strictly an ascidian from the Indian Ocean. And they separated but did not name a third species, comprising some Pacific Ocean populations.

The new collection allows us to confirm that *P. nigerrima* n. sp. is effectively different from *P. nigricans*, and exactly corresponds to the description given by C. Monniot (1987b: 286, fig. 5).

The new species includes none of the specimens collected in the Indian Ocean which belong to *P. nigricans* Heller, 1878. In the Pacific two different but closely allied species coexist. These are *P. nigerrima* n. sp. and *P. tokiokai* Monniot F. & Monniot C., 1996 from Palau and Indonesia, including material described by Monniot C. & Monniot F. 1987, under the name *P. nigricans* from the Philippines. Kott (1985: 174) has mixed all three species under the name *P. nigricans*.

Polycarpa papillata (Sluiter, 1885)
(Figs 94; 128F)

Styela (Polycarpa) papillata Sluiter, 1885: 192. Type locality: Indonesia.

Polycarpa papillata – Kott 1985 part, pl. IIIg, Queensland.

Non *Polycarpa papillata* – Monniot C. 1987b, New Caledonia. — Monniot F. & Monniot C. 1996, Papua New Guinea.

MATERIAL EXAMINED. — Indonesia. Komodo Island, coll. Erhardt.

DESCRIPTION

The specimens are erect, the largest 8 cm in height and 3.5 cm in diameter with the siphons 2.5 cm apart. Both siphons are large with four lobes and four longitudinal red stripes (Fig. 128F). Some other red patches occur on the naked white tunic, and are present throughout its thickness. There is

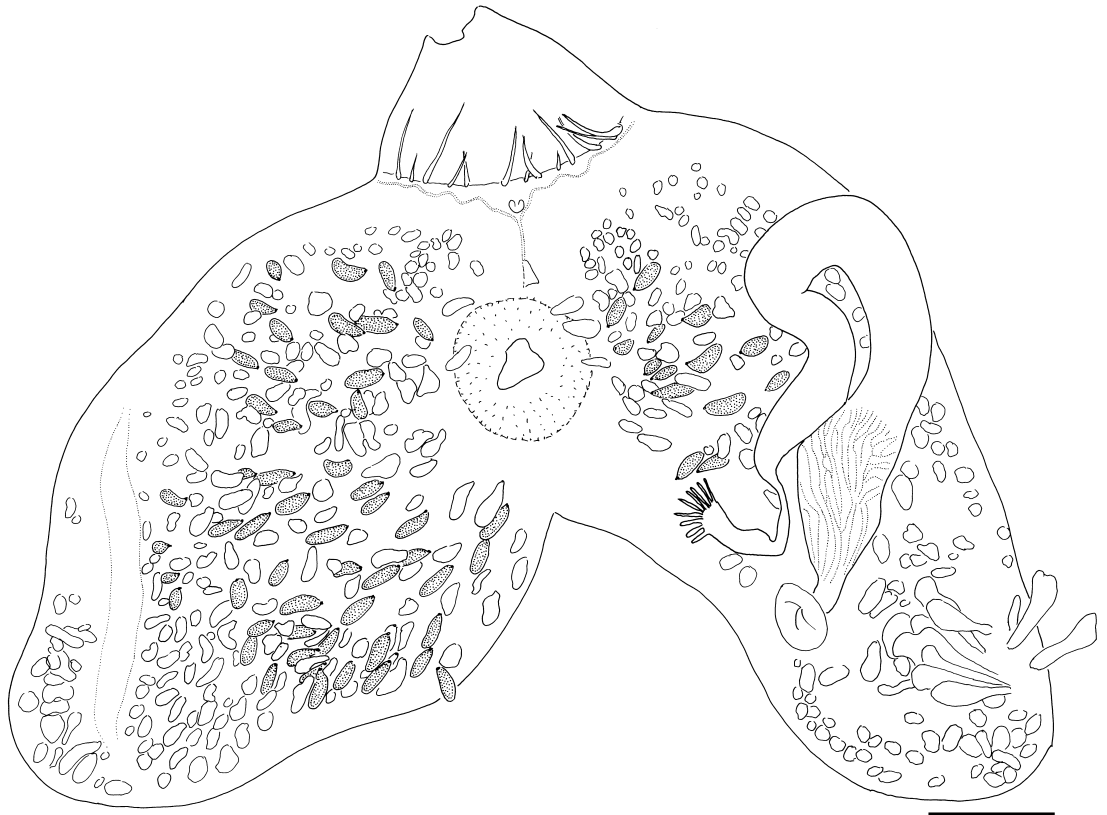


FIG. 94. — *Polycarpa papillata* (Sluiter, 1885). Scale bar: 1 cm.

a dense transverse musculature in the external layer of the body wall and, on the oral siphon, external longitudinal muscular bundles.

There is no oral velum. Sixteen oral tentacles in three orders of size are well-spaced over a muscular ring. The prepharyngeal band has two blades. It curves in a dorsal V prolonged by a groove 2 mm long. The dorsal tubercle is simple, slightly protruding, with a U-shaped opening with inwardly curved horns (Fig. 94). The dorsal lamina is a low membrane ending before the oesophagus entrance. The endostyle is long, encircling the posterior extremity of the body to reach the oesophagus entrance four fifth of the way down the body length. Thus, the branchial sac forms a pouch posterior to the oesophagus. The four high branchial folds overlap each other. The right side formula is:

R.E. 7 15 6 18 4 20 7 17 4 D.L.

The folds end without papillae around the oesophagus entrance. The first fold on the right side is parallel to the dorsal lamina. The space between the dorsal lamina and the first longitudinal vessel does not widen posteriorly.

The gut forms a closed loop, very loosely attached to the body wall (Fig. 94). The oesophagus is short; the stomach has numerous low ridges. Many finger-like lobes surround the anus. The polycarps are oval, scattered on both sides of the internal body wall, more numerous on the right side than on the left side (Fig. 94). There are no polycarps posterior to the gut on the left side. The endocarps are very numerous, round except in an area posterior to the stomach where they are elongated (Fig. 94).

The internal surface of the cloacal siphon is covered with papillae.

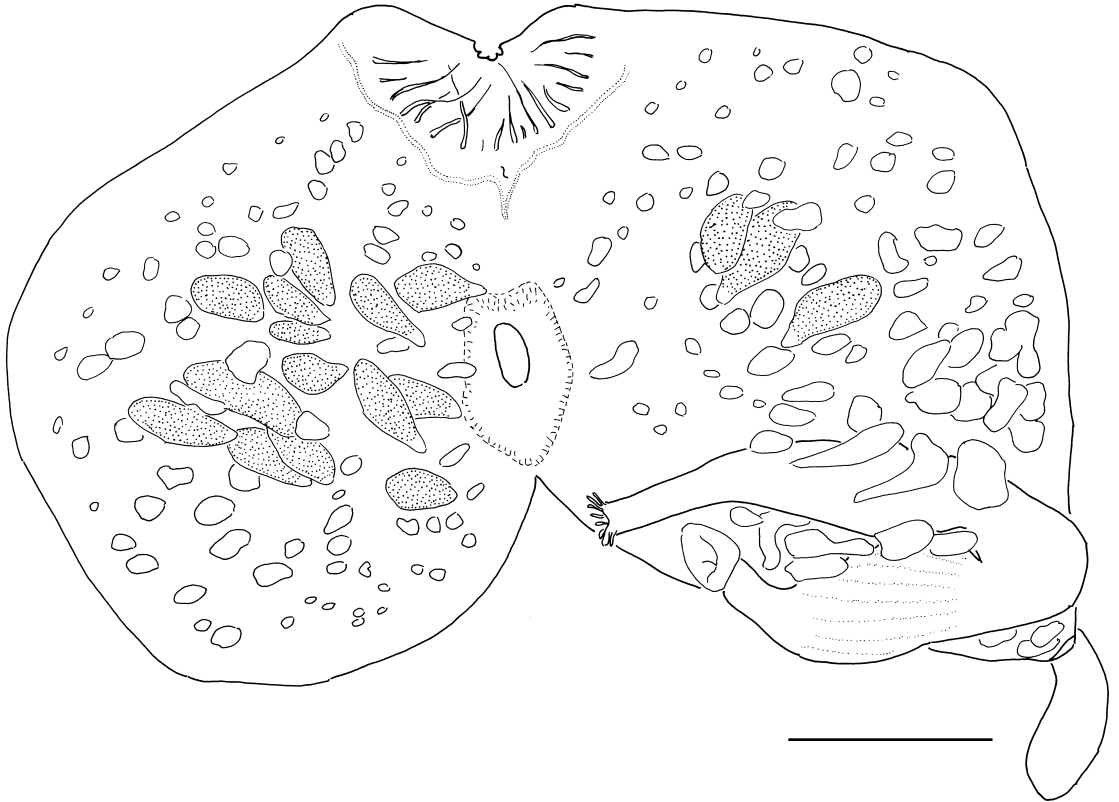


FIG. 95. — *Polycarpa reviviscens* n. sp. Scale bar: 0.5 mm.

REMARKS

Specimens from New Caledonia and Papua New Guinea were erroneously assigned to *P. papillata* by Monniot C. (1987b) and Monniot F. & Monniot C. (1996), and are now identified as a new species, *Polycarpa reviviscens*.

Kott (1985) describes a large variability in *P. papillata*, with different sizes of the specimens, different colours, and variations in the internal anatomy. The variability that she attributes to *P. papillata* corresponds to at least three species; the large *P. papillata* (Sluiter, 1885) with red marks on the tunic, *P. captiosa* (Sluiter, 1885) recorded from Indonesia (Monniot F. & Monniot C. 1996: 249, fig. 53) which has a complex dorsal tubercle and gonads in lines, and the smaller *P. reviviscens* n. sp., with aggregated individuals, a dorsal tubercle with a U-shaped open-

ing, less numerous polycarps, and a posterior extension of the body wall on the left side.

Polycarpa pigmentata (Herdman, 1906)

Styela pigmentata Herdman, 1906: 318. Type locality: Ceylon.

Polycarpa pigmentata – Monniot F. & Monniot C. 1996: 252, fig. 54A, B, pl. 9E.

MATERIAL EXAMINED. — Papua New Guinea. Milne Bay Province, East Cape, Boia Boia Waga Island, 10°12.26'S, 150°44.75'E, 20 m, 27.V.1998 (MNHN S1 POL.B 405).

Polycarpa reviviscens n. sp.
(Figs 95; 129A)

Polycarpa papillata – Monniot C. 1987b: 299, fig. 10, shallowest form. — Monniot F. & Monniot C. 1996: 252, pl. 9D.

TYPE MATERIAL. — **Papua New Guinea**. Louisiades, Calvados Island, Brooker Channel, overhang, 11°03.09'S, 152°28.62'E, 7 m, 1.VI.1998 (MNHN S1 POL.B 406).

ETYMOLOGY. — From the Latin *revivisco*: to be live again.

MATERIAL EXAMINED. — **Papua New Guinea**. Milne Bay Province, N side of East Cape, Hiliwau, wall, 10°15.65'S, 150°42.75'E, 10 m, 28.V.1998 (MNHN S1 POL.B 407).

Solomon Islands. Santa Cruz Islands, Vanikoro, 33 m, 25.III.1998, coll. Erhardt (MNHN S1 POL.B 419).

DESCRIPTION

The individuals, 2 to 3 cm high and 1 cm in diameter, are erect, grouped in clumps (Fig. 129A). The tunic is clean except at the base, where it forms a kind of peduncle that carries some epibionts. The colour is pale yellow with a pink tint at the siphonal rims. The siphons have four lobes.

The body wall is yellowish and opaque. It penetrates into the basal peduncle in a thick, dense, and vascularised extension.

The oral tentacles, about twenty, are in three orders, with minute ones between them. The prepharyngeal band has two blades, with undulations around the top of the folds and a deep dorsal V. The dorsal tubercle is not protruding; its aperture is a variable sinuous slit.

The dorsal lamina is long with a smooth edge. The branchial sac has four high folds on each side which do not overlap each other. There are eight to 11 vessels on the folds and two to four vessels between the folds. Parastigmatic vessels are present.

The gut forms a simple loop (Fig. 95). Entirely enclosed in a large mesenteron, the stomach has low longitudinal ridges and a small, curved caecum. The straight rectum ends in numerous finger-like anal lobes (Fig. 95).

The gonads are elongate polycarps (Fig. 95). We usually counted three or more polycarps in the middle of the left side of the body and an average of 14 polycarps scattered on the right side. The endocarps are distributed over the whole internal side of the body wall; those anterior to the gut are

longer (Fig. 95). There is a thin cloacal velum covered with numerous thread-like papillae.

REMARKS

This new species has probably been confused several time with *P. papillata* (Sluiter, 1885) and *P. captiosa* (Sluiter, 1885), with which it shares many characters. The differences include the size of the individuals (smaller here), the structure and colour of the tunic surface, the assemblage of individuals in clumps, and the posterior fleshy prolongation of the body wall.

Polycarpa rima

Monniot F. & Monniot C., 1996

(Fig. 96)

Polycarpa rima Monniot F. & Monniot C., 1996: 254, fig. 54C, D, pl. 9F. Type locality: Papua New Guinea.

MATERIAL EXAMINED. — **Palau**. Airai Ongelungel, 7°20.69'N, 134°32.08'E, 7 m, 15.V.1996 (MNHN S1 POL.B 380).

Federated States of Micronesia. Yap, Goofnuw Channel, 9°34.27'N, 138°12.26'E, 18 m, 5.VIII.1995 (MNHN S1 POL.B 382).

Fiji. Viti Levu, Suva Harbour Channel, 18°08.63'S, 178°24.07'E, 3 m, 23.X.1996 (MNHN S1 POL.B 381).

Tonga. Tongatapu, Hakau Mama'o Reef, 20°59.80'S, 175°12.85'W, 7 m, 19.XI.1997 (MNHN S1 POL.B 415).

Papua New Guinea. Coral Sea, Eastern fields, 10°00.66'S, 145°39.90'E, 65 m, 14.VI.1998 (MNHN S1 POL.B 416). — Louisiade Archipelago, Deboyne Lagoon, Nivani Island, 10°47.46'S, 152°23.08'E, 12 m, 30.V.1998 (MNHN S1 POL.B 404). — Milne Bay Province, Samarai, 10°36.98'S, 150°39.77'E, 27 m, 10.VI.1998 (MNHN S1 POL.B 423).

DESCRIPTION

The specimens are 6 to 8 cm long, 3 cm wide and 2 cm thick. The protruding siphons, 1 to 2 cm long, are 1 cm in diameter. They clearly have four lobes with the aperture forming a cross when contracted. The body is fixed by the left posterior side. In life the tunic is a pale ochre or grey and the cloacal siphon has four pinkish patches on the lobes. When fixed in formalin the tunic becomes a dark brown. The tunic is partly covered with epibionts, algae and

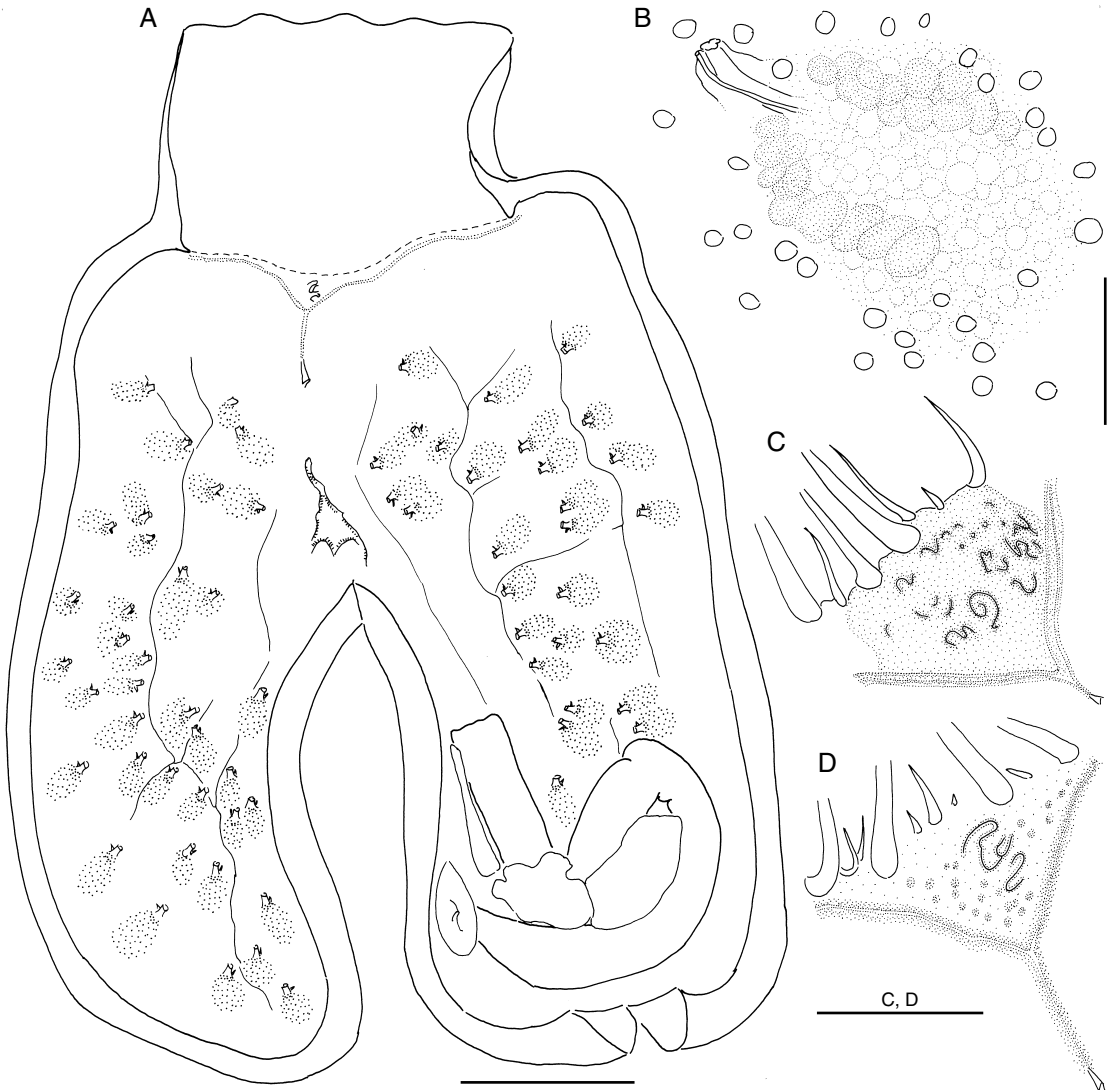


FIG. 96. — *Polycarpa rima* Monniot F. & Monniot C., 1996; **A**, gonads distribution; **B**, polycarp; **C**, **D**, dorsal tubercles. Scale bars: A, 1 cm; B, 2 mm; C, D, 1 mm.

didemnids. It is thin and soft but tough. Its interior surface is slightly nacreous.

The 1 mm thick body wall is opaque. It is made of three layers: one external, thin, with granules, one internal, containing a dark musculature, and a lighter internal layer containing the gonads and full of granules, which are pale with a black spot or entirely dark. The granules around the gonoducts are always dark. The

internal side of the siphons has a continuous layer of longitudinal fibres.

There are about 50 oral tentacles in three or four orders of size, those of smallest order with a variable development. The prepharyngeal band is close to the tentacular ring. It is made of two fleshy pads on the sides of a deep groove (Fig. 96C); it makes a dorsal V and is prolonged by a more or less developed groove towards the

dorsal lamina. The dorsal tubercle is flat and full of granules. Its opening is complex (Fig. 96C, D). The dorsal lamina is fleshy and low. Its height increases near the oesophagus. The endostyle is not attached to the body wall and is particularly high (1 mm).

The branchial sac is light brown with black granules on its external side. One formula is:

R. E. 7 18 4 16 5 17 5 15 3

D.L. 2 13 7 16 4 16 4 14 6 E. L.

The formula is slightly different in specimens from Yap;

R. E. 3 10 4 13 3 15 3 (8 2 5) 0

D. L. 3 13 4 16 3 14 3 14 3 E. L.

The first fold on the right doubles posteriorly when four of the six sinuses of the anterior part of the branchial sac form a pseudo-fold. The formula becomes ([7 to 8] [5])2 D. L. etc. The first vessel on the right parts from the dorsal lamina posteriorly. By the oesophagus entrance it is separated from the dorsal lamina by more than 20 stigmata. The folds are high and slightly overlap each other. There are more than 10 elongated stigmata in a mesh between the folds and five to eight on the folds. There are no parastigmatic vessels.

The gut occupies the posterior third of the left side (Fig. 96A). The stomach is externally smooth. In section the glandular grooves are irregular and not well-marked. The rectum has some black granules. It is attached to the body wall. The anus has a smooth or undulated rim and opens at some distance from the cloacal siphon.

The gonads (Fig. 96B) are included in the thickness of the body wall. In section they are spherical with a central ovary circled by elongated male lobes. The ducts open in the middle of a mass of black granules. The male papilla diverges the female papilla. In one specimen the gonads are numerous (about 90 on the right and 70 on the left side) but almost inactive. They are less numerous (about 37 on the right and 28 on the left) in specimens from Yap (Fig. 96A), but they are functional, more protruding, and form somewhat polygonal masses.

There are three endocarps in the intestinal loop, one of them a thin blade following the rectum. There are no endocarps elsewhere.

REMARKS

This species seems common and widely distributed in the western tropical Pacific Ocean. It belongs to the group that Kott (1985) names the "pedunculata group" which comprises species having one to three endocarps in the gut loop, and gonads included in the body wall and encircled by granules. These species, some of which have bright colours in life, generally become dark brown or black in fixatives. The species differ in the shape of the dorsal tubercle, the gonad structure and particularly the shape of the testis lobes, and the shape of the gut loop and anus.

Polycarpa pedunculata Heller, 1878 has few gonads, elongated and clearly protruding into the cloacal cavity, with testis lobes deeply divided.

Polycarpa ovata Pizon, 1908 is a more or less pedunculate species with a simple dorsal tubercle and lobed testis lobes.

Polycarpa molgulooides Herdman, 1882, adapted to live on soft bottoms, shows differentiation of the tunic and has a coating of sand. The dorsal tubercle is simple, the testis lobes are ramified, and the anus is lobed.

Polycarpa viridis Herdman, 1880 is slightly pedunculate with a complex dorsal tubercle, lobed testis lobes and a divided anus. There is a single endocarp, in the gut loop.

Polycarpa obscura Heller, 1878 has a black tunic in life, with an orange ring around each siphon. The dorsal tubercle is complex and the testis lobes are very elongated. As described by Kott (1985) *P. obscura* is a pedunculate species, erect, with a long oral siphon oriented toward the current.

Polycarpa flava Kott, 1985 is a bright yellow in life, and has a simple dorsal tubercle, a lobed anus, and only one endocarp.

P. descipiens Herdman, 1906 is a small species (2 cm) with a simple dorsal lamina, divided testis lobes, and a rolled and lobed anus.

P. rima Monniot F. & Monniot C., 1996 is distinguished by a gut with a long rectum; the

gonads have long ducts protruding into the cloacal cavity. The siphons of *P. rima* have a light internal surface.

P. rima approaches the species group *Polycarpa mytiligera* (Savigny, 1816)-*P. pigmentata* Herdman, 1906. But both those species are larger (more than 10 cm), erect, and totally black in life. They have only one or two endocarps in the intestinal loop.

Polycarpa stirpes Kott, 1985
(Figs 97; 129B)

Polycarpa stirpes Kott, 1985: 202, fig. 95, Queensland, Indonesia, and Philippines, and synonymy. — Monniot C. 1987b: 278, fig. 1C, D, New Caledonia.

MATERIAL EXAMINED. — **Philippines.** W Luzon, Zambales, Masinloc town, Luan Island, 15°29.90'N, 119°54.44'E, 7 m, 4.V.1995 (MNHN S1 POL.B 383).

DESCRIPTION

This species, 3.5 cm tall by 2.5 wide by 2 cm thick, is erect, fixed by the posterior part of the left side. The tunic is covered with epibionts (Fig. 129B) and is difficult to see on the substrate. The square siphons have white spots, which can fuse to make a line. The inner tunic of the siphons is flesh-coloured. The tunic is tuberculated, internally white. Its thickness varies from 1 to 3 mm and it is soft.

The body wall is yellow and remains the same colour after formalin fixation. It is 0.5 mm thick. It contains whitish granules but remains translucent, and one can see the gonads through it. The musculature is not very well-developed. Both siphons have a large, thin velum, easily torn. The oral tentacles are inserted in the bottom of the siphon, almost in contact with the prepharyngeal band. There are 12 long tentacles in two or three orders and one to three very small tentacles between them (Fig. 97D). The prepharyngeal band has a single crest, which is not wavy at the level of the branchial folds. It curves in a pronounced dorsal V, which is prolonged by a medio-dorsal pad anterior to the beginning of the dorsal lam-

ina. The fold on each side ends at the level of this crest. The dorsal tubercle is U-shaped (Fig. 97D), dug into the body wall rather than protruding. The dorsal lamina progressively increases posteriorly in height; it ends obliquely cut at the middle of the oesophagus entrance. The branchial sac has four round, high folds. We counted:

R. E. 3 7 4 13 4 12 2 7 4

D.L. 2 7 3 13 4 12 3 10 3 E. L.

The folds progressively lessen and disappear at the oesophagus entrance. The first longitudinal vessel on the right side is thicker than the others; it joins posteriorly the vessels and forms a pseudo-fold in the posterior part of the body. It moves away from the dorsal lamina posteriorly; anteriorly we counted six to seven stigmata in this dorsal space and more than 30 stigmata at the oesophagus entrance. The longitudinal vessels are high. The meshes contain 10 to 12 elongated stigmata between the folds and an average of six on the folds. Parastigmatic vessels only appear where a stigmata row divides.

The gut, a closed loop, is located in the posterior third of the left side (Fig. 97B, C). The stomach is slightly enlarged with 16 clearly marked internal grooves. The external wall is smooth. There is a small caecum. The intestine draws a regular curve, the rectum is short, and the anus lobed. A large endocarp occupies the centre of the intestinal loop, and two smaller ones lie between the oesophagus and the intestine (Fig. 97C).

The gonads are included in the thickness of the body wall. The central ovary is encircled by a crown of testis follicles. The sperm ducts converge in a non-protruding papilla that opens near the female papilla (Fig. 97E).

A ring of small tentacles encircles the cloacal siphon (Fig. 97C).

REMARKS

This inconspicuous species, by its anatomy, is closely allied to *P. argentata* (Sluiter, 1890). The species differ essentially in the gonad disposition: ventral in *P. argentata* and located in the centre of

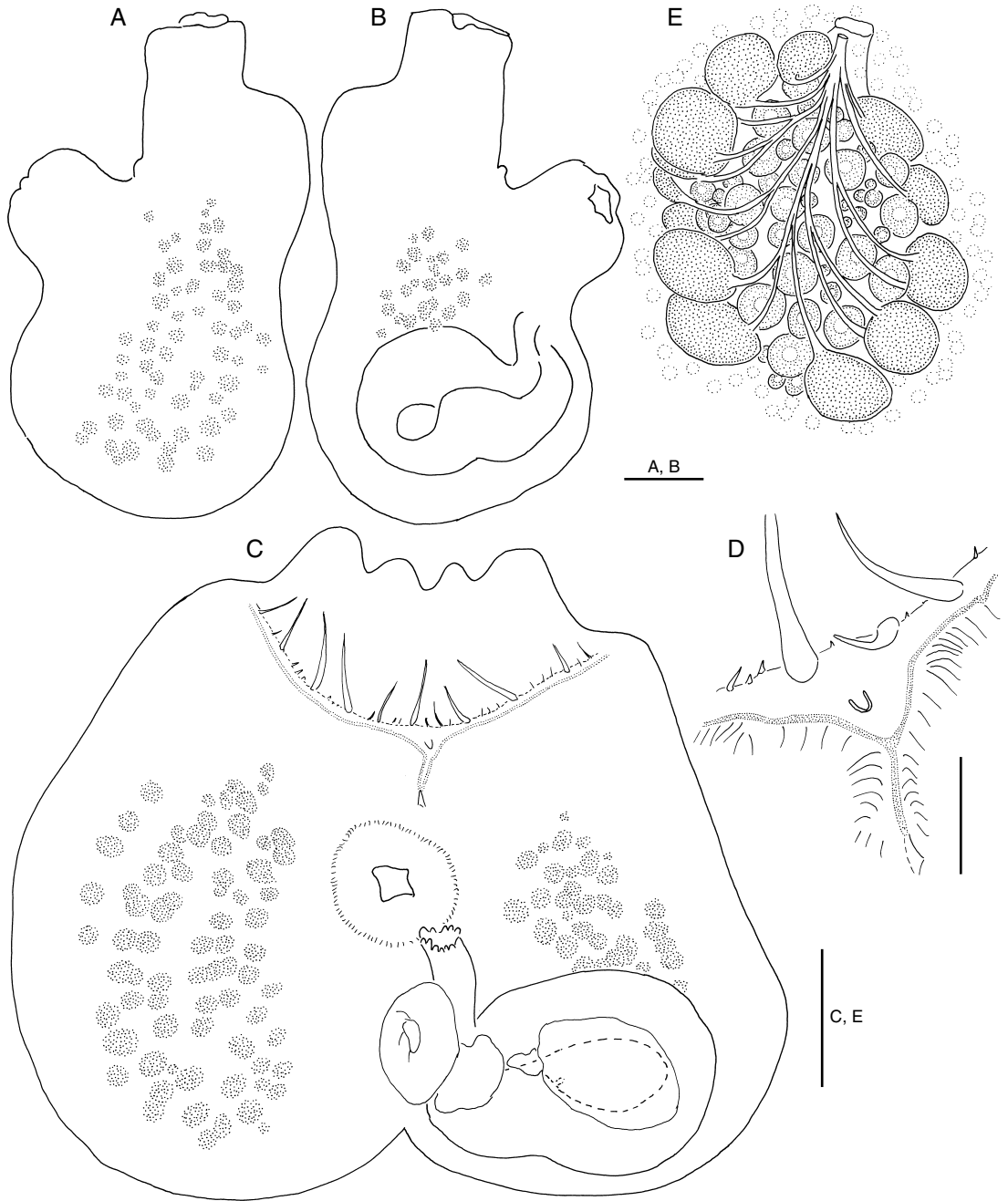


FIG. 97. — *Polycarpa stirpes* Kott, 1985; **A, B**, right and left sides of a specimen; **C**, specimen ventrally opened; **D**, dorsal tubercle; **E**, polycarp. Scale bars: A, B, 5 mm; C, 2 cm; D, E, 0.5 mm.

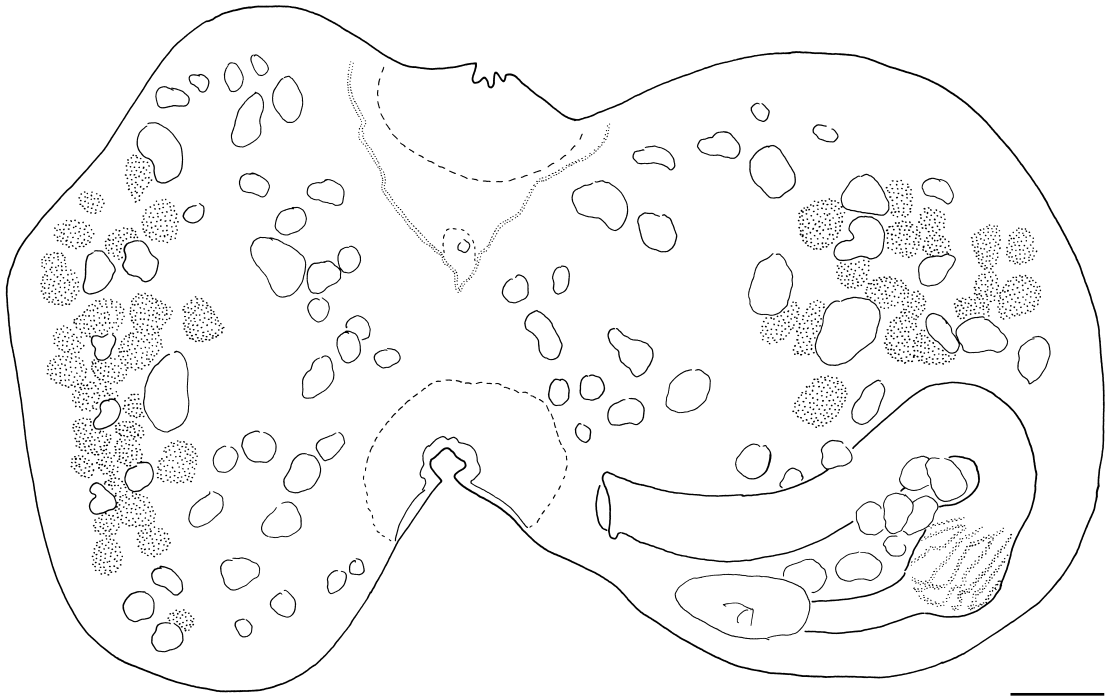


FIG. 98. — *Polycarpa tumida* Heller, 1878. Scale bar: 2 mm.

the lateral body wall in *P. stirpes*. In their external appearance these species are very different, as well.

Polycarpa tokiokai

Monniot F. & Monniot C., 1996

Polycarpa tokiokai Monniot F. & Monniot C., 1996: 255, fig. 55, pl. 9G. Type locality: Palau.

MATERIAL EXAMINED. — **Philippines**. Cebu Straits, Cabilao Island, 9°53.39'N, 123°45.45'E, 5 m, 15.IV.1997 (MNHN S1 POL B 376).

REMARKS

The characters separating *P. tokiokai* from *P. nigricans* Heller, 1878, based on the disposition of the gonads, have been specified by Monniot F. & Monniot C. (1999) based on specimens of *P. nigricans* from Tanzania.

The distribution of this species includes the Philippines Islands, New Caledonia, Palau, and Indonesia.

Polycarpa tumida Heller, 1878

(Figs 98; 129C)

Polycarpa tumida Heller, 1878: 103. Type locality: Jamaica. — Monniot C. 1972: 630, Bermuda; 1983: 446, fig. 9, Guadeloupe. — Monniot C. & Monniot F. 1987: 117, Polynesia.

MATERIAL EXAMINED. — **Palau**. Mecherchar Island, Jellyfish Lake, marine lake, 7°09.83'N, 134°22.50'E, 1 m, 5.VI.1994 (MNHN S1 POL B 364).

REMARKS

The Palau specimens are settled in groups of individuals covered with sand (Fig. 129C). The anatomical characters correspond to the previous descriptions of material from the western Atlantic and Polynesia (Fig. 98). The occurrence of the species in Palau increases its geographical distribution in the Pacific Ocean. Its frequent location in mangrove areas should be noted.

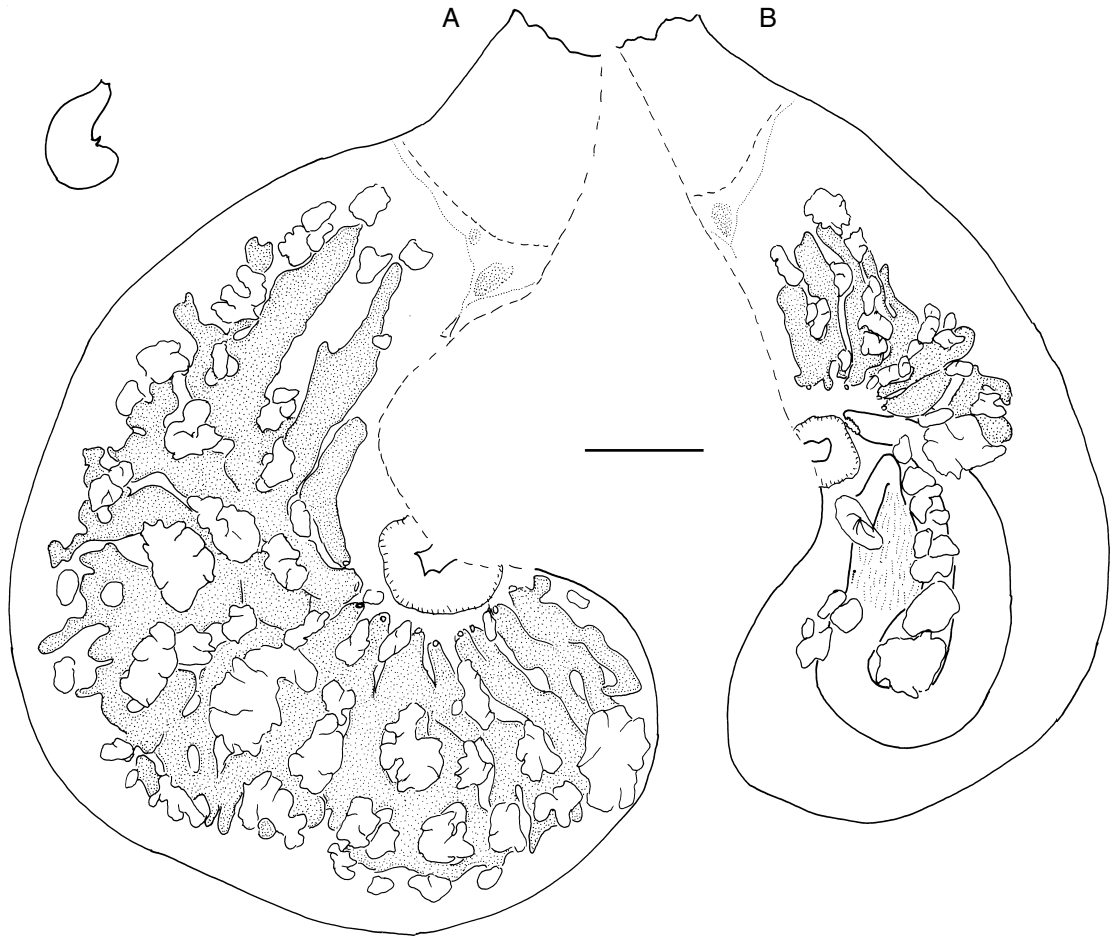


FIG. 99. — *Cnemidocarpa pedata* (Herdman, 1881); **A, B**, right and left sides of a specimen. Scale bar: 1 cm.

Genus *Cnemidocarpa* Huntsman, 1912

Cnemidocarpa pedata (Herdman, 1881)
(Figs 99; 129D)

Polycarpa pedata Herdman, 1881: 71. Type locality: Philippines.

Synonymy and distribution: see *Cnemidocarpa pedata* – Tokioka 1958: 322, figs 5; 6. — Kott 1985: 132, fig. 60; 1998: 205.

MATERIAL EXAMINED. — **Philippines.** Bohol Sea, Pamilacan Island, 9°30.01'N, 123°55.57'E, 30 m, 17.IV.1997 (MNHN S1 CNE 176).

Papua New Guinea. Louisiade Archipelago, Calvados Island Chain, Brooker Channel, 11°03.09'S, 152°28.62'E, 3 m, 2.VI.1998 (MNHN S1 CNE 181).

DESCRIPTION

This species has a characteristic shape, with an enlarged postero-ventral side, the oral siphon terminal, and the cloacal siphon mid-way down the length of the body (Fig. 99B). The colour in life is peach, with a white rim to the siphons and a black colour internally (Fig. 129D). The posterior side of the body carries diverse, but not very dense epibionts. The tunic is hard with irregular low grooves in the surface.

The external appearance and the internal anatomy correspond well to Kott's (1985) and Tokioka's (1958) descriptions. No stalk is pre-

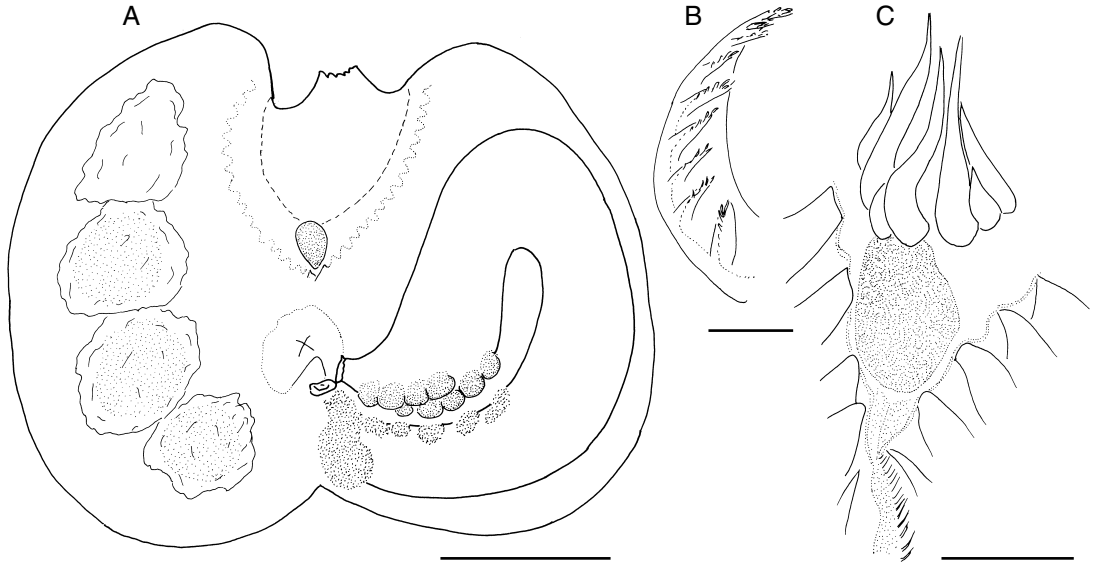


FIG. 100. — *Herdmania armata* n. sp.; **A**, specimen ventrally opened; **B**, oral tentacle; **C**, dorsal tubercle. Scale bars: A, 10 cm; B, C, 0.5 cm.

sent in the two specimens in this collection. The largest specimen is 13 cm long.

The body wall is dark and thick. The dorsal tubercle is a large pad with numerous small holes (Fig. 99). As in previous descriptions, the branchial sac has four folds and accessory folds between the first fold and the dorsal lamina. The folds are high and are themselves folded in secondary or tertiary folds.

The gut loop is very simple. The internal folds of the stomach can be seen in transparency (Fig. 99B). The intestinal limb of the gut is long. The anus has several lobes and opens at the base of the cloacal siphon.

The gonads (Fig. 99) are included in the thick body wall and so are difficult to see. The ovaries are numerous on the right side, less numerous on the left side, and ramified and so expanded that their outline cannot be defined. All the gonoducts, ten on the right, and four on the left, open along a circle around the base of the cloacal siphon (Fig. 99). This arrangement is very characteristic of the species. Numerous endocarps are scattered on the inner side of the body wall, and several occur inside the gut loop.

Genus *Styela* Fleming, 1822

Styela canopus (Savigny, 1816)

Cynthia canopus Savigny, 1816. Type locality: Red Sea.

Styela canopus — Kott 1985: 112, fig. 48, Australia. — Monniot C., Monniot F. & Laboute P. 1991: 222, Polynesia. — Nishikawa 1991: 114, Japan Sea.

MATERIAL EXAMINED. — Palau. Koror, Ngermeuangel Island, Goby Lake, marine lake, 7°18.76'N, 134°30.10'E, 1 m, 3.II.1995 (MNHN S1 STY.A 237).

Philippines. Mindanao, Davao, Samal Island Beach Park, 7°06.25'N, 125°39.79'E, 12 m, 1.IV.1996 (MNHN S1 STY.A 238).

Family PYURIDAE Hartmeyer, 1908

Genus *Herdmania* Lahille, 1888

Herdmania armata n. sp.

(Figs 100; 101; 129E)

TYPE MATERIAL. — Papua New Guinea. Nivani, coarse sand and rubble, 10°47.46'S, 152°23.08'E, 10-18 m, 29.V.1998 (MNHN S2 HER 20).

ETYMOLOGY. — From the Latin *armatus*: armed.

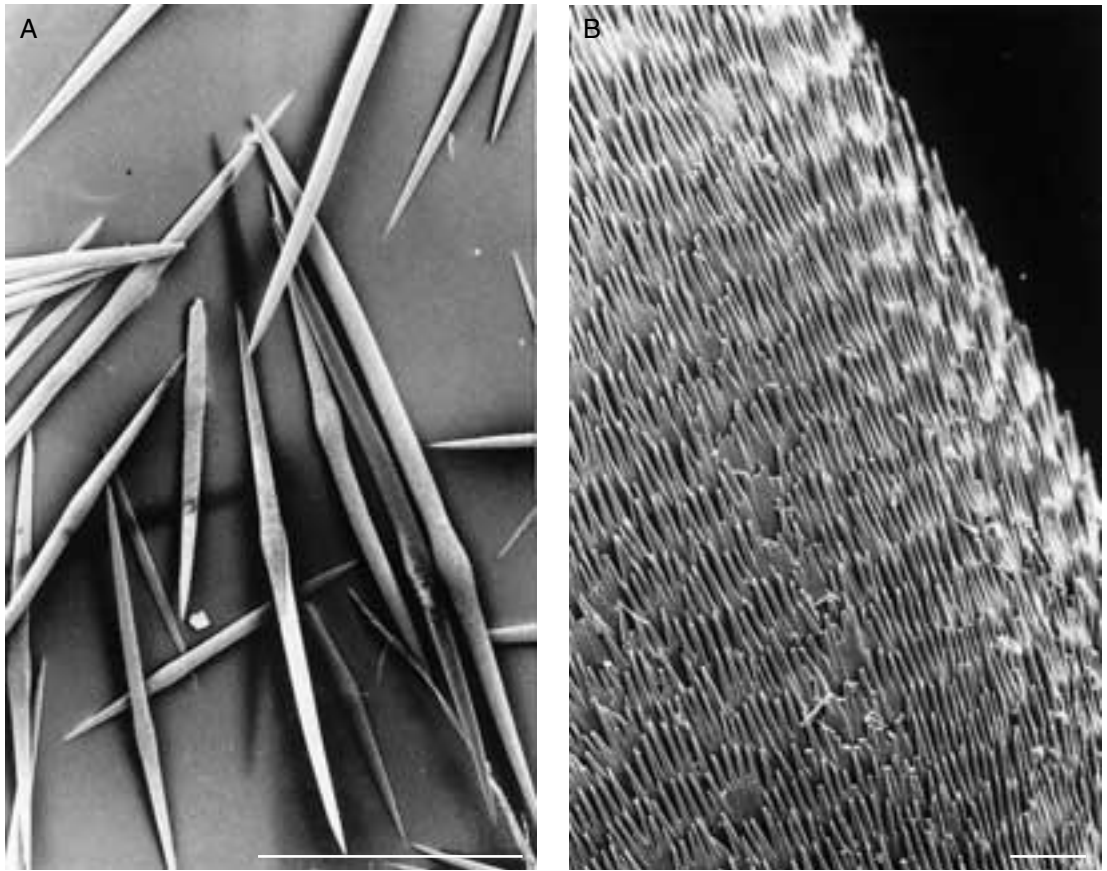


FIG. 101. — *Herdmania armata* n. sp., spicules. Scale bars: A, 1 cm; B, 10 μ m.

DESCRIPTION

Two individuals were found on a sandy bottom, the largest 20 cm in height and 15 cm in diameter. The tunic in life was dark brown, covered with epibionts, the internal surface of the siphons yellow (Fig. 129E) with a pink rim. Both siphons have a square section; they are far apart and diverging. The tunic is thick, leathery, very hard. All tissues of the body are filled with spindle-like spicules (Fig. 101), all parallel, giving a nacreous quality to the external side of the body wall. The muscles are strong but difficult to see through the opaque pale tissue. The internal and external sides of the siphons are tinted in red.

The tentacles are thick and flattened with thick ramifications of the first order and small ones of

the second order. There are eight large, well-spaced tentacles (Fig. 100B) with eight smaller ones between them and small intermediate ones. The prepharyngeal groove is thin and draws a deep dorsal V. The large dorsal tubercle occupies the whole space inside the V. It is pierced by numerous small holes, making a network of convoluted lines (Fig. 100C).

The branchial sac contains abundant spicules in the main transverse vessels. There are 14 overlapping folds on each side. In the middle of the branchial sac there is an average of 28 fully developed longitudinal vessels on the folds and eight between the folds. There are also smaller intermediate, flat longitudinal vessels. The transverse vessels are of several orders and as a

result the stigmata are very small compared with the size of the branchial sac, with three to four in a mesh.

The digestive tract occupies the whole left side of the body (Fig. 100A). The gut loop is closed. The oesophagus is not distinct. The stomach is not wider than the intestine. No compartments can be identified along the intestine.

The hepatic gland is made of several massive lobes, one on the internal side of the oesophagus, the others in a line along the internal side of the loop (Fig. 100A). On the stomach these round lobes are dark brown. The anus opens against the oesophagus with a scalloped margin.

The gonads (Fig. 100A) are spherical masses included in an opaque tissue. On the left side they lie in a line along the rectum inside the gut loop. On the right side they are large, in a longitudinal line of four masses; the most anterior mass seems empty. These masses are linked by the gonoducts. Each gonad has a single male papilla joined to the female papilla at the distal end of the last gonad lobe, near the cloacal siphon. There are no endocarps on the body wall.

REMARKS

This species is unique for its very large size, the abundance of its spicules, and the peculiar shape of the hepatic gland and of the gonads. It has been placed in the genus *Herdmania* on the basis of the presence of abundant spicules, but its other anatomical characters do not correspond well to the general structure of species in the genus, and so its assignment to the genus *Herdmania* remains doubtful.

Herdmania insolita n. sp. (Figs 102; 103)

Herdmania momus – Monniot F. & Monniot C. 1996: 263, Indonesia (MNHN S2 HER 6).

TYPE MATERIAL. — **Federated States of Micronesia.** Yap, Colonia, main wharf, 9°30.91'N, 138°07.57'E, 7 m, 4.VI.1996 (MNHN S2 HER 21).

ETYMOLOGY. — From the Latin *insolitus*: unusual.

OTHER MATERIAL EXAMINED. — **Palau.** Koror, Malakal Harbour, Buoy #1, 7°19.88'N, 134°27.50'E, 1 m, 28.I.1998, 2 specimens (MNHN S2 HER 22). **Philippines.** Davao, 07°05.89'N, 125°47.58'E, 8 m, 2.IV.1996 (MNHN S2 HER 17).

DESCRIPTION

Both specimens from Palau and the one from Yap were collected in harbours. The tunic is thin, soft, and semi-transparent. It bears some epibionts on the dorsal part of the body and contains short spicules (Fig. 103). The siphons form an angle of 90°. One of the specimens contains numerous small patches of red pigment in the dorsal part of the body; the pigment is much less abundant in other specimens.

The muscles are large, strong bundles issuing from each siphon (Fig. 102A). They cross each other but do not extend onto the ventral side, which has no musculature.

The pinnate tentacles are irregular. In one specimen from Palau we counted 16 large tentacles in two orders of size separated by smaller, more irregular ones. In the two other specimens, the dorsal tentacles were not developed. The tentacles contain spicules (Fig. 103), as do all other organs. There is a large oral velum. The prepharyngeal band draws a deep V. The dorsal tubercle is distinctly protruding. Its opening is horseshoe-shaped or forms a C that opens anteriorly (Fig. 102B). The peri-tubercular area is covered with small papillae in two specimens.

The dorsal lamina is long, made of numerous sharp languets.

The branchial sac has eight folds on the right side but only seven on the left, except in one sample where two longitudinal vessels are joined against the endostyle on the left side. In this specimen the formula is:

R.E. 1 3 1 9 2 11 2 13 2 15 2 14 2 13 2 9 2 D.L.
D.L. 2 11 2 13 3 15 2 15 2 14 2 13 1 9 1 2 E.L.

The folds diminish to join a circular crest around the oesophagus entrance. There are parastigmatic vessels.

The gut forms a straight and open loop (Fig. 102B). The hepatic gland has two lobes made of multiple round papillae. There is one

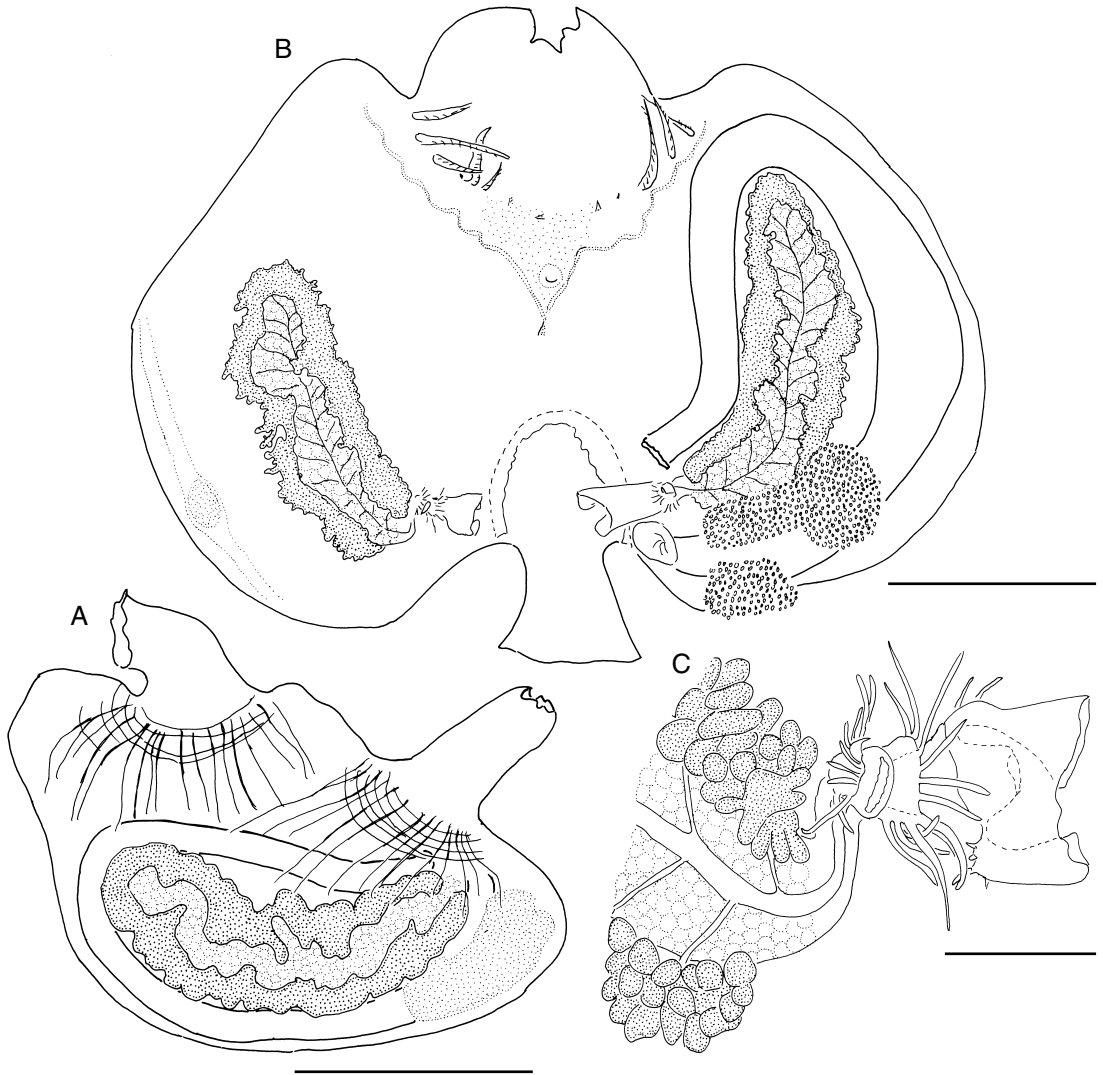


FIG. 102. — *Herdmania insolita* n. sp.: **A**, left side of the body; **B**, specimen ventrally opened; **C**, gonoducts. Scale bars: A, 1 cm; B, 5 mm; C, 1 mm.

gonad (Fig. 102B) on each side. The ovary, in the centre of the gonad, is sinuous and long. The testis lobes are all around it along its whole length. The sperm ducts join a common axial duct on the ovary (Fig. 102B). The male papilla is surprising; it is enclosed in a tuft of long filiform papillae located on the internal side of the oviduct (Fig. 102C). The female papilla is a long open flange of transparent tissue surround-

ing the opening of the oviduct and extending out into the cloacal cavity from it. There is a large cloacal velum. Cloacal tentacles were not found.

REMARKS

This species differs from all other *Herdmania* species in the strange structure of its male genital papillae.

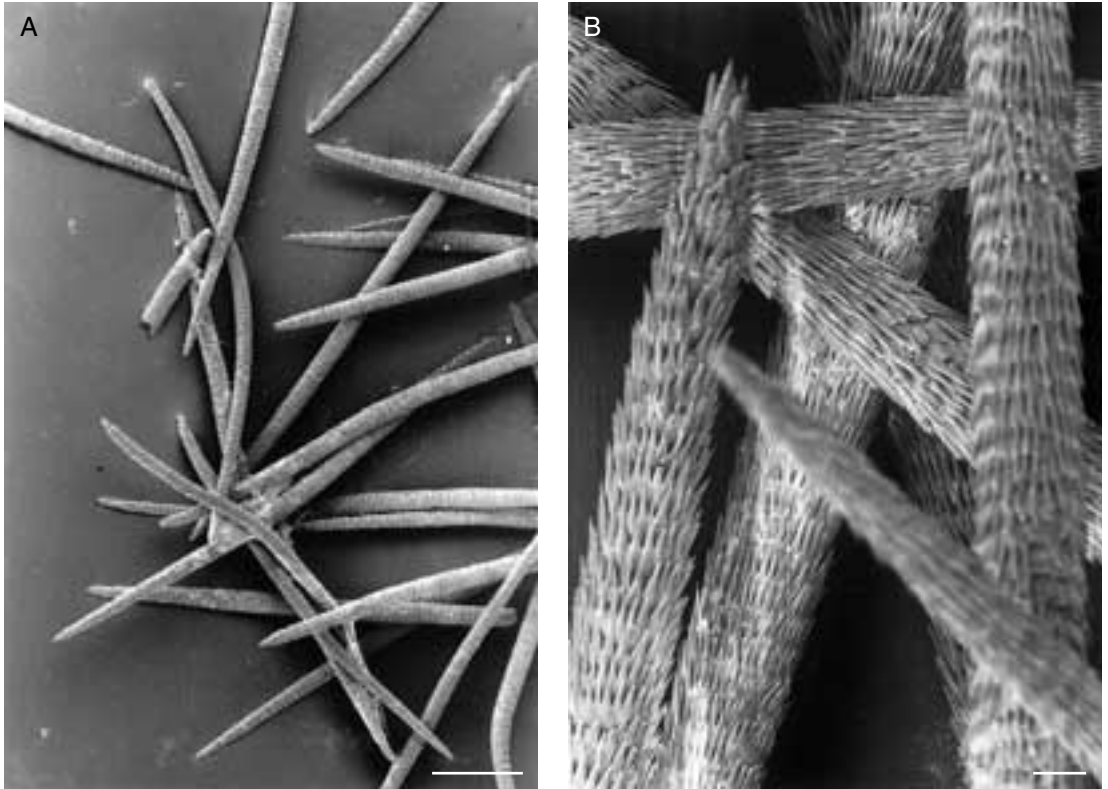


FIG. 103. — *Herdmania insolita* n. sp., spicules. Scale bars: A, 100 μ m; B, 10 μ m.

?*Herdmania pallida* (Heller, 1878)
(Figs 104; 129F)

Cynthia pallida Heller, 1878: 96, pl. III, figs 17; 18.
Type locality: unknown.

Herdmania momus – Monniot C. 1992: 16, fig. 6A.

MATERIAL EXAMINED. — Palau. Koror, Ngederrak Reef along Ngel Channel, seagrass bed, 7°17.90'N, 134°28.34'E, 19.VI.1996 (MNHN S2 HER 23). — Koror, Mutmelachel, Ucheliungs Island, algae flat, 7°18.56'N, 134°30.10'E, 17.II.1995 (MNHN S2 HER 24).

DESCRIPTION

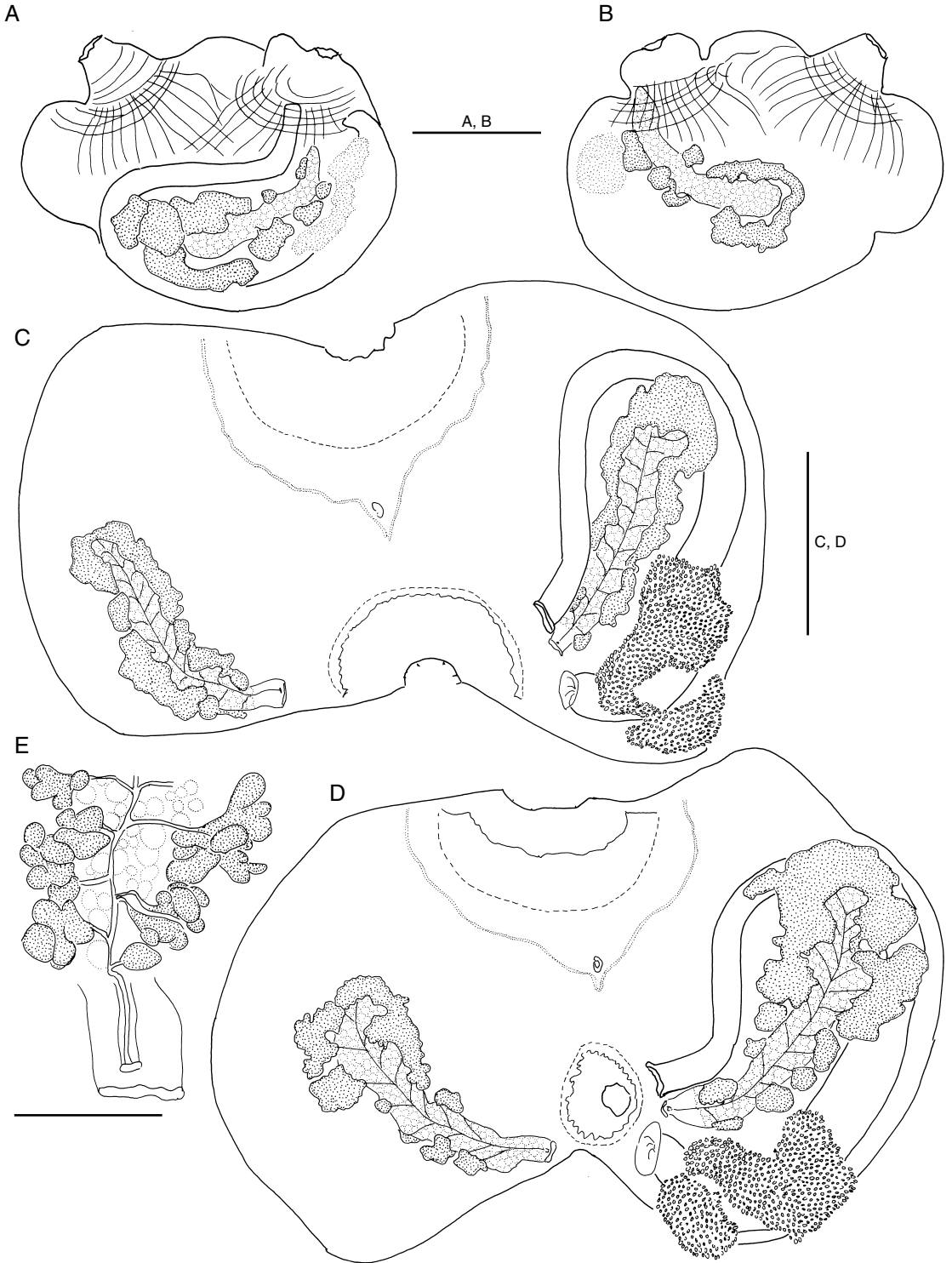
The body is round and the tunic has no epibionts. Some sediment particles adhere to the tunic (Fig. 129F). The siphons were red in life. In preservative the tunic becomes transparent, colourless, and soft. All tissues contain acicular spicules with rings of spines.

There is a large oral velum. The tentacles are bushy and pinnate. The dorsal tubercle is very protruding, with a horseshoe-shaped opening, and included in a deep V of the prepharyngeal band (Fig. 104C, D). The dorsal lamina is long with numerous sharp languets. The musculature is restricted to the siphonal areas (Fig. 104A, B). In the largest specimen, 4 cm in diameter, the branchial sac has nine folds on the right side and eight on the left side with the formula:

R.E. 0 3 0 8 1 12 1 14 1 17 1 16 1 17 1 14 2 9 2 D.L.
D.L. 2 11 2 14 1 17 1 17 1 17 1 14 1 10 1 6 2 E.L.

The youngest specimens have fewer branchial folds and fewer vessels on them.

The gut forms an open loop that contains the left gonad (Fig. 104C, D). The rectum is slightly curved. The hepatic gland has two lobes (Fig. 104C, D) made of very numerous digitiform papillae with round tips. The anus is plain.



The gonads, one on each side, are elongated and straight (Fig. 104C, D). The ovary is central in an elongated mass; the testis lobes encircle it. Well-separated in young specimens, the testis lobes join when the animal grows. Their ducts are directed toward the axis of the ovary, where they fuse to make a straight common sperm duct running on the ovary's internal side. The simple male papilla lies close to the wide short female papilla (Fig. 104E). There is no membrane developed around the female opening

There is a large cloacal velum but no cloacal tentacles. The spicules are of the usual shape in the genus *Herdmania*: long spindle-like spicules with two pointed ends in the tissues, and short sticks with a round end raised in numerous small points in the tunic, as described by Lambert G. & Lambert C. (1987).

REMARKS

By its straight ovary this species recalls the cosmopolitan form described as *C. pallida* Heller, 1878. It clearly differs from the typical *H. momus* (Savigny, 1816) from Suez, which has a contorted ovary and multiple openings of small sperm ducts, a lobed anus – all characters confirmed by a re-examination of old material from Suez. Numerous forms have been described and that identified as *H. momus* differ mainly in the shape of the gonads and their ducts. The number of branchial folds and longitudinal vessels are not reliable for identification, as they vary according to the size and maturity of the specimens. The variability also reflects the substrate and habitats where the animals are collected, a higher variability being found in harbours.

Herdmania polyducta

(Monniot C. & Monniot F., 1989)
(Figs 105; 130A)

Pyura polyducta Monniot C. & Monniot F., 1989: 237, fig. 4, pl. 1F, G. Type locality: Philippines.

MATERIAL EXAMINED. — **Philippines.** W Luzon, Zambales, Masinloc town, Luan Island, 15°29.90'N, 119°54.44'E, 7 m, 4.V.1995 (MNHN S2 HER 15).

DESCRIPTION

The body is round, covered with rhizoids (Fig. 130A), and only the siphons are clean, with red pigment spots. The body wall is thin and translucent and contains acicular spicules. The tentacles are white in life, of at least five orders of size. The largest are in two or three orders, and numerous smaller one are intercalated. The largest tentacles are doubly ramified.

The prepharyngeal band has unequal rims, the anterior blade higher. The dorsal V is pronounced. The dorsal tubercle is protruding; its opening is horseshoe-shaped with horns inwardly rolled (Fig. 105B). The short dorsal lamina is made of long, sharp languets; it stops ahead to the oesophagus entrance.

The branchial sac has eight folds on each side. The formula on the right side is:

R.E. 3 9 3 13 3 17 3 17 3 15 3 15 3 13 3 D.L.
On the left side the eighth fold, near the endostyle, is not complete and the seventh fold is low. The folds are high and overlap each other. A crest circles the oesophagus entrance where the folds end.

The gut forms an open loop (Fig. 105A). The hepatic gland has three unequal lobes (Fig. 105A). The anus has digitiform lobes.

There is one elongated gonad on each side (Fig. 105A). The left gonad is entirely included in the intestinal loop. The testis completely covers the ovary and opens in multiple short papillae (Fig. 105C). The long oviduct ends in a wide papilla without encircling membrane (Fig. 105C).

REMARKS

This species is now placed in the genus *Herdmania* by virtue of its soft consistency, the presence of acicular spicules, its large number of branchial

◀ FIG. 104. — *Herdmania pallida* (Heller, 1878); **A, B**, left and right sides of a specimen; **C, D**, two specimens ventrally opened; **E**, gonoducts. Scale bars: A-D, 5 mm; E, 1 mm.

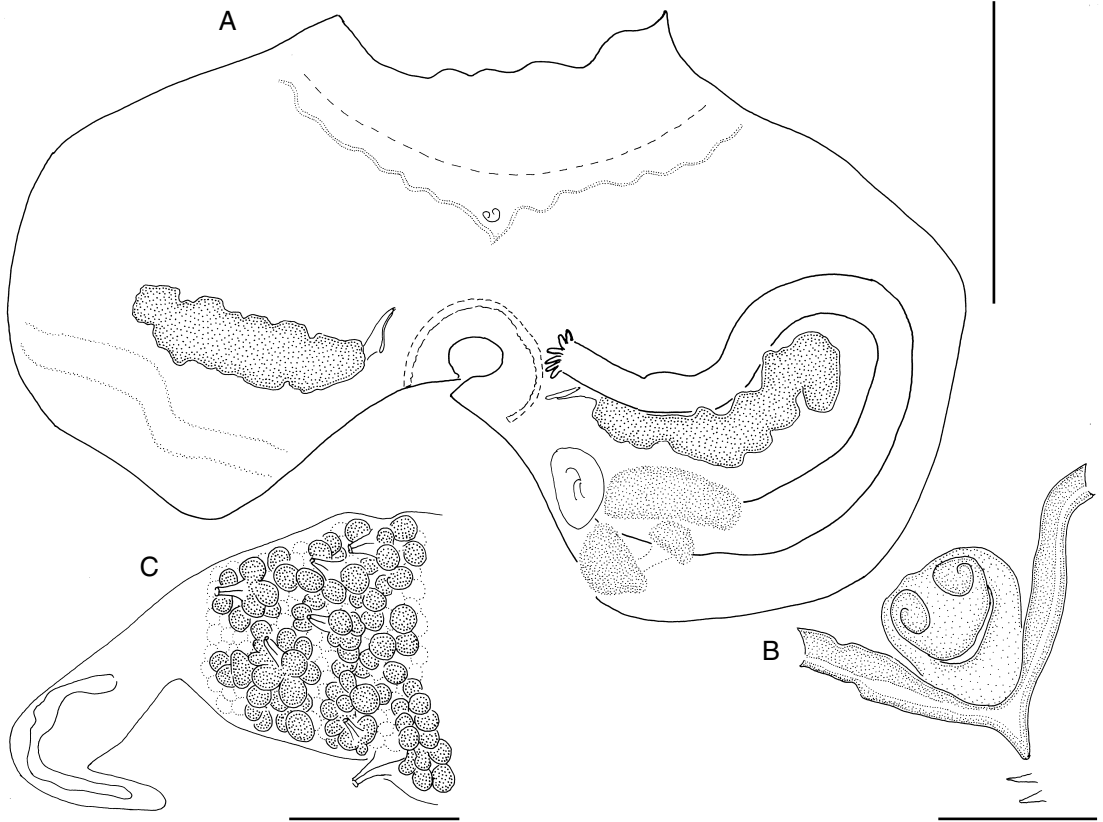


FIG. 105. — *Herdmania polyducta* (Monniot C. & Monniot F., 1989); **A**, specimen ventrally opened; **B**, dorsal tubercle; **C**, gonoducts. Scale bars: A, 1 cm; B, C, 1 mm.

fold, and the elongated shape of its gonads. The characteristics of the genus *Herdmania* have been detailed by C. Monniot (1992).

Genus *Pyura* Molina, 1782

Pyura gangelion (Savigny, 1816)
(Figs 106; 108A; 130B)

Cynthia gangelion Savigny, 1816: 90-147. Type locality: Red Sea.

Halocynthia gangelion – Sluiter 1905: 102, Djibouti.

Pyura gangelion – Monniot C. 1973: 57, Red Sea.

Pyura (Halocynthia) sansibarica Michaelsen, 1908: 251, Zanzibar.

Pyura sansibarica – Michaelsen 1918: 8, Red Sea. — Millar 1956: 929 Mozambique. — Vasseur 1969: 926, Madagascar.

Pyura obesa – Hartmeyer 1919: 14, Australia. — Kott 1985: 315, Australia.

Pyura robusta Hartmeyer, 1922: 319. — Kott 1998: 185.

Pyura albanensis Michaelsen, 1927: 193, Albany. — Hartmeyer & Michaelsen 1928: 435. — Monniot C. 1989: 492, fig. 8, pl. IIA, B, New Caledonia. — Monniot C. & Monniot F. 1991: 411, fig. 27D, F, New Caledonia. — Monniot F. & Monniot C. 1996: 263, fig. 58, Papua New Guinea.

MATERIAL EXAMINED. — **Federated States of Micronesia.** Pohnpei, North lagoon, Yusan-maru, permanently moored ship, 6°98.91'N, 158°17.53'E, 1 m, 14.X.1996 (MNHN S2 PYU 385).

Maldives. N Male Atoll, Feydhoo Findhu Island, 4°12.88'N, 73°29.27'E, 2 m, 15.IX.1997 (MNHN S2 PYU 383).

Mozambique. Ibo Island 1995; Djibouti 1996, coll. Monniot (MNHN S2 PYU 388).

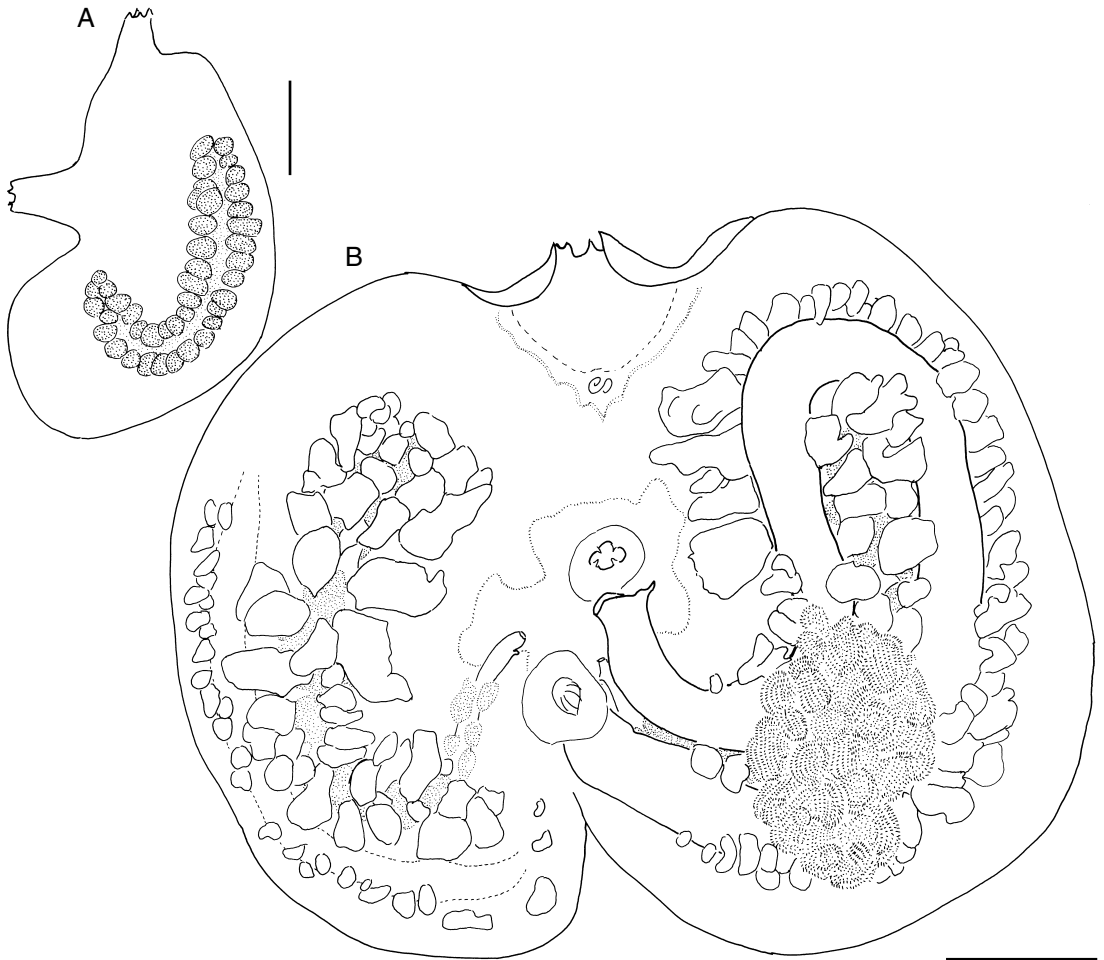


FIG. 106. — *Pyura gangelion* (Savigny, 1816); **A**, body shape; **B**, body ventrally opened. Scale bars: 1 cm.

REMARKS

All synonym specimens have the same anatomical characters (Fig. 106) whatever the ocean in which they were collected. Their external aspect may be variable. The species is generally dark brown-red, but in the Maldives it is black (Fig. 130B), with yellow stripes on the siphons. The siphonal spinules (Fig. 108A) are regularly arranged but of different sizes, small and larger ones intercalated. The specific name *P. gangelion* has priority even if the specimens are frequently cited with other names.

The distribution of the species is especially wide in the tropical Indian and Pacific oceans.

Pyura styeliformis n. sp.
(Figs 107; 108B; 130C)

TYPE MATERIAL. — Palau. Koror, Ngermerrangel Island, Flatworm Lake, marine lake, cave, 7°19.12'N, 134°30.40'E, 1 m, 23.VII.1997 (MNHN S2 PYU 391).

ETYMOLOGY. — From the Latin *forma*: shape and the genus *Styela*.

DESCRIPTION

This cave-dwelling species, 1 to 1.5 cm in diameter, has a smooth tunic that is slightly wrinkled around the siphons. It seems gregarious, as the

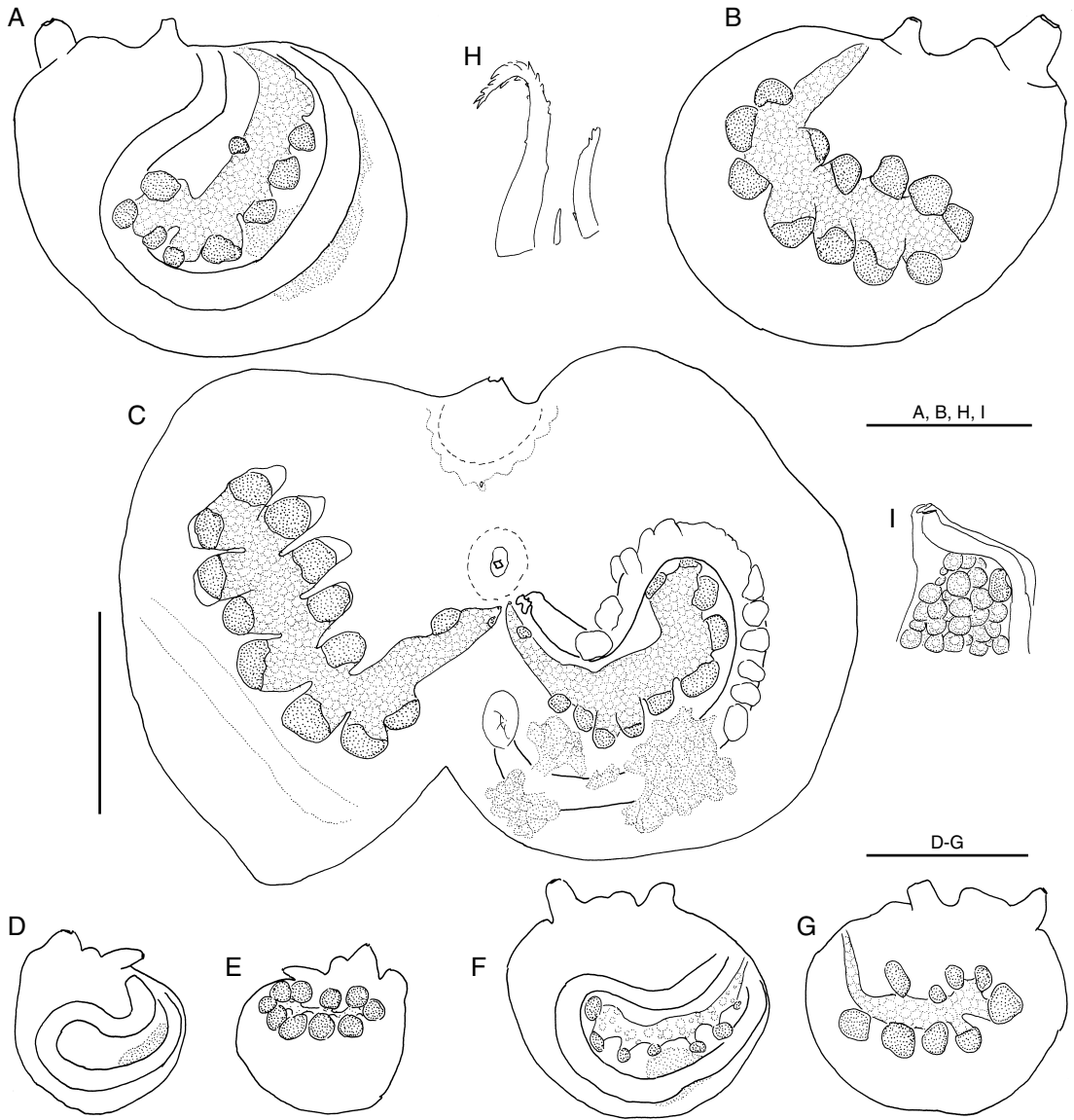


FIG. 107. — *Pyura styelliformis* n. sp.: **A, B**, left and right sides of the body; **C**, body ventrally opened; **D-G**, both sides of two different bodies; **H**, oral tentacles; **I**, gonoducts. Scale bars: A-C, 5 mm; D-G, 1 mm; H, I, 0.5 mm.

individuals attach to each other, with young settling on adults (Fig. 130C). In some cases the tunics can fuse. The animal is globular. The oral siphon is terminal, the cloacal siphon is clearly mid-dorsal. Both siphons have long, sharp and dense spinules of equal size: about 100 μm (Fig. 108B). The pink-ochre colour persists in fix-

atives. The appearance is unusual for a pyruid: it more resembles a styelid (Fig. 130C) (hence the species name).

The musculature is weak. It comprises about 30 thin ribbons arising from each siphon. Near the gonads the ribbons disintegrate to make anastomosed fibres. The body wall is transparent. The

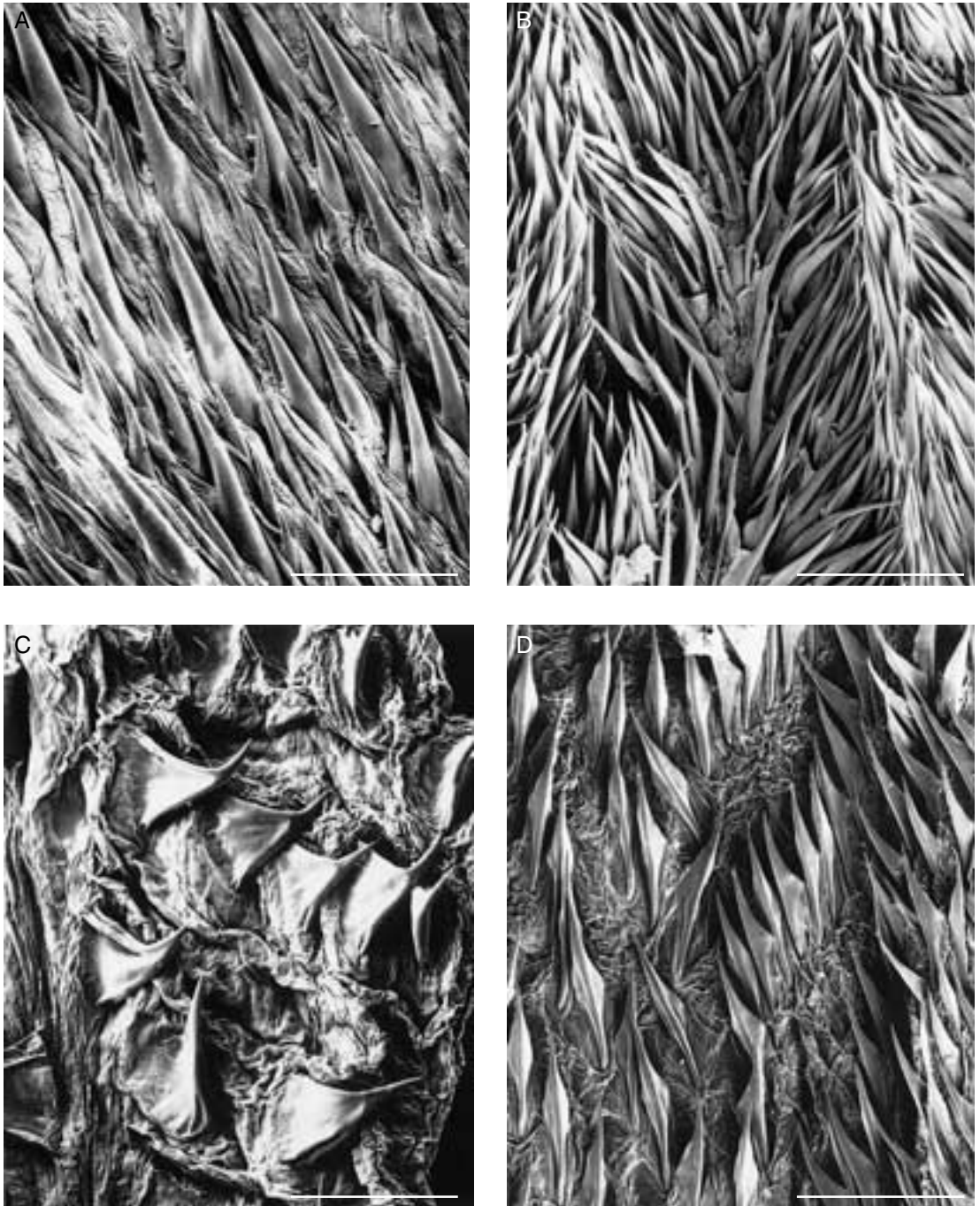


FIG. 108. — Siphonal spinules; **A**, *Pyura gangelion* (Savigny, 1816); **B**, *Pyura styeliformis* n. sp.; **C**, *Microcosmus bitunicatus* n. sp.; **D**, *Microcosmus pacificus* n. sp. Scale bars: 100 μ m.

siphons are red as is the external tunic. The tentacles are not numerous, about 10 of two or three orders, located anteriorly in the oral siphon. They are poorly ramified and the smallest are simple (Fig. 107H). The prepharyngeal band has two equal rims. It is wavy around the tops of the branchial folds and makes a slightly dorsal indentation. The dorsal tubercle has a small, simple opening. The rather short dorsal lamina is made of short languets. The branchial tissue is thin with six high folds on each side. The right side formula is:

R.E. 5 9 6 15 6 19 6 20 5 18 3 17 3 D.L.

At the oesophageal entrance the folds lower rapidly. The longitudinal vessels do not protrude as blades or papillae. Between the folds, the stigmata are irregular; we counted three to five of them in a mesh. But they are very regular on the folds, with three to four in a mesh. They are short and wide open. There are no parastigmatic vessels. At the top of the folds the stigmata are short, sometimes curved.

The limbs of the digestive tract lie well apart (Fig. 107A, C). The oesophagus is short, and the undilated stomach is covered by a colourless, unramified hepatic gland made of two anterior lobes and a large posterior lobe (Fig. 107C). The cylindrical intestine ends in a short rectum. The anus is more wavy-edged than lobed. The gonads are attached to the body wall by their whole surface. Each is made of an irregularly lobed ovary and testes covering the extremities of the ovarian lobes (Fig. 107B, C). The ovaries are long; their papillae open close to each other and close to the anus. The sperm ducts of each lobe gather at the ovary surface into a common duct which opens against the oviduct in a small, scarcely visible papilla (Fig. 107I).

The development of the gonads is not synchronous on the two sides of the body. In small specimens (Fig. 107D, E) the right gonad develops early and the male part becomes functional, while the left gonad is not visible. Later, the left gonad appears but remains late compared to the right gonad (Fig. 107F, G). When the right side male and female parts are both functional, on the left only the testis is well-developed. In large individuals, however, both gonads are equivalent.

There are only a few endocarps on some male lobes of the right gonad and the external side of the gut loop (Fig. 107C).

Genus *Microcosmus* Heller, 1877

Microcosmus bitunicatus n. sp.
(Figs 108C; 130D)

?*Microcosmus manaarensis* Herdman, 1906: 311. — Monniot F. & Monniot C. 1996: 265, fig. 59, Philippines.

TYPE MATERIAL. — **Philippines**. Cebu Straits, Cabilao Island, 9°53.39'N, 123°45.45'E, 10 m, 15.IV.1997 (MNHN S2 MIC 157).

ETYMOLOGY. — From the Latin *tunicatus*: dressed in a tunic.

DESCRIPTION

A second specimen has been collected of *Microcosmus* having two encased tunics, one inside the other. This peculiar structure of the tunic previously seemed a possible artefact, but the collection of another specimen gives this structure a unique significance.

The new specimen (Fig. 130D) is larger, being 10 cm long instead of 5 cm. It was attached in a rocky hollow by a ball of extremely hard compact, tunic. The remainder of the body has developed above the substrate and has a regular shape.

All characters described by Monniot F. & Monniot C. (1996) are confirmed, particularly the independence of the apertures of the external tunic and the siphons of the encased tunic. The spinules (Fig. 108C) covering the external and internal sides of the encased tunic grow from the deepest part of the reflex tunic. As the animal increases in size, the spinules move towards the external rim of the siphon. In some cases they can invade all the body, and this is so for the present specimen.

The absence of spinules on the openings of the external tunic implies that the dissociation between the encased and external tunics occurred at an early stage of the growth of this specimen.

REMARKS

It was with doubt that the first specimen was identified as *M. manaarensis*. We supposed it to be an ecological form from rocky bottoms of a species normally living on gravel. The internal morphology, the number of branchial folds, and the shape and disposition of the gut and gonads are very similar. On sedimentary bottoms *M. manaarensis* has a tunic in two parts: one internal which is normal and one external made by a network of ramified hairs agglomerating the sediment. The two tunics are linked by rhizoids. Several Stolidobranchia show a similarly double tunic structure (*Pyura tunica* Kott, 1969; *S. rhizoides* Diehl, 1969; etc.). But *M. bitunicatus* n. sp. does not follow this pattern. The external tunic, with its openings corresponding to the siphons, is not in continuity – at least in large specimens – with the functional siphons of the animal. The growth of the two tunics seems to occur independently.

Microcosmus helleri Herdman, 1882 possesses a sedimentary form with a thin tunic encrusted with sand, and another form with a thick, clean hard tunic living on rocks, and intermediate forms exist. This is not the case between the typical *M. manaarensis* and *M. bitunicatus*.

Microcosmus pacificus n. sp.
(Figs 108D; 109)

TYPE MATERIAL. — Papua New Guinea. Milne Bay Province, Samarai Island, 10°36.98'S, 150°39.77'E, 27 m, 10.VI.1998 (MNHN S2 MIC 159).

ETYMOLOGY. — Named after the Pacific Ocean.

OTHER MATERIAL EXAMINED. — Philippines. Musorstom 3, 11°37'N, 121°43'E, 120-122 m, 5.VI.1985 (MNHN S2 MIC 160).

DESCRIPTION

Both specimens were collected on a sandy bottom. They are very similar, 3 cm in length, covered with coarse sand and broken shells. The siphons are well apart. The body wall is thin and pale in formalin except for the red extremity of the siphons. Internally the siphons are long and narrow. The internal spinules are arranged in

chevrons and their section is angular (Fig. 108D). The musculature forms a network of crossed and regularly spaced bundles issuing from both siphons.

The tentacles are inserted at the base of a high velum. There are 12 large, bushy tentacles in two orders of size with three orders of branchings (Fig. 109D); smaller ones are irregularly intercalated. The prepharyngeal band is very close to the branchial tissue. It is deeply indented dorsally. The dorsal tubercle is protruding; its opening is horse-shoe shaped, anteriorly opened with horns inwardly rolled (Fig. 109D). The neural ganglion is particularly long (Fig. 109D).

The dorsal lamina is a high blade of equal height along its whole length.

The branchial sac counts seven folds on each side.

The formula on the right side is:

R.E. ? 10 2 15 2 17 1 19 1 19 1 17 2 D.L.

The folds are high, overlapping each other. There are five to six stigmata per mesh between the folds and three to four on the folds. At the top of the folds one or two stigmata are curved. There are parastigmatic vessels.

The gut makes a very long and curved loop with both limbs very close together (Fig. 109A, C).

The stomach is only slightly enlarged. It is covered by a massive hepatic gland constituted of lamellae. Many filiform papillae arise from the hepatic lobes (Fig. 109C).

The rectum is cylindrical, its posterior part attached to the oesophagus. The anus is wide open with two lobes. There is one gonad on each side, protruding well above the body wall (Fig. 109A-C). The left gonad lies in the secondary loop of the gut but does not overlap the rectum (Fig. 109C). The general outline of the gonads is oval. The male lobules surround the sinuous ovaries and penetrate them in furrows (Fig. 109E) The gonoducts are joined, opening at the same level.

The endocarps are irregular in size, and lobulated. They lie inside the gut loop, on both sides of the body wall ventrally, and above the gonads (Fig. 109C).

There is a large cloacal velum with an irregular ring of filiform papillae at its base.

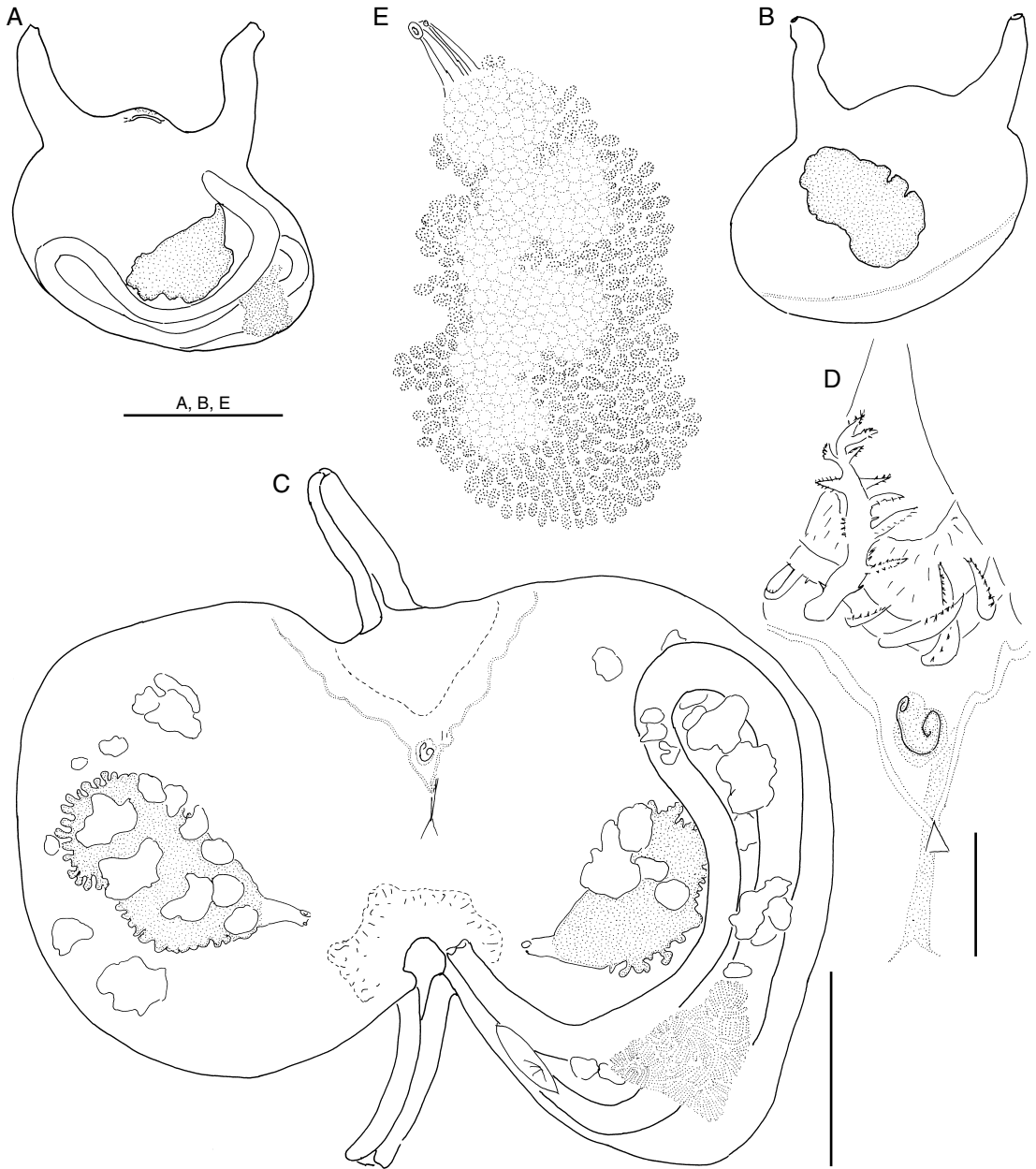


FIG. 109. — *Microcosmus pacificus* n. sp.; **A, B**, left and right sides of the body; **C**, body ventrally opened; **D**, dorsal tubercle; **E**, gonad. Scale bars: A, B, 1 cm; C, 5 mm; D, E, 2 mm.

REMARKS

By its sediment-covered tunic, the length of its well-separated siphons, its branchial sac, and its long narrow gut loop, this species resembles

Microcosmus madagascariensis Michaelsen, 1918 from Madagascar. But the latter has the left gonad overlapping the gut loop. As well, the endocarps are differently distributed in these two species.

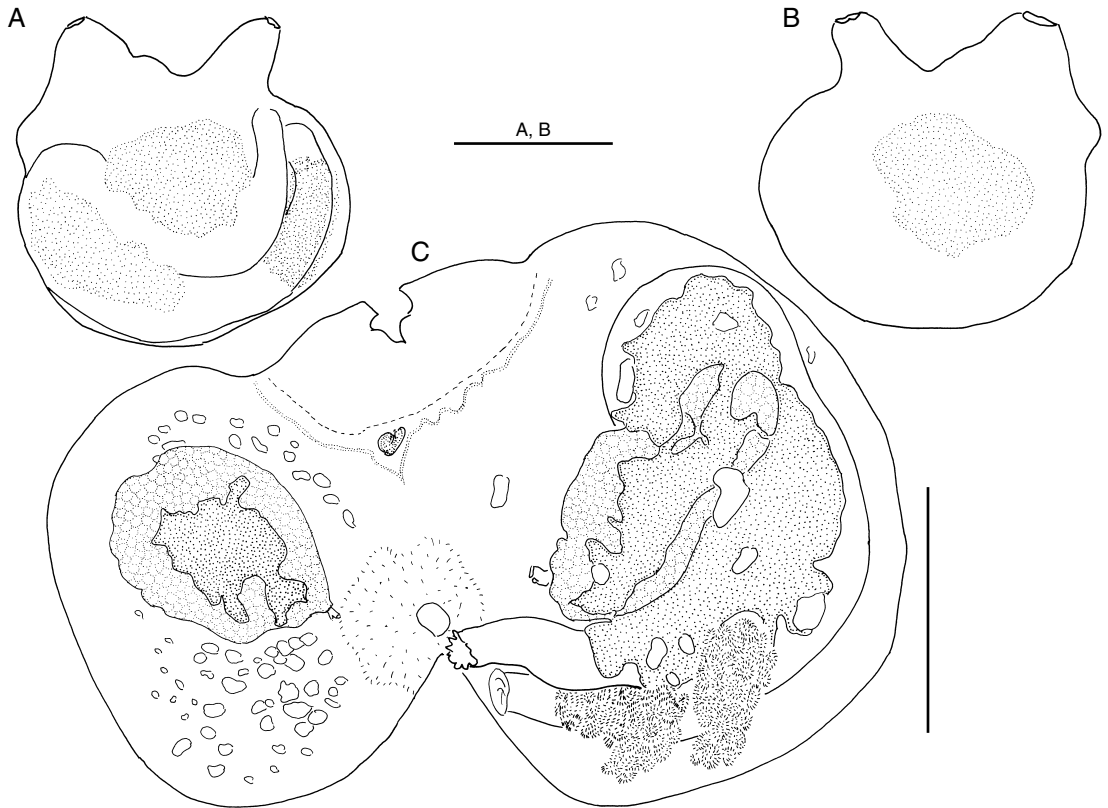


FIG. 110. — *Microcosmus vesiculosus* n. sp.; **A, B**, left and right sides of the body; **C**, body ventrally opened. Scale bars: 1 cm.

Microcosmus agglutinans Hartmeyer, 1919 from western Australia is also closely allied. It differs in having its the siphons close together, and it has a more accentuated secondary loop of the gut with the anus level with the top of the primary gut loop. It has no oral velum.

Hartmeyer & Michaelsen (1928) synonymised *M. madagascariensis* and *M. agglutinans*, an opinion that Kott (1985) supported, but we believe that these are different species. Kott's description corresponds better to *M. agglutinans*. Moreover the description given by Vasseur (1969) for *M. madagascariensis* collected in Madagascar corresponds well to the description of Michaelsen's type from the same locality. The geographic distance separating them – one in Madagascar, the other in western Australia – is an additional argument for separating the two species.

***Microcosmus vesiculosus* n. sp.**
(Figs 110; 111)

TYPE MATERIAL. — Palau. Koror, Malakal Island, 7°20.27'N, 134°27.40'E, 1 m, 8.IX.1995 (MNHN S2 MIC 158).

ETYMOLOGY. — From the Latin *vesiculosus*: with many vesicles.

DESCRIPTION

The specimens are light yellowish, with white longitudinal stripes on the internal side of the siphons. The largest of the three specimens is 3.5 cm in diameter. The specimens were collected on an intake line, attached by their ventral side with other fouling species. The tunic is soft but thick. The siphons lie well apart. The siphonal spinules are long and conical (Fig. 111). There are

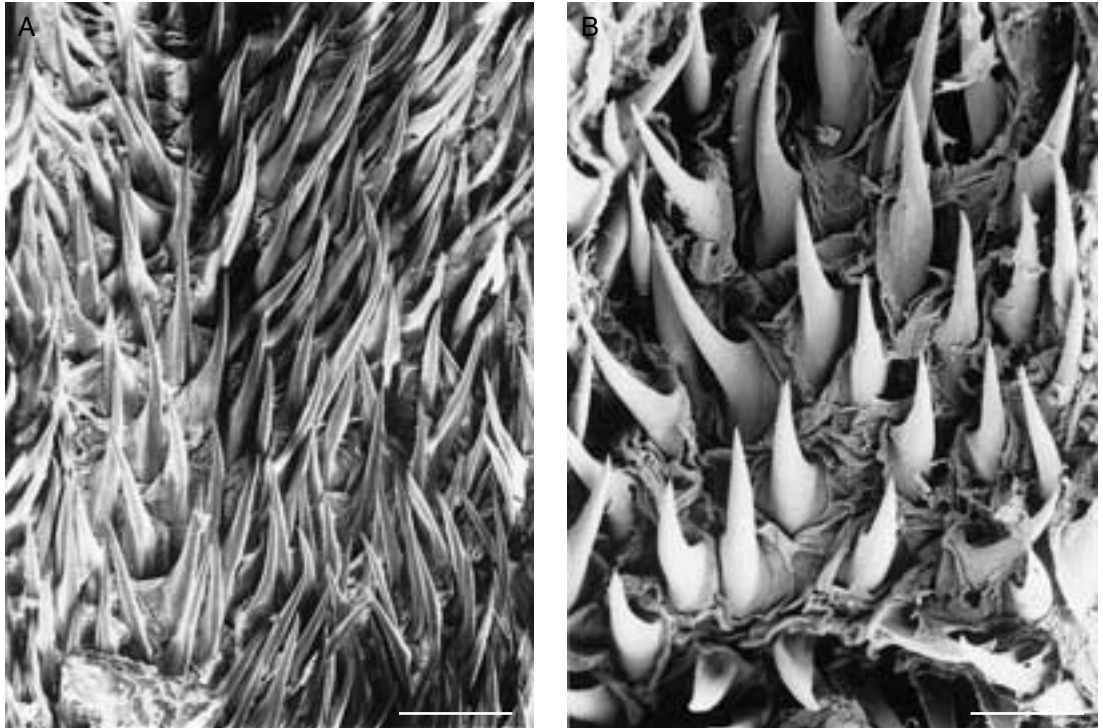


FIG. 111. — *Microcosmus vesiculosus* n. sp., siphonal spinules. Scale bars: A, 50 µm; B, 35 µm.

no epibionts and the tunic surface is smooth. The body wall is brown in formalin. The muscles are strong and form a regular network of crossed bundles issuing from each siphon. The internal side of the body wall is particularly thin and transparent. There are about 30 relatively small tentacles in three orders of size. The largest have two orders of ramifications. They are inserted at the base of the velum.

The prepharyngeal band has two equal blades. The dorsal tubercle in its V-shaped indentation is large and protruding with an opening that has horns rolled inward. The dorsal lamina is a low blade.

The branchial sac has seven folds on the right side but only six on the left side. The formula is:

R.E. 3 11 5 13 5 13 5 15 5 16 5 16 3 15 2 D.L.

D.L. 3 16 3 17 5 15 5 16 5 15 5 14 4 E.L.

The folds are high, overlapping each other. There are six to seven stigmata in a mesh between the

folds and four to five on the sides of the folds. One or two stigmata in each row at the top of the folds are curved. There are parastigmatic vessels.

The gut forms a closed loop (Fig. 110A, C) attached to the body wall along its whole length. The end of the rectum is attached to the dorsal lamina. The hepatic gland has two equal lobes, it is covered with thin papillae (Fig. 110C). The anus is lobed. On each side there is one gonad that forms a single mass there (Fig. 110). The gonoducts are very short. The male and female papillae are joined. They open at some distance from the cloacal siphon.

The endocarps are particularly numerous for the genus. They are large on the left side and smaller on the right side. Their shape is papillated, the protrusions being more visible as they are filled with brown cells.

There is a large cloacal velum covered with numerous fine hairs.

REMARKS

This species is characterised by massive gonads in a single lobe, and by how the left gonad is much larger than the right one. The left gonad is placed more anteriorly than in other species of the genus. The large number of endocarps, especially on the left side, is exceptional (hence the species name). The gut loop occupies most of the left side of the body, which is much more developed than the right side.

This species is closely allied to *Microcosmus anchylodeirus* Traustedt, 1883, a species known from the Caribbean area: Saint Thomas and Martinique. They mainly differ in the number of endocarps on the left side of the body. The geographical distance between the two species' sites of occurrence persuades us against synonymizing them.

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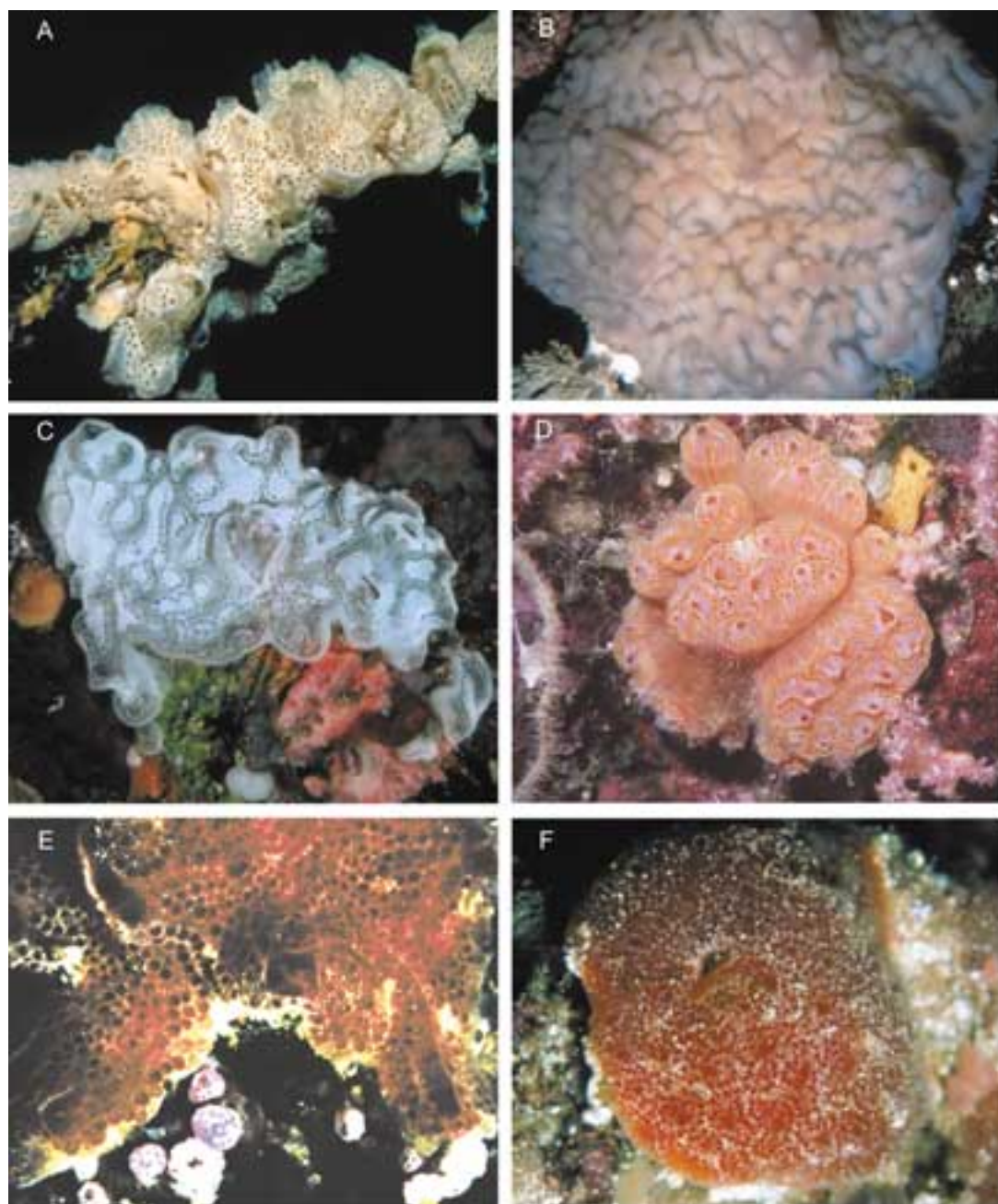


FIG. 112. — **A**, *Aplidium breviventor* n. sp.; **B**, *Aplidium cerebrum* n. sp.; **C**, *Aplidium intextum* n. sp.; **D**, *Aplidium longithorax* Monniot F., 1987; **E**, *Aplidium macrolobatum* Kott, 1992; **F**, *Aplidium nadaense* (Nishikawa, 1980).

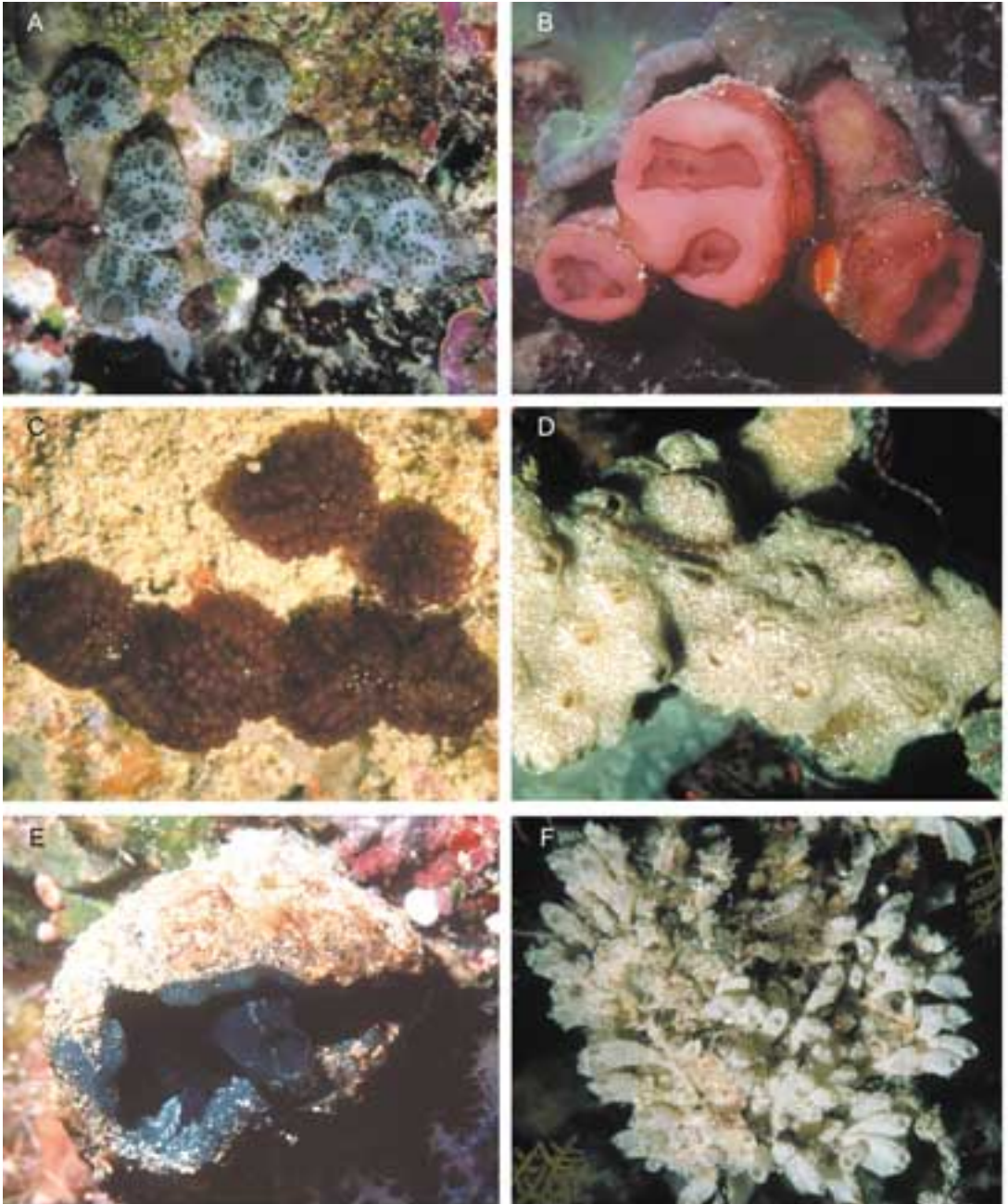


FIG. 113. — **A**, *Aplidium pictum* n. sp.; **B**, *Aplidium rosaceum* n. sp.; **C**, *Aplidium sacciferum* n. sp.; **D**, *Aplidium solidum* (Herdman, 1891); **E**, *Aplidium vulcanium* n. sp.; **F**, *Monniotus pacificus* n. sp.

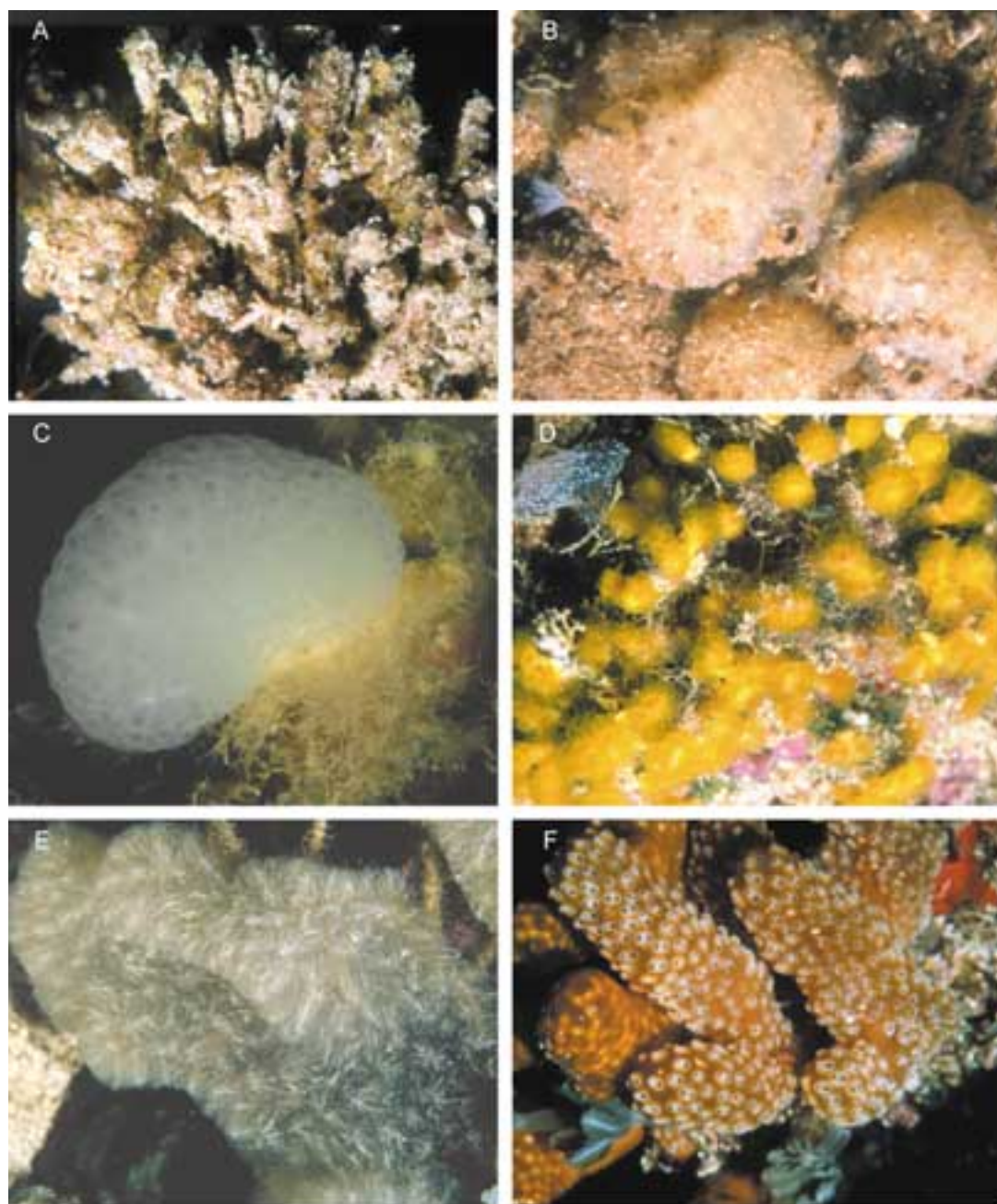


FIG. 114. — **A**, *Monniotus papillosus* n. sp.; **B**, *Polyclinum psammiferum* Hartmeyer, 1911; **C**, *Pseudodistoma aureum* (Brewin, 1957); **D**, *Pseudodistoma digitata* n. sp.; **E**, *Pseudodistoma fragile* Tokioka, 1958; **F**, *Pseudodistoma novaezelandiae* (Brewin, 1950).

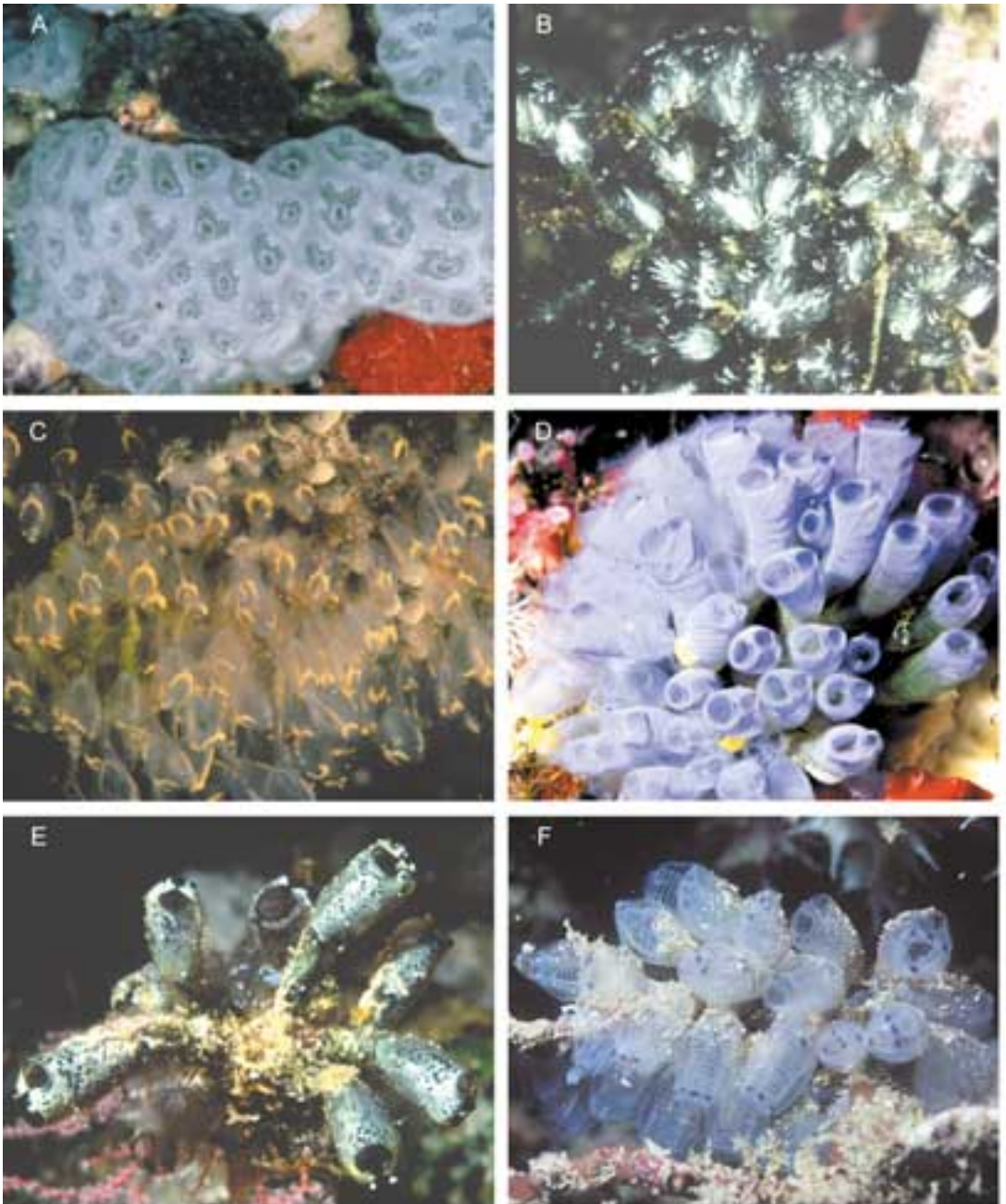


FIG. 115. — **A**, *Synoicum castellatum* Kott, 1992; **B**, *Clavelina arafurensis* Tokioka, 1952; **C**, *Clavelina detorta* (Sluiter, 1904); **D**, *Clavelina fecunda* (Sluiter, 1904); **E**, *Clavelina maculata* n. sp.; **F**, *Clavelina moluccensis* (Sluiter, 1904).

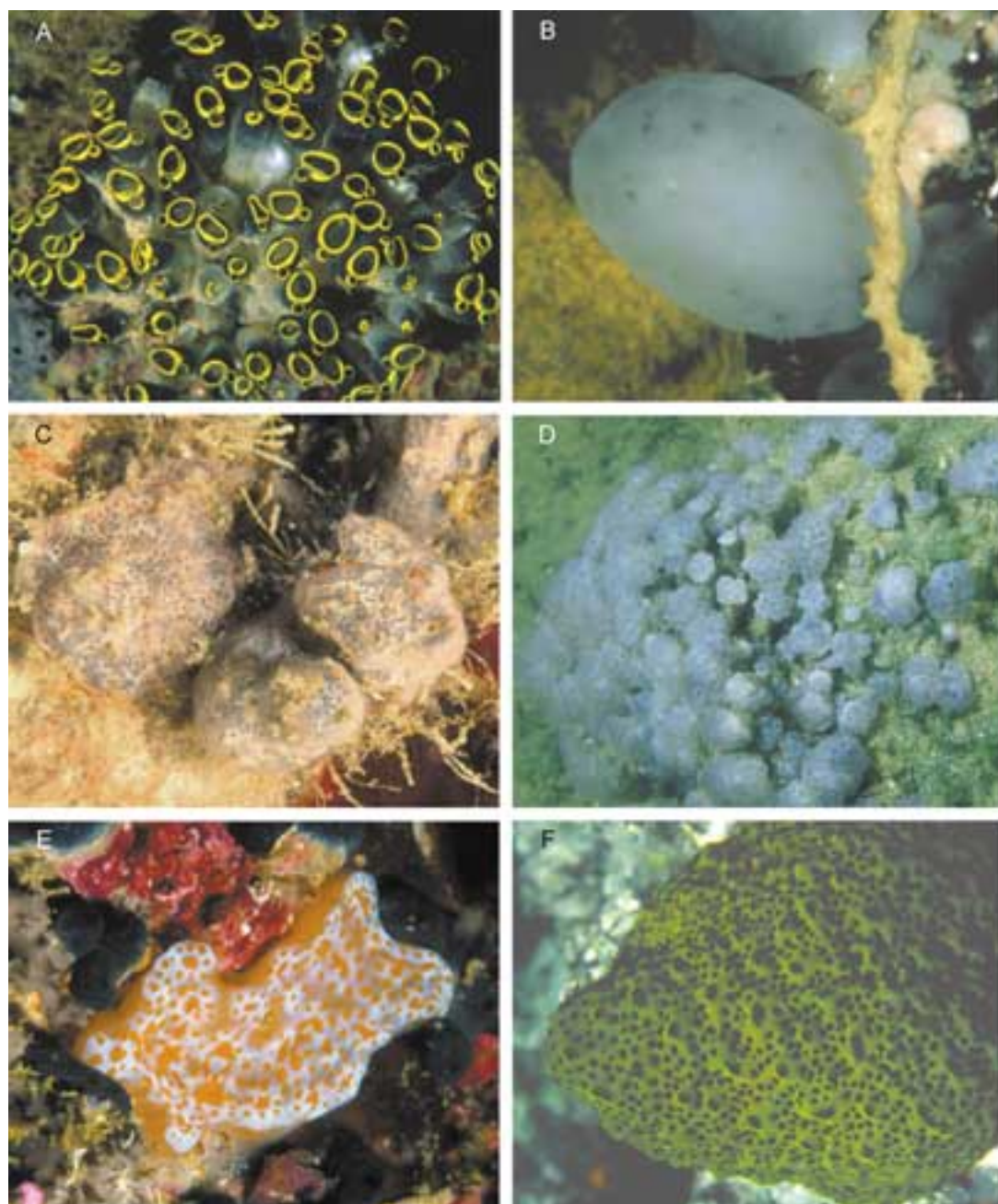


FIG. 116. — **A**, *Clavelina robusta* Kott, 1990; **B**, *Citorclinum laboutei* Monniot F. & Millar, 1988; **C**, *Cystodytes hapu* Monniot C. & Monniot F., 1987; **D**, *Eudistoma album* Monniot F., 1988; **E**, *Eudistoma fluorescens* n. sp.; **F**, *Eudistoma fucatum* n. sp.

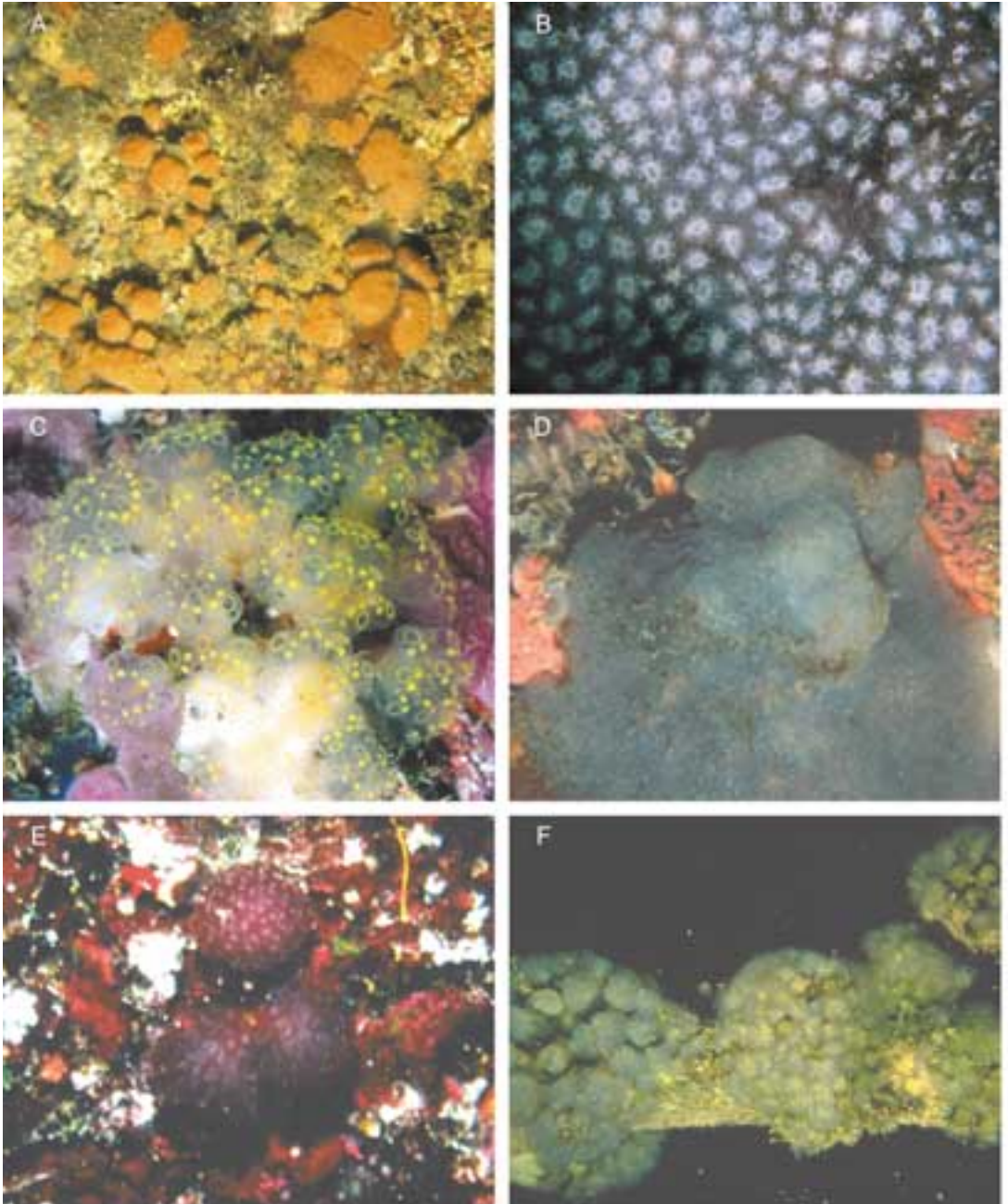


FIG. 117. — **A**, *Eudistoma inauratum* n. sp.; **B**, *Eudistoma ovatum* (Herdman, 1886); **C**, *Eudistoma punctatum* n. sp.; **D**, *Eudistoma tumidum* Kott, 1990; **E**, *Eudistoma vineum* n. sp.; **F**, *Eudistoma viride* Tokioka, 1955.

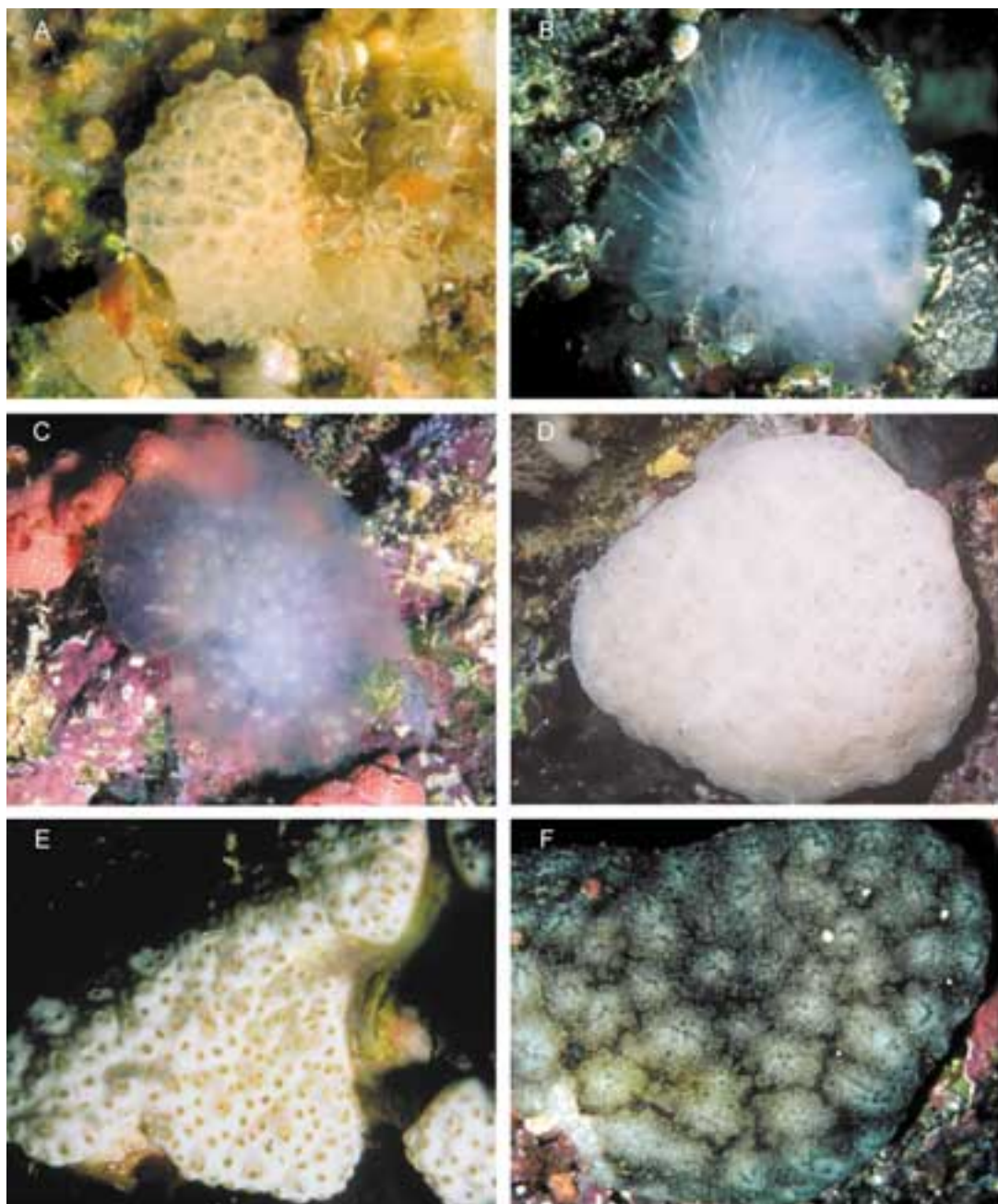


FIG. 118. — **A**, *Eudistoma* sp.; **B**, *Polycitor giganteus* (Herdman, 1899); **C**, *Polycitor translucidus* Kott, 1957; **D**, *Polycitorella coronaria* Monniot F., 1988; **E**, *Polycitorella mariae* Michaelsen, 1924; **F**, *Polycitorella stellifera* n. sp.

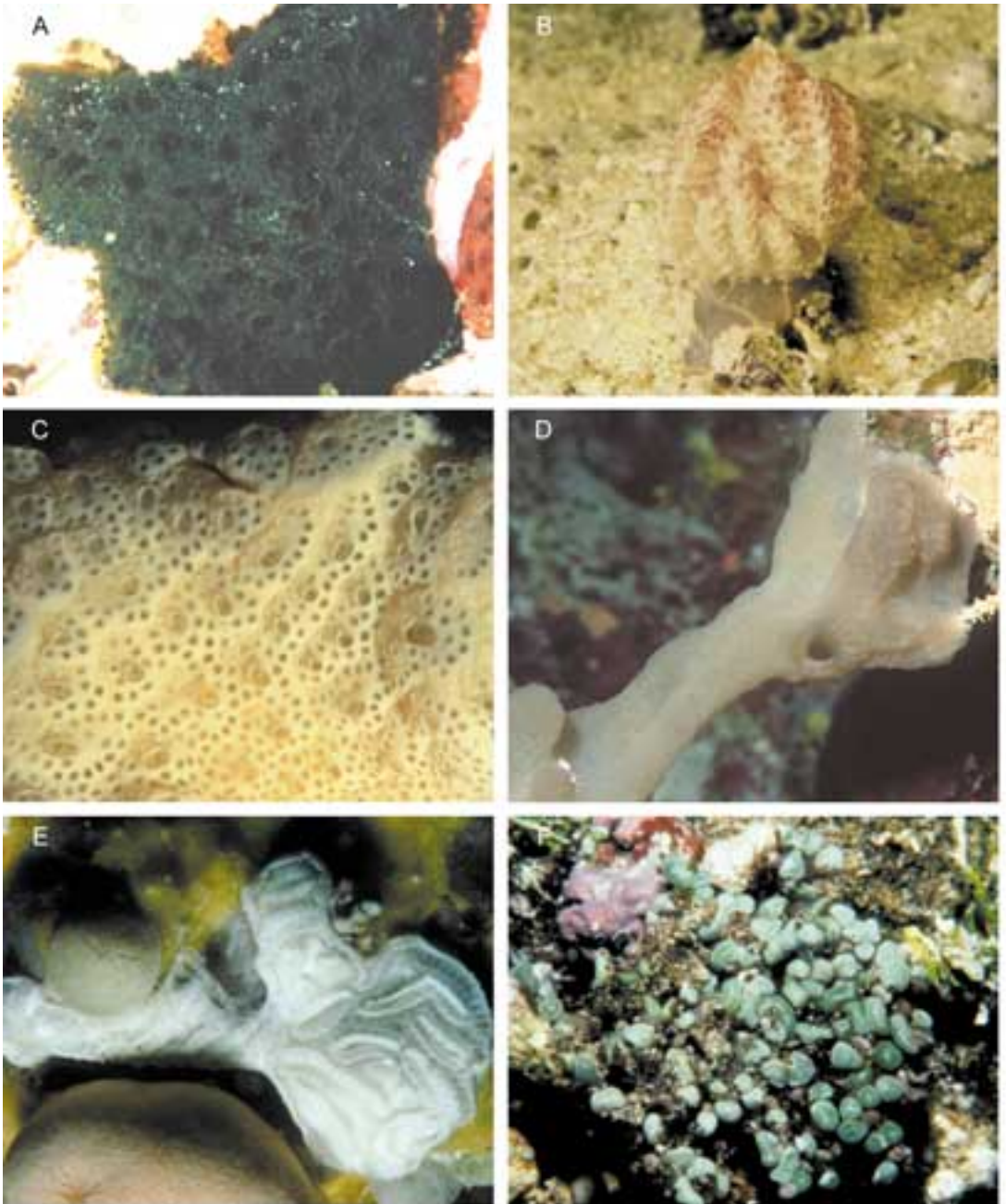


FIG. 119. — **A**, *Polydistoma oculum* n. sp.; **B**, *Distaplia mikropnoa* (Sluiter, 1909); **C**, *Distaplia stylifera* (Kowalevsky, 1884); **D**, *Trididemnum inermum* n. sp.; **E**, *Trididemnum poma* n. sp.; **F**, *Trididemnum strigosum* Kott, 1990.



FIG. 120. — **A**, *Didemnum algasedens* n. sp.; **B**, *Didemnum cuculliferum* (Sluiter, 1909); **C**, *Didemnum lacertosum* Monniot F., 1995; **D**, *Didemnum madeleinae* n. sp.; **E**, *Didemnum obscurum* Monniot F., 1969; **F**, *Didemnum rodriguesi* Rocha & Monniot F., 1993.

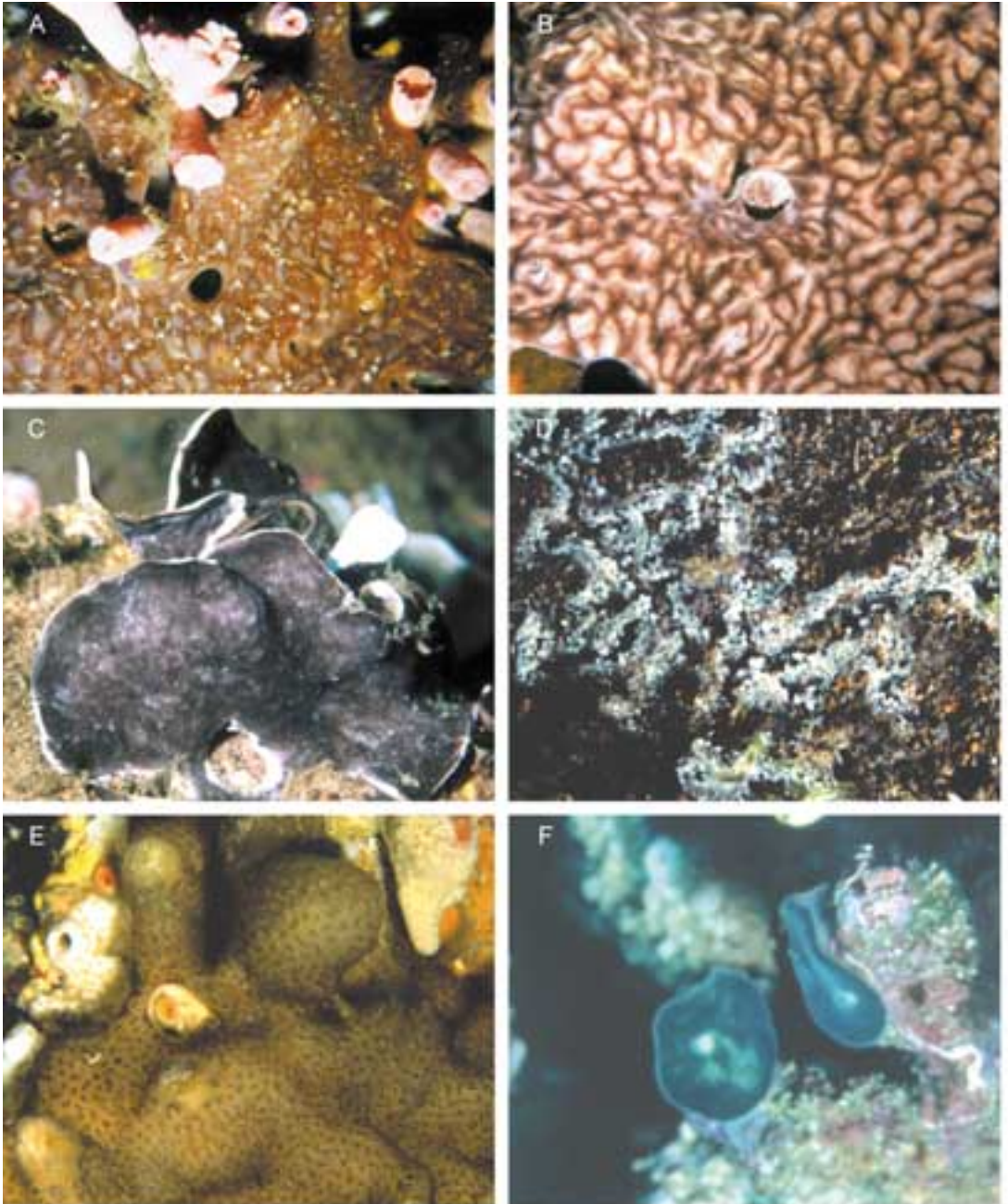


FIG. 121. — **A**, *Polysyncraton aspiculatum* Tokioka, 1949; **B**, *Polysyncraton cerebellum* n. sp.; **C**, *Polysyncraton thallomorpha* Monniot F., 1993; **D**, *Diplosoma marsupiale* n. sp.; **E**, *Diplosoma pannosum* n. sp.; **F**, *Diplosoma pavonia* Monniot C. & Monniot F., 1987.

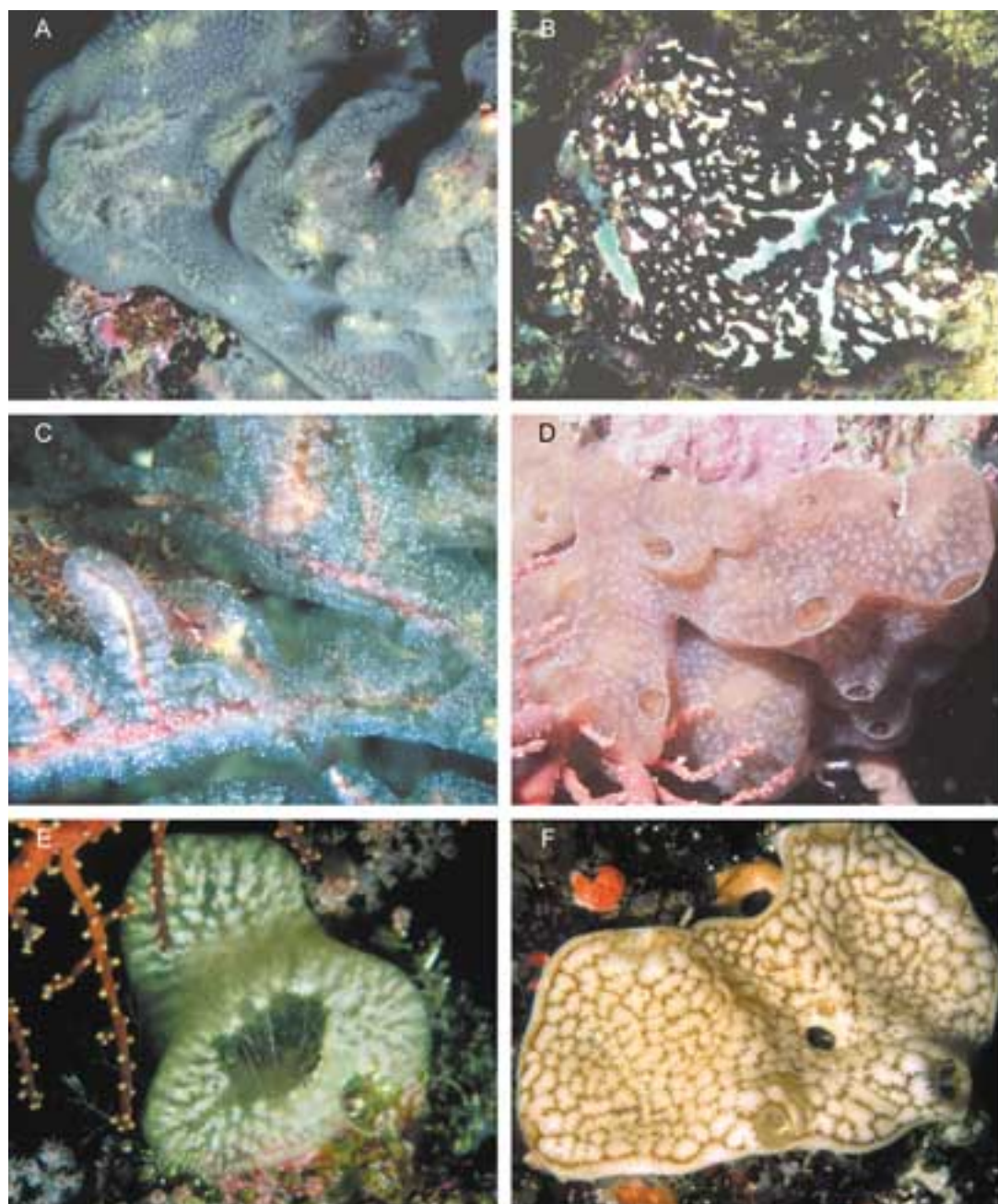


FIG. 122. — **A**, *Diplosoma redika* Monniot F., 1994; **B**, *Diplosoma versicolor* Monniot F., 1994; **C**, *Lissoclinum abdominale* Monniot F., 1983; **D**, *Lissoclinum guinense* n. sp.; **E**, *Lissoclinum taratara* Monniot C. & Monniot F., 1987; **F**, *Lissoclinum textile* n. sp.

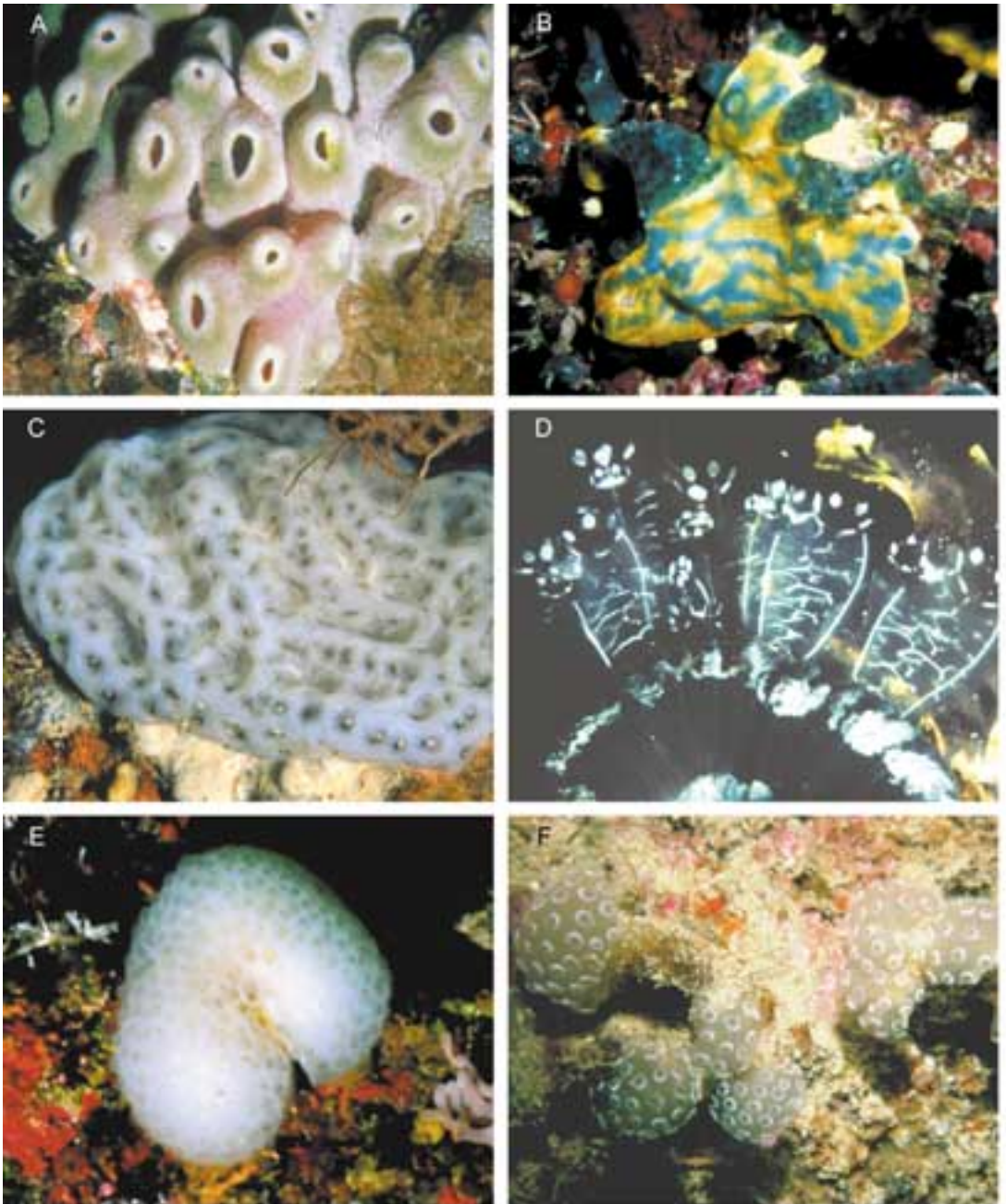


FIG. 123. — **A**, *Atrilum robustum* Kott, 1983; **B**, *Leptoclinides madara* Tokioka, 1953; **C**, *Leptoclinides subviridis* (Sluiter, 1909); **D**, *Diazona formosa* Monniot F. & Monniot C., 1996; **E**, *Diazona fungia* n. sp.; **F**, *Diazona pedunculata* n. sp.

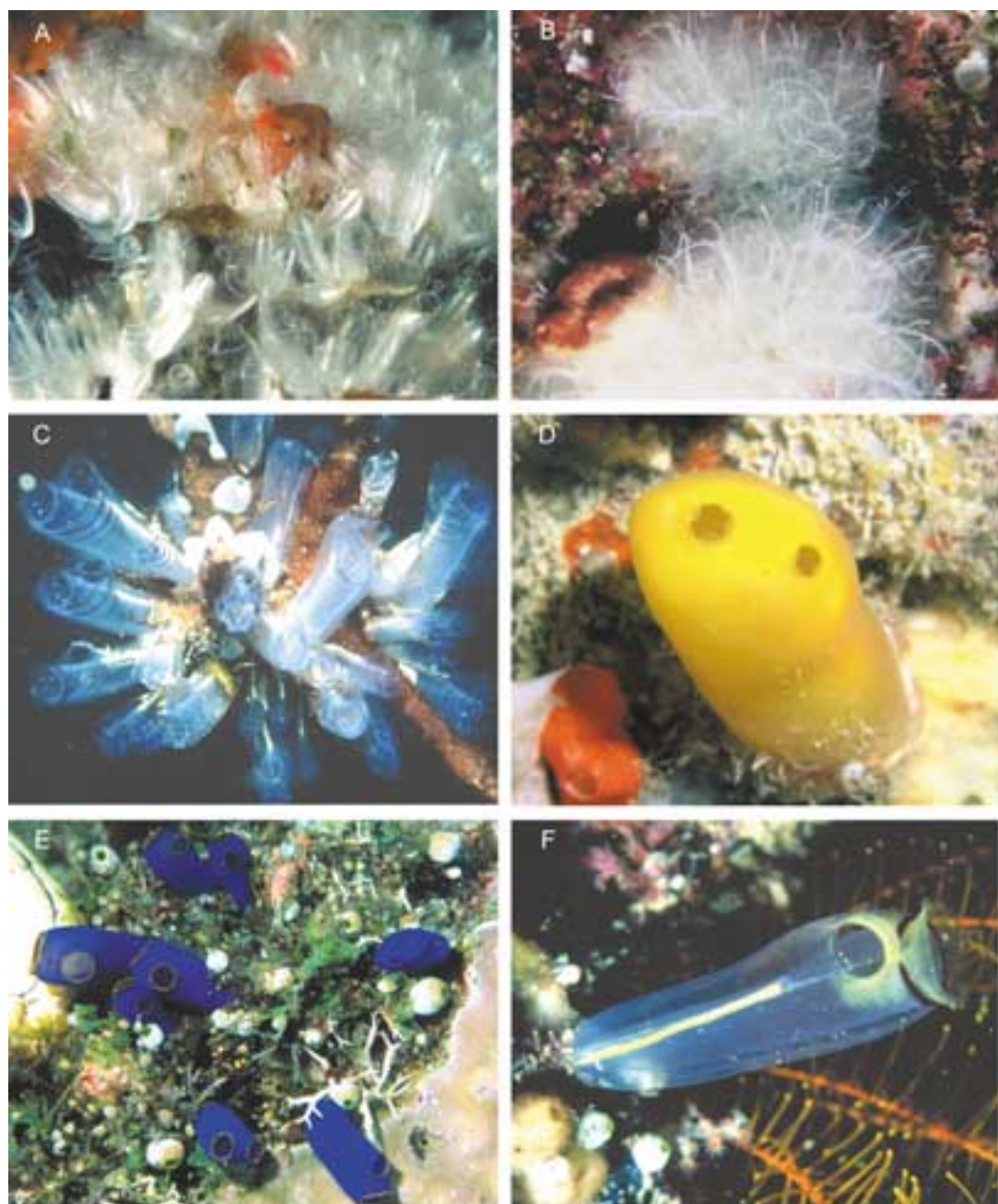


FIG. 124. — **A**, *Diazona tenera* Monniot F. & Monniot C., 1996; **B**, *Diazona textura* Monniot C., 1987; **C**, *Rhopalaea circula* n. sp.; **D**, *Rhopalaea crassa* (Herdman, 1880); **E**, *Rhopalaea fusca* (Herdman, 1880); **F**, *Rhopalaea respiciens* Monniot C., 1991.

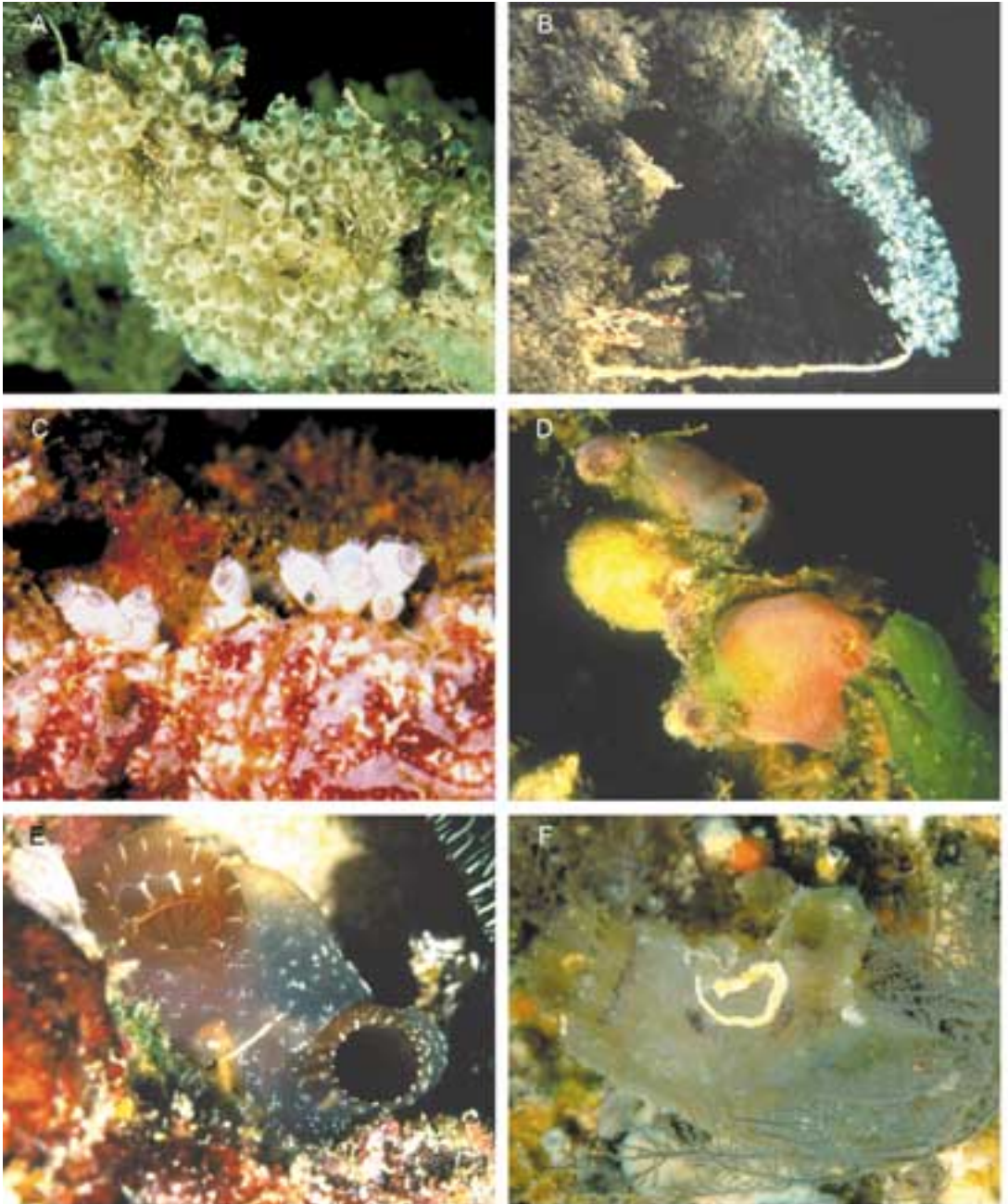


FIG. 125. — **A**, *Perophora modificata* Kott, 1985; **B**, *Perophora namei* Hartmeyer & Michaelsen, 1928; **C**, *Ecteinascidia bandaensis* Millar, 1975; **D**, *Ascidia gemmata* Sluiter, 1895 s.l.; **E**, *Ascidia ornata* n. sp.; **F**, *Ascidia sydneyensis* Stimpson, 1855.

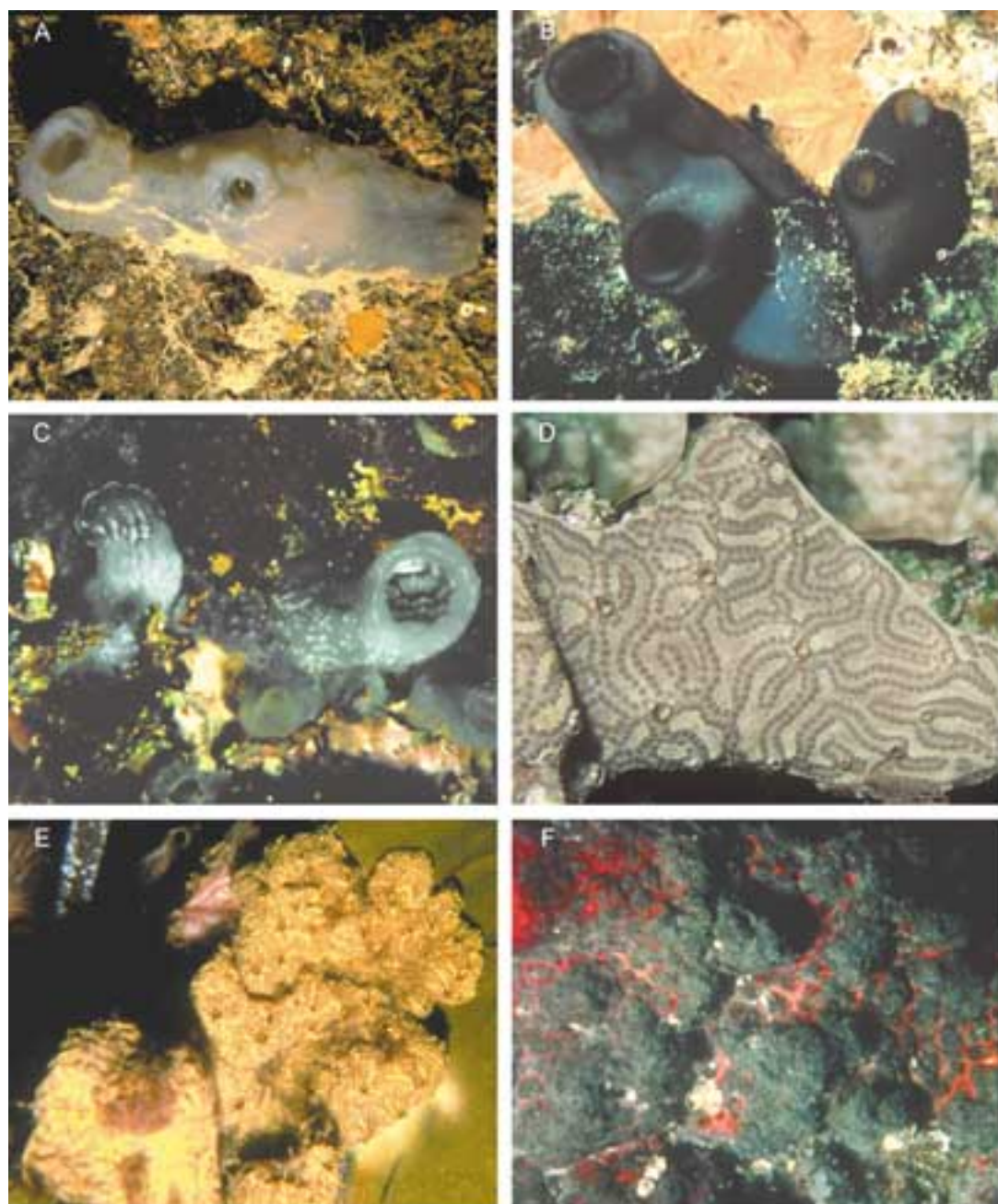


FIG. 126. — **A**, ?*Phallusia obesa* (Herdman, 1880); **B**, *Phallusia philippinensis* Millar, 1975; **C**, *Phallusia* sp.; **D**, *Botryllus perspicuus* (Herdman, 1886); **E**, *Botryllus tyreus* (Herdman, 1886); **F**, *Eusynstyela hartmeyeri* Michaelsen, 1904.

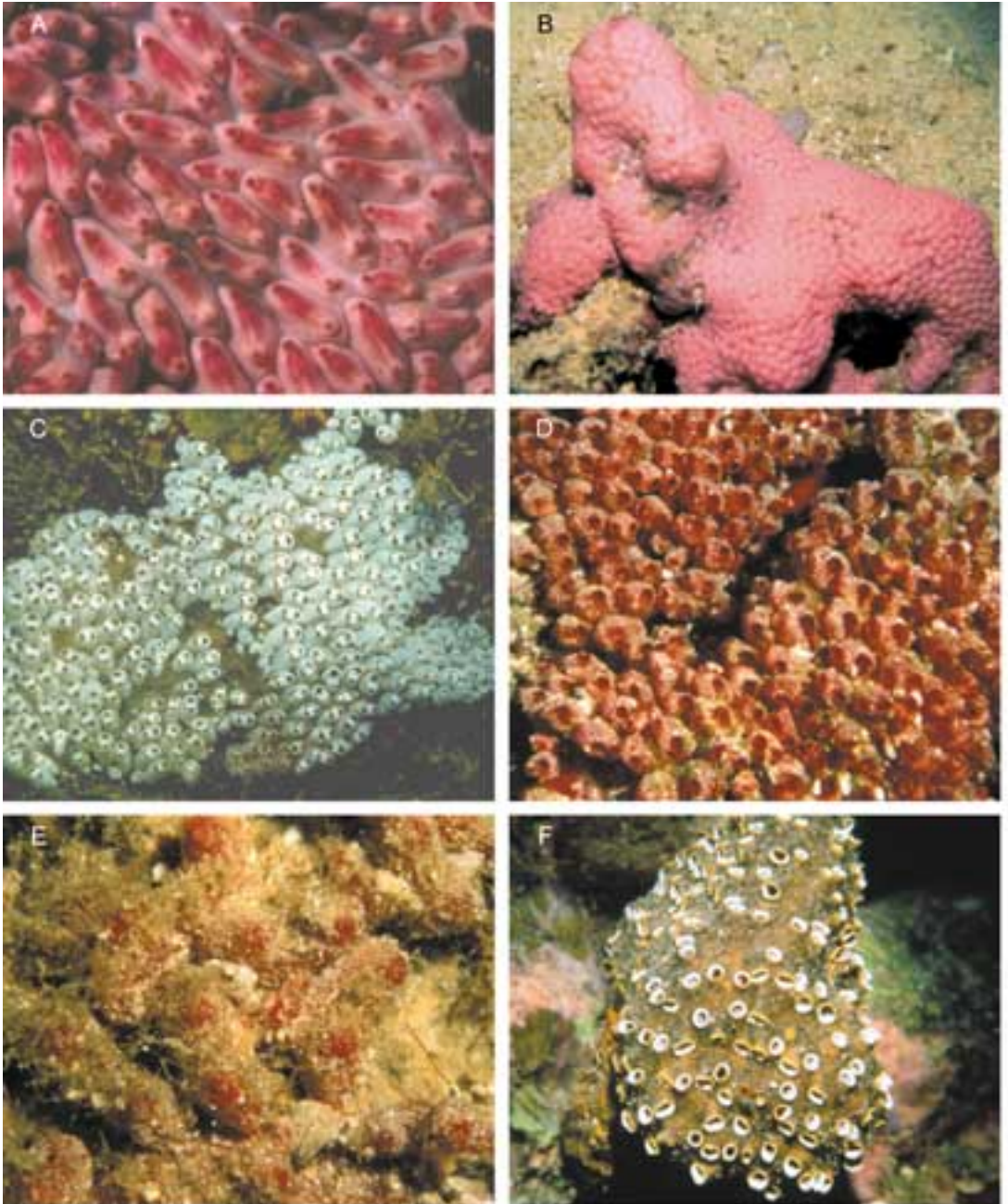


FIG. 127. — **A**, *Eusynstyela latericius* (Sluiter, 1904); **B**, *Symplegma rubra* Monniot C., 1972; **C**, *Symplegma rubra* Monniot C., 1972; **D**, *Stolonica bigyna* n. sp.; **E**, *Seriocarpa tongae* n. sp.; **F**, *Polyandrocarpa polypora* n. sp.

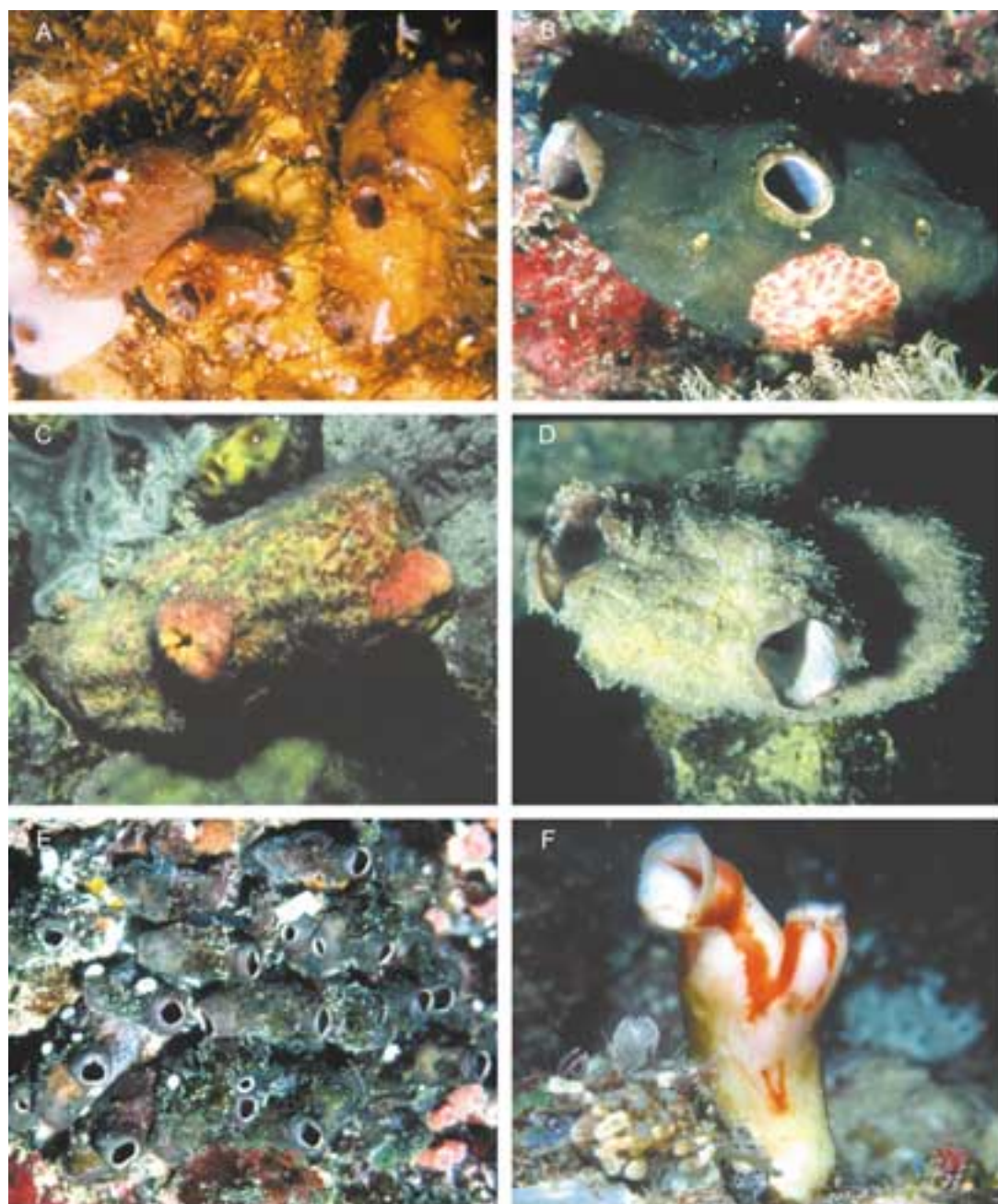


FIG. 128. — **A**, *Polycarpa argentata* (Sluiter, 1890); **B**, *Polycarpa camptos* n. sp. covered by a black didemnid; **C**, *Polycarpa captiosa* (Sluiter, 1885); **D**, *Polycarpa cryptocarpa* (Sluiter, 1885); **E**, *Polycarpa nigerrima* n. sp.; **F**, *Polycarpa papillata* (Sluiter, 1885).

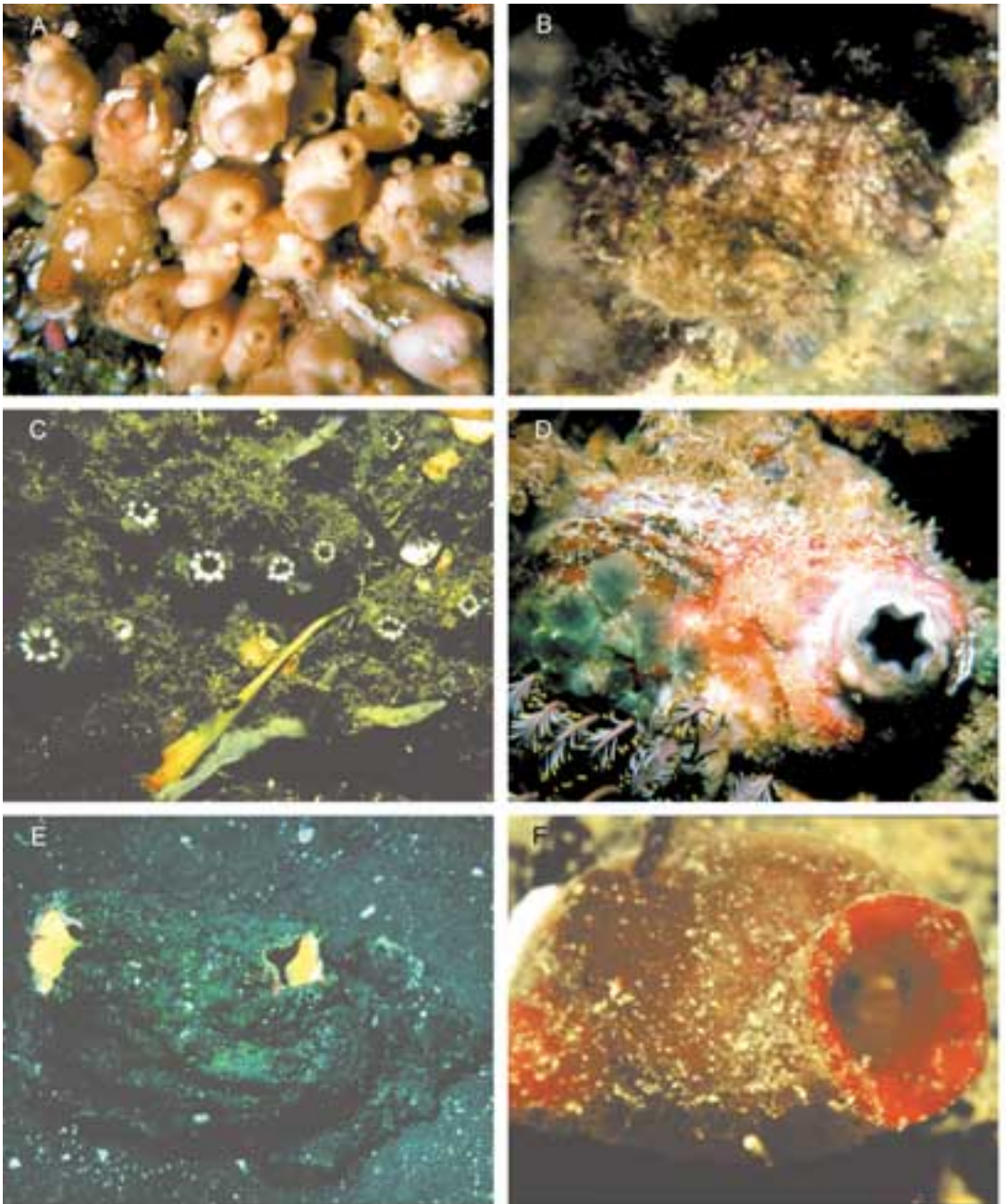


FIG. 129. — **A**, *Polycarpa reviviscens* n. sp.; **B**, *Polycarpa stirpes* Kott, 1985; **C**, *Polycarpa tumida* Heller, 1878; **D**, *Cnemidocarpa pedata* (Herdman, 1881); **E**, *Herdmania armata* n. sp.; **F**, *Herdmania pallida* (Heller, 1878).

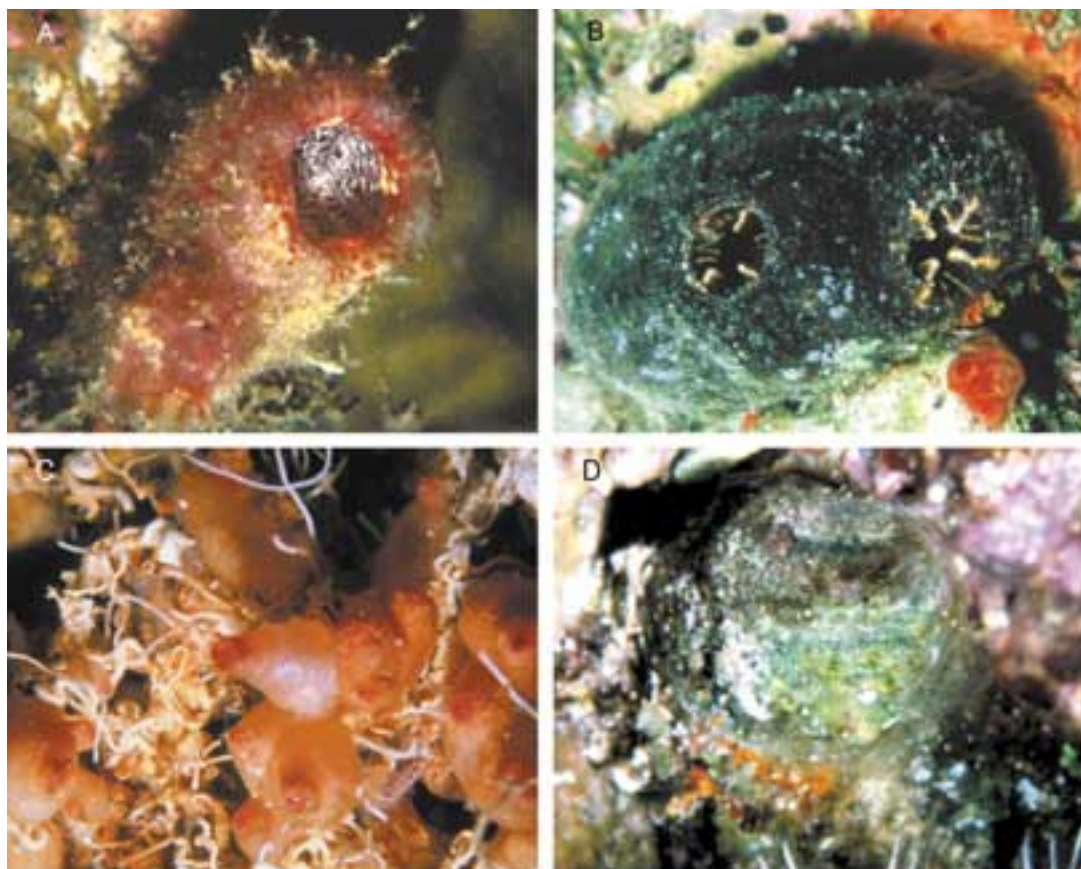


FIG. 130. — **A**, *Herdmania polyducta* (Monniot C. & Monniot F., 1989); **B**, *Pyura gangelion* (Savigny, 1816); **C**, *Pyura styeliformis* n. sp.; **D**, *Microcosmus bitunicatus* n. sp.

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Family POLYCLINIDAE Milne-Edwards, 1841

- Genus *Aplidium* Savigny, 1816
breviventer n. sp.
cerebrum n. sp.
controversum Monniot F. & Monniot C., 1996
cratiferum (Sluiter, 1909)
cyclophorum n. sp.
grisiatum Kott, 1998
intextum n. sp.
lineatum Monniot F. & Monniot C., 1996
longithorax Monniot F., 1987
macrolobatum Kott, 1992
nadaense (Nishikawa, 1980)
pictum n. sp.
rosaceum n. sp.
sacciferum n. sp.
solidum (Herdman, 1891)
vulcanium n. sp.

- Genus *Aplidiopsis* Lahille, 1890
ocellatus Monniot F. & Monniot C., 1996

- Genus *Monniotus* Millar, 1988
pacificus n. sp.
papillosus n. sp.

- Genus *Polyclinum* Savigny, 1816
constellatum Savigny, 1816
psammiferum Hartmeyer, 1911

- Genus *Pseudodistoma* Michaelsen, 1924
aureum (Brewin, 1957)
coronatum Monniot F. & Monniot C., 1996
digitata n. sp.
fragile Tokioka, 1958
megalarva Monniot F. & Monniot C., 1996
novaezealandiae (Brewin, 1950)

- Genus *Synoicum* Phipps, 1774
castellatum Kott, 1992

Family CLAVELINIDAE Forbes & Hanley, 1848

- Genus *Clavelina* Savigny, 1816
arafurensis Tokioka, 1952
detorta (Sluiter, 1904)
fecunda (Sluiter, 1904)
maculata n. sp.
moluccensis (Sluiter, 1904)
robusta Kott, 1990

Family POLYCITORIDAE Michaelsen, 1904

- Genus *Citorclinum* Monniot F. & Millar, 1988
laboutei Monniot F. & Millar, 1988

Genus *Cystodytes* Drasche, 1884

- aucklandicus* Nott, 1892
hapu Monniot C. & Monniot F., 1987
solitus Monniot F., 1988
violatinctus Monniot F., 1988

Genus *Eudistoma* Caullery, 1909

- album* Monniot F., 1988
amplum (Sluiter, 1909)
fasciculum Monniot F. & Monniot C., 1996
fluorescens n. sp.
fragum Monniot F., 1988
fucatum n. sp.
gilboviride (Sluiter, 1909)
glaucum (Sluiter, 1909)
?gracilum Kott, 1990
hospitale Monniot F., 1998
inauratum n. sp.
incrustatum Monniot F. & Monniot C., 1996
laysani (Sluiter, 1900)
ovatum (Herdman, 1886)
punctatum n. sp.
reginum Kott, 1990
toealense Millar, 1975
tumidum Kott, 1990
vineum n. sp.
viride Tokioka, 1955
vulgare Monniot F., 1988
 sp.

- Genus *Exostoma* Kott, 1990
ianthinum (Sluiter, 1909)

Genus *Hypodistoma* Tokioka, 1967

- deerratum* (Sluiter, 1895)

Genus *Nephtheis* Gould, 1856

- fascicularis* (Drasche, 1882)

Genus *Polycitor* Renier, 1804

- circes* Michaelsen, 1930

- giganteus* (Herdman, 1899)

- translucidus* Kott, 1957

Genus *Polycitorella* Michaelsen, 1924

- coronaria* Monniot F., 1988

- mariae* Michaelsen, 1924

- stellifera* n. sp.

Genus *Polydistoma* Kott, 1990

- oculeum* n. sp.

Family HOLOZOIDAE Berrill, 1950

- Genus *Distaplia* Della Valle, 1881
mikropnoa (Sluiter, 1909)

- regina* Kott, 1990
stylifera (Kowalevsky, 1874)
 Genus *Sycozoa* Lesson, 1832
cerebriformis Quoy & Gaimard, 1834)
 Genus *Sigillina* Savigny, 1816
cyanea (Herdman, 1889)
signifera (Sluiter, 1909)
 Family DIDEMNIDAE Giard, 1872
 Genus *Trididemnum* Della Valle, 1881
cyclops Michaelsen, 1921
discrepans (Sluiter, 1909)
inermum n. sp.
polyorchis Monniot F. & Monniot C., 1996
poma n. sp.
strigosum Kott, 1980
 Genus *Didemnum* Savigny, 1816
algasedens n. sp.
biglutinum Monniot F., 1995
cuculliferum (Sluiter, 1909)
granulatum Tokioka, 1954
guttatum Monniot F. & Monniot C., 1996
lacertosum Monniot F., 1995
linguiferum Monniot F. & Monniot C., 1996
madeleineae n. sp.
molle (Herdman, 1886)
moseleyi (Herdman, 1886)
obscurum Monniot F., 1969
parau Monniot C. & Monniot F., 1987
perlucidum Monniot F., 1983
psammatbodes (Sluiter, 1895)
rodriguesi Rocha & Monniot F., 1993
rubeum Monniot F. & Monniot C., 1996
 Genus *Polysyncraton* Nott, 1982
adelon n. sp.
aspiculatum Tokioka, 1949
cerebellum n. sp.
thallomorpha Monniot F., 1993
vestiens n. sp.
 Genus *Diplosoma* Macdonald, 1859
listerianum (Milne-Edwards, 1841)
marsupiale n. sp.
pannosum n. sp.
pavonia Monniot C. & Monniot F., 1987
redika Monniot F., 1994
simile (Sluiter, 1909)
unitestis n. sp.
versicolor Monniot F., 1994
 Genus *Lissoclinum* Verrill, 1871
abdominale Monniot F., 1983
badium Monniot F. & Monniot C., 1996
bistratum (Sluiter, 1905)
fragile (Van Name, 1902)
guinense n. sp.
patella (Gottschaldt, 1898)
?taratara Monniot C. & Monniot F., 1987
textile n. sp.
 Genus *Atrioolum* Kott, 1983
robustum Kott, 1983
 Genus *Leptoclinides* Bjerkan, 1905
dubius (Sluiter, 1909)
madara Tokioka, 1953
oscitans Monniot F. & Monniot C., 1996
reticulatus (Sluiter, 1909)
subviridis (Sluiter, 1909)
sulawesii Monniot F. & Monniot C., 1996
 Order PHLEBOBRANCHIA
 Family DIAZONIDAE Seeliger, 1906
 Genus *Diazona* Savigny, 1816
angulata Monniot F. & Monniot C., 1996
chinensis (Tokioka, 1955)
formosa Monniot F. & Monniot C., 1996
fungia n. sp.
pedunculata n. sp.
tenera Monniot F. & Monniot C., 1996
textura Monniot C., 1987
 Genus *Rhopalaea* Philippi, 1843
circula n. sp.
crassa (Herdman, 1880)
fusca (Herdman, 1880)
respicens Monniot C., 1991
 Family CIONIDAE Lahille, 1887
 Genus *Ciona* Fleming, 1822
hoshinoi Monniot C., 1991
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 Genus *Perophora* Wiegmann, 1835
modificata Kott, 1985
namei Hartmeyer & Michaelsen, 1928
 Genus *Ecteinascidia* Herdman, 1880
bandaensis Millar, 1975
remanea n. sp.
 Family ASCIDIIDAE Herdman, 1882
 Genus *Ascidia* Linné, 1767
archaia Sluiter, 1890
gemmata Sluiter, 1895 *s.l.*
ornata n. sp.
sydneiensis Stimpson, 1855
 Genus *Phallusia* Savigny, 1816
julinea Sluiter, 1919
?obesa (Herdman, 1880)
philippinensis Millar, 1975
 sp.
 Family PLURELLIDAE Kott, 1973
 Genus *Plurella* Kott, 1973
kottae Monniot F. & Monniot C., 1996
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 Family STYELIDAE Sluiter, 1895
 Genus *Botryllus* Gaertner, 1774
niger (Herdman, 1886)
perspicuus (Herdman, 1886)
tuberatus Ritter & Forsyth, 1917
tyreus (Herdman, 1886)
 Genus *Eusymstyela* Michaelsen, 1904
hartmeyeri Michaelsen, 1904
latericius (Sluiter, 1904)
 Genus *Symplegma* Herdman, 1886
brakenhielmi (Michaelsen, 1904)

rubra Monniot C., 1972
 Genus *Stolonica* Lacaze-Duthiers & Delage, 1892
bigyna n. sp.
limbata Monniot F. & Monniot C., 1996
 Genus *Seriocarpa* Diehl, 1969
tongae n. sp.
 Genus *Polyandrocarpa* Michaelsen, 1904
polypora n. sp.
 Genus *Polycarpa* Heller, 1877
argentata (Sluiter, 1890)
camptos n. sp.
captiosa (Sluiter, 1885)
cryptocarpa (Sluiter, 1885)
nigerrima n. sp.
papillata (Sluiter, 1885)
pigmentata (Herdman, 1906)
reviviscens n. sp.
rima Monniot F. & Monniot C., 1996
stirpes Kott, 1985

tokiokai Monniot F. & Monniot C., 1996
tumida Heller, 1878
 Genus *Cnemidocarpa* Huntsman, 1912
pedata (Herdman, 1881)
 Genus *Styela* Fleming, 1822
canopus (Savigny, 1816)
 Family PYURIDAE Hartmeyer, 1908
 Genus *Herdmania* Lahille, 1888
armata n. sp.
insolita n. sp.
 ?*pallida* (Heller, 1878)
polyducta (Monniot C. & Monniot F., 1989)
 Genus *Pyura* Molina, 1782
gangelion (Savigny, 1816)
styeliformis n. sp.
 Genus *Microcosmus* Heller, 1877
bitunicatus n. sp.
pacificus n. sp.
vesiculosus n. sp.