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ASCIDIANS COLLECTED IN TANZANIA

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ABSTRACT

Ascidians were collected in Tanzania in January 1996 by SCUBA diving. Among 31 species reported here, nine are new. Several species were also recently collected in Mozambique. Full descriptions are given with figures and colour plates. The present collection of Tanzanian ascidians significantly increases the number of species known in the tropical western Indian Ocean, and enlarges the range of other ascidians previously unrecorded from the Indian Ocean.

INTRODUCTION

Ascidians have seldom been collected along the African coasts; in fact, there are few records at all from the western Indian Ocean. And yet the first descriptions of ascidians in this area go back to Savigny (1816) who was the first to mention them from the Red Sea and Mauritius. Much later, Sluiter (1898, 1905) published some rather imprecise descriptions of South African species; then Hartmeyer (1905) reported on ascidians from Mauritius and Michaelsen (1918a, b, 1919, 1920a, b, 1921, 1934) on ascidians from the western Indian Ocean. These descriptions, mostly without illustrations, are so inconsistent and incomplete that they are hardly useful now; the type specimens they cite are often badly preserved or missing. Millar (1955, 1956, 1962, 1975, 1988) greatly increased the number of known eastern African ascidians, especially those found in the southern countries. Other studies include those of Plante & Vasseur (1966) and Vasseur (1970) for Madagascar, Vasseur (1967) for Mauritius, Monniot & Monniot (1976) for Inhaca Island in Mozambique, and Kott (1957) for "Southern Arabia".

None of these studies pretends to represent a thorough inventory, even a local one, and neither does the present study. Our contribution, based on collections made by SCUBA diving during some recent brief biological investigations, adds to previous records. Most of the collection in Tanzania was done by the Coral Reef Research Foundation. M. Richmond provided additional material from Zanzibar. Abundant material collected in the north of Mozambique and Djibouti by C. Monniot, but not yet completely studied, contained several species that are common in Tanzania and are included here. Some other samples collected by P. Laboute in Madagascar, and still others collected in northern South Africa by M. Schleyer are also included. For each described species, we specify the origin of the material.

The species diversity seems high, with nine new species among 31 collected. This is due partly to the use of SCUBA on hard bottoms, while previous records were obtained only by dredging. Nevertheless, some comments, even if preliminary, are in order about the present

collection. All the new species belong to the Aplousobranchia, and once more colonial ascidians appear to be dominant in tropical waters. Many of these species have a relatively wide geographical distribution, from the Arabian Peninsula to the northern part of South Africa. This probably reflects the continuously shallow coastal margin with warm waters along the eastern African coast. In contrast, south of Durban, the South African ascidian fauna is clearly of a different, temperate sort.

Some cosmopolitan species, not redescribed here, are part of the Tanzanian fauna. Most of these are didemnid ascidians living in symbiosis with unicellular algae; they are found in all coral reef habitats in the Pacific or Indian oceans. Some other cosmopolitan species belong to the worldwide fauna that inhabits harbours or fouls ship hulls in warm waters.

DESCRIPTIONS

***Didemnum brevioris* sp. nov. (fig. 1, 3A)**
Station: Tanzania, Zanzibar, Chwaka Bay, intertidal (Richmond coll.), Type: MNHN A2 Did C 344.

White crusts of this species are common under high intertidal overhangs at the base of cliffs. The colony surface is flat with common cloacal openings in simple holes, difficult to see. The colonies are thin sheets; the cloacal channels are narrow at the thoracic level. The colonies are of a hard consistency and brittle due to spicule density.

In formalin the zooids remain slightly brown. The short oral siphon is reduced to six very sharp teeth (fig. 1A). The cloacal aperture forms a small slit in contracted zooids. There is no languet. The round lateral thoracic organs protrude at the level of the third row of stigmata (fig. 1A). There are five stigmata in a half row. The short retractor muscle arises from the base of the thorax (fig. 1A). The oesophageal peduncle is short.

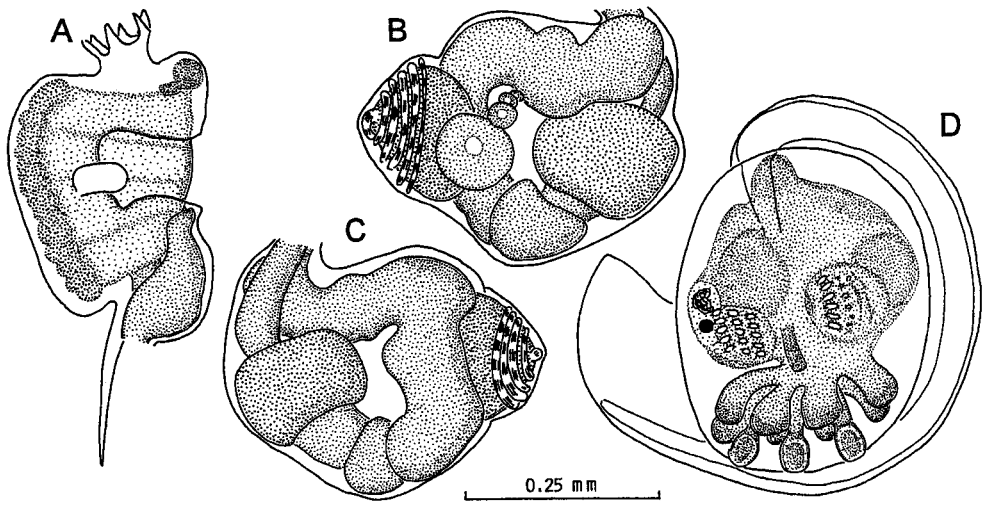

Figure 1. Didemnum brevioris *sp. nov.: A, thorax; B and C, both sides of the same abdomen; D, larva.*

The abdomen is folded under the thorax. The slightly twisted gut loop has the usual *Didemnum* shape. The single testis vesicle lies inside the gut loop or partly on the mid-intestine (fig. 1B, C). The sperm duct coils seven times or less.

Larvae (fig. 1D) are numerous in August colonies. They are small (390 μm long), have three adhesive papillae, and four pairs of rounded ampullae. They are gemmiparous, a character unusual in larvae of such a small size.

The spicules (fig. 3A) have numerous hexagonal rays cut straight and ending in a narrower round tip.

Remarks: This species may have been confused with so-called *Didemnum candidum*, as are many other white *Didemnum* species recorded worldwide. Its main distinctive characters are the small size of the zooids and the larvae, and the precocious buds in the small tadpoles.

***Didemnum captivum* sp. nov. (fig. 2, 3B)**

Station: Tanzania, Zanzibar, Prison Island, 6 m on corals (Richmond coll.), Type: MNHN A2 Did C 346.

The colonies form large crusts, flat and thin, and easily broken. Their colour in life is pale orange. Under magnification the zooids can be seen to form a pattern of small, regularly spaced spots. The spicules are dense throughout the colonies. In the basal layer, accumulations of red material form irregular, dense masses.

The zooids have a large, cylindrical oral siphon with six lobes (fig. 2A). The narrow dorsal cloacal aperture lies quite posteriorly (fig. 2A). There is no languet. Contraction reduces the cloacal siphon to a mere slit. The lateral thoracic organs protrude at the level of the third transverse vessel (fig. 2A), and are either round or vertically elongated. By row, the branchial sac has 8, 7, 7, 6 stigmata on each side. The retractor muscle is sometimes long, protruding from the anterior part of the oesophageal peduncle (fig. 2A).

The gut loop is folded on itself. The single testis vesicle (fig. 2B, C) lies posteriorly on the mid-intestine, covered by six to eight coils of the sperm duct. A large oocyte develops at its side.

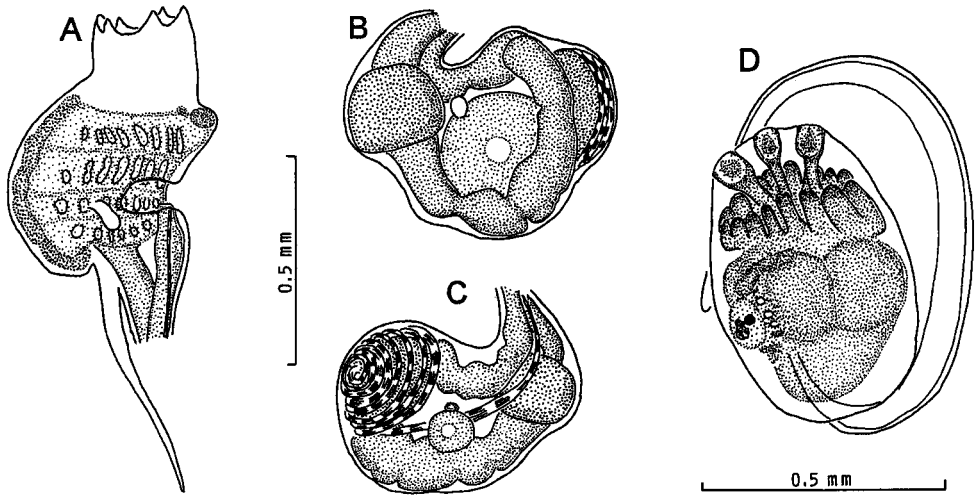

Figure 2. Didemnum captivum *sp. nov.: A, thorax; B, digestive tract; C, gonads; D, larva.*

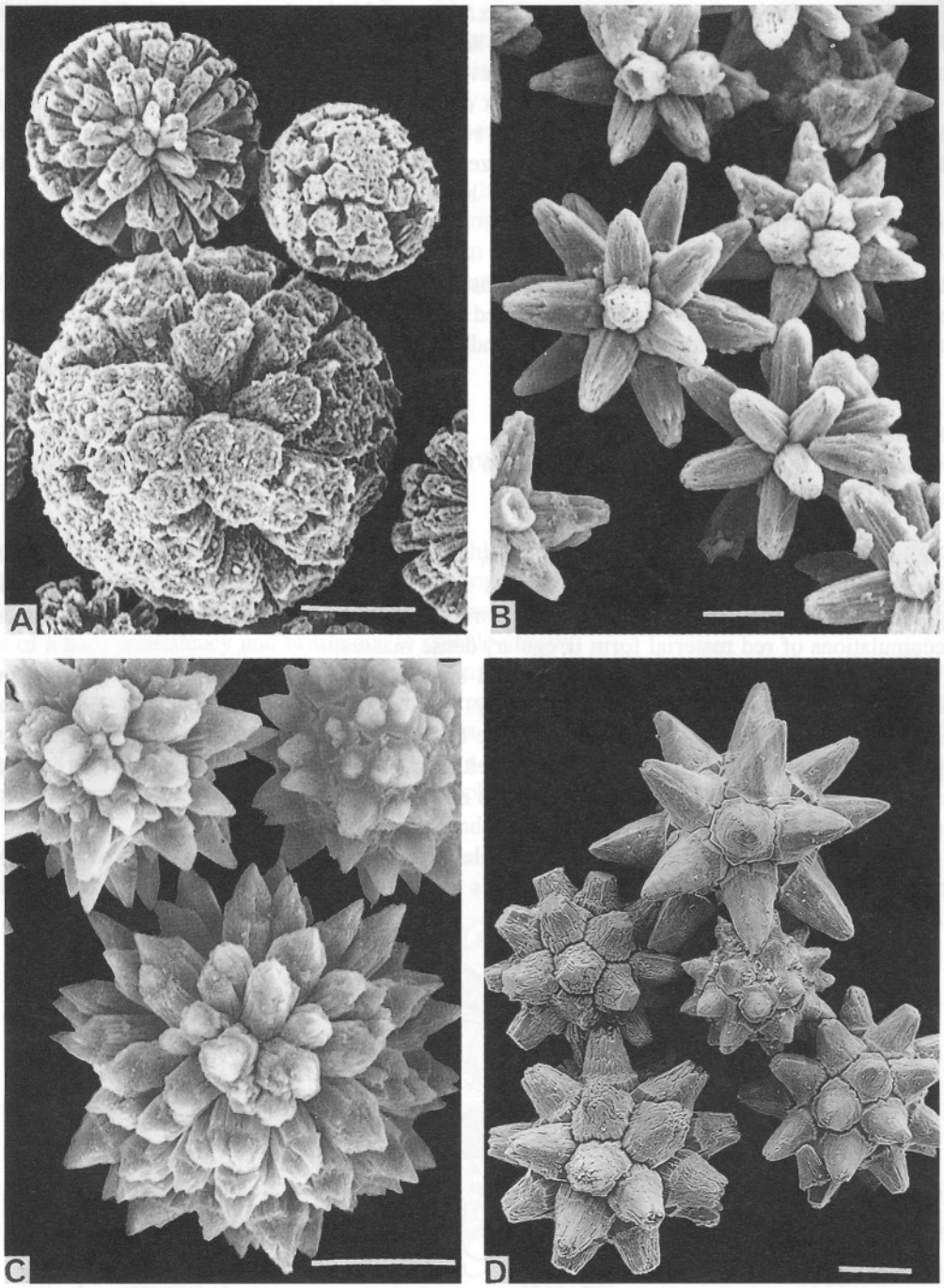

Figure 3. Spicules: A Didemnum brevioris*; B,* Didemnum captivum*; C,* Didemnum contortum*; D,* Didemnum dicolla. *Scale bars = 10 µm.*

The larval trunk (fig. 2D) measures 0.6 mm long. Larvae have three adhesive papillae in a line, in the middle of a crown of 16 to 18 digitiform ampullae.

The spicules (fig. 3B) have few, sharp, conical rays. The largest spicules are 40 μm across. Their shape is uniform throughout the colony.

Remarks: This species has no unique character except the high number of elongated ampullae around the adhesive papillae of the larva. But the colour in life, which disappears in formalin, the long oral siphon, and the posterior location of the cloacal siphon taken together, do not correspond to any of the few *Didemnum* species described from the tropical western Indian Ocean. The species name refers to the collection site.

***Didemnum contortum* sp. nov. (fig. 3C, 4; pl. 1A)**

Station: Tanzania, west of Zanzibar town, Neange Reef, 27 m, 6°12.00'S-039°07.80'E (CRRF coll.), Type: MNHN A2 Did C 410.

The leathery colonies are red with slightly scalloped white margins around the common cloacal openings. The colony shape is irregular, with convoluted swellings at the top of which open one or several round common cloacal apertures (pl. 1A). The thin surface layer of the colony covers large thoracic channels. The zooids' abdomens lie in stout pillars of tunic joining the upper surface to a thicker, softer layer underneath, with fewer spicules; this under-layer contains strands of tunic filled with many spicules, resembling a sponge skeleton. The basal layer of the colony has dense spicules and forms a hard sheet. Where the colony lacks thickening, pillars connecting only the thinner two apposed outer layers contain the zooids, for there the thick, softer internal part is missing.

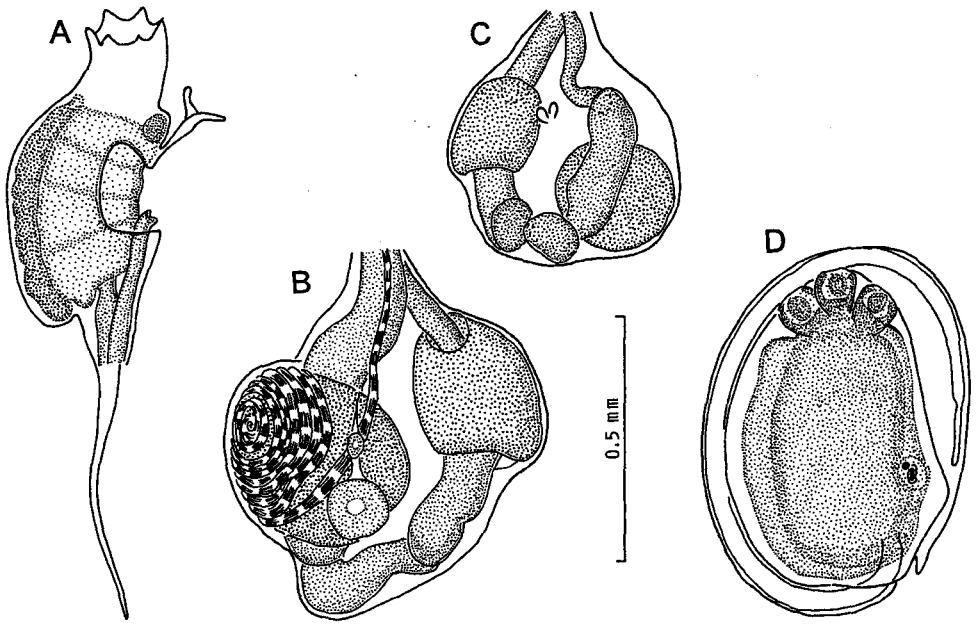

Figure 4. Didemnum contortum *sp. nov.: A, thorax; B, gonads; C, digestive tract; D, larva.*

The zooids have a cylindrical oral siphon with six sharp teeth (fig. 4A). The cloacal aperture is not very wide. A rather small and narrow languet is deeply cut into two lobes (fig. 4A). The lateral thoracic organs are very small, above the fourth row of stigmata. The retractor muscle, arising from the side of the oesophageal peduncle (fig. 4A), may be even longer than the thorax. The digestive tract, in an open loop, has well-individualised segments (fig. 4C). The testis vesicle is spherical and protruding, and carries five to eight turns of the sperm duct (fig. 4B). The ovary, on the side of the testis, has a single oocyte maturing at a time.

Only one embryo was found. It is not fully developed (fig. 4D). It has an ocellus, an otolith, and three adhesive papillae. The trunk measures 0.6 mm long.

The spicules (fig. 3C) reach only 30 μm in diameter. They have numerous sharp rays, often of unequal length.

Remarks: This species looks like *Didemnum spongioides* Sluiter, 1909, or *Didemnum roberti* Michaelsen, 1930, or *Didemnum diffundum* F. Monniot, 1994, except for its colour. The common cloacal openings have the same location on top of the colony's lobes, and the internal layer of the thickened parts has the same structure with a central core of tunic crossed by branched solid strands. But in this species the zooids have a cloacal languet.

***Didemnum dicolla* sp. nov. (figs 3D, 5; pl. 1B)**

Stations: Tanzania, south of Zanzibar, Menai Bay, 6°24.48'S-039°24.64'E 1.5 m on sea grass bed (CRRF coll.), Type: MNHN A2 Did C 396. Djibouti, Mescha Island, 0 to 20 m (Monniot coll.) MNHN A2 Did C 397-401.

The red, orange, or rusty colonies form tough crusts on different kinds of substrates such as sea grass blades, shells, or corals (pl. 1B). The common cloacal apertures appear as darker spots at the top of small swellings. The colony is of slight thickness, no more than 2 mm deep. The density of spicules makes the colony brittle. Pigments are limited to the colony surface. The common cloacal cavity is quite thin, restricted to the thoracic layer, making it difficult to delaminate the colony's upper surface.

The zooids themselves have no special characteristics. The oral siphon is short with six triangular lobes (fig. 5A). The cloacal opening is not wide and no languet arises from its margin. There are six to eight branchial stigmata in a row. The vertically elongated lateral thoracic organs protrude from the rim of the cloacal aperture beside the third row of stigmata (fig. 5A). The retractor muscle is linked to the oesophageal peduncle (fig. 5A); its free length does not exceed the length of the thorax.

The abdomen is folded on itself (fig. 5B, C). The gut loop bends at the level of the post-stomach and rectum. The testis vesicle lies on the gut loop, covered by four to five turns of the sperm duct (fig. 5C). In colonies containing an ovary and larvae, the testis has disappeared (fig. 5B).

Numerous larvae are incubated in the basal layer of the colonies. The larval trunks measure 330 μm to 350 μm long. The ocellus, otolith, and three rows of stigmata are developed. There are two adhesive papillae, and on each side sometimes five but more often seven pairs of elongated ampullae of unequal length (fig. 5D, E). The larvae are not gemmiparous.

The spicules (fig. 3D) are stellate, the largest about 50 μm across. The size of the spicules is, on an average, smaller in Tanzania than in Djibouti. The rays are very regularly placed on pentagonal bases. Their tips are either sharp or neatly truncated.

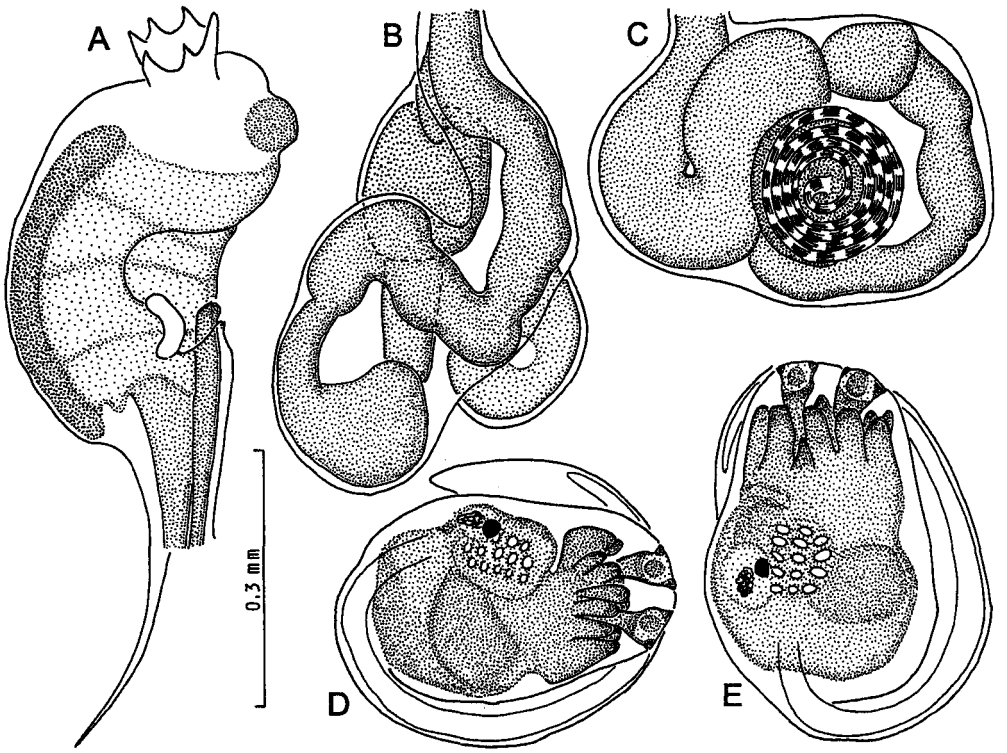

Figure 5. Didemnum dicolla *sp. nov.: A, thorax; B, digestive tract; C, testis; D and E, larvae.*

Remarks: This species has the same colour as *Didemnum yolky* Monniot & Monniot 1997, described from Bahrain and also present in Tanzania and Mozambique, but the surface of this new species is smooth. The species' zooids, larvae, and spicules also are different. *D. dicolla* has a larva very similar to that of *D. pitipiri* Monniot & Monniot 1987 from Polynesia, but the zooids and spicules again are different.

***Didemnum nocturnum* sp. nov. (fig. 6, 7A; pl. 1C)**
Station: Tanzania, 6 miles west of Zanzibar town 06°11.30'S- 39°07.70'E, 21 m on sand (CRRF coll.), Type: MNHN A2 Did C 404.

The colonies are 3 to 4 mm thick, soft and of a deep "nocturnal" blue (hence the species name), with lighter blue patches (pl. 1C). The zooids are not visible through the deeply coloured tunic. The paler areas are due to irregular accumulations of small spicules. The edges of the colonies are noticeably rounded.

The zooids lie perpendicular to the colony surface, grouped in pillars of tunic that cross wide cloacal channels and enclose both thoraces and abdomens. In formalin the blue tint (pl. 1C) disappears, leaving the tunic brownish and slightly translucent. Dark brown pigment cells are scattered in the test, more densely around common cloacal cavities.

The cylindrical oral siphons bear six short round lobes (fig. 6A). The thorax has a square outline. The narrow cloacal aperture (fig. 6A) lacks a languet, and becomes a mere slit in

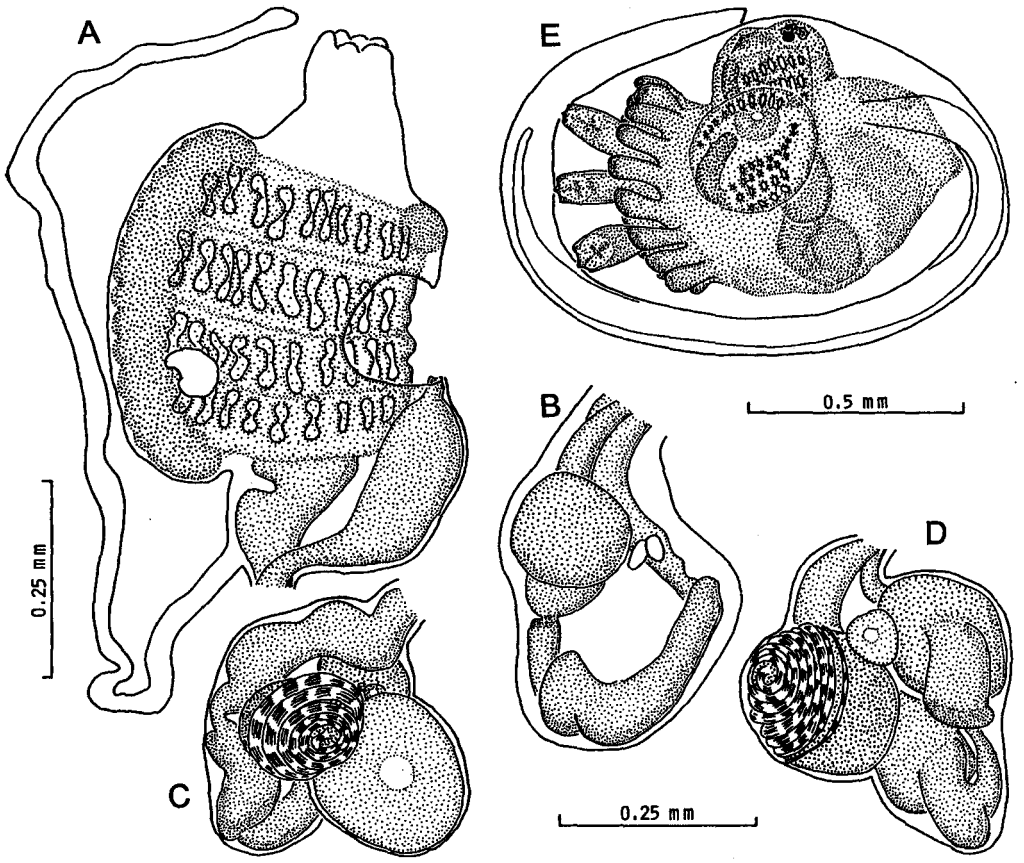

Figure 6. Didemnum nocturnum *sp. nov.: A, thorax; B, digestive tract; C and D, gonads.*

contracted zooids. The branchial sac has 10 stigmata in each of the three first rows and nine in the fourth (fig. 6A). The lateral thoracic organs are round, located close to the endostyle at the third transverse vessel. The zooid's "waist" is short; the retractor muscle protrudes from it and may extend at least three times the length of the thorax (fig. 6A), reaching the basal layer of the colony.

The wide gut loop has a stomach that is small compared to the post-stomach, widens before a short mid-intestine, and has a long rectum (fig. 6B, C, D). The testis vesicle can reach a large size in the centre of the gut loop. When the ovary develops, the testis is pushed against the rectum by a very large oocyte (fig. 6C). The sperm duct makes about nine tight turns on the testis (fig. 6D).

The larval trunk (fig. 6E) measures 1 mm long. Larvae have three cylindrical adhesive papillae encircled by 16 to 18 finger-like ampullae. There is an ocellus and an otolith in the oozooid above the initial three rows of stigmata. A well-developed bud with four stigmata rows lies on the left side of the larva. The tail makes only a half turn around the trunk and appears brown in formalin.

The spicules (fig. 7A) are not well crystallised for the most part. Only some of them show the usual stellate shape. They have only a few short pointed rays and their largest diameter is 40 μm.

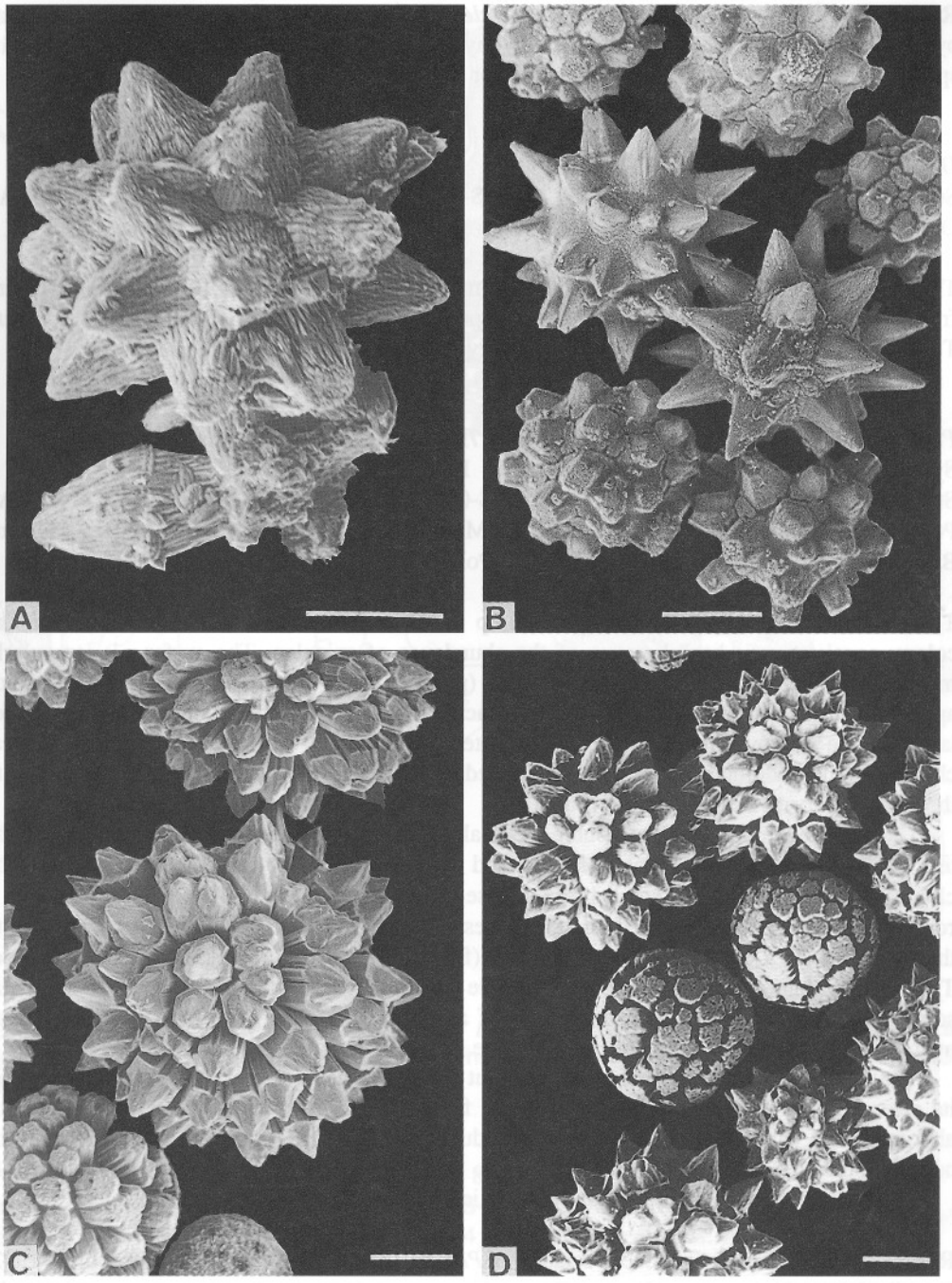

Figure 7. Spicules: A, Didemnum nocturnum*; B,* Polysyncraton millepore*; C, D,* Polysyncraton rostrum. *Scale bars = 10μm.*

Remarks: This species differs from other *Didemnum* species with large gemmiparous larvae by virtue of the dark blue colour of its colony (pl. 1C), the disposition and structure of its spicules, and the length of the zooid's retractor muscle.

Didemnum yolky **Monniot & Monniot, 1997**
Station: Tanzania, Pemba Island, 05°26.58'S-039°39.43'E, 3 m (CRRF coll.) MNHN A2 Did C 393.

This didemnid has been described from Mozambique and Bahrain. All Tanzanian records are from 1 to 12 m deep. When described, this species was compared to *Didemnum granulatum* Tokioka, 1954 with which it appears to be very closely allied.

Polysyncraton millepore **Vasseur, 1968 (figs 7B; 8A-D; pl. 1D, E)**
Synonymy: *Polysyncraton millepore* Vasseur, 1968: 917, Madagascar, Tuléar.
Stations: Tanzania, Pemba Island, 05°0029'S-039°39.25'E, 30 m (CRRF coll.), MNHN A2 Pol 82. Mozambique, Ibo Island, 5 to 10 m (Monniot coll.), MNHN. South Africa, Sodwana Bay, 8 to 22 m (Schleyer coll.), MNHN A2 Pol 75-77.

The colonies form large encrusting sheets up to 20 cm across and 0.3 to 1 cm thick. The colony consistency is hard because of the abundance of spicules. The surface is irregularly mottled with black, brown, or grey patches (pl. 1D, E). The oral apertures of the zooids appear as little dark spots. The common cloacal apertures have a scalloped rim. The upper layer of the colony can easily be delaminated at the level of the large thoracic cloacal channels. The abdomens are solidly embedded in the basal tunic. The layer in contact with the substrate forms a thin, smooth crust.

The zooids are arranged in double rows along channels encircling low swellings of the test, or flat areas. The oral siphon is long and cylindrical, ending in six teeth (fig. 8A). The cloacal aperture is large. A small languet arises from its dorsal edge (fig. 8A), either with a round tip or a tip that is indented into two lobes. The length of the languet varies according to the proximity of a common cloacal aperture (fig. 8A, B), but it always has a narrow base. The vertical lateral thoracic organs protrude at the level of the third row of stigmata; sometimes they are larger than the length of a stigma (fig. 8A). The branchial sac has an average of 10 elongated stigmata per row. The retractor muscle is shorter than the thorax.

The oesophageal peduncle is long. The gut loop is smaller than the thorax, scarcely half its size. Four or five testis vesicles protrude from the gut loop in the posterior part of the abdomen, and carry four coils of the sperm duct (fig. 8C, D). No larvae were found in the colonies studied.

The spicules (fig. 7B) are stellate with conical rays and an average size of 30 μm.

Remarks: This species is closely related to *Polysyncraton thallomorpha* F. Monniot, 1993, described from New Caledonia. It differs in its pigmentation, the thickness of the colony, the length of the oral siphon, and the size of the lateral thoracic organs. The lack of larvae in our specimens of *P. millepore* as yet precludes further comparison.

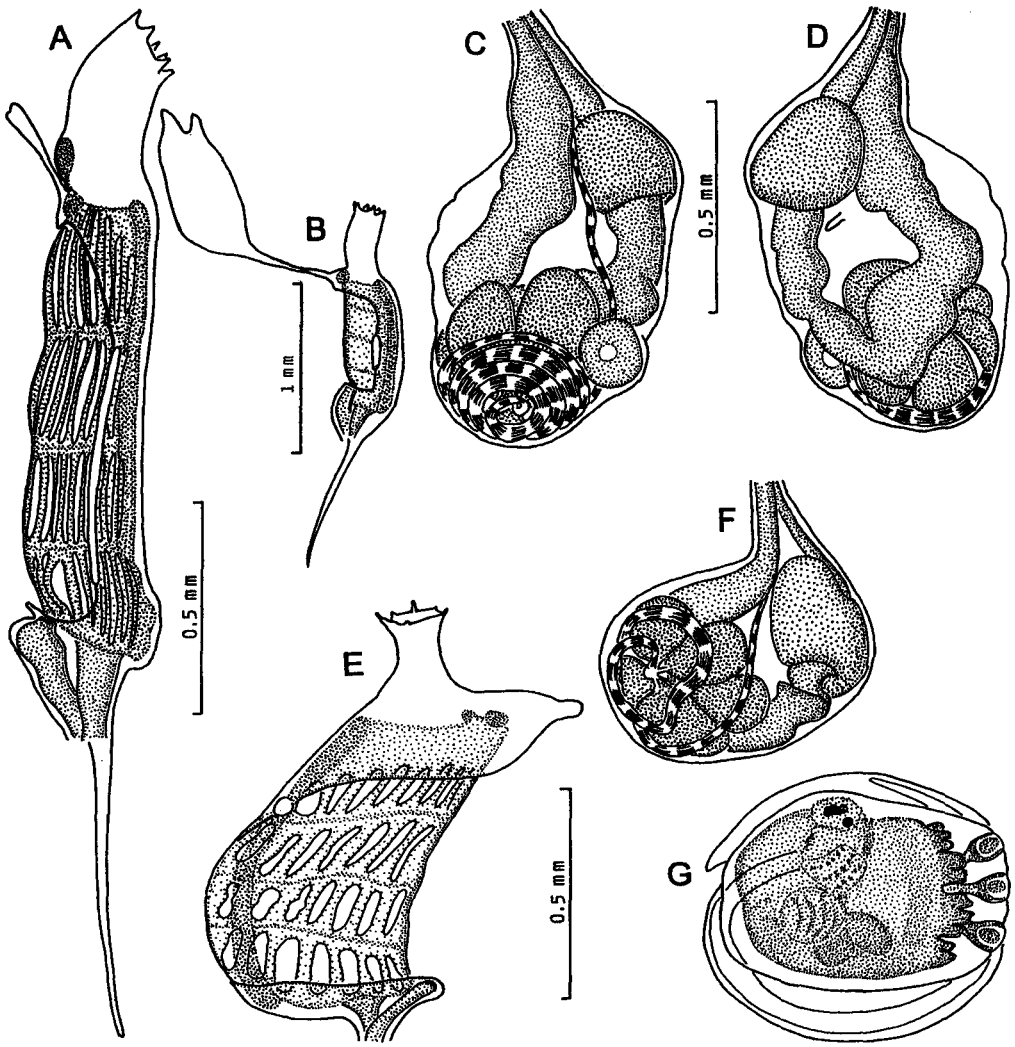

Figure 8. Polysyncraton millepore*: A, thorax, B, thorax in the vicinity of a common cloacal aperture; C, gonads; D, digestive tract.* Polysyncraton rostrum *sp. nov.: E, thorax; F, testis; G, larva.*

Polysyncraton rostrum **sp. nov. (fig. 7 C, D; 8 E-G. pl. 1F)**
Stations: Tanzania, Pemba Island: 05°23.07'S-039°35.24'E and 05°27.18'S-039°43.07'E, 1 to 6 m (CRRF coll.), Type: MNHN A2 Pol 84; additional specimens: A2 Pol 85.

This species covers rocks and corals in crusts as broad as 30 cm but only 1 to 2 mm thick. Its colour in life is light to deep orange-red (pl. 1F), lighter around the common cloacal apertures. The upper surface is raised into many small and regularly spaced elevations where the common cloacal apertures open (pl. 1F). The darker oral siphons give a spotted design to the colony surface. The spicules are dense throughout the whole thickness of the easily broken crusts. The upper layer of the colony can be delaminated at the level of the thoracic

cloacal channels. The basal part of the colony is the thickest and contains abdomens and larvae.

The zooids have funnel-like oral siphons with sharp lobes, three short lobes alternating with three longer ones (fig. 8E). This arrangement is apparent under magnification because the tunic around each of the three longest oral lobes contains spicules that protrude as three teeth into the oral aperture. The cloacal siphon is prolonged anteriorly as a little beak with a tiny round, button-like languet (fig. 8E). This languet is larger near the common cloacal apertures. The lateral thoracic organs lie at the level of the first row of stigmata (fig. 8E), which has eight to ten stigmata. The thorax has a straight, wide base without a retractor muscle (fig. 8E).

The abdomen is less voluminous than the thorax. The digestive tract has the usual shape; inside the loop are five to six testis vesicles pressed to each other in a spherical mass encircled by two to three turns of the sperm duct (fig. 8F). The gonad protrudes from the gut loop. In one colony dark cells were present in the abdominal body wall.

The larval trunk (fig. 8G) is 600 μm long. The three adhesive papillae are surrounded by 16 to 20 ampullae in a circle; these ampullae have irregular, more or less deeply indented tips. An ocellus and an otolith are present, as are three rows of already pierced stigmata. There is a bud on each side of the larval trunk (fig. 8G).

The spicules (fig. 7C, D) have very different sizes. The largest are about 40 μm across. Their rays are numerous and usually pointed, not regularly arranged, and they are present in variable number, and may even be truncated to form balls.

Remarks: This species shows some similarities with *P. poro* Monniot & Monniot, 1987 from Polynesia, in the colour and shape of the colony and the zooids. But the cloacal languet here is shorter and not bifid, and the spicules are very different.

Some unicellular algae were present on the surface of one colony, but they did not remain after collection.

***Aplidium colini* sp. nov. (fig. 9; pl. 2A)**

Station: Tanzania, Pemba Island, 05°23.45'S-039°37.86'E; 18 m (CRRF coll.), Type: MNHN A1 Apl B 384.

The colonies form masses 10 cm or more across; they comprise bunches of conical lobes, separated down to their bases, but tightly pressed against each other (pl. 2A). The lobes are 3 to 5 cm high and less than 1 cm across at the top, where the surface is flat and less impregnated with sand than the walls. A single ring of oral siphons surrounds a central common cloacal aperture atop each lobe. The tunic is glassy, colourless, and impregnated with sand superficially but not between the zooids.

The zooids are extremely long, up to 25 mm. The oral siphon has eight round lobes (fig. 9A). The cloacal siphon is elongated into a tube whose dorsal margin has a short languet with three terminal lobes (fig. 9A). The thoracic muscles are strong and organised into about 10 longitudinal bundles. The branchial sac has 18 rows of stigmata; an unperforated area lines each side of the endostyle. In the middle of the thorax a half-row contains 18 stigmata. There are no parastigmatic vessels.

The abdomen is shorter than the relaxed thorax. The oesophagus is short compared to the cylindrical stomach, which has five folds (fig. 9C). There is an annular post-stomach

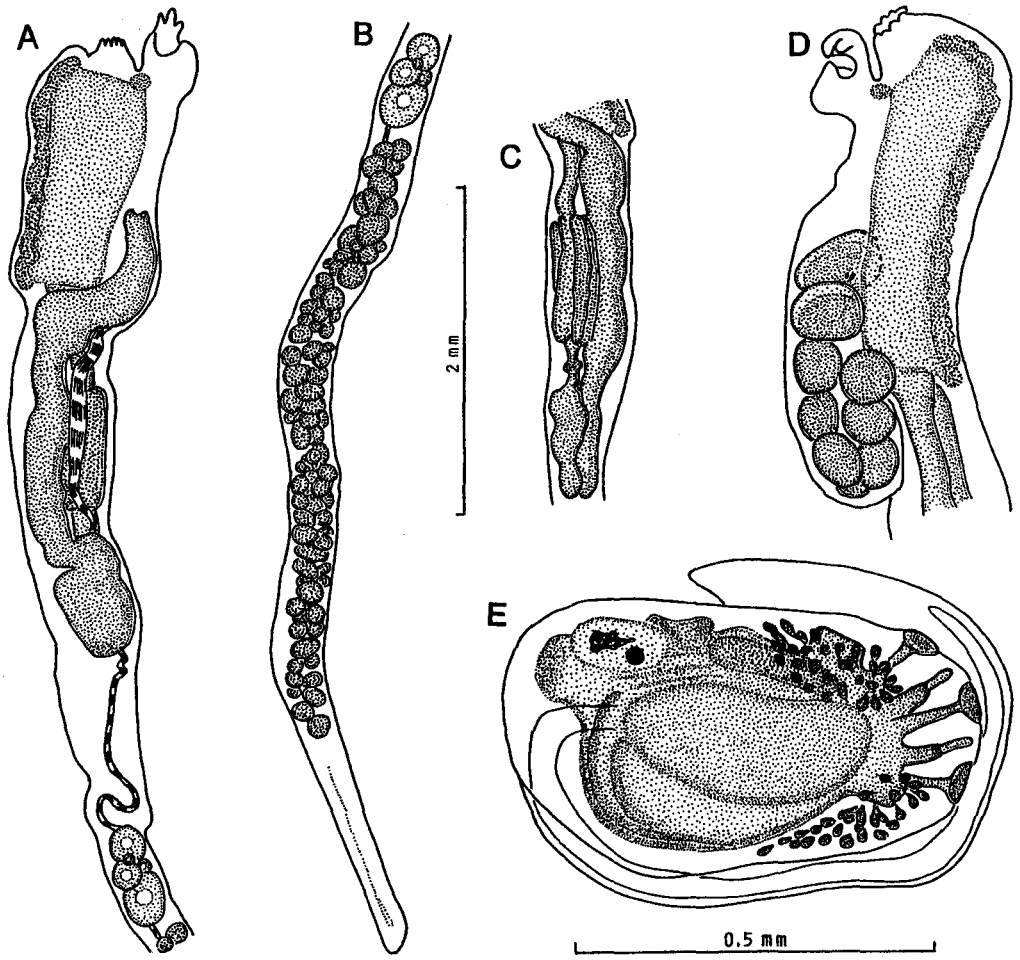

Figure 9. Aplidium colini *sp. nov.: A, B, zooid; C, abdomen; D, brooded embryos; E, larva.*

(fig. 9C). The mid-intestine forms the curve of the gut loop. The rectum begins after a constriction in the ascending limb of the gut opposite the post-stomach.

The post-abdomen is the longest segment of the zooid. The ovary lies at a short distance below the gut. It is followed by a long, irregular, double line of testis vesicles (fig. 9B).

The abundant larvae (fig. 9D) are incubated in the cloacal cavity, which may contain up to 10 embryos. The larval trunk is 700 μm long and three quarters encircled by the tail. The three adhesive papillae have thin stems separated by two odd, elongated protuberances (fig. 9E). Numerous round ampullae are distributed on each side in a dorsal and a ventral clump (fig. 9E). An ocellus and an otolith are present.

Remarks: With eight oral lobes, a tubular cloacal siphon prolonged as a languet with three lobes, numerous stigmatal rows, and a stomach with five folds, this species resembles *Aplidium protectans* (Herdman, 1899) and *Aplidium amorphatum* Kott, 1963. It differs in the peculiar shape of its colony lobes, which are separated from each other almost to their bases, and in its sand-impregnated tunic. The exceptional length of the zooids and the larval structure are also distinctive.

This new species is dedicated to Patrick and Lori Colin, who were responsible for the Tanzanian shallow-water marine collection programme for natural products, supported by the US National Cancer Institute.

***Aplidium solidum* (Herdman, 1891) (fig. 10; pl. 2B)**

Synonymy: *Psammaplidium solidum* Herdman 1891: 170; 1899: 85 pl. PclV, fig. 1–5. Synonymy and distribution: see Kott, 1992: 586 fig. 102. non *Amaroucium solidum* Ritter & Forsyth, 1917.

Station: Tanzania, Pemba Island, 05°27.41'S-039°41.90'E, 15 m on coral reef (CRRF coll.), MNHN A1 Apl B 386.

The colonies form digitate masses 10 cm across and 1 cm thick, impregnated with sand (pl. 2B). Large common cloacal apertures that open at the top of the lobes show a red internal coloration (pl. 2B). The oral apertures of the zooids appear as red spots in curved double rows. Some red pigment remains in the thoraces of the zooids after preservation.

The zooids (fig. 10A) are very thin and short, not exceeding 3 mm in total length when relaxed. The thorax, abdomen, and post-abdomen each have approximately the same length. The oral siphon has six short, rounded lobes (fig. 10A, B). The cloacal aperture may be very large, uncovering the branchial sac from the third to the sixth row of stigmata, or it may be reduced. A thin, short languet arises from the rim of the siphon (fig. 10A, B). The branchial sac has 11 to 12 rows of stigmata, each with seven to eight stigmata per side. The stomach, with five folds, occupies the middle of the digestive loop (fig. 10A). It is followed by a long

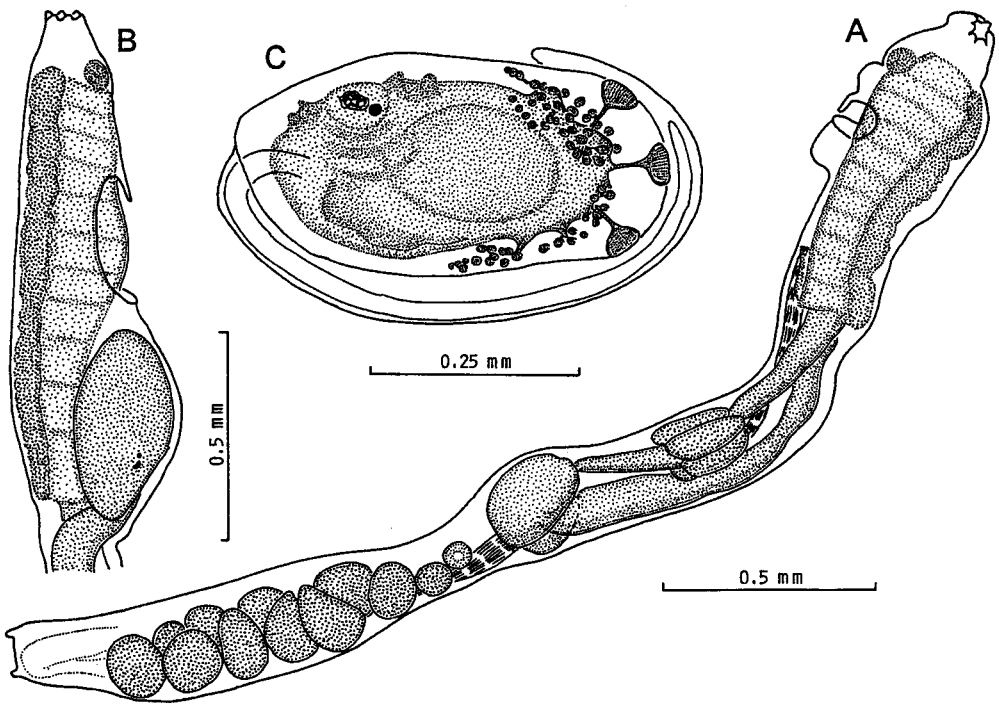

Figure 10. Aplidium solidum*: A, zooid; B, thorax; C, larva.*

and narrow straight segment clearly separated from the wider intestine. The anus opens at the level of the tenth stigmata row (fig. 10A). The post-abdomen is relatively short. The ovary is located immediately below the gut loop (fig. 10A), followed by eight to 12 testis vesicles in a line. The tip of the post-abdomen is cut straight across the abdominal axis and has two tiny horns (fig. 10A).

One or two larvae are brooded in the bottom of the cloacal cavity. When mature (fig. 10C), their oval trunk is 0.5 mm long. The three adhesive papillae have very thin peduncles. Two very small conical swellings separate them. On each side is a series of small irregularly distributed ampullae (fig. 10C). The tail is wound three quarters of the way around the trunk. An ocellus and an otolith are present.

Remarks. This species corresponds well to the description given by Kott (1992). The general organisation is rather similar to that of *Aplidium ritteri* (Sluiter, 1895), which differs in having small cloacal apertures and a different colony shape.

The geographical distribution of *A. solidum* is surprising, as this species has been recorded only from several parts of Australia. *A. solidum* (Ritter & Forsyth, 1917) has a very different appearance, is a different species and needs a new name.

***Ritterella dispar* Kott, 1957 (pl. 2C)**
Synonymy: see Kott, 1992: 406
Station: Tanzania, Zanzibar, Prison Island, mid-shore (Richmond coll.), MNHN A1 Rit 21

This species has been collected previously in Mozambique (Monniot & Monniot, 1976: 360). The present specimens agree well with other descriptions. The colour of living Zanzibar specimens was white and iridescent (pl. 2C).

***Ritterella tokiokai* Kott, 1992 (fig. 11; pl. 2D)**
Synonymy: *Ritterella pedunculata* Tokioka, 1953: 184, pl. IX fig. 1-4, Sagami Bay, Japan. *Ritterella tokioka* Kott, 1992: 402 nom. nov. for *R. pedunculata* Tokioka, 1953 preoccupied by Herdman, 1899 for *Psammaplidium pedunculatum*.
Stations: Tanzania, Pemba Island, 05°27.18'S-039°43.07'E, 15 m (CRRF coll.), MNHN A1 Rit 23. Mozambique, Ibo Island, several stations on coral reef between 5 and 20 m (Monniot coll.), MNHN A1 Rit 22.

All colonies of this species have a similar, characteristic appearance (pl. 2D). They are composed of lobes gathered into a clump arising from a common base. Each lobe has a hard narrow stalk covered with sediment and epibionts, and a soft, almost spherical head, with a naked, transparent orange tunic that reveals the zooids inside. The stalk reaches 3.5 cm in height; its basal diameter gradually increases to reach 0.8 cm under the head, which is neatly set off and may be 3 cm in diameter. The siphons are regularly placed in lines. Their slightly protruding apertures are each encircled by a brown ring (pl. 2D). The narrow abdomens and post-abdomens lie in the peduncle.

The zooids are orange in life. Both siphons are short with six pointed teeth (fig. 11A, B). About 30 oral tentacles of three size orders are distributed in three circles. The thoracic musculature is weak with thin longitudinal and transverse fibres. The branchial sac has 10 to 11 rows of stigmata, with 25 to 35 stigmata in a half-row, each row totally or partially cut by

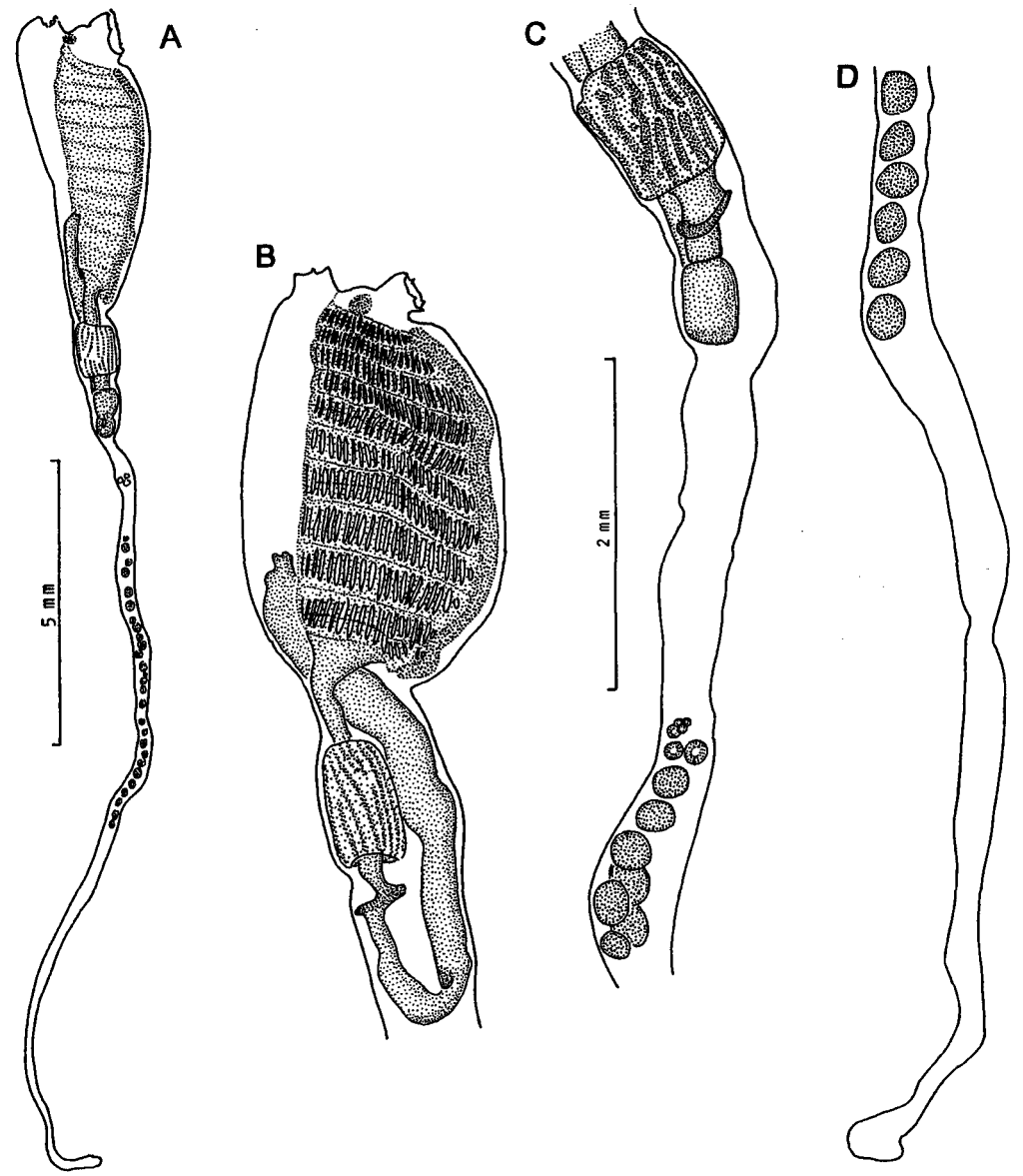

Figure 11. Ritterella tokiokai*: A, zooid; B, relaxed thorax and abdomen; C and D, disposition of gonads in the post-abdomen.*

a parastigmatic vessel (fig. 11B). The colonies studied had not reached full maturity; they probably would have developed more parastigmatic vessels in a later stage.

The abdomen generally is shorter than the thorax (fig. 11A). The wall of the cylindrical stomach has longitudinal thickenings, somewhat irregular or interrupted (fig. 11A, B, C); a transverse section shows about 15 of them. There is an annular post-stomach in the middle of a narrow segment of gut followed by a slightly enlarged mid-intestine, separated in turn by a

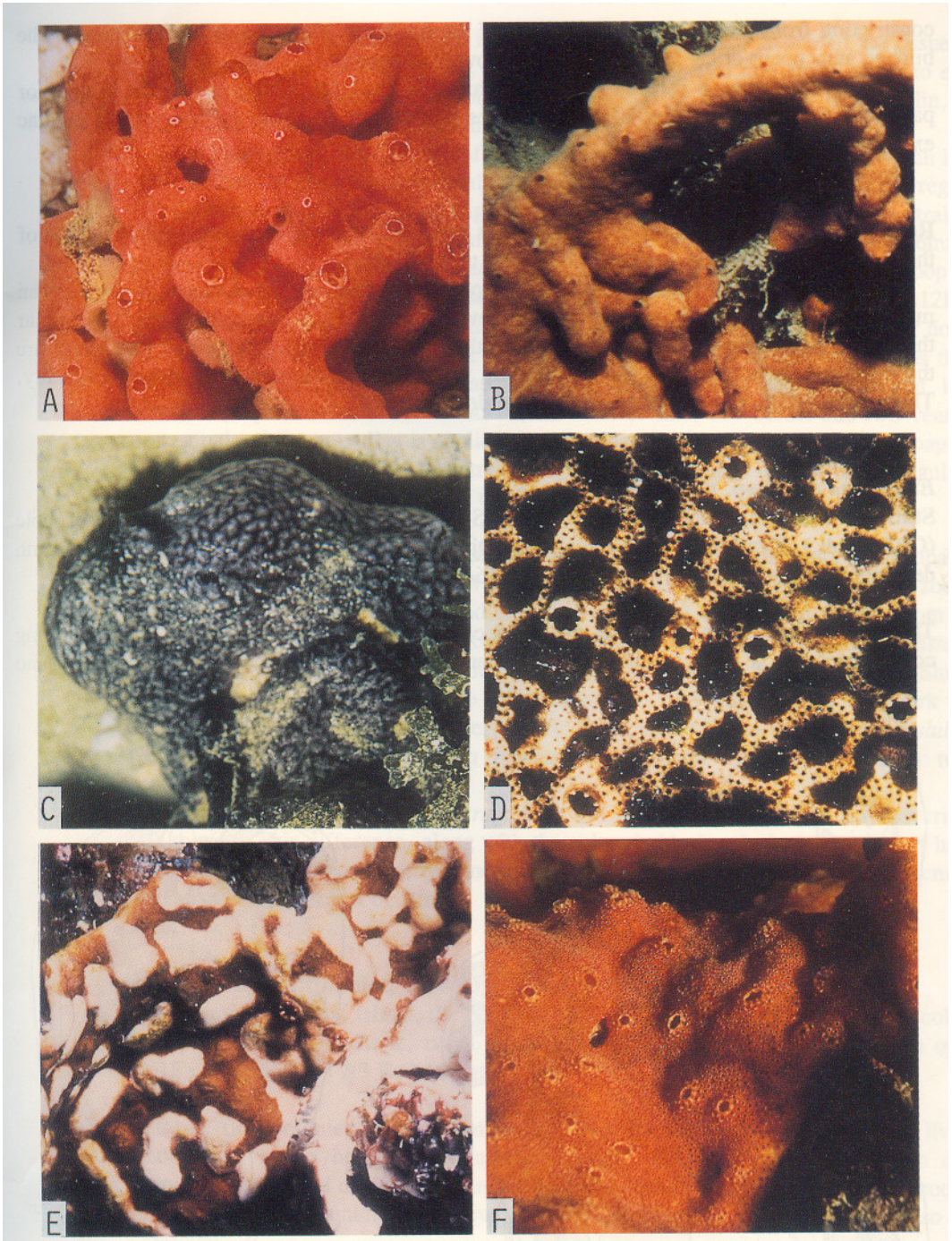

Plate 1. A, Didemnum contortum *sp. nov. B,* Didemnum dicolla *sp. nov. C,* Didemnum nocturnum *sp. nov. D, E, different patterns in* Polysyncraton millepore. *F,* Polysyncraton rostrum *sp. nov.*

constriction from the rectum at the bottom of the gut loop. There are two small caeca. The bilobed anus opens at the level of the eighth row of stigmata.

The post-abdomen is extremely long and thin (fig. 11C, D). The ovary lies in its anterior part, followed by a long line of testis vesicles that do not reach all the way to the cardiac extremity (fig. 11D).

No larvae were found.

Remarks: The spelling of the species name is modified to avoid confusion with the name of the author who had given a preoccupied name to this species.

The differences between Tanzanian and Japanese samples are not obvious. In our African material, the parastigmatic vessels are less developed and the stomach folds are less regular than those figured by Tokioka. The shape of the colonies and the structure of the zooids are the same and do not justify a separate species in spite of the distance from the type locality. This record is the only one since the original description.

***Eudistoma atrum* sp. nov. (fig. 12; pl. 2E)**

Stations: Tanzania, Pemba Island, 05°27.18'S-039°43.07'E, 8 m on coarse sand and rubble (CRRF coll.), Type: MNHN A3 Eud 163. Djibouti, Mescha Islands, 3 to 6 m, underneath dead coral (Monniot coll.), MNHN A3 Eud 164-165.

The colonies are 1 cm thick and up to 15 cm across. When touched, the rubbery living colony produces a large quantity of mucus and expels many zooids (pl. 2E). There is no

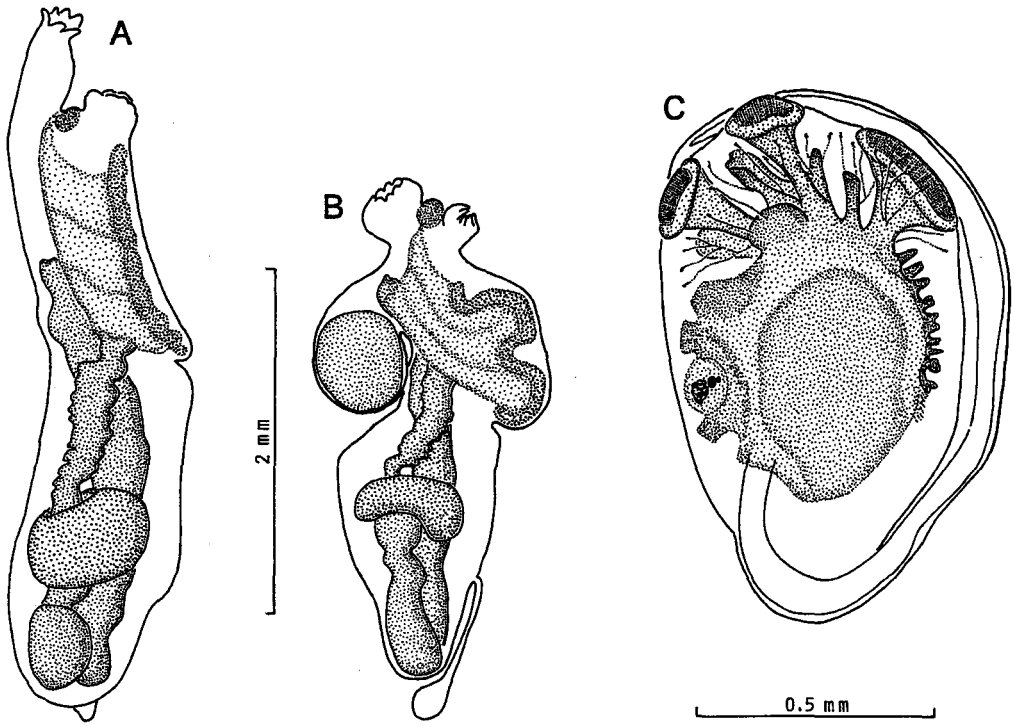

Figure 12. Eudistoma atrum *sp. nov.: A, B, two zooids; C, larva.*

embedded sediment. The colony surface is shiny and black (pl. 2E), as are all the tissues of this species (thus the species name). The oral siphons are arranged in a circle of six to eight simple holes around grouped cloacal siphons in the centre of a flat area. In formalin, the tunic turns opaque brown and the zooids dark brown.

The strong longitudinal musculature of the zooids greatly contracts the bodies, which have rather short abdomens even when relaxed (fig. 12A). Both siphons have six short, irregular lobes. The branchial sac has too many stigmata to count. The digestive tract forms a straight-sided loop (fig. 12A, B). The short, round stomach is followed by a conical post-stomach. The mid-intestine is enlarged. The gonads lie behind the stomach inside the gut loop, as usual. In all zooids a long vascular process extends from the side of the abdomen (fig. 12B).

One larva at a time is incubated in a dilated pouch that protrudes from the posterior dorsal part of the cloacal cavity (fig. 12B). The larval trunk measures 1.25 mm long. It has three large oval-tipped adhesive papillae in a line (fig. 12C). They are separated by three odd, leaf-shaped papillae perpendicular to the dorso-ventral anterior line, one dorsal and two ventral. In addition, a pair of flat ampullae is applied on each side of the most dorsal adhesive papilla. Irregular ampullae protrude from a ventral stem (fig. 12C). Many thread-like, irregularly branched filaments are distributed around the adhesive papillae (fig. 12C).

Remarks: *E. atrum* differs from *E. hospitale* by its opaque and softer tunic, its incubation mode and the size and structure of the larvae. It has no thread-like organism inside the zooid.

By its colour in life, and the size and shape of the larva, our species differs from the western Pacific specimens described by Kott, 1990 p. 220, and wrongly renamed *Eudistoma mucosum* nom. nov. If the material studied by Kott corresponds to *Polycitor mollis* Sluiter 1909, it must take the new name given to it by Hartmeyer, who was the first to remark that Sluiter's name was preoccupied by Ritter, 1900. The correct name is *Eudistoma sluiteri* Hartmeyer 1909. The name *Eudistoma mucosum* was given by Drasche (1883) to a Mediterranean species.

The larval structure of *Eudistoma atrum* does not correspond to that of any described *Eudistoma* species. This difference, along with the colony's black naked surface and its habit of producing abundant mucus, justify a new species. Its distribution seems to be extensive along the tropical eastern coast of Africa.

Eudistoma hospitale F. Monniot, 1998 (fig. 13A-C; pl. 2F)

Stations: Tanzania, Mnemba Island, 05°50.40'S-39°23.51'E, 15 m open reef, (CRRF coll.), MNHN A3 Eud 159. Leven Bank, north of Zanzibar, 05°38.20'S-39°19.00'E, 18 m open reef, (CRRF coll.), MNHN A3 Eud 160.

The very large, firm colonies reach 50 cm across and a thickness of 2 to 5 cm. Their living colour underwater was a brilliant ultramarine blue (pl. 2F) or black. Six to eight oral openings encircle conjoined cloacal apertures. Preserved, colonies are dark with black zooids in a somewhat translucent tunic. The opaque zooid tissues contain strong muscles, and so are much contracted.

The zooids' cloacal siphons are longer than their oral siphons (fig. 13A). Both are fringed with six round lobes. The very numerous tentacles could not be counted; they are of at least three orders of size on several circles. An unperforated space occupies the anterior part of the thorax (fig. 13A). The first stigmata row has about 30 stigmata and is curved dorsally (fig. 13A). The oesophagus is typically long. The posterior stomach has, on each side, a crest

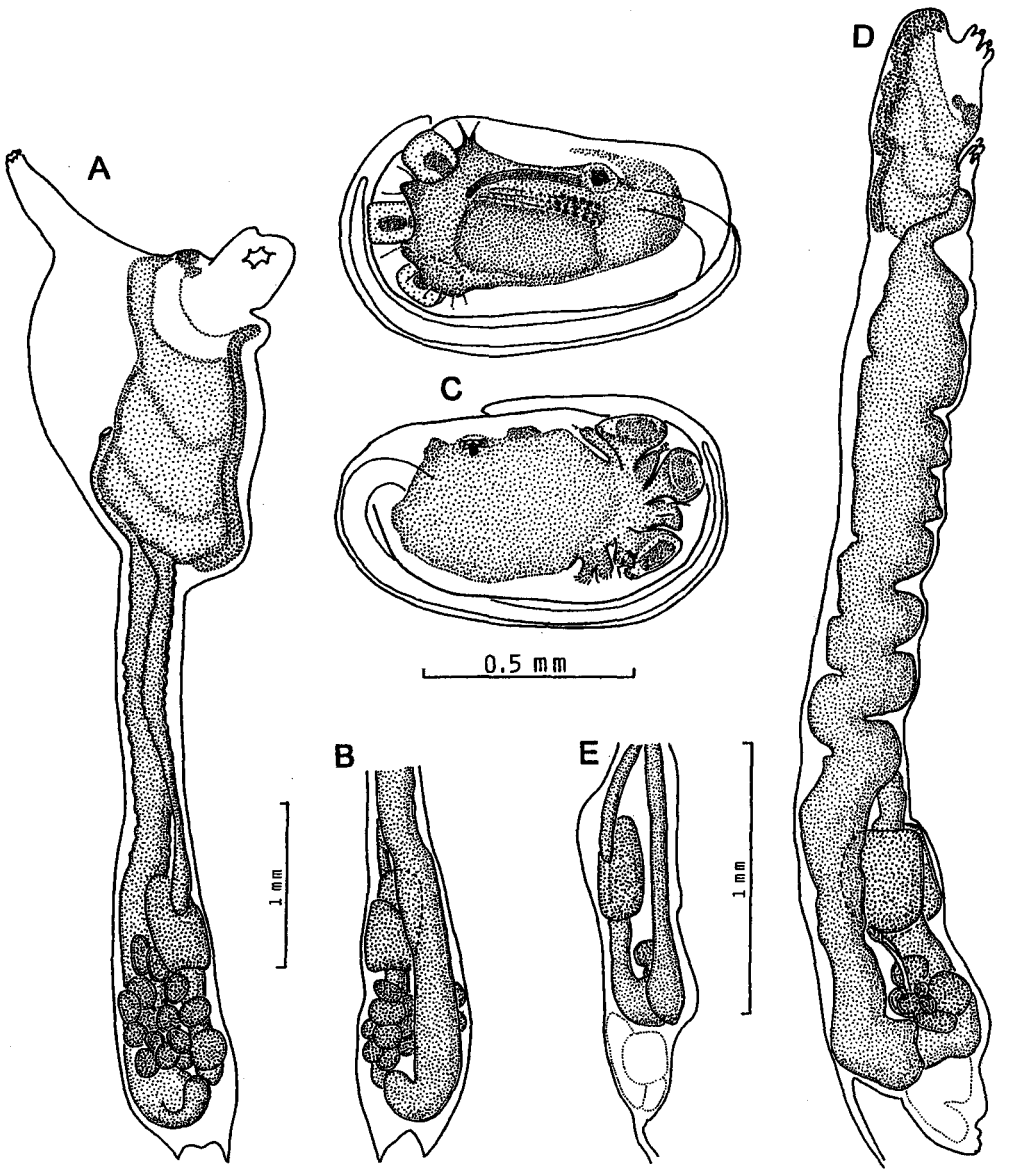

Figure 13. Eudistoma hospitale*: A, zooid; B, reverse side of the abdomen; C, larvae.* Eudistoma murrayi*: D, zooid; E, cardiac extremity of the abdomen.*

probably due to the contraction; in relaxed zooids the stomach section is square. The digestive loop is not twisted. In its curved part, the rectum begins with paired caeca (fig. 13A). The large round testis vesicles are contained in the gut loop below the stomach (fig. 13A, B). The ovary lies in the centre of the male vesicles.

We have found up to three embryos at different stages of development in the cloacal cavity. The tadpoles (fig. 13C) have a trunk 0.9 mm long. Three short, thick adhesive papillae are separated by two leaf-shaped vesicles. In addition there are a pair of dorsal flat papillae, two ventral protrusions and several thread-like prolongments nearby. An ocellus and

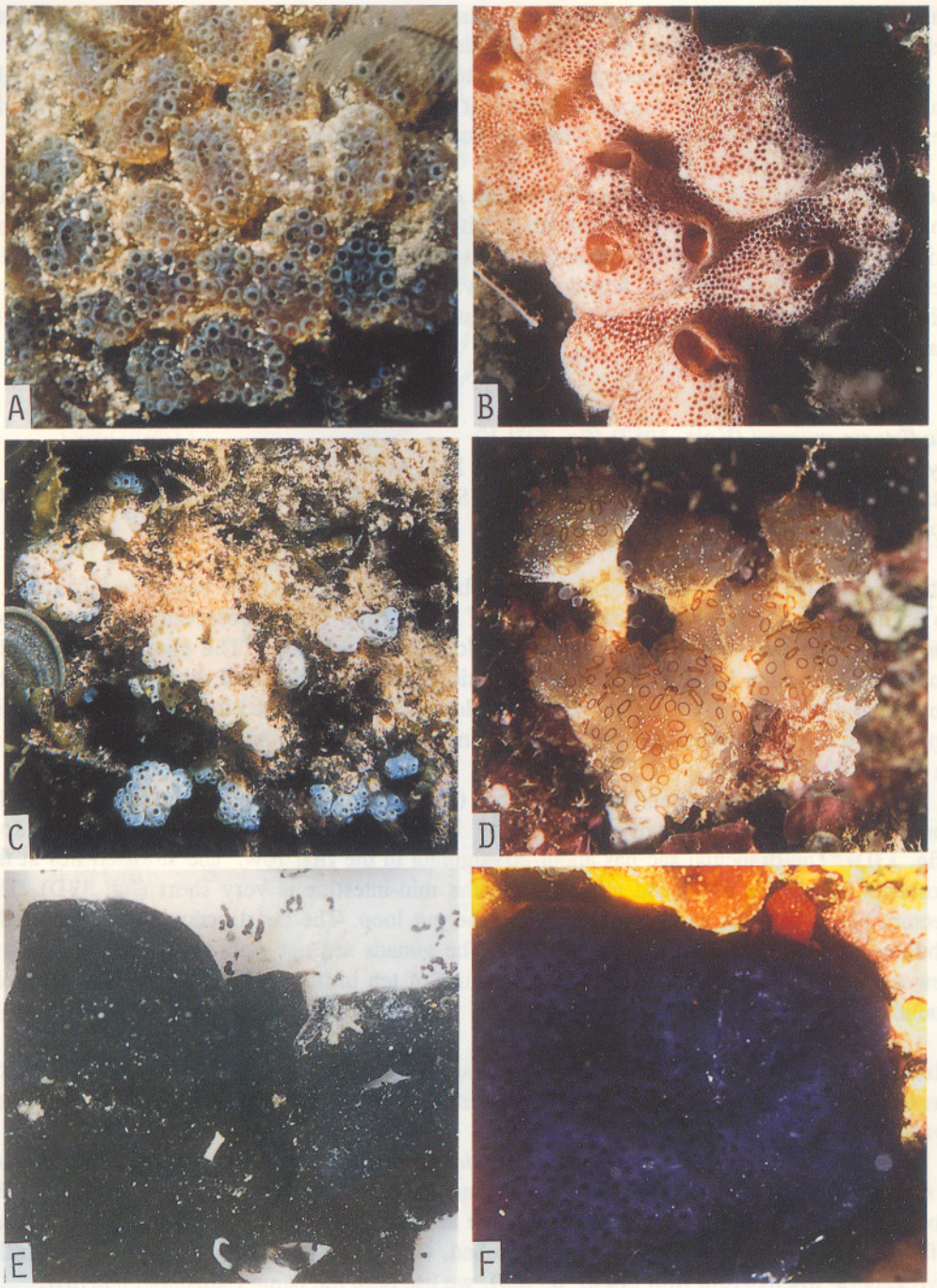

Plate 2. A, Aplidium colini *sp. nov. B,* Aplidium solidum. *C,* Ritterella dispar. *D,* Ritterella tokiokai. *E,* Eudistoma atrum *sp. nov. F,* Eudistoma hospitale.

an otolith are present, as are three rows of numerous stigmata. Two masses of refringent cells lie posteriorly at the base of the tail. All tissues of the larvae are deeply pigmented.

A thread-like organism occupies the posterior part of the abdominal cavity, densely coiled, but which does not reach the thorax. It is less developed than in colonies previously described from the western Pacific Ocean or South Africa (Monniot, 1998).

Remarks: The samples differ from *Eudistoma hospitale* of other localities by their deep blue colour. The larval structure, the association with a filiform organism, the very large size and thickness of the colonies with circular systems are exactly the same in all populations. The geographical distribution of *E. hospitale* is now very wide, from the western Pacific: Fiji and Chesterfield islands, to a large part of the western Indian Ocean from the Cape province to Tanzania.

***Eudistoma murrayi* (Kott, 1957) (fig. 13D-E)**
Synonymy: *Archidistoma murrayi* Kott, 1957: 134, Arabia
Station: Tanzania, Pemba Island, 05°23.45'S-039°37.86'E, 18 m sandy channel (CRRF coll.), MNHN A3 Eud 162.

The colonies are bushy clumps of elongated lobes, ramified from their base; the lobes are up to 35 mm long and have an apical diameter of 2 to 3 mm. When preserved, only the tips of the lobes poke out of the sediment that envelops their peduncles. The siphons open at the enlarged tips of the lobes. The colourless tunic is densely embedded with sand. Each lobe contains an average of 10 parallel zooids prolonged by one or two long vascular processes apiece that extend down to the base of the colony. The zooids themselves measure only 5 mm in length.

Both siphons are short and have six lobes (fig. 13D). The cloacal siphon parts from the thorax more posteriorly than usual, at the level of the second or third stigmata row (fig. 13D). The branchial sac has about 20 stigmata in the first row. The stomach lies at the posterior end of the elongated abdomen, so the mid-intestine is very short (fig. 13D). The rectum begins without caeca at the bend of the gut loop. The heart occupies the end of the abdomen below the gut loop (fig. 13D, E). The gonads are not well developed, and only a few testis vesicles are present, up to a maximum of ten inside the gut loop. No larvae were found.

Remarks: The shape and size of the colonies and the zooids correspond well to Kott's description. The new record extends the distribution of the species described from Arabian waters, south into the western Indian Ocean.

The difference between the genera *Archidistoma* and *Eudistoma* is not well defined. *Archidistoma* has zooids that are partially isolated as projections from the general mass of the common tunic, while the zooids of *Eudistoma* are grouped and totally included in that mass of common tunic even when the colony is lobed. On the basis of this distinction between the two genera, discussed in Kott (1990, p. 163), we use here the name *Eudistoma murrayi*.

***Polycitor africanus* sp. nov. (fig. 14; pl. 3A)**
Stations: Mozambique, Ibo Island, 20 m, Type MNHN A3 Pol A 24. Several stations around Ibo Island, 5 to 20 m, MNHN A3 Pol A 25 (Monniot coll.). Tanzania, west side of

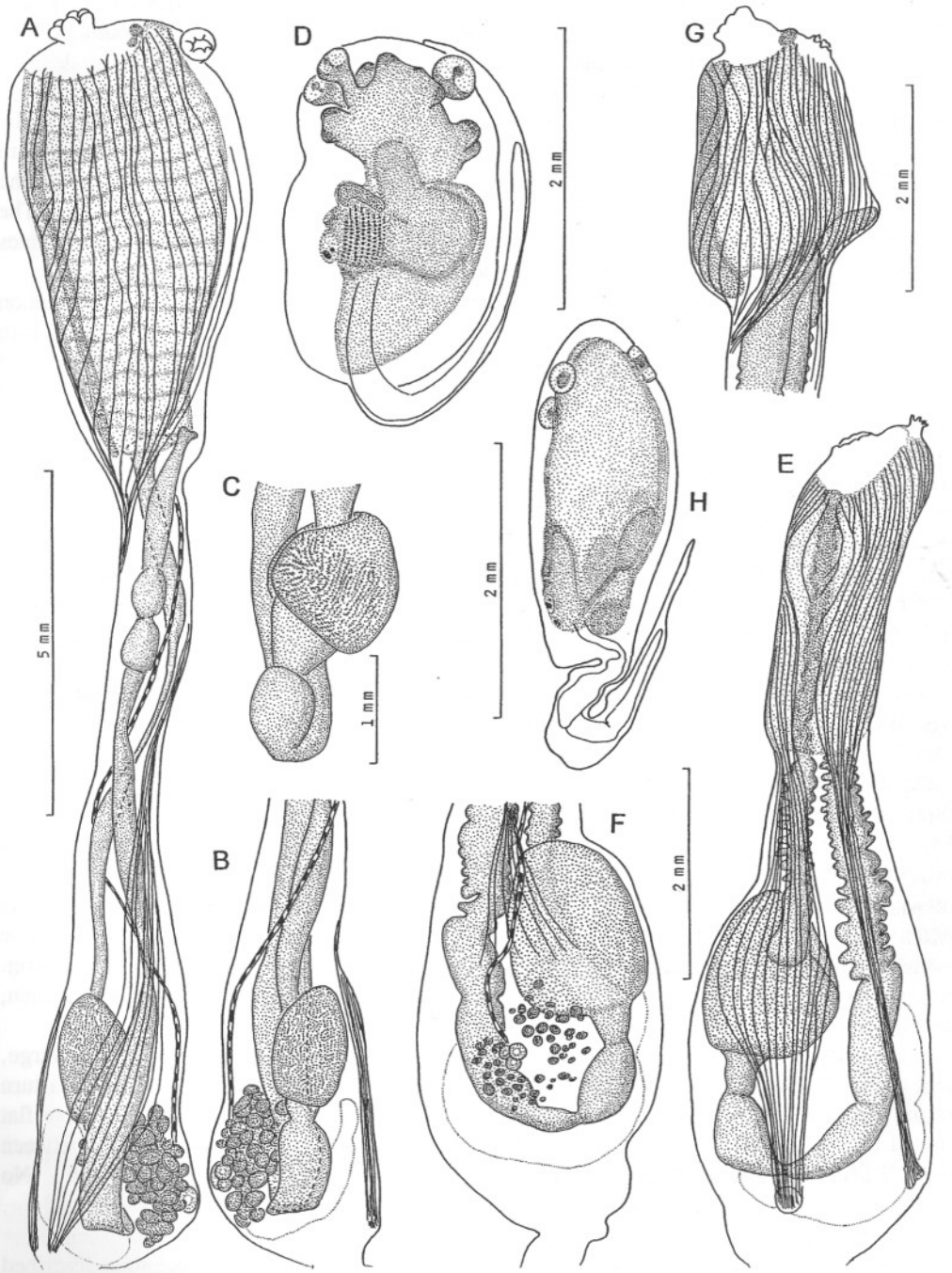

Figure 14. Polycitor africanus *sp. nov.: A to D: material from Mozambique: A, zooid; B, other side of zooid A; C, stomach; D, larva. E to F: material from Tanzania: E, zooid; F, gonads; G, thoracic muscles; H, larva.*

Pemba Island, 05°14.42'S-039°35.61'E, 30 m, outer reef (CRRF coll.), MNHN A3 Pol A 21. Madagascar, Nosy-Be, 30 m (Laboute coll.), MNHN A3 Pol A 22. South Africa, Sodwana Bay, Nine Mile Reef (Schleyer coll.), MNHN A3 Pol A 23.

The colonies are sessile or pedunculate cushions (pl. 3A) reaching 8 cm in diameter. The stalk, when present, is short; it does not exceed 1.5 cm under the largest head, which is 3 cm thick. The colour in life is always yellowish white with a pale green iridescent tint on the upper surface (pl. 3A). The zooids open in lines converging at the top of the colony. The cartilaginous tunic is not transparent. It does not contain sediment particles but sometimes harbours green symbiotic bodies.

The zooids are large when relaxed but are generally deeply withdrawn into the common tunic. Both siphons are short with six round, petal-like lobes. The body wall is thick with greenish iridescent cells that are also very abundant in the branchial tissue. There are several red or yellow pigment spots: one above the neural ganglion, one at the base of each oral lobe, six distributed on the ring of oral tentacles. This pigment disappears in formalin. There are four long oral tentacles, and between them a variable number of smaller ones, 16 to 32 in all, in two or three orders of size. The strong thoracic musculature (fig. 14A, E, G), mostly longitudinal, makes about 15 to 20 bundles on each side. These muscles are gathered into two bands along the abdomen, anchoring at the cardiac extremity (fig. 14B, E).

The branchial sac has 18 to 22 rows of about 60 elongated stigmata apiece on each side (in the middle of the thorax). The transverse vessels form prominent blades. The dorsal languets become progressively longer down to the oesophagus but are only slightly displaced to the left side.

The abdomen is elongated, thickened in the posterior part by the stomach and gonads (fig. 14A, B). The heart is terminal. One or two short vascular processes, without muscles, arise from the tip of the abdomen. The oesophagus is a flat ribbon. The stomach has no folds; when stained, very small convoluted thickenings appear in its wall (fig. 14B, C). In contracted specimens irregular, large gastric plications occur. There is a conical post-stomach. An olive-shaped mid-intestine (fig. 14C, E, F) is separated by a strong constriction from the posterior intestine, which is enlarged at its beginning but lacks caeca (fig. 14E, F). Just below the thorax, the rectum has two short swollen compartments independent of the gut content (fig. 14A). The bilobed anus opens two or three stigmata rows above the base of the branchial sac. The testis is made of numerous round vesicles and the ovary is central (fig. 14B, F). A large amount of reserve cells often embeds the posterior part of the abdomen, making it difficult to study.

The embryos are incubated in the whole length of the abdomen. Mature larvae are large, their trunk 2.5 mm long (fig. 14D, H), with a short tail that makes only a quarter of a turn around the trunk. The larva has three adhesive papillae in a triangle, separated by large flat bilobed vesicles (fig. 14D). The neural vesicle with its ocellus and otolith protrudes between the well-formed siphons. Several rows of stigmata are already developed in this larva. No larval buds were found.

Remarks: This *Polycitor* species differs by the following characters from the four described species that have 18 or more stigmata rows:

- *Polycitor adriaticus* (Drasche, 1883) from the Mediterranean Sea was recently studied by Brunetti (1994). It has an areolated stomach wall and the larvae are incubated in the thorax.

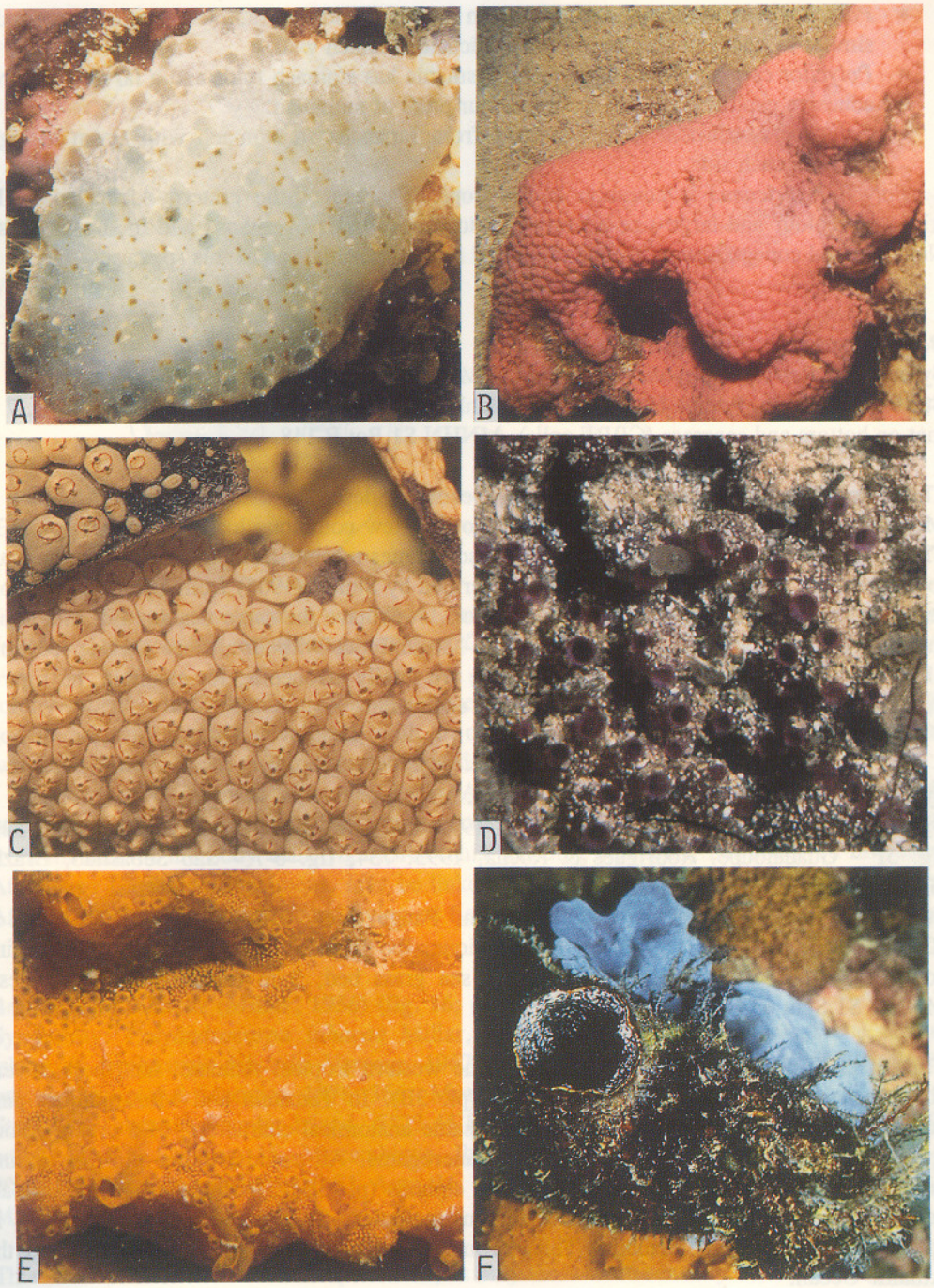

Plate 3. A, Polycitor africanus *sp. nov. B, C, different colours of* Symplegma rubra. *D,* Amphicarpa inhacae. *E,* Botryllus gregalis. *F,* Polycarpa mytiligera.

- *Polycitor circes* Michaelsen, 1930 from Australia and the southwest Pacific is the most similar to this new species but has a plicated stomach wall.
- *Polycitor columna* Kott, 1954 from Tasmania has stomach folds and a larva with three adhesive papillae in a line, between four pairs of ampullae.
- *Polycitor renziwadai* Tokioka, 1952 from Japan has a stomach with seven to eight folds on each side.

Polycitor africanus is common in the tropical waters of the eastern Africa coast. Its iridescent colour and large size advertises it to divers under overhangs and in shaded areas. Notodelphyid copepods were frequently found in the branchial sac of this species.

***Botryllus gregalis* (Sluiter, 1898) ? (pl. 3E)**
Synonymy: *Botryllus gregalis* ?: Monniot & Monniot, 1997: Bahrain.
Station: Tanzania, Pemba Island, Shalufu Bank 1 mile offshore, 5°26.58'S-39°39.43'E, 7 m mat on bottom and seagrass (CRRF coll.), MNHN S1 Bot B 148.

This sample has the same characters as specimens described from Bahrain (Monniot & Monniot, 1997), especially the presence of notably few common cloacal apertures (pl. 3E). The zooids are arranged in circular, oval, or sometimes meandriform systems where they are joined on their ventral side. The colonies described by Sluiter (1905) from Djibouti and more recent material from Djibouti (Auracea mission 1996) have the same design. But this is not the case with the type specimen, collected in Mozambique without a more precise location. Sluiter's description and drawings of the type are totally erroneous; for example, he figures this *Botryllus* with five longitudinal vessels on each side!

***Symplegma rubra* Monniot, 1972 (fig. 15; pl. 3B, C)**
Synonymy: *Symplegma rubra* C. Monniot, 1972: 622, fig. 2E-F, 3 - Bermuda; 1983: 429, fig. 3F - Guadaloupe. Rodrigues & Rocha, 1993: 734, fig. 6-7 - Sao Sebastiao, Brazil. Goodbody, 1993: 36 - Jamaica.
Stations: Tanzania, West of Zanzibar town, Pange Reef, 6°09.45'S-39°09.30'E, 18 m (CRRF coll.), MNHN S1 Sym 60. Mozambique, Ibo Island, south of Matemo 20 m (pink colonies), MNHN S1 Sym 61. Ibo Island, sea grass bed, 3 m (cream-yellow colonies), MNHN S1 Sym 63 (Monniot coll.).

This species, previously known only from the western tropical Atlantic, has there a very characteristic opaque, uniform pink colour (pl. 3B). In Tanzania and Mozambique, pink colonies were collected, but others, with the same anatomical characters, of a cream colour (pl. 3C), were found attached to marine phanerogams. All zooids, either pink or cream-yellow, show a dorsal red ring crossing both siphons (pl. 3B, C) which is obvious on pale zooids, but sometimes hardly visible on pink colonies. This pigmentation disappears in specimens preserved in formalin. This chromatic polymorphism was not observed in the Atlantic Ocean.

The species has the peculiarity, in each colony, to clearly alternate well separated male and female stages. In colonies in male phase, the testes are voluminous in two lobed masses, while the ovary is present only with very small oocytes (fig. 15B). In the female and brooding phase, the ovaries contain simultaneously young and mature oocytes (fig. 15A); only a trace then remains of two empty testis vesicles and a long sperm duct (fig. 15C). One

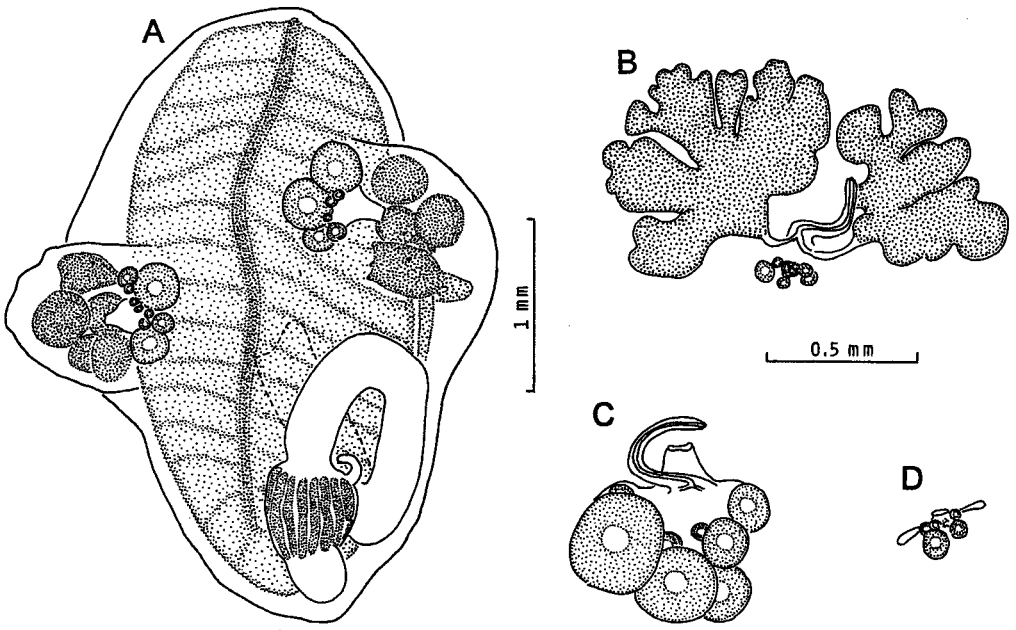

Figure 15. Symplegma rubra*: A, ventral side of a zooid with embryos; B, male gonad; C, fully developed ovary with a remaining sperm duct; D, young gonad.*

colony collected in Mozambique was simultaneously female and budding. In young zooids the gonads are only slightly developed, with an ovary comprising numerous small oocytes and two testis lobes without visible spermatogenesis (fig. 15D).

Very small differences separate western Atlantic and eastern African specimens. In the latter, the zooid's stomach is slightly shorter and the tadpoles develop in a pouch protruding from the side of the body wall (fig. 15A). This brooding character, not observed in western Atlantic or Caribbean specimens, may be linked to the very widely spaced pattern of eastern African zooids, which were found living on flat bivalve shells.

***Amphicarpa inhacae* (Millar, 1956) (fig. 16; pl. 3D)**

Synonymy: *Polyandrocarpa inhacae* Millar, 1956: 927, fig. 14 - Mozambique, Inhaca Island. ? *Amphicarpa inhacae*: Vasseur, 1967: 112, pl. 4, fig. 26-29 - Mauritius. *Stolonica inhacae* Monniot & Monniot, 1976: 366 - Mozambique, Inhaca Island.

Stations: Tanzania, Pemba Island, 5°23.45'S - 39°37.86'E, 18 m sandy channel. (CRRF coll.), MNHN S1 Amp 15. Mozambique, Ibo Island, Matemo cliff and outer reef, 10 to 20 m (Monniot coll.), MNHN S1 Amp 16. Mozambique, Inhaca Island (Bouillon coll.), MNHN S1 Amp 3.

This description is of Ibo Island specimens, as only these were sexually mature.

The zooids are small spheres about 0.7 mm in diameter linked by a web of stolons. The thin tunic is covered with sediment or debris. In living animals the tunic is purple (pl. 3D), but in formalin it turns dark brown. The shape of the stolons varies with the substrate: in colonies living at Ibo or Inhaca Island on the outer reef, the stolons are short and thin and the

zooids are not pedunculate. But on sand, in Tanzania, the stolons are long and thicker, and the specimens appear as pedunculate.

The oral siphon is partially closed by a velum with an undulating rim. About 35 tentacles, in three orders of size, project below this velum. They are short, none exceeding the height of the velum (fig. 16B). The pre-pharyngeal ring has a single crest and makes a deep dorsal V. The dorsal tubercle (fig. 16B) forms a long antero-posterior slit. The neural gland forms an irregular mass on each side of the ganglion not as well defined as figured by Millar (1956) and Vasseur (1967). The dorsal lamina is high and long.

The branchial sac varies according to the specimen. Folds 1 and 3 on each side are always well developed, with seven to 10 longitudinal vessels each. Fold 2 on the left side is absent, replaced simply by a higher longitudinal vessel. Fold 2 on the right has three to five vessels but remains lower than folds 1 and 3. Folds 4 are only present in the anterior half of the branchial sac, and they may be absent. On the right side of the dorsal lamina, posteriorly,

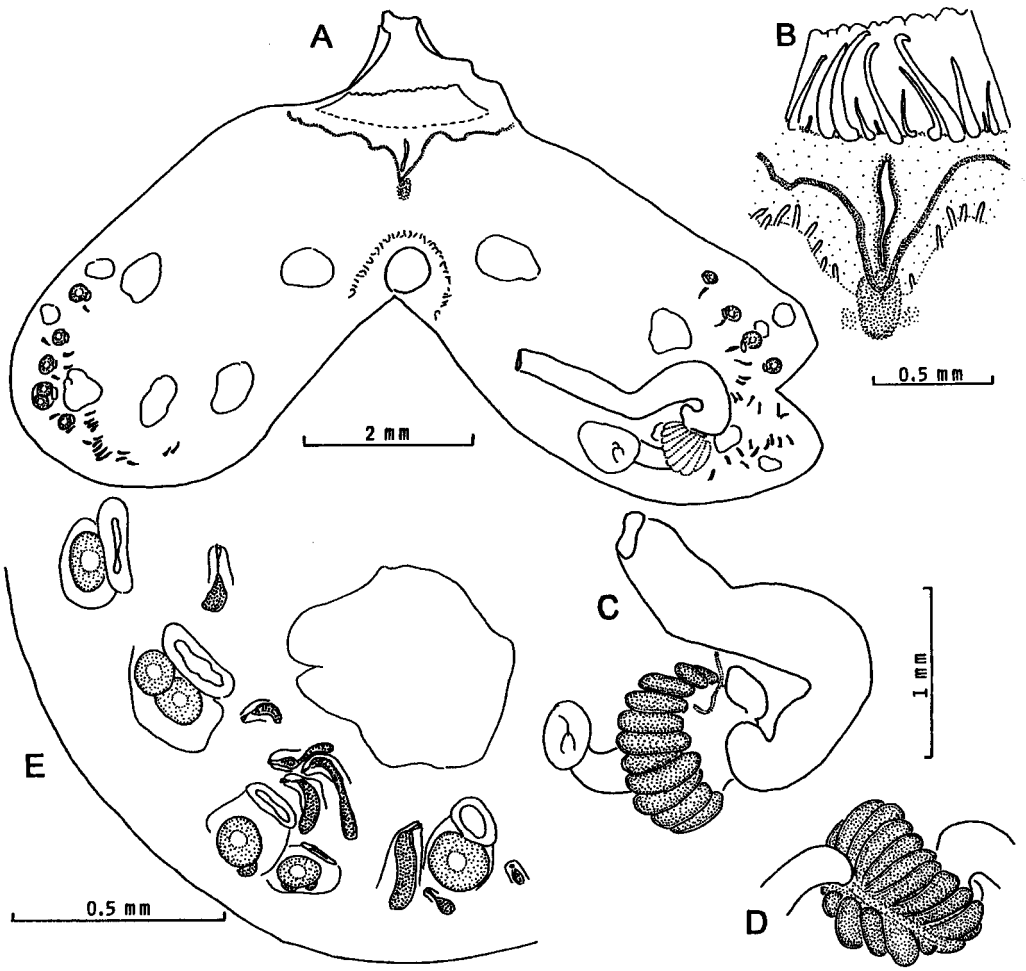

Figure 16. Amphicarpa inhacae*: A, body opened along the ventral side; B, neural region; C and D, stomach; E, gonads.*

one or two longitudinal vessels appear between the dorsal lamina and the first fold. Between the folds are three to four vessels. The branchial meshes are elongated and have two to three stigmata apiece (one to two on the folds), regularly cut by a parastigmatic vessel.

The gut (fig. 16A, C) forms an open loop. The stomach is wider than it is long (fig. 16C, D), with 18 neat, short folds. The caecum is large, protruding and curved. The intestine ends in a wide anus with a plain rim. The length of the intestine depends on the shape of the zooid and its disposition on the substrate.

There is a line of ovaries on each side in the posterior part of the body (fig. 16E). The ovaries are protruding, with few oocytes, and each ovary has a large papilla. The testes are distributed haphazardly around the ovaries and under the gut. Each is a simple, comma-shaped, erect vesicle tipped by a small papilla. There is a large endocarp on each side of the cloacal siphon and some others scattered posteriorly, more numerous on the right side. The cloacal siphon is encircled by a ring of thin tentacles.

The larvae, no more than two in a zooid, are large, with trunks up to 1 mm long, with three adhesive papillae encircled by a crown of long ampullae.

Remarks: The genera of polystyelid ascidians are defined by the disposition of the male and female gonads on both sides of the body. Millar (1956) placed the present species in the genus *Polyandrocarpa* but he had only immature specimens to examine and so was unable to determine the gonadal structure.

In 1976 we examined Inhaca Island specimens (Bouillon coll.) in which zooids were at the beginning of sexual maturity but with larvae. We found ovaries only on the right side and in a single line, persuading us to place this material in the genus *Stolonica*.

Vasseur (1967) described from Mauritius a compact colony with somatic characters similar to those reported by Millar and a gonadal disposition characteristic of the genus *Amphicarpa*. But Vasseur's species identification remains doubtful, as he figured long and narrow oviducts, ovaries on the right but not in a line, and all the testes posterior to the ovaries.

The material in the present collections from northern Mozambique and Tanzania corresponds well to the Inhaca Island specimens in all somatic characters and also in the gonadal distribution.

***Polycarpa mytiligera* (Savigny, 1816) (fig. 17; pl. 3F)**

Synonymy: *Cynthia mytiligera* Savigny, 1816: 98, pl. 8, fig. 2 - Suez. *Polycarpa mytiligera*: Hartmeyer, 1916: 208, fig. 1-2 - Red Sea; Monniot C., 1973: 55, fig. 3A - Eilat. non *Polycarpa mytiligera* ?: C. Monniot, 1987: 284, fig. 4 - New Caledonia.

Stations: Tanzania, west side of Pemba Island, 27 m, outer reef 5°14.01'S - 39°35.61'E, (CRRF coll.), MNHN S1 Pol. B 369. Mozambique, Ibo Island, outer reef (Monniot coll.), MNHN S1 Pol. B 370.

Among the *Polycarpa* species in the western Indian Ocean, *P. mytiligera* is the largest, reaching 10 cm. In the Mozambique region it is found on vertical walls of dead corals. The tunic of this species is dark brown, covered with the same epibionts as are found on the substratum around it, so only its shape reveals the ascidian's presence. When its siphons are open, their rims have a thin orange line. The internal tunic of the siphons is black with white spots in Tanzania (pl. 3F), but is uniformly black in Mozambique samples. The tunic often shows longitudinal ridges on the body, but it is not especially stiff. The internal layer of the

tunic is soft and whitish. The body wall, at least 1 mm thick, is opaque, filled with dark brown muscles and sometimes pale, but more often with dark grains protruding from both its external or internal sides.

The following description is based on the Mozambican samples. The oral tentacles, up to 40, are irregularly spaced and may be missing on the ventral side. The prepharyngeal groove is close to the tentacular ring and the branchial sac; it consists of a flat pad anteriorly and a crest posteriorly. Dorsally it is curved to enclose the dorsal tubercle (fig. 17), which has a spongy appearance but few openings. The low dorsal lamina begins 2 to 3 mm behind the dorsal curve of the prepharyngeal band, and ends suddenly before the entrance to the oesophagus.

The branchial sac has four low folds. On the right side we counted an internal longitudinal vessel formula as follows: E. 3 (13) 6 (16) 4 (17) 5 (15) 5 D.L.

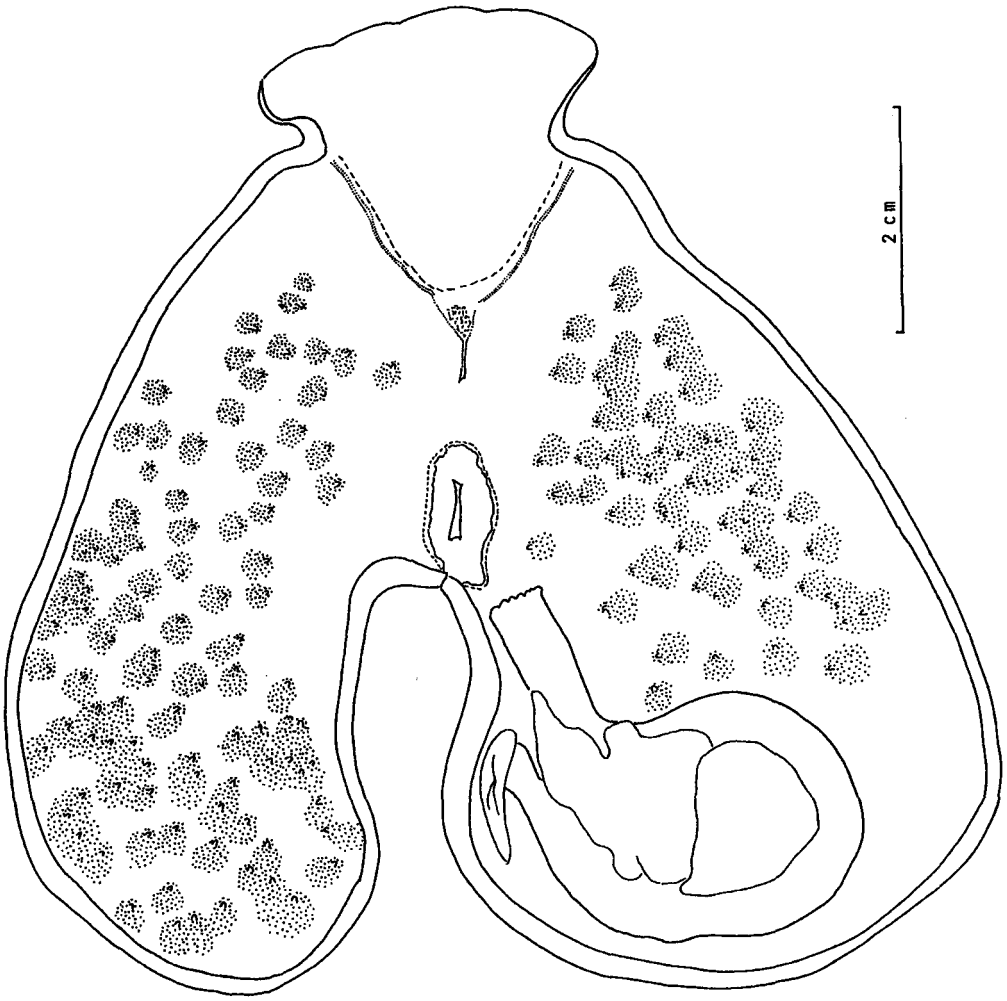

Figure 17. Polycarpa mytiligera*: body opened along the ventral side.*

The first vessel on the right side is a little more developed than the others and remains parallel to the dorsal lamina. In the posterior part of the branchial sac, the vessels on the right side are tighter together but do not form a protruding fold. At the level of the oesophagus, the folds fade away and the vessels end without papillae. There are up to 15 oval stigmata per mesh between the folds and five to eight on the folds. There are no parastigmatic vessels.

The gut (fig. 17) forms a closed loop with a faint secondary curve. The stomach is slightly enlarged, with a smooth wall. The anus is widely open and has a scalloped rim.

The gonads, about 100 on the right side, are totally included in the thickness of the body wall (fig. 17). Each comprises a central ovary and a radiating cluster of testis lobes. The male and female ducts open at the body wall surface on slightly protruding papillae, close to each other. When the gonads are fully developed they distort the body wall, which then appears as cut into irregular polygonal areas, each containing several gonads.

There are generally two flat endocarps, but sometimes only one, in the gut loop. A fleshy crest with small tentacles encircles the internal base of the cloacal siphon.

Remarks: This species looks very much like *Polycarpa pigmentata* (Herdman, 1906), described from New Caledonia (Monniot, 1987: 283, fig. 3) and from New Guinea (Monniot & Monniot, 1996: 252, fig. 54A-B, pl. 9E). Its appearance is similar in the field, with the same orange ring on the siphons. The only marked difference is the number of gonads: about 10 on each side in New Guinea, 30 in New Caledonia, and about 100 in the western Indian Ocean.

Some small differences exist between specimens from Tanzania and Mozambique, on the one hand, and specimens from the northern Red Sea, on the other (Monniot, 1973). The latter, 8 cm in length, have a maximum of 13 sinuses per fold instead of 17, and their rectum is somewhat longer.

***Polycarpa nigricans* Heller, 1878**

Synonymy: see Monniot and Monniot 1996: 258.

Stations: Tanzania, 15 m channel between Makongwei and Pemba Island, 5°23.45'S-39°37.86'E (CRRF coll.), MNHN S1 Pol B 368. Mozambique, Ibo Island, South of Matemo, 5 to 20 m outer reef and cliff (Monniot coll.), MNHN S1 Pol B 373.

This species sometimes occurs in clumps extending over several dm^2 or specimens can live quite isolated from each other. The colour in life is reddish brown, but this is often hidden by epibionts. The siphons have four lobes with a ring of pale points at the aperture rim, the internal tunic is black. When fixed, the whole tunic, inside and out, turns black.

Remarks: In 1996 we separated *P. nigricans sensu stricto* from *P. tokiokai* Monniot and Monniot, 1996; these were previously confused as one species. The two species are similar in their external appearance and in most parts of their anatomy, but they differ clearly in the disposition of the gonads. In *P. tokiokai* the gonads protrude markedly into the cloacal cavity, and each of them is linked to the branchial tissue by a dermato-branchial strand. In *P. nigricans* the gonads protrude only slightly or they are completely included in the body wall, and the dermato-branchial strands are not linked to the gonads.

ADDITIONAL RECORDS

Several other ascidian species with a wide geographical distribution are present along the Tanzanian coast:
Lissoclinum bistratum (Sluiter, 1905)
Diplosoma listerianum (Milne-Edwards, 1841)
Didemnum granulatum Tokioka, 1954
Didemnum molle (Herdman, 1886)
Didemnum perlucidum Monniot F., 1983
Didemnum psammathodes (Sluiter, 1895)
Polyclinum constellatum Savigny, 1816
Eudistoma amplum (Sluiter, 1909)
Sigillina signifera (Sluiter, 1909)
Styela plicata (Lesson, 1830)

GEOGRAPHICAL REMARKS

Among the 31 species collected in Tanzania and reported here, 22 were previously known, some solely along the east coast of Africa, others over wider areas, and a few worldwide. The general paucity of ascidians collected so far from eastern Africa does not let us use this taxon to characterise biogeographic provinces in that part of the Indian Ocean, but some distributional patterns of the ascidians themselves nonetheless can be discerned.

There is a globally distributed ascidian fauna inhabiting harbours and other largely manmade habitats throughout the tropical oceans. Among this fauna we have identified: *Didemnum granulatum, Didemnum perlucidum, Didemnum psammathodes, Diplosoma listerianum, Polyclinum constellatum, Sigillina signifera, Styela plicata.* These cosmopolitan species account for more than a fifth of the species diversity in the current collections.

Other Tanzanian ascidians occur elsewhere in the Indian Ocean and the western Pacific including the Great Barrier Reef. They are: *Didemnum molle, Lissoclinum bistratum, Aplidium solidum, Ritterella dispar, Eudistoma amplum, Eudistoma hospitale. Ritterella tokiokai*, previously known only from Japan, now can be added to this list.

The distribution of *Symplegma rubra* is more peculiar. This species, now recorded from Tanzania, earlier had been found in the western Atlantic: Bermuda, Guadeloupe, Jamaica, and Brazil.

All these widely distributed species taken together make up almost half of the species collected so far in Tanzania. It is remarkable that among these wide-ranging species, only two are non-aplousobranch and only one (*Styela plicata*) is solitary.

Some ascidians that are restricted to the western Indian Ocean nonetheless occur along much of the eastern African coast, from the Arabian Peninsula to Mozambique. This is the case with *Didemnum yolky, Eudistoma murrayi, Botryllus gregalis, Polycarpa mytiligera.* A few Tanzanian species are also found to the east, in Mauritius: *Polycarpa nigricans* and *Amphicarpa inhacae.*

Even though nine new species (of the 31 species collected) are described here, one cannot conclude that a high rate of endemism characterises the ascidian fauna of Tanzania and Mozambique. The novelty of the eastern African fauna found so far probably reflects in part simply the novelty of modern searches for it along these shores and elsewhere in the tropical Indian Ocean. We believe further studies will probably show that an important biogeographic

frontier separates the warm-water eastern African fauna from that of the colder waters of South Africa. Otherwise it appears that the ranges of ascidian species found in Tanzania and Mozambique mostly extend elsewhere in the various ways we have suggested.

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