THE AUSTRALIAN ASCIDIACEA, PHLEBOBRANCHIA AND STOLIDOBRANCHIA, SUPPLEMENT

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This supplement to the Australian Ascidiacea Part 1 (Kott 1985) is based largely on new collections of material from southwestern and southeastern Australia (Albany and Western Port), and southeastern and northern Queensland (Moreton Bay and Torres Strait). New species of the genera *Perophora*, *Polycarpa* (2), *Eusynstyela*, *Polyzoa* (2), *Botryllocarpa* and *Pyura* are described. The previously known geographic range in Australia is extended for *Microgastra granosa*, *Cnemidocarpa tripartita*, *Polycarpa aurita*, *P. flava*, *P. lucilla*, *P. nota*, *P. plenovata*, *Polyandrocarpa sparsa*, *Stolonica australis*, *S. nodula*, *S. reducta*, *Metandrocarpa miniscula*, *Botryllus stewartensis*, *B. tuberatus*, *Pyura tasmanensis*, *P. arenosa*, *Halocynthia papillosa*, *Microcosmus madagascarensis*, *M. planus*, *M. stoloniferus*, *Hartmeyeria formosa*, *Molgula calvata*, *M. incidata*, *M. rima*, *Eugyra millimetra* and *Pareugyrioides exigua*. The deep water Antarctic *Cnemidocarpa barbata*, and western Pacific *Microcosmus curvus* are newly recorded from Australia. Additional morphological data for many of these species and for *Ctenicella antipoda*, and new ecological data for *Polycarpa fungiformis* is recorded. □ *Indo-West Pacific, Ascidiacea, Phlebobranchia, Stolidobranchia, biogeography.*

Patricia Kott, Queensland Museum, PO Box 300, South Brisbane, Queensland, 4101, Australia: 7 July, 1988.

Ascidians of the suborders Phlebobranchia and Stolidobranchia were reviewed by Kott (1985). Examination of more recently collected, as well as previously unsorted material has expanded the known geographic range of some species, and has added new records and new taxa to the known Australian fauna. This information supplements that presented by Kott (1985).

New records, or newly observed variations in morphology, are presented only where these are outside previously known ranges. For detailed data on distribution, the registration records of Australian museums must be consulted.

Museum registration numbers are given for all examined material. Abbreviations used are AM (Australian Museum), SAM (South Australian Museum), QM (Queensland Museum) and MV (Museum of Victoria).

Suborder PHLEBOBRANCHIA Lahille, 1887

Family PLURELLIDAE Kott, 1973
Genus **Microgastra** Kott, 1985

Microgastra granosa (Sluiter, 1904)

Ascidia granosa Sluiter, 1904, p. 36.
Microgastra granosa: Kott, 1985, p. 70 and synonymy.
Ascidia (?) *aenigmatica* Nishikawa, 1986, p. 177.

DISTRIBUTION

NEW RECORDS: Queensland (Moreton Bay, QM GH3891 GH3896), specimens were taken at about 6m attached to loose coral rubble on a sandy substrate off Dunwich, Stradbroke I.

RECORDED RANGE: Moreton Bay and north along the east coast of Australia, Indonesia, Sri Lanka. With the recognition of *Ascidia aenigmatica* Nishikawa as a synonym the species range is extended to Japan.

DESCRIPTION

The newly recorded specimens are laterally flattened, the left side lying on the substrate, and the right side raised into a low dome. The atrial aperture is halfway along the body toward the side of the upper low dome-shaped surface. Entire specimens are from 1 to 2cm long. A fragment of a larger specimen consisting of a long (2cm) atrial siphon and part of the test and body wall at its base indicates that larger specimens do occur.

Family PEROPHORIDAE Giard, 1872
Genus **Perophora** Wiegmann, 1835

Perophora sabulosa n.sp.
(Figs 1,2)

DISTRIBUTION

TYPE LOCALITY: Queensland, Moreton Bay off Dunwich, dredged 6m, coll. P. Kott, 26.8.86, holotype QM GH3894, paratypes QM GH3902; Point Lookout, North Stradbroke I., in rock crevices, intertidal, coll. P. Kott 12.5.87, paratype QM GH4265.

FURTHER RECORDS: Queensland (Moreton Bay QM GH3892–3; Point Lookout QM GH4264 GH4279). One specimen lot (QM GH4264) is part of a sand adapted fauna found high in the intertidal zone in rocky outcrops on a sandy beach.

DESCRIPTION

Colonies consist of branching basal stolons on which spherical zooids of 3 to 4mm diameter are supported on short stalks of about 1mm. Basal stolons, stalks and zooids are completely covered with sand. Sometimes colonies are quite compact,

with adjacent zooids adhering to the sand on one another's test. The test is delicate and fragile despite the embedded sand. Apertures are quite close together on the terminal free end of each zooid. Each aperture and its fringe of 10 small, pointed lobes is obscured by sand.

The body wall is delicate. It contains a conspicuous vascular network that obscures the fine muscles, some radiating from the short siphons, and others crossing the dorsal mid-line behind the atrial siphon and sweeping ventrally and posteriorly. Muscles are conspicuous only on the anterior half of the body, fading out posteriorly. There are 24 branchial tentacles of various sizes, some quite long. The neural duct has a simple, vertical, ciliated opening on the dorsal tubercle.

The branchial sac has 11 rows of about 16 stigmata and about 12 internal longitudinal branchial vessels. The gut forms a simple loop across the posterior end of the body, and a short rectum curves anteriorly at right angles to it. The small, smooth stomach, narrowing to the intestine at its distal end, is in the middle part of the proximal limb of the gut loop. The oesophagus curves anteriorly to open into the stomach a short distance along its posterior border. Gonads are in the gut loop, the testis follicle deeply divided into about 5 long, parallel lobes, and the ovary a small cluster of eggs at the distal end of the male follicle. Small, almost spherical larvae, about 0.5cm diameter, lie in the right peribranchial cavity of specimens collected in June.

Remarks: As new species of Perophoridae are described definitions separating *Perophora* from *Ecteinascidia* based only on the number of rows of stigmata are increasingly unsatisfactory. Kott (1985) redefined the former genus as having a horizontal gut loop, a short rectum, and relatively fewer and larger male follicles than *Ecteinascidia*. However, as Monniot and Monniot (1987) have suggested, the length of the rectum appears to be a secondary character related to the length of the branchial sac rather than being a plesiomorphic character distinguishing *Perophora* from *Ecteinascidia*. *Perophora multistigmata* (see Kott 1985) and the present species, both with 8 or more rows of stigmata, have a longer rectum than species with 5 or fewer rows. Nevertheless, there are two groups of species — those with numerous, small male follicles and those with few, large male follicles. The type species of *Perophora*, *P. listeri* Forbes and Hanly, 1848, has the latter type of testis and the type species of *Ecteinascidia*, *E. turbinata* Herdman, 1880, has the former type. The distinction based on the form of the testis follicles is a valid amendment to the definition of the genera.

Accordingly, the present species, despite its unusually large number of rows of stigmata, is assigned to *Perophora* on account of its single testis follicle with relatively few, long branches. *Perophora multistigmata* Kott, 1952 a possibly related species (which, like *P. sabulosa*, appears indigenous to Moreton Bay, has more than 5 rows of stigmata, a similarly lobed male follicle, and a similar colony) is distinguished by its naked test, larger zooids, long siphons and 8 rather than 11 rows of stigmata. Unlike *P. multistigmata*, *P. sabulosa* appears to be adapted for sandy habitats.

Perophora faaopa (Monniot and Monniot, 1987), from Tahiti, has 2 male follicles (lobed as in the present species), numerous (15) rows of stigmata, and zooids which lie on their left side.

Suborder STOLIDOBRANCHIA Lahille, 1887

Family STYELIDAE Sluiter, 1895
Subfamily STYELINAE Herdman, 1881
Genus **Cnemidocarpa** Huntsman, 1912

Cnemidocarpa barbata Vinogradova, 1962
(Figs 3–5)

Cnemidocarpa barbata Vinogradova, 1962, p. 202. Monniot, 1978, p. 189.

Distribution

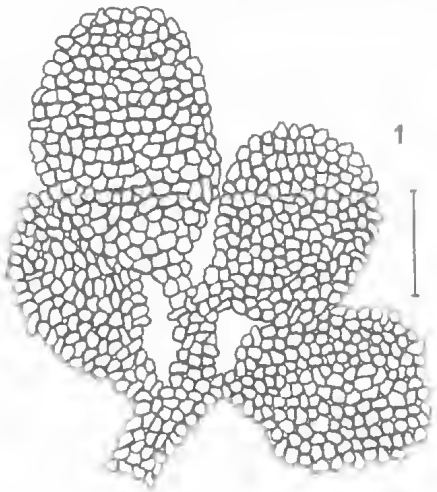
New Record. New South Wales (24°27'S, 151°27'E, AM Y2126). The specimens were taken from 1,200m, the greatest recorded depth for this species.

Recorded Range: Indian Ocean (64°15'S, 107°33'E, 639 m, Vinogradova 1962; Kerguelen Continental Shelf, Monniot 1978).

Description

The new record is of two specimens. They are both upright and oval, 1.2cm high and 1cm in diameter with apertures on the upper surface and the characteristic beard of hair-like roots from a limited area at the posterior end of the body. In these specimens the roots are slightly postero-dorsal so that the branchial aperture is terminal,

Figs 1–5: *Perophora sabulosa* n.sp. (holotype QM GH3894) — 1, portion of a colony; 2, body removed from the test, viewed from the left. *Cnemidocarpa barbata* (AM Y2126) — 3, external appearance; 4, part of antero-dorsal region of the pharynx showing branchial tentacles and dorsal tubercle; 5, left body wall showing gut, gonads and endocarps. (Scales: 1, 3, 5 — 2mm; 2, 4 — 0.5mm).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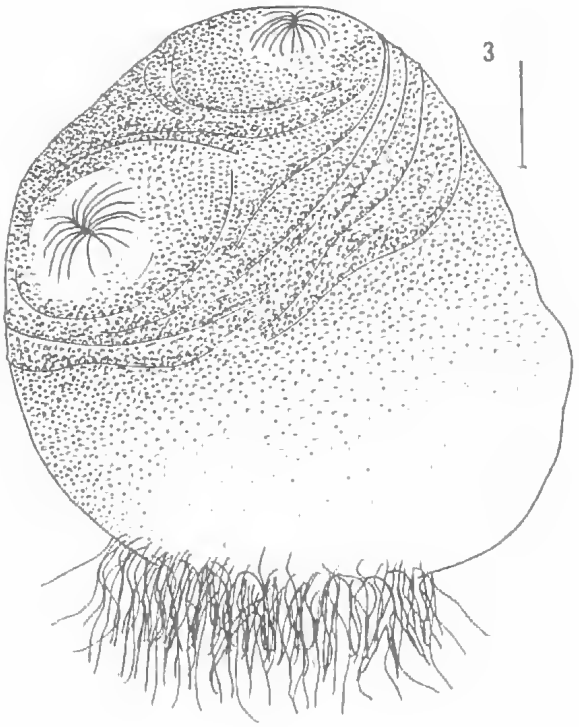
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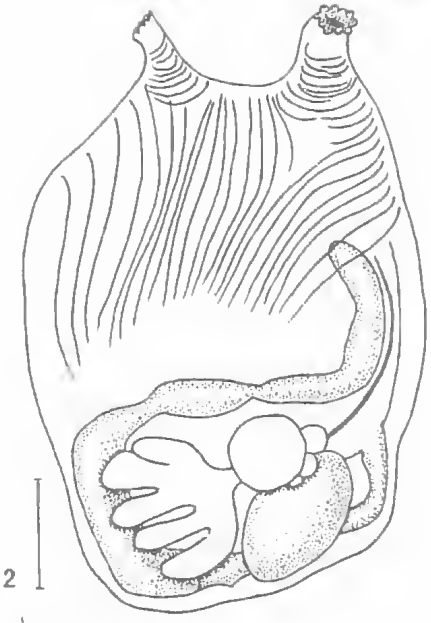
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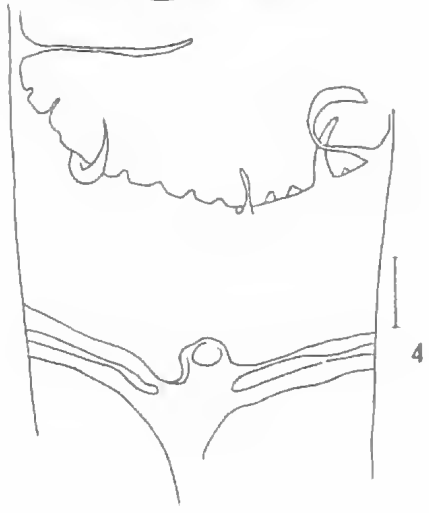
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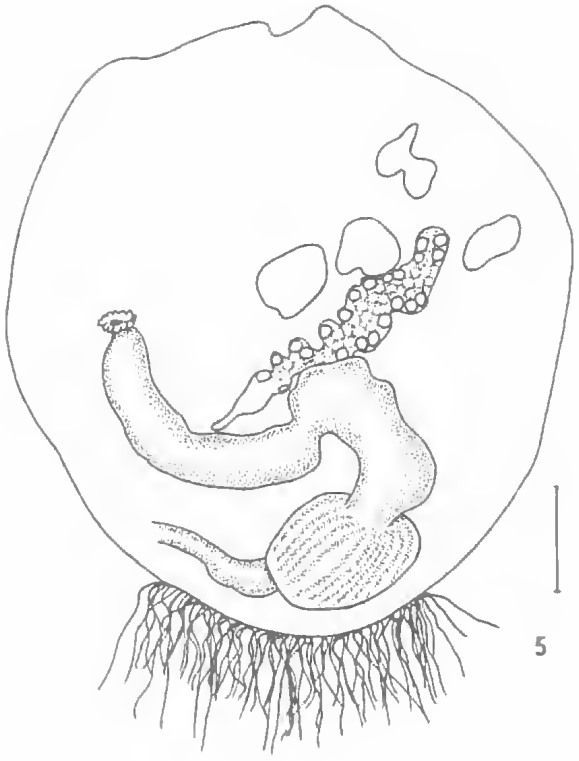
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and the atrial aperture turned to the side. The 4-lobed apertures, on slight conical swellings, are obscured by the fine folds of test that radiate from each. The test is thin and translucent, with fine rounded papillae giving it a granular appearance, and horizontal wrinkles anteriorly that possibly result from contraction.

There are very fine longitudinal muscles in the body wall, and circular ones confined to the siphons. About 16 branchial tentacles of very different lengths, some very long, and others short, alternate with one to 3 rudimentary ones. The tentacular ring is separated from the peripharyngeal groove by a moderately wide prebranchial area. The anteriorly directed C-shaped opening of the neural gland is on a small papilla projecting forward in the mid-dorsal line. The dorsal lamina is a plain-edged membrane. There are 3 low branchial folds on each side with very wide, flat expanses of branchial wall between them. Internal longitudinal vessels have the formula E8(9)8(18)13(15)4DL3(10).... The most dorsal fold on the left terminates anteriorly about half-way up the dorsal lamina, and does not reach the peripharyngeal groove. There are 3 or 4 stigmata per mesh. The gut loop lies across the posterior end of the body and is slightly curved. The stomach, in the middle part of the ascending limb, is short with about 20 parallel longitudinal folds. The anal aperture, near the atrial opening, has about 15 shallow rounded lobes. There are 4 or 5 irregularly shaped endocarps on each side of the body.

A single long undulating gonad on each side, extends postero-dorsally from about half-way along the ventral part of the body wall. In the newly recorded specimens the left oviduct opens in the base of the secondary gut loop.

There is a ring of very fine tentacles around the edge of the atrial velum.

REMARKS: The external appearance of the newly recorded specimens agrees well with those previously recorded, as do most of the internal organs. There are some variations in the branchial folds, although the total number of internal longitudinal vessels recorded by Vinogradov (1962) and Monniot (1978) are the same as in the newly recorded specimens. There is some variation in the number of anal lobes — Vinogradova (*loc. cit.*) recording a bilabiate anal border while Monniot's specimen appears to have had about 10 lobes (Monniot 1978, fig. 7D).

Characteristics of the present species are the tendency to loss of folds in the branchial sac, the beard of hair-like roots from a limited area of the posterior end of the body, the single undulating gonad on each side, and the short stomach with numerous longitudinal folds.

Cnemidocarpa digonas Monniot and Monniot, 1968 from much deeper water (2197 to 4008m) from the northern and southern Atlantic (Monniot and Monniot 1982) resembles the present species externally, and in its branchial sac and endocarps. It differs in its gut, in the number of stomach folds and in the form and number of its gonads.

Cnemidocarpa bythia (Herdman, 1882), which has similar gonads, also resembles the present species externally; and it has been recorded from the Tasman Sea (Millar 1959). However it is taken at greater depths (4000 to 7000m) than the present species, and it has a deep peritubular area, dorsal languets and fewer stomach folds.

Cnemidocarpa tripartita Kott, 1985

Cnemidocarpa tripartita Kott, 1985, p. 140.

DISTRIBUTION

NEW RECORD: South Australia (Spencer Gulf, AM Y2129). The specimen is from 32m.

RECORDED RANGE: Victoria (Bass Strait).

The new record suggests that this small species has a wider range in southern Australian temperate waters than was formerly recognised.

DESCRIPTION

The newly recorded specimen has the same oval shape, sessile apertures and reduced branchial sac as the type material. The ovaries are characteristically lobed, and undulating, with testis follicles in clumps between the lobes as in *C. lobata* (Kott, 1952). However the newly recorded material differs from the type in having two rather than three gonads on the left side.

Genus **Polycarpa** Heller, 1877

Polycarpa aurita (Sluiter, 1890)

Styela aurita Sluiter, 1890, p. 338.
Polycarpa aurita: Kott, 1985, p. 152 and synonymy.

DISTRIBUTION

NEW RECORDS: Queensland (Torres Strait, QM GH4289 30 GH4844).

RECORDED RANGE: Northeastern Australia to Port Jackson, north-western Australia to Cockburn Sound, the Gulf of Carpentaria, Indonesia, the tropical western Pacific (New Caledonia and the Philippines) and the Atlantic Ocean (Gulf of Mexico and the Caribbean).

DESCRIPTION

The newly recorded specimens are 2 to 4cm long, laterally flattened, and have sand adhering to projections from the test to form a thick sandy coating. Sand can be seen from the inside of the tough, but thin and translucent test.

The branchial sac is especially tough and fibrous. It has the characteristic wide, flat connectives attaching the transverse vessels to the parietal body wall. In these specimens the transverse vessels themselves are especially conspicuous, being filled with tough white fibres which have not previously been reported for this species. These fibres are like those found in the branchial vessels of *Polycarpa obscura* (see Kott 1985).

Polycarpa directa n.sp.
(Figs 6,7)

Distribution

Type Locality: Victoria, Crib Pt, Western Port, 15m, fine sand and mud, Crib Point Survey, Marine Studies Group, Fisheries and Wildlife Department 9.3.65, holotype MV F54203, paratypes MV F53298 F53306.

Further Records: Victoria (Crib Pt, MV F53315 to F53354 F53357 F54207).

Description

The more or less egg shaped body, rounded anteriorly, is 1.5 to 2cm high and about 0.7mm maximum width. The terminal branchial aperture is directed obliquely upwards, away from the atrial aperture which is on a rounded knob about one-third of the body length down the dorsal surface projecting away from it rather like a stumpy thumb. Posteriorly there is a beard of fine, branching, hair-like roots that conceal the pointed posterior end of the body. The small area around each aperture is naked and the test is gathered in around the opening. The rims of the apertures do not appear to be lobed. The remainder of the test is covered with a dense coat of sand. The body wall is muscular, with an outer layer of crowded circular fibres and inner longitudinal bands. A narrow branchial velum is present anterior to the ring of about 50 fine branchial tentacles of various sizes. The peripharyngeal groove runs straight across the anterior end of the dorsal lamina without forming a V-shaped peritubercular area and the prominent dorsal tubercle, with a conspicuous U-shaped slit, is in the dorsal mid-line in the centre of the prebranchial area. The dorsal lamina is long and straight.

The branchial sac is very much contracted in these specimens and does not extend posterior to the oesophageal opening which is about two-thirds of the distance down the body. Both the transverse and internal longitudinal vessels are thick and obscure the stigmata, of which there are about 4 per mesh in the centre of the branchial sac. The branchial formula is E0(8)1(8)1(6)1(12)0DI, 0(9)3(8)1(10)1(8)OE. The dorsal fold on the left is very close to the dorsal lamina.

The simple, almost straight and relatively narrow gut loop projects almost vertically behind the branchial sac. The oesophagus is short and the stomach pear-shaped, increasing in width toward its pyloric end where a moderately long gastric caecum projects into the pole of the loop. The stomach wall has 8 broad longitudinal folds. The anal opening, its rim divided into 16 rounded lobes, is only slightly anterior to the oesophageal opening.

Flask-shaped polycarps of various sizes are scattered over the anterior two-thirds of the body wall, their narrow tapering ends directed toward the atrial aperture. There are 2 rows of pyriform, unbranched male follicles beneath each ovary. Numerous small endocarps are scattered between the gonads and posterior to them. Both gut loop and gonads are only lightly attached to the body wall.

Remarks: Characteristic of this species are its shape and the course of the gut, with the body, and the vertically oriented gut loop projecting behind the pharynx, and into the pointed posterior end of the body. These characters can be used to distinguish the species from *P. papyra* with which it otherwise shares a position in the key to the Australian *Polycarpa* (see Kott 1985). However it does not appear to have a close relative in the Australian fauna.

Both *Polycarpa sobria* and *P. plenovata* have a gastric caecum but lack endocarps between the scattered polycarps and have horizontally oriented gut loops and deeply curved branchial sacs. *Polycarpa nota* does have small endocarps scattered amongst the gonads, and a gastric caecum. However it also has several endocarps scattered in the gut loop while there are none in that position in the present species.

Polycarpa flava Kott, 1985

Polycarpa flava Kott, 1985, p. 165 and synonymy.

Distribution

New Records: Western Australia (Albany, AM). The species is common in sea grass beds (*Posidonia australis* and *P. sinuosa*).

Recorded Range: South Australia (Great Australian Bight, Spencer and St. Vincent Gulfs). Tasmania (Bass Strait, eastern coast). Victoria (Cape Wooloomai, Point Nepean).

Description

Numerous specimens, all relatively small (seldom more than 1cm long), are characteristically black in preservative, with a tough wrinkled test and sessile apertures. They are stalked or sessile. What appear to be senescent specimens,

without gonads, have thinner test, and are less contracted and wrinkled.

REMARKS: The external shape of this species resembles that of *Polycarpa fungiformis* (see below); and although their ranges do not overlap, they appear to occupy a similar habitat in seagrass beds. It is possible that the stalk and lower half of the body of *P. flava* is embedded in the substrate as it is in *P. fungiformis*. Both these species are unusual amongst stalked species in having the apertures relatively close together on the upper surface (see Kott 1989).

Polycarpa fungiformis Herdman, 1899

Polycarpa fungiformis Herdman, 1899, p. 43. Kott, 1985, p. 166 and synonymy.

DISTRIBUTION

RECORDED RANGE: Moreton Bay, Queensland to Lizard I.

REMARKS: The species has been observed in sparse seagrass beds in Moreton Bay with the stalk and lower half of the body embedded in the substrate (see *P. flava*, above). Many specimens were fresh but torn and empty tests, the body possibly removed by *Dugong dugon* which were seen feeding in the area (A. Preen *pers.comm.*).

Polycarpa lucilla Kott, 1985

Polycarpa lucilla Kott, 1985, p. 171.

DISTRIBUTION

NEW RECORDS: Western Australia (Albany, QM GH4627). Queensland (Torres Strait, QM GH4832).

RECORDED RANGE: Western Australia (Cape Jaubert). South Australia (Upper Spencer Gulf). Queensland (Gladstone – Townsville). The new records extend the known tropical range of this species and confirm its occurrence in temperate waters. Both of the records from temperate waters (Upper Spencer Gulf and Albany) are from sea grass beds.

Polycarpa kapala n.sp.
(Figs 8,9)

DISTRIBUTION

TYPE LOCALITY: Off the New South Wales Continental Shelf, 34°27'S, 151°2'E, 1,200m, FV *Kapala* St. 76-23-02, coll. J. Lowry 3.12.76, holotype AM Y2123, paratype AM Y2124.

DESCRIPTION

The holotype, slightly larger than the paratype, is 6mm long, including the foraminifers that adhere to the test in a dense coating. Individuals are lozenge-shaped, more or less flattened dorso-ventrally. Very long, branched, hair-like roots penetrate through the coating of foraminifers around the outer margin of the lower surface, but are absent from the remainder of the body. The almost sessile apertures, at opposite ends of the upper surface, are surrounded by finer particles adhering to the test than those over the rest of the body. The test is very thin and delicate.

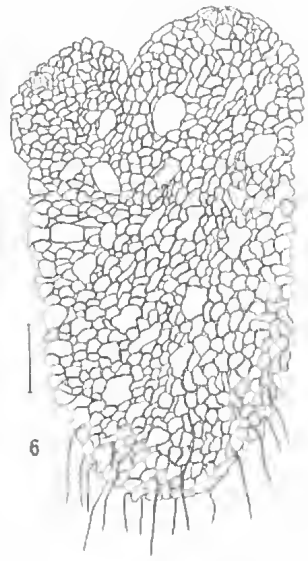
The body wall is delicate with a thin layer of fine muscle bands. About 16 fine branchial tentacles are of various sizes. The dorsal tubercle is small with a simple longitudinal opening of the neural gland. The dorsal lamina is very long, extending the whole length of the dorsal surface. The branchial sac is delicate. The relatively few internal longitudinal vessels are present only on the low folds, as in the formula E0(4)0(5)0(2)0(5)0DL. About 8 relatively short, rectangular stigmata per mesh are present in the interspace (between the folds), but only one or 2 in the meshes on the folds. There are only 8 rows of stigmata and no parastigmatic vessels. The second fold from the dorsal line is always the smallest.

The gut forms a small, simple loop at the posterior end of the body, just below and to the left of the atrial aperture. The oesophagus is short, and the short almost spherical stomach, with about 8 deep folds, occupies most of the ascending limb of the gut loop. The short wide post-pyloric part of the gut curves around from the distal end of the stomach to open in a smooth-rimmed anus near the atrial opening. On the right are 2 short oval polyearps longitudinally oriented in a line parallel with the longitudinal axis of the body. A single one is on the left. The ovary is oval and sac-like with a short terminal duct. A single male follicle lies beneath the ovary, its duct passing around the dorsal side of the ovary to open on its mesial surface at the base of the oviduct.

There are 4 or 5 long irregular endocarps on each side of the body.

REMARKS: Only 10 species of the genus *Polycarpa* have been described from 1000m or more; and the great majority of these have been described by C. and F. Monniot (1968, 1974; 1977a,b; 1985) and C. Monniot (1970), mainly from the Atlantic Ocean. Only one species,

Figs 6–12: *Polycarpa directa* n.sp. (holotype MV F54203) – 6, external appearance; 7, internal organs. *Polycarpa kapala* n.sp. (holotype AM Y2123) – 8, external appearance; 9, internal organs. *Polycarpa nota* (QM GH4278) – 10, internal organs. *Eusynstyela grandis* n.sp. (holotype QM GH4281) – 11, external appearance; 12, body removed from test, viewed from dorsal surface. (Scales: 6, 7, 12 – 2mm; 8, 9, 10 – 1mm; 11 – 5mm).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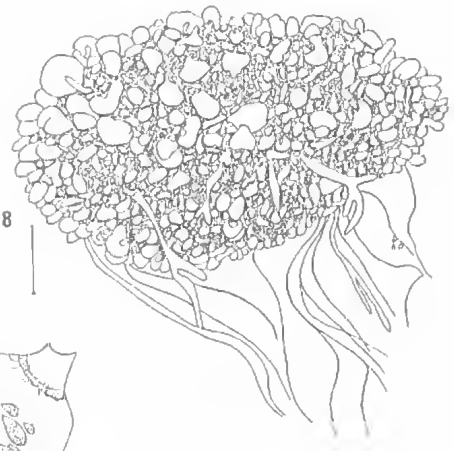
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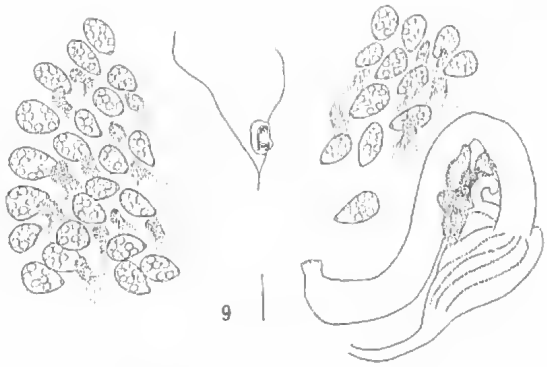
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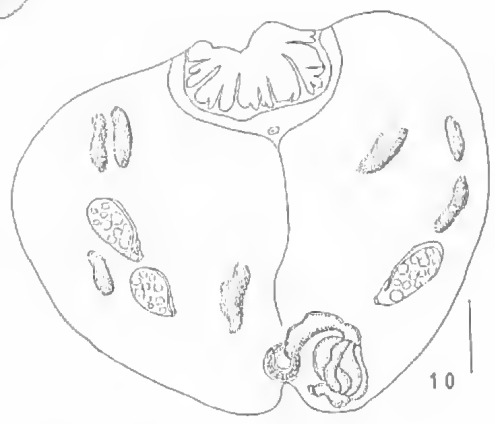
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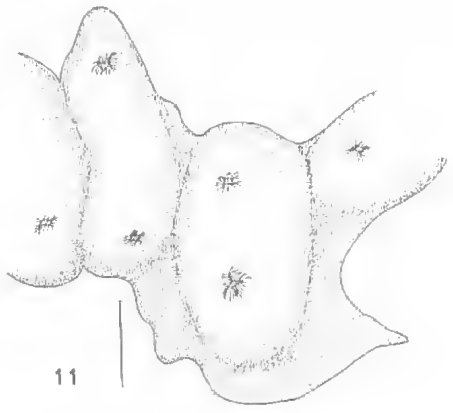
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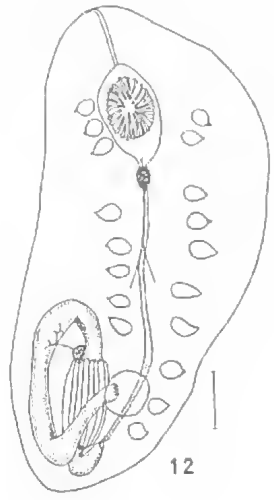
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Polycarpa indiana Monniot and Monniot, 1985 (= *P. albatrossi* : Millar, 1959), has been taken from the Indian Ocean.

The present species is apparently the first of the genus to be recorded from the Pacific Ocean.

All the known species of *Polycarpa* from deep waters show convergent adaptations probably associated with their small size. They are also similar to small, interstitial species of this genus that are found in shallow water, indicating that the morphology is the result of small size rather than an adaptation associated with deep water habitats. These small species are invariably invested with a coating of foraminifers and other particles that adhere to their test, and most have long, branched, hair-like roots from the under surfaces, although a few are stalked. The branchial folds are low, and sometimes are lost altogether, the number of rows of stigmata is reduced from that known in larger species, and the number of internal longitudinal vessels is reduced — these vessels often being completely absent from the interspaces between the folds. The gut is always reduced in length, usually forming a simple loop in the postero-dorsal part of the body. The gonads are generally characteristic of the genus, although they are seldom as numerous as in most larger species of the continental shelf, and the number of male follicles is usually reduced, often to one or 2 in each polycarp.

The minimum number of polycarps, one or 2 per side, is recorded for *P. pseudoalbatrossi* Monniot and Monniot, 1968, *P. biscayensis* Monniot and Monniot, 1977a and *P. itera* Monniot and Monniot, 1977b as well as in the present species. However the 3 Atlantic species are distinguished by the loss of some of the branchial folds, while in *P. kapala* all 4 are present on each side. Of the previously described species, *P. porculus* Monniot and Monniot, 1979, from relatively shallow water (250m) in the northern Atlantic Ocean off Norway, most closely resembles the present species. *Polycarpa porculus* has only 2 or 3 gonads on each side, each consisting of a large sac-like ovary with one or more male follicles, internal longitudinal vessels are absent from the interspaces, and the number on the folds varies between 3 and 7, the smallest fold being the second from the dorsal line. However, its gonads are spherical rather than oval, it has a long curved gastric caecum that is not present in *P. kapala*, and the apertures are close together, rather than being at opposite ends of the body. These differences suggest that the resemblance between *P. kapala* and *P. porculus* are the result of convergence rather than being indicative of a close relationship.

Polycarpa is a predominantly tropical genus that, in shallow shelf habitats, appears to be subject to isolation and speciation in temperate waters (Kott 1985). It is not a diverse genus in deep slope and abyssal water, where, again, its species have a conspicuously limited geographic range in comparison with species of other phlebobranch and stolidobranch genera. The pattern of its colonisation off the continental shelf may therefore be similar to that in temperate waters – *viz.* through speciation of isolated populations, in this case isolated from those on the adjacent continental shelf. The larval strategies that contributed to the inhibition of gene flow in temperate waters may very well have the same effect in shelf and abyssal waters and prevent the establishment of *Polycarpa* species with wide geographic ranges in the ocean slopes and basins. *Polycarpa* is not known from either shelf or deep water habitats in the southern oceans — a fact that tends to support the hypothesis that the sister species of deep water forms may be found on the adjacent continental shelf.

Polycarpa nota Kott, 1985
(Fig. 10)

Polycarpa nota Kott, 1985, p. 176.
Polycarpa tumida: Monniot and Monniot, 1987, p. 113.

Distribution

New Record: Queensland (Moreton Bay, QM GH4278 GH4280).

Recorded Range: Heron Island, Great Barrier Reef and French Polynesia (see *P. tumida*: Monniot and Monniot, 1987).

Description

The new record is of 2 specimens taken from mud flats at Myora. Both specimens are about 1.5cm long, with the branchial aperture at one end of the upper surface and the atrial aperture about half way along. The inconspicuous, 4 lobed apertures are on very slight prominences and are surrounded by the very tough wrinkled test which is a dirty white colour in preservative. One specimen was fawn coloured when alive, dorso-ventrally flattened, convex dorsally and attached by a flat, wide base; and the other one was brown, its body narrower, less flattened, and attached by a narrow strip along the ventral surface. The shape of the body appears to be affected by the shape of the hard shell or rock to which the individual is attached.

The body wall is a greenish-brown colour in the preserved material and there are 4 dark stripes

in the wall of the short siphons. The prebranchial area is wide, with an obtuse peritubercular V. The dorsal tubercle itself is a prominent circular cushion with a deep conspicuous C-shaped to circular (one horn overlapping the other) slit. The branchial tentacles are slender.

There are not more than 2 internal longitudinal branchial vessels in the interspace, and up to 10 on the dorsal folds — which are larger than the others. Four to 6 stigmata are present in each mesh in the interspace in the centre of the branchial sac. The gut forms a narrow loop around the postero-ventral curve of the body, extending about halfway up the ventral surface. The stomach has about 12 deep, longitudinal internal folds. It occupies the middle one-third of the ascending limb of the gut loop. The anal border is divided into small, rounded lobes. The oval gonads are crowded in 2 to 4 rather regular rows. The gonoducts are directed dorsally. Where only 2 rows of gonads are present they are in the ventral half of the body wall, but 4 rows cover the ventral three-quarters. The gonads are anterior and dorsal to the gut loop on the left. Between the gonads are upright, flattened endocarps. Sometimes they expand at the top and sometimes they are lobed. There are also about 5 similar endocarps crowded into the distal part of the gut loop. These obscure the large gastric caecum that curves around in the loop of the gut, and is attached to the intestine by the gastro-intestinal ligament.

Remarks: The newly recorded specimens are larger than the holotype; the gonads are more numerous, larger and more crowded; there are more numerous internal longitudinal branchial vessels; the gut loop is longer; and although dark stripes are present in the wall of siphons, they are not present in the test around the siphons — as they are in the holotype. However, these specimens agree with the holotype in their tough, externally wrinkled test, the position and form of the apertures, the low rounded branchial folds, the length and structure of the stomach and the general form and distribution of gonads and endocarps.

Monniot and Monniot (1987) have assigned specimens from French Polynesia to the Atlantic species *Polycarpa tumida* Heller, 1878 (see Monniot, C. 1972, and *Polyandrocarpa sabanillae*: Van Name, 1945). Not only is the latter species geographically isolated from *P. nota*, but also it is distinguished from it by its aggregating habit, its more numerous internal longitudinal branchial vessels (up to 17 on a dorsal fold in a 2cm individual: see Van Name, 1945), short and inconspicuous gastric caecum, interrupted and irregular stomach folds, and only a moderately projecting dorsal tubercle with a variable but more or less convoluted slit.

Minute projections similar to those that Monniot and Monniot (1987) describe as atrial tentacles on an atrial velum of the French Polynesian specimens are present in those newly recorded from Moreton Bay. However, in the latter they are on the lower part of the siphonal linings of both siphons — on the membrane from the body wall that covers the lower part of the test where it turns in to line the outer part of the siphons.

There is some disparity between the structure of the dorsal tubercle of the newly recorded specimens and that described for those from French Polynesia which are reported to have a circular crater-like opening turned to the left. Superficially (see Monniot and Monniot 1987 fig. 46[2]) these tubercles resemble those of the Moreton Bay specimens. The tubercle itself is transparent, and the whole depth of the ciliated pit is clearly seen. It is deep and vertical, and its sides are folded together to form the usual cleft that opens on the surface of the tubercle in a narrow slit. Each end of this cleft progressively curves in, eventually forming a cylinder with one end overlapping the other. The concave side of the curve is toward the left. There is no sign of the circular opening on the left that Monniot and Monniot (*loc. cit.*) have recorded, although the gap between the ends of the cleft is present in this position.

The French Polynesian and Australian specimens are otherwise identical. The species is apparently part of the wide-spread Indo-West Pacific fauna. The small size and cryptic habitat of this species have apparently previously caused it to be overlooked, although it is said to be the most common species in French Polynesia (Monniot and Monniot 1987).

Polycarpa plenovata Kott, 1985

Polycarpa plenovata Kott, 1985, p. 194.

Distribution

New Record: Victoria (Crib Pt, Western Port, MV F53331). The single specimen was taken from 13m.

Recorded Range: The species previously was recorded from Bass Strait at 71 to 84m.

Description

The specimen is identical with the type material except that there are 2 (rather than one) parallel transversely wrinkled stalks from the postero-ventral corner of the body. The siphons are contracted into wart-like knobs but are probably very long when extended.

Subfamily POLYZOINAE Hartmeyer, 1903
Genus **Polyandrocarpa** Michaelsen, 1904

Polyandrocarpa sparsa Kott, 1985

Polyandrocarpa sparsa Kott, 1985, p. 222.

Distribution

New Records: New South Wales (Byron Bay, AM Y2130), ? location, AM Y2168. The collector has noted that the specimens, from Byron Bay, taken at 10m, were common at this location.

Recorded Range: The newly recorded location is on the northern New South Wales coast, extending the range only slightly from the type locality on North Solitary I.

Genus **Eusynstyela** Michaelsen, 1904

Eusynstyela grandis n.sp.
(Figs 11,12)

Distribution

Type Locality: Wistari Reef, Capricorn Group, Great Barrier Reef, under rubble near reef crest, low tide, coll. P. Kott 5.11.86, holotype QM GH4281.

Description

The holotype colony consists of 4 large zooids embedded in common test. The dorsal surface of each zooid protrudes from the upper surface of the colony as a long (1.6cm) oval swelling. Branchial and atrial apertures are both more or less quadrilateral. In preserved specimens blue irideseent stripes extend down each siphonal lining, one from the centre of each of the 4 sides of the aperture. The apertures are, respectively, about one-third of the zooid length from the anterior and posterior ends of each zooid. The living colony is an even brick red colour and smooth, but wrinkled when contracted. The test is tough and leathery on the upper surface, but the basal test, attached to the substrate, is very thin and transparent. The zooids lie on their ventral surface and the body wall is folded around the meridian about half way down each side.

Generally the body wall is delicate. There are strong circular muscles around each low conical siphon and around the base of each siphon. Fine longitudinal muscles radiate from each siphon across the upper (dorsal) half of the body and curve around the lateral meridian, but they do not extend across the lower (ventral) surface. The ventral body wall is very delicate, and closely associated with the equally delicate test. Living specimens have white longitudinal stripes – 4 thick ones alternating with 4 thinner ones – in the siphonal lining. About 24 simple branchial tentacles alternate with rudimentary ones.

The opening of the neural gland is a simple, long, vertical slit, in a fairly long, narrow perituhercular area. The dorsal lamina is a plain-edged, broad membrane. The endostyle is long. There are 4 branchial folds on each side. Internal longitudinal vessels have the formula E1(5)3(6)3(10)4(12)1DL. There are about 6 long rectangular stigmata per mesh between the folds in the centre of the branchial wall.

The oesophagus is fairly long, first extending posteriorly and then bending abruptly around the posterior end of the branchial sac, to open into the stomach on the ventral surface of the body wall. The long stomach, occupying about the middle third of the ascending limb of the gut loop has 16 long parallel folds in its wall. The whole of the ascending limb of the gut loop (including the stomach), is parallel to the longitudinal axis of the body. A flat collar of the body wall projects from inside the gut loop at the junction of the stomach with the intestine, but there is no caecum. A ligament containing the gastro-intestinal duct (from the stomach to the intestine) extends from the outer rim of the collar. The primary gut loop occupies about half the length of the ventral surface of the body, and the short rectum bends sharply around the lateral meridian to open at the base of the atrial siphon by an 8-lobed anal opening.

There is a single row of short oval polycarps along each side of the endostyle – up to 12 on the right and 10 on the left. These consist of a single, entire male follicle beneath each sac-like ovary. The short male duct curves around the side of the short oviduct to open on top of it. Along each side of the endostyle, the body wall, containing the polycarps, is embedded in the thin basal test. Here the test accommodates irregularities of the substrate and the polycarps are thus protected amongst these irregularities. There are small, sometimes crowded endocarps around the lateral meridian of the body.

Remarks: The species is characterised by its large zooids, single testis follicles, absence of a gastric caecum and presence of a collar of the internal parietal body wall in its place, lobed anal border, and the embedded section of the body wall (with its contained gonads) in the test. The internal longitudinal branchial vessels are relatively more numerous than those of *E. latericius* and the rows of polycarps are closer to the ventral line, although the course of the gut in the posterior end of the body is rather similar in these two species.

Eusynstyela monotestis Tokioka, 1953 from Japan and *Polyandrocarpa* (*Monandrocarpa*) *tarona* Monniot and Monniot, 1987 (> *Eusynstyela tarona*) from Tahiti are the only other

known Pacific species of this genus with a single male follicle. The former is distinguished from *E. grandis* by its upright zooids, horizontally oriented stomach with a gastric caecum, long rectum and smooth anal border. Although *Eusynstyela tarona* has dorso-ventrally flattened zooids and similar gut loop and gonads to those of the present species, its zooids are only 4 to 5mm long and it has a long, curved gastric caecum.

Polyandrocarpa maxima (Sluiter, 1904) has zooids up to 1.7cm long that lie on their ventral surfaces, are embedded in common test like those of the present species, and have a similar branchial sac and stomach. Kott (1985) suggested that it could be a species of *Eusynstyela*. It is distinguished from the present species by its horizontal rather than longitudinally oriented gut loop and its smooth rather than lobed anal border.

The tendency, in this genus, for gonads to project out from the body wall into the test, has been discussed by Kott (1985) and compared with the situation in *Seriocarpa* where the test protrudes into the body wall to encase the gonads.

Genus **Stolonica** Lacaze Duthiers and Delage, 1892

The type species of *Stolonica*, *S. socialis* Hartmeyer, 1903 – erroneously referred to as *S. australis* Hartmeyer, 1903 in Kott (1985) — has 2 rows of lobed, male gonads, with an accessory row anterior to the gut. In the posterior part of the row on the right side of the endostyle there are ovaries associated with the male gonads. Zooids are joined by stolons, the branchial sac is folded, and there are numerous internal longitudinal vessels. The male gonads consist always of a single follicle, although it is often lobed, sometimes quite deeply. However, these lobes are not separate follicles as Michaelsen (1922) and Berrill (1950) state them to be.

As new species with the general characteristics of this genus have been described, the definition of the genus has been amended to accommodate species with different arrangements of male, female and hermaphrodite polycarps.

In Michaelsen's (1922) amended definition of *Stolonica* the polycarps are arranged (as in the type species) in a row on each side of the body, the left row with male organs only and the right with male organs anteriorly and hermaphrodite organs, posteriorly. In the same work, Michaelsen defined *Amphicarpa* as having irregularly distributed male, female and hermaphroditic polycarps on each side of the body.

Colonies of *Stolonica australis* Michaelsen, 1927 from Albany departed from the genus as defined by having hermaphroditic as well as male gonads on both sides of the body. Michaelsen concluded that in the genus *Stolonica* there existed a range of arrangements of male and female gonads from the type species *S. socialis* to *Amphicarpa*. He further amended the definition of *Stolonica* to comprise species with hermaphroditic and unisexual gonads on both sides of the body near the ventral mid-line, the male gonads often extending dorsally.

Kott (1985) included in *Stolonica* those species in which large and often lobed male polycarps, some with ovaries associated with them, are limited to two rows, one each side of the endostyle. Species in which numerous small, single male follicles are found in patches outside the two primary rows were assigned to the genus *Amphicarpa*.

In both *Amphicarpa* and *Stolonica* spp. the female gonads are often absent entirely from the left side of the body. This appears to be an intraspecific variation rather than a generic trait. It may even be associated with maturity. The proliferation of small male gonads, used by Kott (1985) to distinguish *Amphicarpa* from *Stolonica*, is also a character that is expressed in different degrees at different stages within single species in both genera. In some species assigned to *Stolonica* (*S. reducta*, *S. truncata* and *S. vesicularis*) the gonads are very strictly confined to two rows, but in *S. agnata*, *S. aluta* and *S. carnosa* there is some proliferation of male gonads posteriorly that resembles the condition of the gonads in the type specimens of *Amphicarpa nodula* Kott, 1985. Further, the range observed in the condition of the gonads in *Stolonica australis* and in *Stolonica nodula* (> *Amphicarpa nodula*), both discussed below, demonstrates the difficulties in distinguishing these two genera, and reinforces a view that the distinction is an arbitrary one.

Accordingly, the genera are here considered as synonyms. The key that follows combines those for *Stolonica* and its junior synonym, *Amphicarpa*, from Kott (1985).

Key to the Species of *Stolonica* Recorded from Australia

1. Zooids embedded ....*S. carnosa* Millar, 1963
   Zooids joined by stolons 2
2. Siphonal scales present .....
   .....*S. diptycha* (Hartmeyer, 1919)
   Siphonal scales absent 3
3. Gastric caecum present 4
   Gastric caecum absent .....
   .....*S. duplopicata* Sluiter, 1913

4. Branchial folds 4 per side .... *S. agnata* Kott, 1985
   Branchial folds less than 4 per side 5
5. Stomach folds 36; male gonads long, branched ..... *S. truncata* Kott, 1972b
   Stomaeh folds not more than 20; male gonads not long, branched 6
6. Branehial folds 2 on left 7
   Branchial folds 3 on left 8
7. Stomach short with pronounced spur ....*S. vesicularis* Van Name, 1918
   Stomaeh long without pronounced spur..... .....*S. australis* Michaelsen, 1927
8. Gastric spur present; about 20 rows of stigmata.....*S. aluta* Kott, 1985
   Gastric spur not present; 10 to 15 rows of stigmata 9
9. Gastrie caecum very short and not curved ....*S. nodula* (Kott, 1985)
   Gastric caecum long and eurved ....*S. reducta* (Sluiter, 1904)

Stolonica australis Michaelsen, 1927
(Figs 13,14)

Stolonica australis Michaelsen, 1927, p. 202. Kott, 1985, p. 234 and synonymy.

Amphicarpa meridiana Kott, 1985, p. 246 and synonymy.

Distribution

New Records: South Australia (Price I., Avoid Bay, QM GH4142 GH4197). Victoria (Western Port MV F54204). Queensland (Peel I., Moreton Bay, QM GH3879 GH4291).

Recorded Range: The speeies previously was known from Albany, Western Australia, to the Solitary Is off the northern NSW coast. The small specimens newly recorded from Moreton Bay may represent the northern limit of the range of this temperate indigenous species.

Description

The newly recorded colony from the Great Australian Bight is large and cauliflower like forming a dome about 10cm in diameter and 12cm high. It is composed of crowded elub-shaped zooids, the larger ones about 2em long, their anterior ends around the outside of the dome, narrowing posteriorly to broad stalks that join with those of neighbouring zooids as they converge toward the centre of the base of the colony. Smaller spherieal zooids are also present, branehing off the stalks and even off the sides of the larger zooids. There is a layer of sand over the zooids and their stalks. The apertures, sometimes sessile and sometimes on small wart-like siphons, are elose together on the anterior free ends of the zooids. From inside the body, the atrial aperture is seen to be just dorsal to the neural ganglion. About 60 branchial tentacles are of various sizes. The dorsal tubercle has a long vertical slit.

The branchial sac has 2, long, straight folds in its dorsal half, and ventrally a wide expanse of flat branchial sac between the endostyle and the first fold. Internal longitudinal vessels have the formula E8(10)6(9)0DL1(12)4(8)8E. There are 6 to 8 stigmata in a mesh in the eentre of the branehial sae, and 19 rows of stigmata, each erossed by a parastigmatic vessel. Smaller spherical specimens have fewer internal longitudinal vessels and stigmata, but they are present in the same ratio, and the folds are dorsally positioned.

The gut loop is short and obliquely oriented postero-ventrally. A long reetum extends antero-dorsally, more or less in linc with the gut loop, reaching well anterior to the oesophageal opening, almost to the anteriorly positioned atrial aperture. The gut loop is bent anteriorly forming a secondary loop in the smaller spherical specimens. The stomach has about 18 parallel folds. A short, straight eaeeum and a very strong ligament from the intestine passes over the centre of the stomach, appearing to hold the folds of the narrower cardiac end of the stomach in position.

There is a glandular collar around the intestine. The gut loop eneloses 2 endoearps, one in the pole and one on the dorsal side of the gastro-intestinal ligament. The gut loop is attached to the parietal body wall by a series of short, strong ligaments plaeed equidistant from one another along its outer curve. The gonads are very variable in the South Australian eolony, and it is possibly becoming seneseent. In some zooids about 10 small inconspicuous ovaries, each eontaining 3 to 4 eggs, and a few, scattered, small, elliptieal male follieles, form a row along each side of the endostyle. In others, the ovaries, in the rows along each side of the endostyle, are directly assoeiated with oval, or elub-shaped or circular testis follicles, and smaller male follieles are in groups at the posterior end of each row and spread into the postero-dorsal part of the body wall. Three or 4 large, oval endocarps are on the body wall on each side.

The newly recorded specimens from Moreton Bay are small (up to 5mm diameter), dome shaped and sessile on a basement membrane. In the living material the orange zooids ean be seen through their sandy coat. There are about 30 crowded branchial tentacles. The dorsal tubercle has a longitudinal slit. The branehial folds are low, and the branchial formula is E2(4)1(8)0DL. The gut forms a short horizontal loop attached by the usual ligamcnts to the body wall, and the rectum forms a right angle with it. The stomach is short with

about 15 folds and a slightly curved caecum. There is a small endocarp in the pole of the gut loop, another on the other side of the gastro-intestinal ligament and a few long ones scattered on the body wall. Immature hermaphrodite polycarps, each consisting of a single circular male follicle beneath a small circular ovarian sac, are arranged in a row along each side of the endostyle, and there are also a few scattered male follicles on the body wall.

REMARKS: The specimens described above from South Australia are the largest known, although otherwise the shape of the colony and the zooids, the course of the gut, shape of the stomach, and other characters resemble figured specimens (including the type) of *A. meridiana* Kott, 1985 from New South Wales. The two newly recorded specimen lots are at opposite ends of the morphological range of this species. The Queensland specimens are less than half the size of previously recorded material, and only a little more than one-tenth the length of the newly recorded material from the Great Australian Bight, and they have fewer internal longitudinal branchial vessels, stomach folds and branchial tentacles than the South Australian specimens. However, specimens from both locations have closely placed apertures, numerous branchial tentacles, and longitudinal opening of the neural duct, 2 branchial folds in the dorsal part of the branchial sac, 19 rows of stigmata crossed by parastigmatic vessels, a similarly shaped stomach with a short caecum and broad folds, and the same arrangement of gonads. The gut loop of the Queensland zooids is bent up more than it is in the long zooids from South Australia.

The structure of both lots of zooids falls within the range previously reported for this species and its synonyms. The arguments for the synonymy of *Amphicarpa* and *Stolonica* are set out in the discussion of the genera (above).

Stolonica nodula (Kott, 1985)

Amphicarpa nodula Kott, 1985, p. 247.

DISTRIBUTION

NEW RECORD: Queensland (Repulse Is, QM GH4295).

RECORDED RANGE: The species has previously been recorded only from Abbot Bay, northwest of Bowen, some 150km from the new location north of Mackay.

DESCRIPTION

The newly recorded specimens are firmly attached to the test of a specimen of *Microcosmus helleri*, forming a fairly crowded layer of zooids around it. Individual zooids are stalked or sessile, spherical to vertically elongated and club-shaped. They are joined basally by wide membranes and short irregular connectives. Both apertures are on the more or less circular, and sometimes flattened, upper surface of each zooid. Zooids and connecting basal membranes are completely covered with a layer of sand. This obscures the sessile apertures which are surrounded by a small area of naked test gathered in around the contracted rim of each opening. The body wall is muscular, but closely adherent to the test and not readily removed from it. There is no pigment in the body wall of these preserved specimens.

In most respects the morphology conforms with that previously reported (Kott 1985). However, the voluminous gut loop is rather variable in its course, sometimes forming a rather wide, open loop rather than a closed one; and the gonads are variable. In the newly recorded specimens a row of about 6 to 8 hermaphrodite polycarps is present on each side of the endostyle rather than only on the right. Some of these polycarps contain a single, large ovum. Other ova, embryos and larvae are in the peribranchial cavity on each side, and tend to distort the branchial sac and the course of the gut. Testis follicles are not mature and there is no sign of the accessory male glands that were present in the Abbot Bay material (Kott 1985).

The larval trunk is 0.8mm long and the tail about 1.3mm long. The larval test around the trunk has small, reddish vesicles scattered in it. The epidermis has about 12 parallel longitudinal ridges each terminating anteriorly in an epidermal ampulla. There is a large photolith and the usual 3, triradially arranged, adhesive organs.

REMARKS: Although it has not been reported previously for this species, one of its most conspicuous characters — confirmed by examination of the type mateial (QM GH702 GH1309 GH2308) — is the very close adherence of the body wall to the test. Other distinguishing characters, in addition to the 3 branchial folds, are the fine, internal longitudinal branchial vessels, short stomach, small gastric caecum, long and voluminous intestine and rectum, and the two large lips of the anal opening.

The dark colour of the body wall observed by Kott (1985) in freshly formalin-preserved specimens is no longer present in the same material now in alcohol.

The gonad arrangement described by Kott (1985) for the Abbot Bay material is not found in the new material, which has zooids with hermaphrodite polycarps on both sides of the body, mature ova and embryos in the atrial cavity, and only a single large ovum in each polycarp on the body wall. Thus, although there are 2 or

3 eggs in the ovaries previously described, it appears from the present specimens that only one matures at a time.

Variation in the condition of the gonads observed in this species is similar to that observed in *Stolonica australis* (see above), and supports the view that *Amphicarpa* is a synonym of *Stolonica*.

Stolonica reducta (Sluiter, 1904)
(Fig. 15)

Styela reducta Sluiter, 1904, p. 72.
Stolonica reducta: Kott, 1985, p. 236 and synonymy.

Distribution

New Record Western Australia (Albany, QM GH4631).

Recorded Range: The species is recorded from the Coral Sea and Indonesia as well as from Triggs L (Western Australia). The new record extends its known range into temperate waters.

Description

Small colonies of sexually immature upright zooids (up to 3mm tall) joined by stolons, are epizooitic on *Polycarpa flava* found in sea grass beds. The 4-lobed apertures are small and wart-like, the test wrinkled around them, and covered with adherent sand. Three folds are present on each side. The branchial formula is D1, 1(9)4(6)4(6)OEO. The stigmata are in 10 rows, each crossed by a parastigmatic vessel. The gut forms a short rounded loop with the long rectum extending anteriorly to the base of the atrial siphon. There are 12 broad stomach folds expanding distally. The proximal ends of the folds on the inner side of the stomach terminate on each side of the suture line. A long caecum is curved in the gut loop which also encloses a small endocarp. There are also some oval to elongate endocarps scattered on the body wall.

Remarks: The newly recorded specimens differ from those previously described in having a shorter stomach with fewer folds, a longer gastric caecum curved back into a U-shape, and sand adhering to the test. These differences may be associated with the small size and immature condition of the material from Albany which, if correctly assigned, represents a population at the southern extreme of the range of this tropical species. The only other species with upright zooids joined by stolons, and 3 branchial folds per side are *Stolonica truncata* Kott, 1972 (with apertures in transverse slit-like depressions, a pronounced gastric spur, and long, narrow male follicles), *S. nodula* (Kott, 1985) (with a very short gastric caecum), and *S. aluta* Kott, 1985 (with more internal, longitudinal branchial vessels than the present species, a characteristic stomach with a pronounced gastric spur, and 20 rows of stigmata rather than the 10 to 12 of the present species).

Re-examination of the type specimens of *Amphicarpa elongata* Kott, 1952 (AM Y1597 Y1599) showed that the long, male gonads referred to by Kott (1952) are oval to elongate endocarps; and that the species is a junior synonym of *Stolonica reducta* (Kott 1985).

Genus **Polyzoa** Lesson, 1831

Polyzoa exigua n.sp.
(Figs 16–19)

Distribution

Type Locality: Albany, Western Australia, epizooitic on *Polycarpa flava* from sea grass beds (*Posidonia sinuosa* and *P. australis*), coll. P. Hutchings January 1988, holotype QM GH4628, paratypes QM GH4629 30.

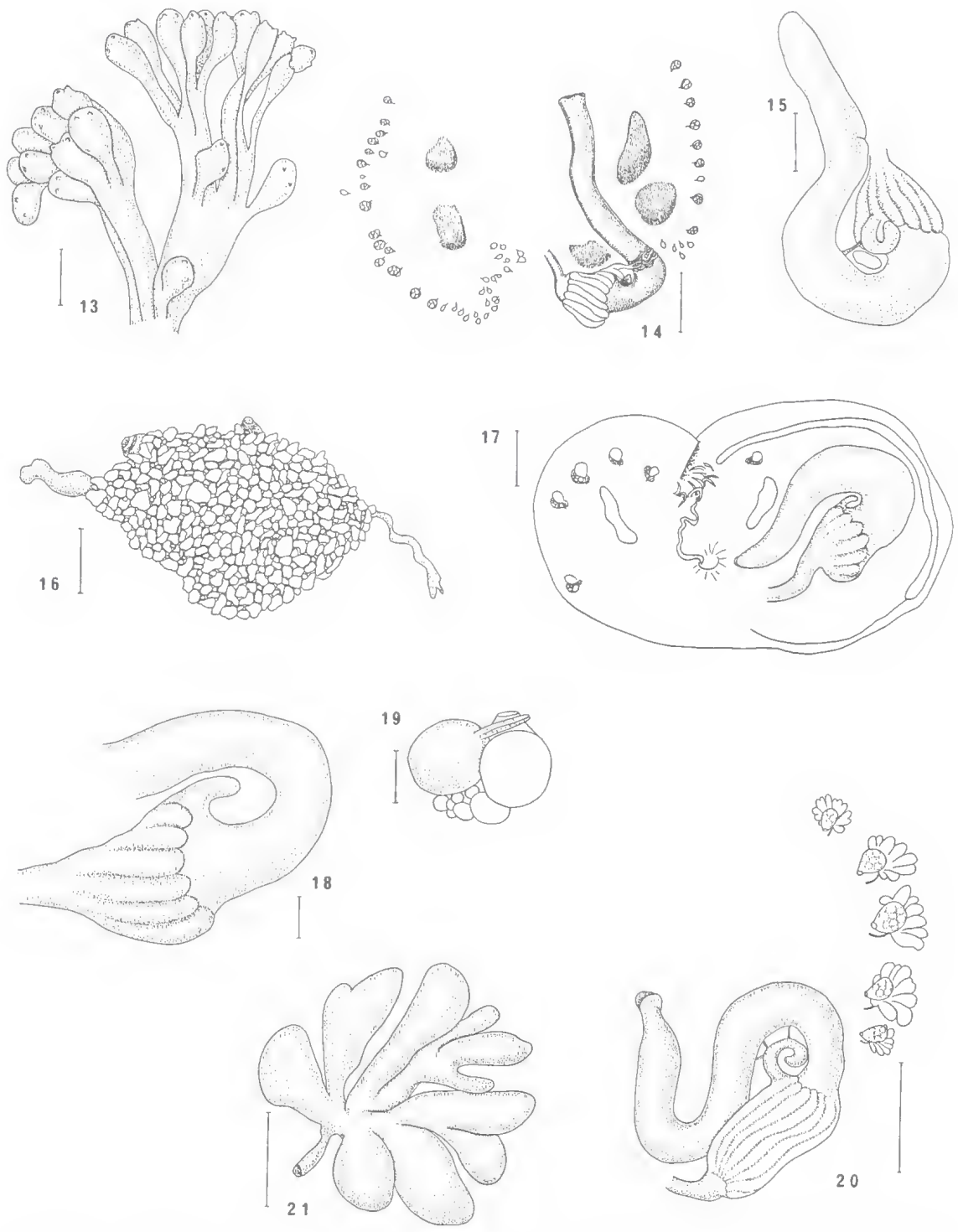
The species occurs with *Molgula incidata* and *Stolonica reducta*, and appears to be part of a flourishing sea grass community made up of similar sized organisms.

Description

Zooids are small and dome-shaped, not more than 5mm in diameter and up to 2mm high. The smooth-rimmed apertures on the upper, rounded surface are on small, conical siphons, the branchial aperture toward the anterior end of the upper surface, and the atrial in the centre. Zooids are partially or completely covered with adherent sand particles, although the apertures are not concealed. A sphincter muscle which appears from the surface as a white circle around each opening, helps to distinguish the species from other similar ones in the same habitat. Between sand grains the slightly translucent but rather tough and wrinkled test is grey to blue in these preserved and contracted specimens. Short stolons radiate from the zooids, although the zooids do not appear to remain connected to one another.

The body wall has a fine mesh of inner, longitudinal and outer circular muscles. The duct of the neural gland has a simple circular opening in the V-shaped pertubercular area. The dorsal lamina is moderately long, but the branchial sac has a long, deep curve around the ventral border and there is a long retropharyngeal groove across its posterior end.

There are 8 rows of stigmata and 3 internal longitudinal vessels on each side. In the centre of the branchial area the stigmata have the formula E10,6–8,6–8,6DL. To accommodate the long ventral curve of the branchial sac there are fewer stigmata in the anterior and posterior rows and the fifth row does not reach the dorsal mid-line. Parastigmatic vessels are present.



Figs 13–21: *Stolonica australis* (QM GH4142) — 13, portion of colony; 14, internal organs. *Stolonica reducta* (QM GH4631) — 15, gut loop. *Polyzoa exigua* n.sp. (holotype QM GH4628) — 16, external appearance; 17, internal organs; 18, gut loop; 19, mature gonad. *Polyzoa nodosa* n.sp. (QM GH4154) — 20, internal organs on left; 21, testis follicle. (Scales: 13, 14 — 2mm; 15, 17 — 0.5mm; 16, 20 — 1mm; 18, 19, 21 — 0.2mm).

The gut forms an almost simple, vertical loop across the middle of the left body wall. The rather short stomach, increasing in diameter toward its pyloric end, is in the middle of the proximal limb of the loop. The stomach has 12 broad folds and a short, straight caecum that projects into the pole of the gut loop. The anal border is bilabiate.

Gonads are arranged in a row around the ventral curve of the right side of the body. They are not all mature at once. Not more than 5 were found in any one zooid, and these were irregularly spaced. Thus, it is probable that gonads could be more numerous. Gonads usually were absent on the left side of the body, although a single polycarp was found just anterior to the gut loop in one specimen only. The gonads are hermaphroditic. The sac-like ovary has one or two large eggs and 5 or 6 smaller ones, and it opens into the atrial cavity by a short, broad duct with a wide opening. The testis is circular and the straight vas deferens crosses over the mesial surface of the oviduct.

There is a long, narrow endocarp on each side of the body.

REMARKS: The absence of connecting stolons between the zooids in this species is unusual, although vegetative zooids develop, as usual, at the end of the rather short but thick stolons. The species is distinguished from *Polyzoa violacea* (see Kott 1985) by its relatively few internal longitudinal branchial vessels, sandy test, short and straight gastric caecum, and deeply curved branchial sac.

From its description, *Polyzoa translucida* Ritter and Forsyth, 1917 (see Van Name 1945) from California differs from the present species only in its upright, stalked zooids and terminal apertures. It is possible that this apparently close resemblance is due to convergence rather a direct phylogenetic relationship. Nevertheless, *Polyzoa* is homogenous and appears monophyletic.

Polyzoa nodosa n.sp.
(Figs 20,21)

DISTRIBUTION

TYPE LOCALITY Price I., South Australia, coll. SAS 9.4.87, 15–20m, holotype SAM E2031, paratype QM GH4154.

DESCRIPTION

Colonies consist of a tangle of fine branching and anastomosing stalks that form a great, loose mass apparently embedded in a sandy substrate. Small (5mm diameter) spherical zooids, sometimes sessile, but sometimes with up to 3 short stems, are attached to the upper surface of this tangled mass, forming a single, often compact, layer of zooids. These probably form a mat on the surface of the sea floor. Both zooids and stalks are covered with a coating of sand. Zooids often are attached to one another through the sand that adheres to the test. The apertures are sessile, and sometimes slightly depressed into the upper surface. Zooids are occasionally laterally flattened but this is probably an artefact of their preservation. In preservative the linings of the siphons are orange.

The body wall adheres closely to the test. Circular muscles surround each siphon, and longitudinal muscles radiate from them, crossing one another as they extend obliquely down the body. The 24 branchial tentacles are of various sizes. The dorsal lamina is wide and smooth-edged. The dorsal tubercle has a simple, longitudinal slit.

The branchial sac has 4 internal longitudinal vessels, no folds, and 8 to 10 rows of stigmata. Usually each row is crossed by a parastigmatic vessel, although in older zooids with 10 rows the posterior 2 and the anterior rows do not have them. About 7 stigmata are present in each mesh.

The oesophagus is short, opening into a fairly long stomach that occupies the proximal half of the ascending limb of the gut loop and has about 15 parallel folds in its wall. At the pyloric end of the stomach there is a long gastric caecum curled around in the gut loop. Three ligaments from the outer curve of the caecum attach it to the inner curve of the intestine. The intestinal loop is narrow and the rectum forms a U-shaped secondary loop with the descending limb of the primary loop. The anal border is smooth and bilabiate. The whole gut loop is in the posterior half of the left side of the body.

Hermaphroditic gonads are in a single row each side of the endostyle, 5 or 6 on the left and 6 to 8 on the right. The small, almost spherical ovaries contain 6 to 8 eggs, and have a short, wide oviduct. The single fan-shaped male follicle beneath each ovary has a short duct curving out to the side of the oviducal opening. The male follicle is deeply divided into about 7, sometimes branched, lobes.

REMARKS: This species is distinguished from the tropical *Polyzoa violacea* by its relatively few, internal, longitudinal branchial vessels and its sandy test. A long gastric caecum does occur in *Polyzoa violacea*, but the stomach of the present species is longer and has more folds.

Polyzoa nodosa is, like *P. exigua* (see above), sandy. However, unlike *P. exigua*, it has conspicuous sandy stolons, spherical zooids with 4 internal longitudinal vessels, a long curled gastric caecum, and a long stomach.

Symplegma arenosa Kott, 1972 (see Kott 1985) has sandy zooids connected by basal stolons, but,

although assigned to the genus *Symplegma*, its gonads are not known. Its holotype has been re-examined. Its upright, sessile zooids with a pronounced terminal depression, more numerous (15) rows of stigmata, short horizontal intestinal loop, long rectum, short stomach and short, straight gastric caecum distinguish it from the present species.

Genus **Metandrocarpa** Michaelsen, 1904

Metandrocarpa miniscula Kott, 1985
(Figs 22,23)

Metandrocarpa miniscula Kott, 1985, p. 254

Distribution

New Records: Queensland (Moreton Bay, Pt Lookout, QM GH4264 GH4266).

Like the syntypes, the newly recorded specimens were taken in the intertidal zone — in crevices in rocky outcrops on a sandy beach. They were found closely associated with a sand-adapted fauna that included *Perophora sabulosa* n.sp. a sandy undescribed *Aplidium* sp, algae and coelenterates.

Recorded Range: Previously known from a single record at Mission Beach, northern Queensland.

Description

Spherical, sessile zooids about 4mm diameter to small club-shaped ones which narrow posteriorly to single stems about the same length as the zooids. These are attached to basal stolons. Colonies form a mat over the substrate or they fill crevices between the associated fauna so that aggregates of diverse taxa have a level, sandy surface.

The apertures of zooids are obscured by adhering sand. Internally, they are on short conical siphons directed away from one another. Circular muscles surround each siphon and the body. Longitudinal muscles radiate from each siphon. The dorsal lamina is a wide membrane. There are 4 internal longitudinal vessels in the branchial sac, and stigmata, in 8 rows, have the formula E6,6,4,4,5DL. The simple gut loop lies in the dorsal half of the body and is more or less vertically oriented. The descending limb, opening at the base of the atrial siphon, is longer than the ascending one. The oesophagus is short, and its opening from the branchial sac is about halfway down the body. The short stomach with 8 to 12 broad folds occupies only a small part of the ascending limb of the gut loop. A short caecum increases in length with increasing numbers of stomach folds — it is straight in zooids with 8 stomach folds and curved in those with 12.

Usually 5 long, vertically-oriented, oval male follicles are in the posterior curve of the body on the right side. Their short ducts are at the anterior end of each follicle. A single male follicle is on the left side of the body ventral to the gut loop. A variable number (up to 3 on each side) of small, sac-like, 3- or 4-egg ovaries are present just posterior to the male follicles on both sides of the body. Many of the zooids that were examined had developing embryos and larvae lying free in the peribranchial cavity (colonies collected in June). The larval trunk is 0.5mm long, and has the same structure as larvae from the syntype zooids.

There are a few round, flat-topped endocarps on the body wall.

Remarks: The newly recorded zooids have more numerous stomach folds than the smaller syntypes, and they have a gastric caecum. However, the gut loop has the same orientation in both specimen lots, the branchial sacs are the same, the gonads (which vary in number in both) are similarly arranged and the specimens are sufficiently alike to be considered conspecific.

The 3 *Metandrocarpa* spp. recorded from Australia are all sandy and resemble one another. Although the gonads of *M. indica* Kott, 1972 are not known, the 2 other species have large, elongate male follicles in the postero-ventral part of the body, and a variable number of sac-like ovaries, rather irregularly arranged, posterior and ventral to the male follicles. The Western Australian *Metandrocarpa agitata* Kott, 1985 is larger and better developed than either *M. indica* from Western and South Australia or the present species. The last two species, are similar in many respects, both having 4 internal longitudinal branchial vessels and 9 (or 10), and 8 rows of stigmata, respectively. The key character used by Kott (1985) to distinguish these two species, *viz* the absence of the gastric caecum, is now invalid, since the caecum is now known to be present in both species, although it is longer in *M. indica* than in *M. miniscula*. *Metandrocarpa indica* can be distinguished from *M. miniscula* by its sessile and flattened, rather than stalked and upright, zooids, and its long, pointed, atrial siphon.

Genus **Botryllocarpa** Hartmeyer, 1911

Botryllocarpa elongata n.sp.
(Figs 24–26)

Distribution

Type Locality: Phillip I., Bass Strait, Victoria, in caves, coll. W. Tiegs, November 1956, holotype AM Y2122.

Description

The holotype colony is narrow, almost cylindrical, and branches along a stem of seaweed. The

test is glassy and transparent. Zooids, arranged in 2 rows, one along each longitudinal border of the colony have their longitudinal axes parallel to one another. The terminal branchial apertures all face the outer edge of the colony, and the atrial apertures, which are near the posterior end of the horizontal zooids, face toward the centre of the colony. Large, spherical, terminal ampullae of the test vessels are scattered in the test between the zooids.

Zooids are only about 2mm long. The margins of both branchial and atrial apertures appear to be smooth. The body wall is very delicate and the organs embedded in it are readily dislodged. A narrow ring of fine muscles surrounds each aperture, and fine, inconspicuous, longitudinal muscles radiate only a short distance from each aperture. Of about 16 branchial tentacles of various sizes found just inside the branchial aperture, 4 are quite long. The dorsal lamina is long and smooth-edged but narrow. Anteriorly it flattens out and extends across the prebranchial area to the tentacular ring as a fairly broad raised area with the simple opening of the neural duct in the centre. The peripharyngeal bands terminate on each side of this raised area.

Three longitudinal vessels on each side of the body cross 9 rows of stigmata, which have the formula DL10,6,5,4E. The oesophagus is short, bending ventrally and anteriorly from the oesophageal opening at the posterior end of the branchial sac to open into a barrel-shaped stomach. There are 8 broad, parallel, longitudinal, gastric folds and a short, straight pyloric caecum. The stomach occupies the proximal half to two-thirds of the ascending limb of the gut loop and is longitudinally oriented. The intestine curves around laterally and posteriorly to lie outside and close to the ascending limb of the gut loop. The rectum is relatively short and curves around the outside of the oesophagus onto the dorsal surface to open near the atrial aperture. The anal border is smooth and bilabiate. The gut loop occupies the posterior half of the left side of the body.

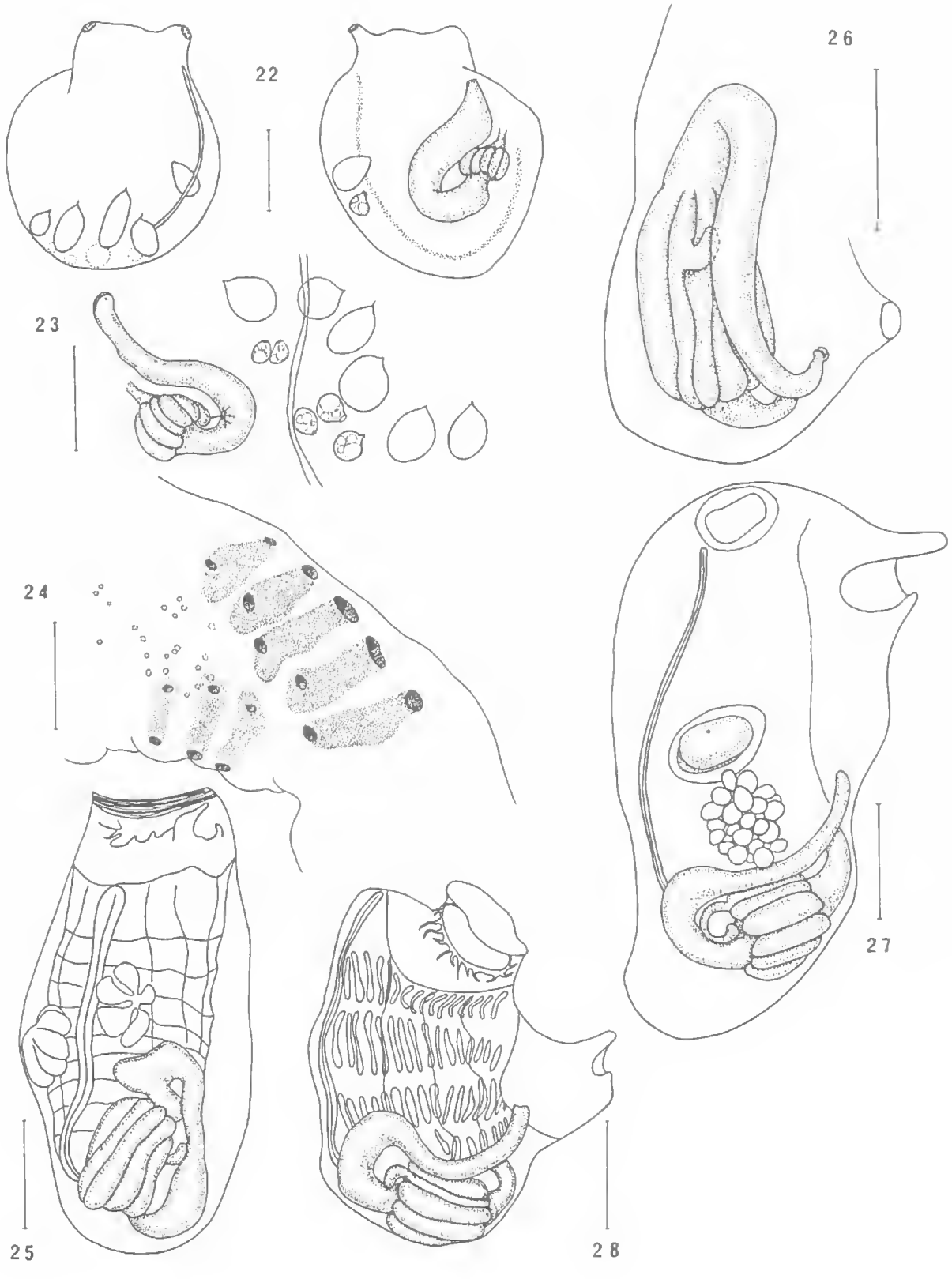
A single testis on each side of the body lies anterior to the gut loop on the left and halfway down the body on the right. Each consists of a single, fan-shaped to circular follicle deeply divided into 3 to 5 tapering lobes. A short vas deferens opens directly into the atrial cavity. Ovaries are not present in this colony.

Remarks: The type species, *Botryllocarpa viridis* (Pizon, 1908) from Indonesia, was assigned originally to *Protobotryllus* (Botryllidae). Hartmeyer (1911) erected *Botryllocarpa* in the Polyzoinae to accommodate it, believing that the Botryllinae, with their cloacal systems, were distinct from the separately opening Polyzoinae. Since then, Kott (1985) questioned whether the genus was distinct from *Chorizocarpa* Michaelsen, 1904, which also has 3 internal longitudinal branchial vessels but dioecious gonads, the male and female on opposite sides of the body.

Tokioka (1972) believed the genus to be a synonym of *Symplegma*, despite the differences in the number of internal longitudinal branchial vessels. He reported that crowded specimens of *Symplegma* do show variations in the number of these vessels, sometimes having only 3 rather than the characteristic 4. However, this is apparently an abnormality impressed by the environment rather than a genetic difference. Other differences between the genera reinforce the difference in the branchial sac. Musculature of *Symplegma* spp. consists of an inner layer of longitudinal fibres and an outer layer of circular fibres, and the apertures become frilled when contracted. In the present genus the musculature is less developed and the apertures remain smooth-rimmed even when contracted. Further, the test of *Symplegma* is delicate and easily torn while that of the present genus is firm and gelatinous, and *Symplegma* spp. appear to be more prolific vegetatively with zooids usually being crowded in the test.

Botryllocarpa and *Chorizocarpa* are not readily separated, for apart from differences in distribution of male and female gonads, both genera have similar colonies, the same firm, glassy test, 3 internal, longitudinal branchial vessels on each side, rather limited musculature, plain-rimmed apertures, a similar number of rows of stigmata and stigmata per row, and both appear to have the same rate of replication. Nevertheless, in the three known species of *Chorizocarpa* (see Kott 1985) the male gonad is on the left and the female on the right, while *Botryllocarpa* has both male and female gonads on both sides of the body. The two genera are therefore regarded here as distinct.

Figs 22–28: *Metandrocarpa miniscula* (QM GH4264) — 22, right and left sides of the body from outside; 23, gut and gonads from inside body wall. *Botryllocarpa elongata* n.sp. (holotype AM Y2122) — 24, portion of colony; 25, zooid from ventral surface; 26, gut loop from left side. *Botryllus stewartensis* (QM GH4262) — 27, body removed from test from left side. *Botryllus tuberatus* (QM GH4274) — 28, body removed from test from left side. (Scales: 22, 23 — 1mm; 24 — 2mm, 25–28 — 0.5mm).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Botryllocarpa elongata n.sp. and the type *Botryllocarpa viridis* (Pizon, 1908) have the same 4 large branchial tentacles, 9 rows of stigmata and a longitudinally oriented stomach and gut loop. However, in Pizon's species the atrial aperture is opposite the third row of stigmata rather than in the posterior half of the body, and, although the rectum is longer than in the present species, the descending limb of the gut loop is shorter. The longer rectum appears to be associated with the anterior position of the atrial aperture about one-third of the body length from the branchial aperture, rather than in the posterior end of the body as it is in the present species. In addition to the circular muscles around the apertures *B. viridis* has longitudinal bands between the branchial and atrial apertures that are not present in the Australian species; the male gonad has two separate follicles in *B. viridis* but only one in *B. elongata*; and there are only 8 stomach folds in the latter species, but 11 to 14 in *B. viridis*.

There are only 3 records of the genus *Botryllocarpa*, *viz.* the type from Indonesia; *Botryllocarpa pizoni* (Tokioka, 1972) from the Pacific coast of Costa Rica (which despite its geographic separation is apparently a junior synonym of the type), and the present species.

Subfamily BOTRYLLINAE Adams and Adams, 1858

Genus **Botryllus** Gaertner, 1774

Botryllus stewartensis Brewin, 1958
(Fig. 27)

Botryllus stewartensis Brewin, 1958, p. 444. Kott 1985, p. 269 and synonymy.

DISTRIBUTION

NEW RECORDS: Western Australia (Albany, QM GH4632). New South Wales (Port Hacking, AM Y2153). Queensland (Moreton Bay, QM GH4262). Western Australian specimens are epizooitic on *Polycarpa flava* from sea grass (*Posidonia sinuosa* and *P. australis*), those from Queensland are from about 6m off Dunwich, and New South Wales records are from Little Turriel Point from 20m.

RECORDED RANGE: South Australia (Spencer Gulf), Victoria (Port Phillip Bay and Ninety Mile Beach), New South Wales (Port Kembla and Port Stephens), and New Zealand (Stewart and South Is.).

DESCRIPTION

The newly recorded material from eastern Australia forms compact colonies consisting of sandy, upright stalks up to 2cm high and 0.5cm diameter with a flat terminal surface onto which the zooids open around a central cloacal aperture. Adjacent stalks adhere to one another through their attached sandy coating. The stalks comprising one colony are all of even height and their flat terminal surface, with the cyclamen pigmentation of the zooids apparent through the sand, appear from the surface as a compact mosaic. Some stalks are wider, flat in section, and subdivided terminally into zooid bearing heads of the usual diameter.

The zooids have 12 rows of stigmata with the formula E5,3,3,4,DL4,2,3,4E. The horizontal gut loop is slightly posterior to the branchial sac. There are 12 broad folds in the wall of the short, barrel-shaped stomach, and a relatively short caecum curves into the gut loop. Larvae are present in the peribranchial cavity of Moreton Bay specimens collected in August. There is a large, lobed testis on each side — just anterior to the gut loop on the left.

Colonies from sea grass beds at Albany are small, cushion-like lobes with relatively short stalks and immature zooids.

REMARKS: Zooids from both newly recorded specimen lots from eastern Australia differ from South Australian material in having a larger interval between the endostyle and the ventral fold on each side, 12 (instead of 10) stomach folds, and a more deeply subdivided testis. These do not appear to be more than population differences.

Botryllus tuberatus Ritter and Forsyth, 1917
(Fig. 28)

Botryllus tuberatus Ritter and Forsyth, 1917, p. 461. Kott, 1985, p. 271 and synonymy.

DISTRIBUTION

NEW RECORDS: Queensland (Moreton Bay, QM GH4274).

RECORDED RANGE: The species is known from Cockburn Sound (Western Australia) and from Hervey Bay northwards to Lizard I. (Queensland) as well as from the western and eastern Pacific, and Japan. It is not impossible that convergence and simplification in these small zooids has obscured species differences, and that the eastern and western Pacific populations are not conspecific.

DESCRIPTION

Living specimens have well-formed orange zooids 1.6mm long, arranged in circular systems in a colourless test. In preservative the zooids are dark. There are about 12 tentacles of various sizes. The stigmata are long, and are arranged in 4 regular rows with the formula DL 3,3,3,5E. The slightly curved, horizontal gut loop is in the posterior end of the body. The barrel-shaped stomach, with 8 broad folds and a curved caecum with a terminal bulb, occupies the middle of the ascending limb of the gut loop.

REMARKS: The newly recorded specimen has larger zooids and more branchial tentacles than previously recorded for this species. The stigmata are long and rectangular, and the rows of stigmata are regular, reaching from the endostyle to the dorsal lamina without a shorter interstitial row being present ventrally. The stomach is longer and more barrel-shaped, and has slightly fewer folds than the 10 previously recorded. Nevertheless, zooids are in regular circular systems in a clear test, the atrial aperture is small and circular and produced dorsally on the end of a conically expanded dorsal surface, there are the same numbers of stigmata in each row, and the gastric caecum is identical with that previously described. The differences between the present colony from Moreton Bay and the previously described specimens from the tropics could be associated with its better developed zooids.

Family PYURIDAE Hartmeyer, 1908
Genus **Pyura** Molina, 1782

Pyura arenosa (Herdman, 1882)

Cynthia arenosa Herdman, 1882, p. 140.
Pyura arenosa: Kott, 1985, p. 289 and synonymy.

DISTRIBUTION

NEW RECORD: Victoria (Bass Strait, MV F54197). The record is from 52m.

RECORDED RANGE: The species has been recorded from the eastern coast of Australia from Mission Beach to Bowen, from Houtman's Abrolhos in Western Australia and from Indonesia, Torres Strait and the Arafura Sea.

This is the first record of this species from temperate waters.

DESCRIPTION

The new record is of a single spherical, sandy specimen 1cm long. The characteristic flattened, leaf-like overlapping spines line the siphons and continue onto their outer surfaces and over the anterior half of the test, where they are obscured by adherent sand.

Pyura rapaformis n.sp.
(Figs 31,32)

DISTRIBUTION

TYPE LOCALITY: Western Australia, Cottesloe, on upper surface of reef near pylon, 2m, coll. L. Marsh 30.12.86, holotype WAM 190.87, paratypes WAM 27.87, QM GH4309.

DESCRIPTION

Individuals are turnip-shaped, more or less flat on their upper surface which is circular and about 3cm in diameter. The 3cm long body tapers to a long (7cm), narrow (0.5cm), flattened posterior root that terminates in short branches. Crowded vertical papillae (up to 1.5mm long), some cylindrical and some flattened lamellae, project from the surface of the test and these and the test between them are covered in sand. Individuals adhere to one another through the sand that covers them, and through the vertical sand-covered projections that interdigitate with those of adjacent individuals. The upper surfaces of the individuals in an aggregate together form an even platform. Individuals in the aggregate adhere to one another along their length, and as they taper posteriorly their basal root-like processes on the under surface of the aggregate are relatively close together.

Both apertures are close together on short 4-lobed siphons in the centre of the upper surface. The lobes on the facing sides of each siphon are larger than the outside ones so that the openings are directed away from one another. The lobes of the apertures are also covered with projecting papillae, similar to those on the remainder of the body, and these and the sand that adheres to them obscure the openings. Papillae are not present on the root where the surface test is densely impregnated with sand. The test itself is relatively thin and transparent, its strength conferred by the adhering sand, projecting papillae, and the adhering test of adjacent individuals. The internal test of the stalk is soft and pierced by 2 wide canals.

Siphons are lined with pointed, overlapping hollow spines, 1mm long, with a long slightly expanded base and a long but constricted opening. The point extends anteriorly in line with the base and is only very slightly curved. The posterior end of the base terminates in 4 rounded swellings. These spines are light green in preservative.

The body wall has a thin, outer layer of circular muscle fibres which are particularly crowded on the anterior half of the body. Internal longitudinal bands terminate in short branches at the posterior end of the body on the right and just anterior to the gut loop on the left. The body comes to a point posteriorly and a thin projection from it extends into the posterior root. There are about 20 long, sickle-shaped tentacles of various sizes, branched 3 times. The first-order branches are relatively long and give the tentacles a feather-like appearance. The prominent dorsal tubercle has a deep slit with each horn spiralling inwards about twice, and the open interval directed forwards. The peritubercular area is relatively shallow.

There are 6 wide, overlapping branchial folds on each side. The branchial formula is E2(7)3(16)3(19)3(22)3(20)2(22)1DL. Eight stig-

mata per mesh are present in the centre of the branchial sac. The dorsal lamina, consisting of pointed languets, is long, the oesophageal opening being at the posterior end of the branchial sac.

The gently curved gut loop encloses about 10 pairs of large polycarp sacs. The liver is large, branching off the ascending limb about halfway along its length. There is only a single accessory diverticulum proximal to the main liver diverticulum. The anal border is plain. There are numerous, branched and lobed endocarps on both gut and gonads.

Remarks: The species is possibly most closely related to *Pyura tasmanensis* from the south-eastern corner of Australia. The position of the apertures (close together on the upper surface) the siphonal spines, the circular body musculature, the feathery branchial tentacles, the double spiral opening of the neural gland, the large overlapping folds of the branchial sac, the course of the gut, and the endocarps on gut loop and gonad sacs are all similar in *P. tasmanensis* and *P. rapaformis*. However, the aggregates of *P. tasmanensis* are irregular, and do not form an even platform as do aggregates of the present species. The Tasmanian species has a more protuberant dorsal tubercle, and has more internal longitudinal vessels in the interspaces. However, the principal distinctions between the two species are found in the test. The test of *P. tasmanensis* is sandy with wrinkles and ridges but lacks the projecting papillae of the present species, and it has a short stem or tufts of posterior, root-like extensions that hold the aggregates together, rather than the single, long, posterior root of the present species.

Pyura tasmanensis Kott, 1985

Pyura tasmanensis Kott, 1985, p. 331

Distribution

New Record: New South Wales (Bermagui, AM Y2174). The new record is from about 300m.

Recorded Range: Previous records are from the eastern coast of Tasmania, mostly storm debris collected from beaches, but one specimen lot is known from 154m. The new record suggests a wider range to the north in deeper waters of the eastern Australian continental shelf.

Genus Ctenicella Lacaze-Duthiers, 1877

Ctenicella antipoda Kott, 1972
(Fig. 29)

Ctenicella antipoda Kott, 1972a, p. 44; 1985, p. 339.

Distribution

New Records: South Australia (Tipara Reef, QM GH4849).

Previously Recorded: St Vincent and Spencer Gulfs (including Tipara Reef) to 20m.

Description

The specimen is large, slightly laterally flattened, and deeper than its height. The rim of test that surrounds the upper surface is discontinuous, made up of a number of upright sandy ridges. Irregular sandy lobes are also present on the upper surface between the apertures, obscuring them. Despite these irregularities of the outer surface of the sandy test, the internal cavity is regularly oval with a smooth lining.

A band of rather flat, asymmetrical, hollow, conical spines surround the outer part of each siphon lining. The free pointed tip of each spine is short, the base long and open, and the outer surface of the cone (facing the lumen of the siphon) long, and flattened and scale-like posteriorly.

The gut is large, the rectum swollen with faecal material, as is usual for this species, and the sessile liver has the usual crowded parallel tubules embedded in the body wall over the pyloric region of the gut. The gonad is degenerate, embedded in the body wall dorsal to the gut loop. The specimen appears to be senescent.

Remarks: Owing to the sandy ridges around the upper surface of this specimen it resembles *Pyura stolonifera*. It especially resembles the rather squat, sandy, estuarine and the sandy, tuberculate, juvenile forms of *P. stolonifera*. Further, the sandy lobes between the apertures superficially resemble the siphons of the latter species. However, in *P. stolonifera* the rim around the upper surface is a fold rather than a solid ridge of test; and the body wall of the zooid is similarly folded, the anterior surface, including the siphons, being depressed into the rest of the body. In *C. antipoda* the body has a smooth oval outline when removed from the test.

The siphonal spines, which previously have been overlooked in this species, also resemble those of *Pyura stolonifera* (see Fig. 30) as well as those of *P. spinosa* and *P. spinifera* (see Kott 1985). However, the free pointed tip of the spines of the present species is shorter than in any other species.

Genus Halocynthia Verrill and Rathburn, 1879

Halocynthia papillosa (Linnaeus, 1767)

Ascidia papillosa Linnaeus, 1767, p. 1087
Halocynthia papillosa: Kott, 1985, p. 344 and synonymy.

Distribution

New Record: New South Wales (Elizabeth Reef, 159°04'E, 29°57'S, about 500km E. of Grafton, AM Y2141). The single specimen was taken from 10m in the lagoon of this isolated coral reef.

RECORDED RANGE. Atlantic coast of France, Mediterranean, Queensland (Heron I.).

REMARKS:

The newly recorded specimen is identical with that previously recorded from Heron I. and with the specimens from the northern hemisphere. The two records from well separated coralline locations off eastern Australia cannot be reconciled with the previously recorded range of this species.

Genus **Microcosmus** Heller, 1877

Microcosmus curvus Tokioka, 1954
(Figs 33–35)

Microcosmus curvus Tokioka, 1954, p. 263; 1967, p. 215. Renganathan, 1983, p. 929.

Microcosmus exasperatus: Monniot and Monniot, 1987, p. 125 (part, Figs 50c,e).

DISTRIBUTION

NEW RECORD Queensland (Heron I., QM GH3814).

RECORDED RANGE. Palau Is., Marianas Is., Wake I., Tokara Is, India (Gulf of Mannar). The synonymy of specimens assigned to *M. exasperatus* by Monniot and Monniot (1987) extends the known range of *M. curvus* to Tahiti.

DESCRIPTION

The newly recorded specimen is 2cm high and 1.2cm wide. The branchial aperture is terminal, directed downwards, and the atrial aperture, from the antero-dorsal surface, is directed obliquely upwards. The posterior two-thirds of the body was buried in coralline sand and lacked pigment. However, the anterior one-third projected from the substrate and was, in life, a red-brown colour. Irregular projections of the surface are present on the anterior part of the body. There are white stripes down the outside of the siphons. The test is tough and leathery.

The siphonal lining has minute, overlapping, flattened, pointed spines not more than 0.02 to 0.03mm long. The posterior end of the base of the spine flares up slightly, rather than being turned under into a hook as in *Microcosmus exasperatus* (see Kott 1985). Spines near the outer part of the siphon are shorter than those at the base and are less pointed, sometimes having almost rounded tips. The body wall is strong and muscular. The branchial tentacles are bushy. The opening of the neural gland, on the dorsal tubercle, forms a single coil about one and a half times in a clockwise direction from the centre. The neural ganglion is long, extending from beneath the dorsal tubercle to the base of the atrial siphon. There are small, finger-like papillae projecting from the peripharyngeal band.

There are 6 conspicuous branchial folds on each side of the body and a seventh rudimentary one on the left nearest to the endostyle. Internal longitudinal vessels have the formula E1(3)1(8)2(10)2(12)2(11)2(11)1DL. There are 4 to 6 stigmata per mesh.

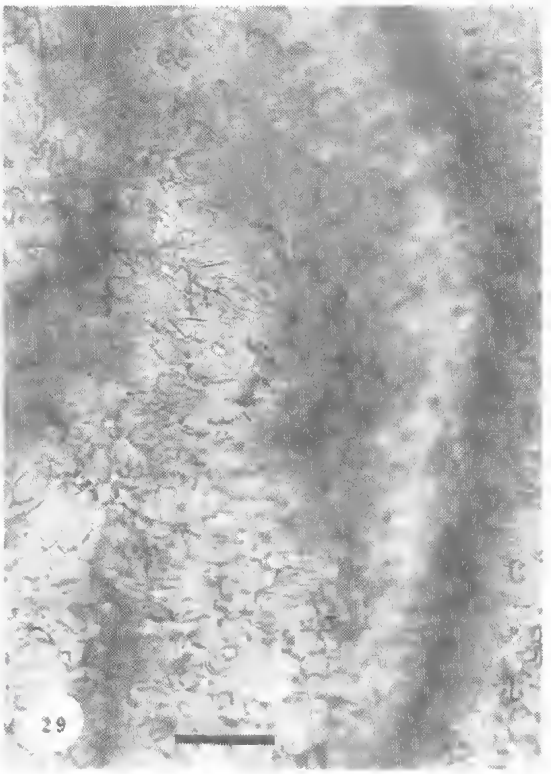
The oesophagus is moderately long and opens into an expanded pyloric region with parallel liver lamellae in its wall. The lamellae in the proximal part of the pyloric region are papillated. The gut loop is open at the pole, and is slightly curved around the posterior border of the body. The anal border is smooth and bilabiate.

The left gonad crosses the descending limb of the gut loop. The right gonad is in the postero-ventral quarter of the right side. Both gonads are slightly lobed at their broad proximal ends, and the narrower distal ends curves up parallel to the proximal end to form a deep U. The gonoducts are directed anteriorly — toward the branchial rather than the atrial apertures. Three or 4 scattered groups of small, pear-shaped male follicles are closely applied to the sides or mesial surface of each ovarian tube.

A few small endocarps are on the gut loop.

REMARKS: There is, in this species, some variation in the presence of tubercles on the anterior part of the test, in the number and direction of coils of the opening of the neural gland and in the curves of the gonads (see Tokioka 1967). Nevertheless, the species is well characterised and is distinguished readily from others in the genus. *Microcosmus curvus* is possibly most closely related to *M. madagascariensis*, both having entire gonads with the left one sometimes crossing the gut, and similarly shaped siphonal spines. However, the present species is distinguished from *M. madagascariensis* by its smaller siphonal spines, rudimentary seventh fold usually present only on the left side, undulating and curving gonads with the gonoducts directed anteriorly, small pyriform male follicles on the sides and upper surface of the ovary, shallow curve of the gut loop, long neural ganglion, and usually the coiling of only a single horn of the opening of the neural gland.

The synonymy of this species with *M. exasperatus* suggested by Monniot and Monniot (1987) is invalid, *M. exasperatus* differing in many characters, most noticeably in the longer siphonal spines with a basal hook, divided gonads, orientation of its gonoducts toward the atrial aperture, and double spiral coil of the opening of the neural gland. Some of the specimens from Tahiti (Monniot and Monniot 1987, figs 50C and E) are almost certainly *M. curvus*, having anteriorly directed gonoducts. Other specimens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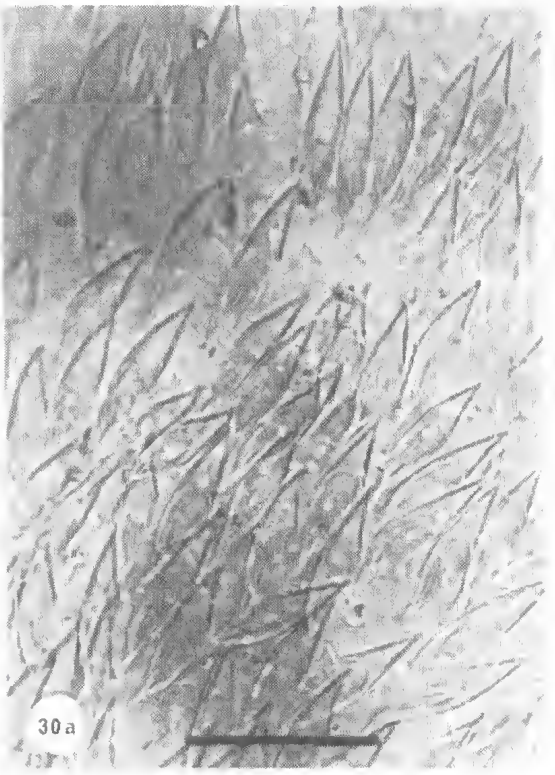
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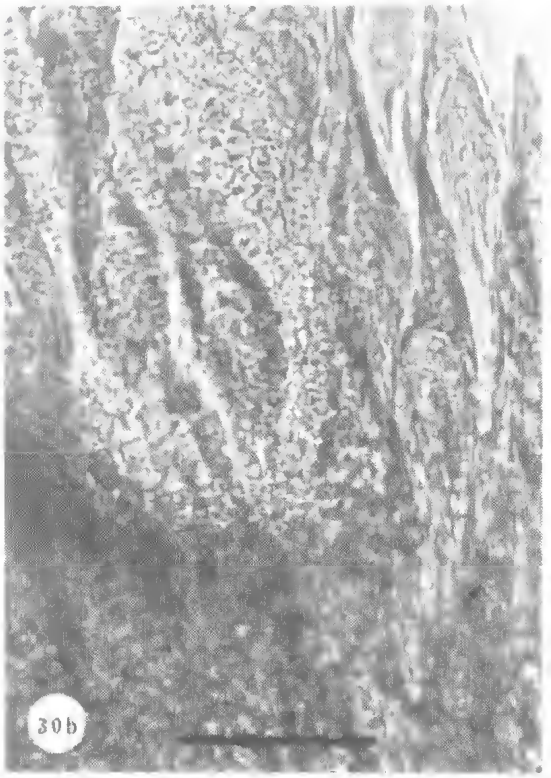
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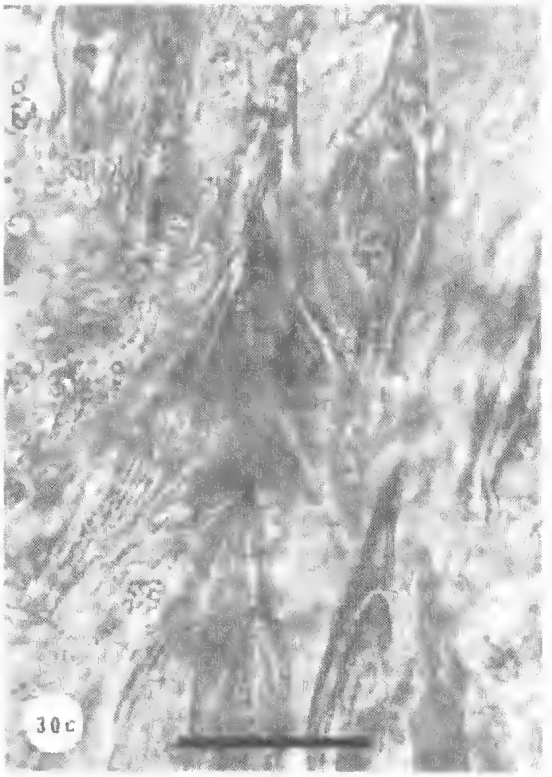

30c

(see Monniot and Monniot 1987, figs 50A, B and D) have their gonoducts directed toward the atrial aperture, and probably are specimens of *M. exasperatus*. However, without information on the siphonal armature a definitive identification of these specimens is not possible.

The specimens described by Tokioka (1967) from Wake I. contained viviparous larvae. This is entirely consistent with the orientation of the gonoducts. Viviparity has not previously been reported in this genus.

Microcosmus madagascariensis Michaelsen, 1918

Microcosmus madagascariensis Michaelsen, 1918, p. 20. Kott, 1985, p. 351 and synonymy.

DISTRIBUTION

NEW RECORDS: Queensland (Moreton Bay, QM GH3883). The newly recorded specimen is from 6m

RECORDED RANGE: The species is known from Western Australia (Broome and Albany) and from Malagasy. The new record from Moreton Bay, in extending the previously known range in the Indian Ocean into the Western Pacific, indicates that the species has a tropical Indo-West Pacific range. However, there is no indication yet that it extends around the temperate southern coast of Australia as the pan-tropical species *Microcosmus exasperatus* and *M. helleri* are known to do (Kott 1985).

DESCRIPTION

The newly recorded specimen is almost spherical and about 2cm in diameter. The apertures are on short, only slightly protruding, naked siphons. However, the remainder of the tough, hard, relatively thin, smooth test has a dense coat of sand adhering to it. The body wall is muscular. The flattened, pointed siphonal spines, 0.1mm long, have a long, open base with its narrow posterior border flaring up slightly. Both horns of the opening of the neural gland spiral inwards once only. The neural ganglion is half the length of the dorsal lamina. There are 8 branchial folds on each side of the body. The gut loop is long and narrow, curving around the postero-ventral curve of the body and reaching at least two-thirds of the distance up the ventral border of the body. Broad gonads with short branches or lobes projecting from each side are deeply embedded in endocarp-like thickening of the body wall. The testis follicles are long and branched, lying in a layer beneath each ovary and projecting out into the body wall around the sides of the ovary.

REMARKS: The specimen is smaller than the ones previously recorded from Australia, it has 8 rather than 7 branchial folds, and its gonads are not so conspicuously branched. Nevertheless it has the characteristic long, flattened siphonal spines, long gut loop, endocarps on the gut and endocarp-like thickenings of the body wall enclosing the gonads. Its long, branched, male follicles beneath the ovary and spreading out around the sides are unusual for this genus, although similar male follicles do occur in *Microcosmus planus* and *M. stoloniferus* (see Kott 1985).

Microcosmus planus Kott, 1975

Microcosmus planus Kott, 1975, p. 15; 1985, p. 353.

DISTRIBUTION

NEW RECORD: Victoria (Bass Strait, MV F54211). The specimen was taken with *Molgula mollis* on a sandy substrate.

RECORDED RANGE: The species previously was known from a single location at 31m, Elliston Bay, Great Australian Bight.

DESCRIPTION

The newly recorded specimen is 1.5cm in diameter — including the sandy coating. It has the same laterally flattened circular shape with a thick ventral keel, as well as the other morphological characters of the type material including the sessile apertures, siphonal spines, long dorsal lamina, and sinuous gonads with the left one outside the gut loop. The long, branched, male follicles are beneath and projecting out around the sides of the ovary. It differs from previously recorded specimens in having 8 rather than 7 branchial folds on the left side, although only 7 folds are present on the right.

Microcosmus stoloniferus Kott, 1952

Microcosmus stoloniferus Kott, 1952, p. 291; 1985, p. 359 and synonymy.

DISTRIBUTION

NEW RECORDS: Torres Strait (QM GH4833–6).

RECORDED RANGE: Formerly recorded from South Australia, Tasmania and through Bass Strait and north to the vicinity of Lizard I. The new record extends the known range of this species into the high tropics.

REMARKS: The newly recorded specimens (dredged from the sea floor) are numerous but small, characteristically sandy, usually tapering to a point posteriorly, but some with the posterior

Figs 29–30: *Ctenicella antipoda* (QM GH4849) — 29, siphonal spines. *Pyura stolonifera* — 30a, siphonal spines from juvenile, Arrawara, NSW (QM GH2246); 30b,c, siphonal spines from large coastal specimens, Albany, WA and Tweed River, NSW (QM GH4646 GH4892). (Scales: 29,30 — 0.05mm).

test produced into thin, short, sand-covered, root-like projections. The apertures are in a narrow depression in the flattened upper surface.

It is probable that this species will be found to occur in Indonesian waters.

Genus **Hartmeyeria** Ritter, 1913

Hartmeyeria formosa (Herdman, 1882)

Cynthia formosa Herdman, 1882, p. 139.
Hartmeyeria formosa: Kott, 1985, p. 363 and synonymy.

Distribution

New Record: Queensland (Swain Reefs, AM Y2179). The species was taken from 76m.

Recorded Range: The new record extends the known range of this species from Australian coastal waters between Torres Strait and Bass Strait out onto the edge of the continental shelf about 200km offshore. It will probably be found to occur over the whole of the Australian Continental Shelf.

Genus **Molgula** Forbes, 1848

Molgula calvata Sluiter, 1904
(Fig. 36)

Molgula calvata Sluiter, 1904, p. 116. Kott, 1985, p. 369 and synonymy.

Distribution

New Records: Western Australia (Albany, QM GH4641). South Australia (Yorke Peninsula, SAM E2088). Victoria (Western Port, MV F53301 F53304 F53317 F54205).

Recorded Range: The species has been recorded from Indonesia, the Philippines, Triggs I. and Albany in Western Australia, and Innisfail, Gladstone, Noosa and northern New South Wales on the eastern coast of Australia. The records are all from shallow depths; the new records for Western Port at 15m are the deepest yet recorded for this species. The species is taken always from sandy substrates, and very likely will be found to occur all along the eastern and western Australian coasts in similar habitats.

Description

The newly recorded specimens have the characteristics previously reported for this species, *viz*., delicate test covered with long, fine, hair-like projections to which sand adheres, 2 internal longitudinal branchial vessels on the ventral side of each fold, the left gonad enclosed in the deep U-shaped curve of the narrow gut loop, and numerous short vas deferens openings along the centre of each ovary. The opening of the neural gland is a reverse C-shape, although in one specimen the lower horn is turned posteriorly. The parietal border of the opening of the rather long oviduct is bent inwards over the end of the tube to create a crescent shaped aperture directed ventrally. The newly recorded specimen collected in November, has a single larva in the peribranchial cavity.

Molgula incidata Kott, 1985
(Figs. 37–39)

Molgula incidata Kott, 1985, p. 377.

Distribution

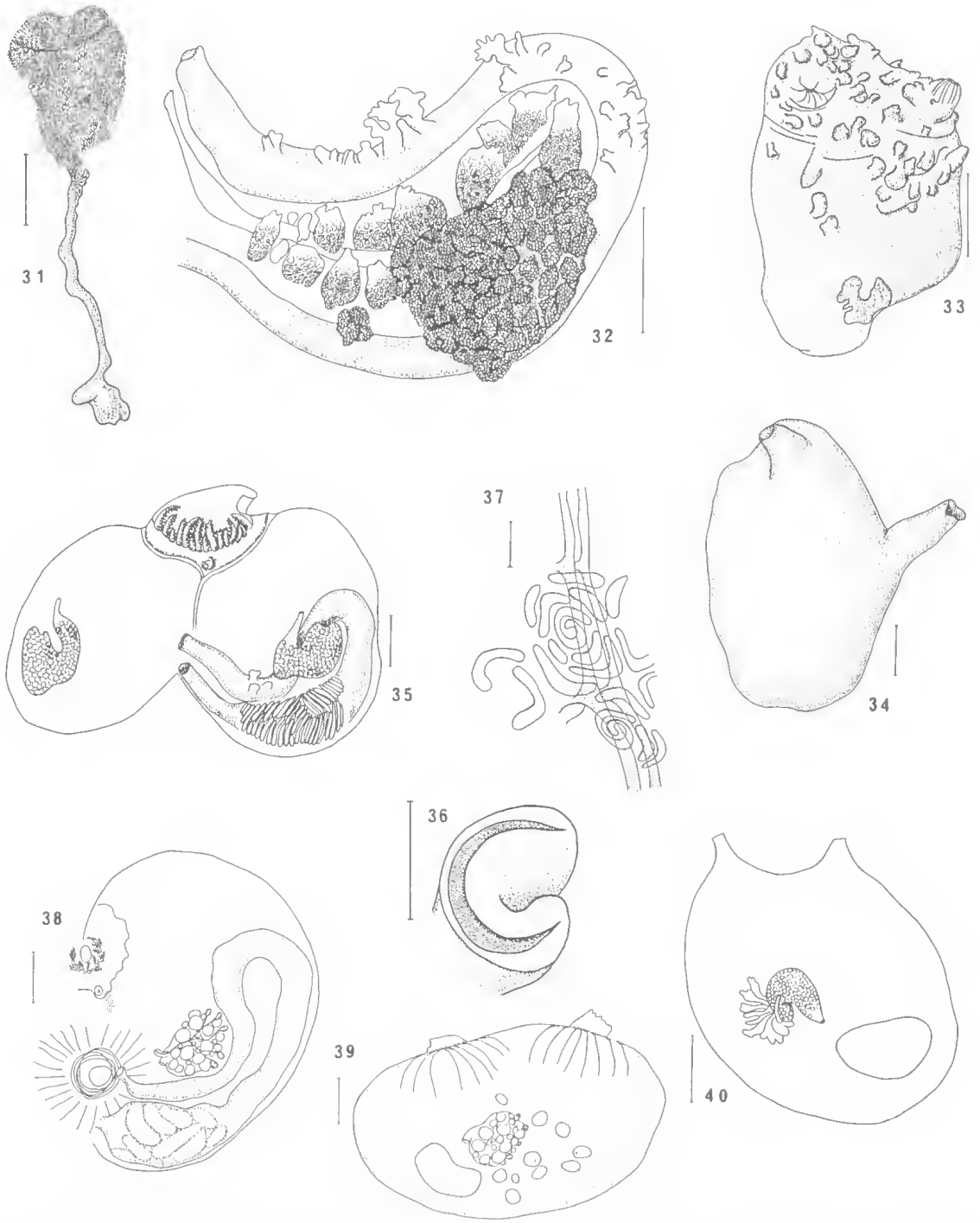
New Records: Western Australia (Albany, QM GH4633–4). Epizoites on *Polycarpa flava* from sea grass (*Posidonia sinuosa*) beds.

Recorded Range: The species formerly was known only from Heron I., Innisfail (Queensland) and Norfolk I. New records suggest that this small, inconspicuous species has a wide range around the Australian coast, and very likely it is more common than the present records suggest. With one exception (see Kott 1985), the specimens recorded are epibionts. However, as Kott (1985) observed, this does not reflect an obligate habitat but rather the fact that these small individuals are not readily observed in the field.

Description

Zooids are small (4mm diameter) domes with a thin test, brittle with embedded sand. The apertures are sessile, about one third of the body length apart in the middle of the upper surface. Circular muscles are around each aperture, and short longitudinal muscles radiate from each side of the siphons. About 12 branchial tentacles of various sizes have moderately long pinnate branches. A single circular opening of the neural duct is to the right of a long neural ganglion. Seven low, branchial folds are on each side of the body. A wide, internal longitudinal vessel is on the ventral side of each fold, another is along the edge, and there are two, fine, internal longitudinal vessels on the dorsal side of all folds except the first and the seventh. The ventral fold contains 9 infundibula, each with a single, coiled stigmatum in the centre surrounded by two concentric, curved stigmata in each quarter. In the second to sixth folds there are 7 similar infundibula. The folds are represented mainly by the internal longitudinal vessels which project above the shallow infundibula on the almost flat branchial wall. The gut loop is long and narrow, and slightly open at the pole. It extends almost halfway around the ventral curve of the body. The gastric folds are lobed and oblique. The kidney is short, almost rectangular and contains a hard concretion.

The left gonad is in the curve of the gut loop and the right one is antero-dorsal to the kidney. The ovary is a round sac with a short, broad oviduct directed postero-ventrally. There are about 5 small, male follicles situated around the proximal curve of the ovary. Their ducts converge



Figs 31–40: *Pyura rapaformis* n.sp. (holotype WAM 190.87) — 31, external appearanee; 32, gut and gonads. *Microcosmus curvus* (QM GH3814) — 33, external appearanee; 34, body removed from test; 35, internal organs. *Molgula calvata* (SAM E2088) — 36, opening of oviduet. *Molgula incidata* (QM GH4633) — 37, portion of branehial sac; 38, internal organs; 39, right side of body, external view. *Eugyra millimetra* (MV F51475) — 40, gonad and kidney on right side. (Scales: 31 — 2cm; 32, 33 — 5mm; 34, 35 — 2mm; 36, 37 — 0.2mm; 38–40 — 0.5mm).

to the vas deferens across the mesial surface of the ovary. The vas deferens projects slightly into the atrial cavity and is directed dorsally.

Almost spherical, tailed larvae, with an otolith but no ocellus, are present in the atrial cavity of these specimens which were collected in January. The species is viviparous.

REMARKS. The newly recorded specimens are dorso-ventrally (rather than laterally) flattened, and the coiled stigmata around the infundibula are better developed than those described from eastern Australia. However, the consistency of the test, shape of the body, disposition of muscles, course of the gut, form of the gonads, and viviparous habit are the same as in the type material.

Molgula rima Kott, 1972

Molgula rima Kott 1972b, p. 250; 1985, p. 385

DISTRIBUTION

NEW RECORD. Victoria (Bass Strait MV F54200). The single specimen is from 52m.

RECORDED RANGE. The species previously was known only to 10m in Moreton Bay, Queensland.

DESCRIPTION

The newly recorded specimen is characteristically laterally flattened, and sandy, with a thin, flaccid test that has long, hair-like extensions to which sand adheres. The left gonad extends dorsally, from deep in the secondary gut loop, parallel to the descending limb of the primary loop. The distal end of the gonad, from which the gonoducts curve over toward the atrial aperture, is located anteriorly. The right gonad forms a loop some distance anterior to the anterior end of the kidney. The gonads have the usual long, branched, male follicles around the outside of the long ovary.

REMARKS. This species is small, inconspicuous, and may well occur along the eastern coast, between the geographically isolated locations from which it is known at present. The differences between this species and *Molgula malvinensis*, which has similar branched male follicles around long ovaries, are confirmed in the present specimen. Although in *M. malvinensis* the left gonad curves around in the secondary gut loop, it is oriented in the same direction as the gut, its distal end (with the gonoducts) opening toward the distal end of the gut. In the present species the left gonad is oriented in the opposite direction, its distal end directed toward the proximal end of the descending limb of the gut loop.

Genus **Eugyra** Alder and Hancock, 1870

Eugyra millimetra Kott, 1985

(Fig. 4I)

Eugyra millimetra Kott, 1985, p. 391.

DISTRIBUTION

NEW RECORDS. Victoria (Western Port, MV F53299 F53321 F53402). The new records are from 15m.

RECORDED RANGE. The species was previously known from only a single specimen lot taken from 51m in Bass Strait.

DESCRIPTION

Two specimens (MV F53299) are almost spherical with a delicate stalk as previously described. However, the other specimen lot is of minute (1mm diameter) juvenile specimens fixed by the whole of their left side to fronds of weed. The test on the lower (left) side of the body is thin and transparent, while that on the upper (right) side is covered with sand. These small individuals sometimes lie close together, often attached to the sand on one another's test.

The muscle band across the dorsal surface reported by Kott (1985) is sometimes, but not always, present. It is formed when separate bands in that region contract and appear to coalesce to form a single, wide band. The green stomach has fine, parallel, glandular ridges in its wall as well as deeper grooves that divide it into 4 sections (see Kott 1985).

REMARKS. Kott (1985) used the presence of a single, wide, muscle band across the dorsal surface, and the posterior flexure of the right ovary to distinguish this species from others in the genus. The former occurs only when the separate bands in this region contract together to form a single, wide band. However, in immature specimens without developed ovaries the division of the stomach wall into 4 broad sections provides a reliable character to distinguish this species from others.

Genus **Pareugyrioides** Hartmeyer, 1914

Pareugyrioides exigua (Kott, 1972)

Molgula exigua Kott 1972b, p. 249; 1985, p. 394 and synonymy.

DISTRIBUTION

NEW RECORDS. Victoria (Western Port, MV54208; Bass Strait, MV F53326 F54199). Specimens were taken at 55m.

RECORDED RANGE. The species has previously been recorded from Bass Strait, Moreton Bay (Queensland) and Indonesia. Individuals are small (usually less than 1cm diameter) and sandy, and very likely will be found to occur at intermediate locations.

DESCRIPTION

The newly recorded specimens are small, about

0.3cm in diameter, and tailed larvae, with otolith but no ocellus, are the peribranchial cavity.

REMARKS. Individuals were reported (Kott 1972b) previously to reach sexual maturity at 0.5cm, erroneously recorded as 0.5mm by Kott (1985). The newly recorded specimens indicate that it occurs even earlier in their life history.

ECOLOGICAL NOTES

Included in the newly recorded material are specimens from a survey of sea grass beds at Albany (Western Australia) made by Drs P. Hutchings of the Australian Museum and D. Walker of the University of Western Australia in 1987; and a survey of Crib Point (Western Port, Victoria) by the Victorian Department of Fisheries and Wildlife in 1965.

The ascidian fauna of the sea grass (*Posidonia australis* and *P. sinuosa*) beds at Albany is dominated by small individuals of *Polycarpa flava* and *Microcosmus squamiger* usually with epibiotic ascidians. Epibionts are *Stolonica reducta*, *Polyzoa exigua* n.sp., occasional small colonies of *Botryllus stewartensis* and *Ritterella pedunculata*, and (rarely) small specimens of *Molgula calvata*, *M. ficus* and *M. incidata*. *Ascidiella aspersa*, *Ascidia gemmata*, and *Pyura stolonifera*, all recorded previously from Albany, occur also in the sea grass beds together with occasional specimens of *Polycarpa chinensis* and *P. lucilla*, both of which may be occupying a refuge at the limits of their respective geographic ranges. *Polycarpa chinensis*, a tropical species formerly known from the eastern coast of Australia south to Bass Strait and on the western coast to Cockburn Sound, is relatively common in shallow embayments (such as Moreton Bay and Gladstone Harbour) where sea grasses occur. Similarly, *Polycarpa lucilla*, also more frequently encountered in tropical waters (see above), has been recorded from Upper Spencer Gulf where, again, sea grasses abound.

The species from Crib Point, Victoria represent a remarkably diverse, sand-adapted community of small, benthic species, many unattached, flattened, and sand-covered, and dominated by taxa with spiral stigmata (in the families Agnesiidae and Molgulidae). The majority of species are known to be temperate, many previously recorded from Bass Strait, although some are tropical forms, possibly occupying a refuge at the limits of their respective ranges. The species taken from Crib Point are: *Agnesia glaciata*, *Polycarpa directa* n.sp., *P. plenovata*, *P. procera*, *Pyura molguloides*, *P. arenosa*, *Microcosmus squamiger*, *Molgula calvata*, *M. mollis*, *M. malvinensis*, *M. mortenseni*, *M. rima*, *Eugyra millimetra*.

The sand-mud benthic fauna of Moreton Bay has similar characteristics to those of the Crib Point community. Some of the same species (*viz*, *Agnesia glaciata*, *Molgula rima* and *Eugyra millimetra*, see Kott 1972b 1985), as well as related ones, occur in both locations, and Moreton Bay may be a refuge for species at the end of their northern ranges as well as an ecological refuge for sand-adapted communities.

The collections from Torres Strait were dredged from a sandy bottom, possibly in regions of fast current flow. For, although free-living benthic species that lie on the surface of the sea floor, such as *Molgula diversa* and *Polycarpa lucilla* are recorded, they are rare in these collections. *Ascidia scaevola* and *Polycarpa decipiens*, the tough *P. chinensis* and *P. aurita*, and the robust *Pyura obesa* and *P. sacciformis*, are all found partially buried in the substrate. By far the most common species in these locations, however, are relatively small specimens of *Microcosmus exasperatus*, *M. helleri*, *M. squamiger* and *M. stoloniferus*, which have tough tests with strong adhesive qualities. These often form large aggregates.

The records from Torres Strait confirm a continuous geographic range from the north-eastern Australian coast to Indonesian waters for *Ascidia scaevola*, *Phallusia julinea*, *Amphicarpa duplicata*, *Styela canopus*, *Polycarpa aurita*, *P. decipiens*, *P. papillata*, and *Pyura obesa*. *Polycarpa chinensis*, *Pyura sacciformis* and *Molgula diversa* (formerly known from the western Pacific and north-eastern Australia). *Microcosmus squamiger* (known from north-western and north-eastern Australia and the Red Sea), and pantropical *Herdmania momus*, *Microcosmus exasperatus* and *M. helleri* were also taken from Torres Strait. *Microcosmus stoloniferus* is the only species newly recorded from Torres Strait to have formerly been regarded as indigenous.

ACKNOWLEDGEMENTS

Scoresby Shepherd, Nigel Holmes and their colleagues of South Australian Fisheries Department collected South Australian material referred to above. Dr F. Rowe of the Australian Museum, Ms L. Marsh of the Western Australian Museum and Ms S. Boyd of the Museum of Victoria arranged the loan of unidentified material that included some of the new species described herein. David Parry and Stephen Cook assisted in the field at Heron I. and in Moreton Bay, Stephen

Cook also completed the line drawings from the author's sketches.

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