

Bryozoan Fauna of Green Island, Taiwan: First Indications of Biodiversity

Tea Gluhak^{1,*}, Jane E. Lewis², and Aleksandar Popijac³

¹The County of Split and Dalmatia, Administrative Department of Town Planning and Environmental Protection, Domovinskog rata 2, 21000 Split, Croatia

²PO Box 7-18, Keelung 202, Taiwan

³Laboratory for Animal Ecology, Department of Zoology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, 10000 Zagreb, Croatia

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Tea Gluhak, Jane E. Lewis, and Aleksandar Popijac (2007) Bryozoan fauna of Green Island, Taiwan: first indications of biodiversity. *Zoological Studies* 46(4): 397-426. As part of an initiative to inventory the poorly known Taiwan bryozoan fauna, this paper reports on results of 2 workshops that processed and identified collections from Green I., southeastern Taiwan. In total, 30 species of 22 genera were found, six of which are new to science. The new species, all in the order Cheilostomata, are *Amastigia tricervicornis*, *Caberea sinensis*, *Catenicella marceli*, *Hemismittoidea taiwanensis*, *Parasmittina spiculata*, and *Celleporina aviculari-dentata*. In comparing the 3 major groups, cheilostomes predominated, only a few cyclostome taxa were recognized, and no ctenostomes were found. These completely new data from Green I. likely reflect the taxonomic richness of the bryozoan fauna in the tropical western Pacific biogeographic region, even though this region still remains relatively poorly inventoried. <http://zoolstud.sinica.edu.tw/Journals/46.4/397.pdf>

Key words: Bryozoa, Faunistic review, New species, Taiwan, Tropical western Pacific.

The living bryozoan fauna of Taiwan has not previously been studied, leaving a large gap in the knowledge of western Pacific taxa. This paper reports an initial taxonomic study of the bryozoan fauna of Green I., off the southeastern coast of Taiwan. Materials were collected during a very limited amount of time from within a single shallow-water reef, yet these new data suggest that the bryozoans of Taiwan are both common and diverse.

In species diversity, the phylum Bryozoa is of medium size, with over 6,000 extant species and around 15,000 known fossils. The phylum's greatest abundance and diversity is found in shallow coastal waters of the western Indo-Pacific region with a significant number of species having also been recorded from Mexico, Western Europe, southeastern Australia, and polar regions (Okada and Mawatari 1958, Kluge 1962 1975, Schopf

1970) (see Gordon 1984). It is presumed by some scientists that the greatest diversity of bryozoan fauna occurs in the tropics but "current knowledge about tropical bryozoan fauna is still largely founded on a very few monographic accounts (Canu and Bassler 1929, Harmer 1915 1926 1934 1957), the usefulness of which is limited by the vast geographical areas they cover, and by their outdated and conservative taxonomy" as Hayward and Ryland (1995: 533) stated in their paper on Bryozoa from Heron I., Australia.

The New Zealand bryozoan fauna was first described by Gray (1843). Subsequent papers on western Pacific marine Bryozoa have appeared sporadically. They include only 5 larger works (Hutton 1873 1904, Brown 1952, Powell 1967, Uttley and Bullivant 1972) until Gordon (1984) published the first of his monographs on 202 species and subspecies from Kermadec Ridge, of

*To whom correspondence and reprint requests should be addressed. Tel: 385-91-5357634. E-mail:tea.gluhak@zg.htnet.hr, tea.gluhak@dalmacija.hr

which 65 were new. In the same work (p. 8) he stated "one may predict that the total number of marine bryozoan species in the New Zealand region may be around 800". Later, Gordon (1986) continued his work, listing the bryozoan fauna from the western South I. continental shelf and slope. He recorded 145 species of which 32 were new. In 1989 he reported on 180 species from the same area, of which 58 were new. In their first account of the bryozoan fauna of Heron I. reef flat, Ryland and Hayward (1992) described 81 species, of which 24 were recorded for the first time from Australian waters, and 14 were new. A further 46 species, of which 20 were new to science and 5 were reported for the first time from Australia, were described in a second account a few years later (Hayward and Ryland 1995). In 2001, Tilbrook et al. reported 92 species, including 20 new species, from Vanuatu in the first study of reef-flat species of the eastern Coral Sea. After Canu and Bassler's monograph "Bryozoa of the Philippine region" (1929), Scholz (1991), working on the Philippine bryozoan fauna, recorded 130 species, of which 4 were new to science. Working further north than previous scientists, in Chinese seas, Liu in his papers published from 1980 to 1992 noted 77 species, among which 33 were new to science and 44 were new records for China (Liu 1980 1982a-d 1983 1984a b 1992). Rho and Seo working in coastal and offshore waters of South Korea in papers published from 1984 to 1998 reported 277 species, of which 73 were new to Korea (Rho and Seo 1984 1985 1986 1988 1990, Seo and Rho 1989, Seo 1992 1993 1994 1995 1996 1998a b).

Even though the bryozoan fauna of the west-

ern Pacific is still poorly known taxonomically, a base of knowledge has gradually accumulated. Monographic literature provided mostly by Liu (Liu 1980 1982a-d 1983 1984a b 1992), Gordon (1984 1986 1989), Rho and Seo (1984 1985 1986 1988 1990), Seo and Rho (1989), Ryland and Hayward (1992), Seo (1992 1993 1994 1995 1996 1998a b), Hayward and Ryland (1995), and Tilbrook et al. (2001) together with other listed references published in the last 20 yr assisted us in identifying our samples from Green I., Taiwan. This description of Green I. bryozoans is the first account of the living bryozoan fauna of Taiwan. The only papers on Taiwanese bryozoans previously published concerned the distribution of skeletal residues of Holocene bryozoans in sediments of the Taiwan Strait (Cheng 1976), fossils from the Pleistocene Tungshiao Formation from which Hu (1986) described 25 bryozoan species and from the Pliocene Kutingkeng Formation with 53 species (Hu 1987), and an unnamed cyclostome with unusual apertural spines (Taylor and Lewis 2003).

MATERIAL AND METHODS

The area studied in this project was Green I., also called Kasyoto or Lutao (22°38'-22°41'N, 121°28'-121°30'E), which lies off the southeastern coast of Taiwan and is one of its associated islands.

Samples were collected by T. Gluhak and A. Popijac during a 5 d field trip (8-12 Feb. 2000) to a site called Dabaisha (22°38'3"N, 121°28'48"E), on the west coast of Green I. (Fig. 1), using scuba diving at different depths down to 25 m, and from

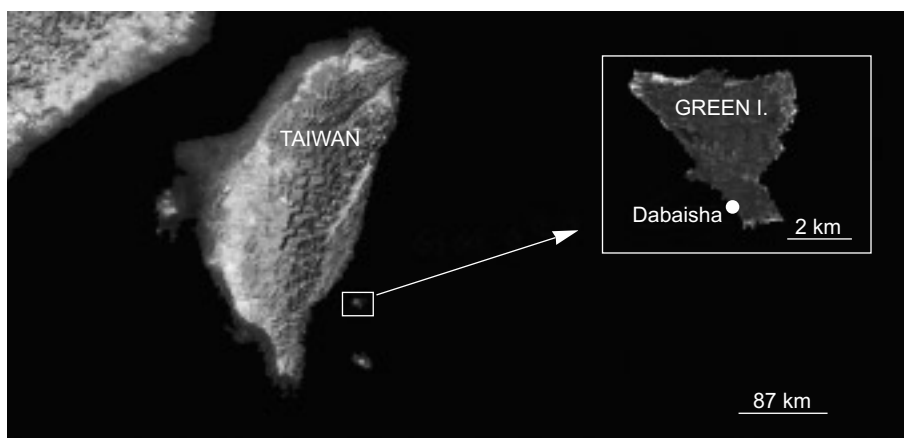


Fig. 1. Collection site, Dabaisha (figure taken from Google Earth and edited by the first author).

different substrata. Once collected, material was examined by scanning electron microscopy (SEM). This involved cleaning (bleaching), washing, sieving, sorting (under a microscope) of representative subsamples, and coating for SEM of selected specimens. Identification to species level was initially done from the resulting SEM images. Papers listed in the reference section were used for identification, with the synonymies limited to Indo-Pacific occurrences. The specimens are now being maintained in the recent bryozoan collection of the Natural History Museum (NHM), London.

TAXONOMY

Class Gymnolaemata Allman

Order Cheilostomata Busk

Suborder Flustrina Smitt

Superfamily Calloporoidea Norman

Family Calloporidae Norman

Genus *Copidozoum* Canu

Type species: *Membranipora plana* Hincks,
1880

Copidozoum sp.

(Figs. 2A-C)

Material: XX colonies (since lost).

Description: Colony small, encrusting, unilaminar. Zooids oval, 0.31-0.39 x 0.22-0.25 mm, somewhat broader proximally giving a pyriform outline. Cryptocyst very narrow, in form of a granular rim within smooth, narrow gymnocyst. Oval opesia occupying almost entire frontal surface of zooid (Fig. 2B). Two distal oral spines (Fig. 2A) present even with an ovicell. Ovicell prominent (Fig. 2C), 0.11 x 0.16 mm, granular, without fenestra or ridges, with a narrow rim of smooth ectoecium.

Autozooids lacking dietellae, and aperture of ovicell not closed by operculum. Avicularia not present.

Remarks: The features of this species, together with the paired distal spines, very narrow cryptocyst, uncalcified ectoecium in ovicells, and the absence of dietellae are all suggestive of *Copidozoum*. However, there is too little material to be confident of assigning this specimen to any described species, and the lack of avicularia may simply be a consequence of the small size of the specimen.

Superfamily Buguloidea Gray

Family Epistomiidae Gregory

Genus *Synnotum* Pieper

Type species: *Loricaria aegyptiaca* Audouin,
1826

Synnotum aegyptiacum (Audouin, 1826)

(Figs. 3A, B)

Loricaria aegyptiaca Audouin 1826: 243; Savigny [1817]: pl. 13, fig. 4(1-5).

Synnotum aegyptiacum: Harmer 1926: 398-400, pl. 27, figs. 3, 4 (cum syn.); Mawatari 1965: 611, fig. 93a, b; Rho and Song 1980: 155, pl. 3, figs. 5, 6; Winston 1982: 127 (cum syn.), fig. 53; Liu 1984b: 299, fig. 43; Gordon 1984: 43, pl. 10, figs. E, F; Ristedt and Hillmer 1985: pl. 1, fig. 12; Scholz 1991: 283, pl. 5, fig. 1; Tilbrook et al. 2001: 52, fig. 6A, C.

Material: NHM 2003.11.18.1.

Description: Colony erect, articulated, and branching; internodes connected by uncalcified joints. Each internode consisting of a pair of zooids, each zooid in pair facing obliquely laterally (Fig. 3A). Single zooid, 0.35-0.41 x 0.12-0.16 mm (width measured immediately below proximal edge

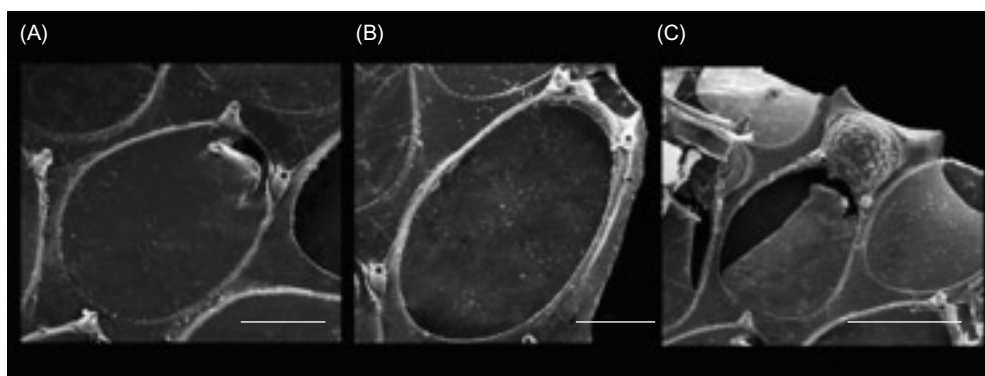


Fig. 2. *Copidozoum* sp. (A) Autozooid with frontal membrane and 2 clearly visible oral spines (scale bar = 0.1 mm); (B) autozooid with no frontal membrane, with narrow cryptocyst and big oval opesia (scale bar = 0.1 mm); (C) ovicell (scale bar = 0.2 mm). 7 Mar. 2000. XX colonies (since lost).

of orifice). Distal frontal wall membranous, other walls smooth and calcified. Large short-stalked avicularia (Fig. 3B) with mandible facing upwards, situated frontally, adjacent to orifice and between paired zooids, infrequent. Smaller, sessile avicularia situated distobasally.

Remarks: *S. aegyptiacum* has a circumglobal distribution.

Distribution: Western Pacific from Japan to northern New Zealand, Indo-Malayan region, Indian Ocean, Mediterranean Sea, western Atlantic (Florida, Brazil), California.

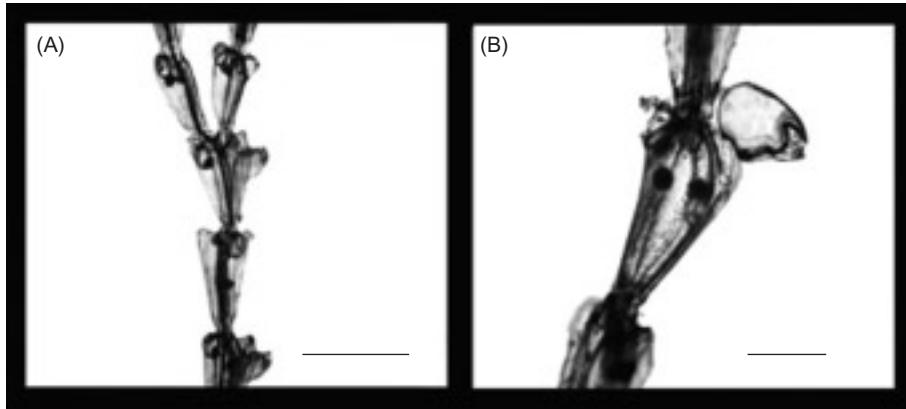


Fig. 3. *Synnotum aegyptiacum*. (A) Group of zooids at the bifurcation, each pair facing laterally (scale bar = 0.5 mm); (B) large, short-stalked avicularium (scale bar = 0.2 mm). 7 Mar. 2000. NHM 2003.11.18.1.

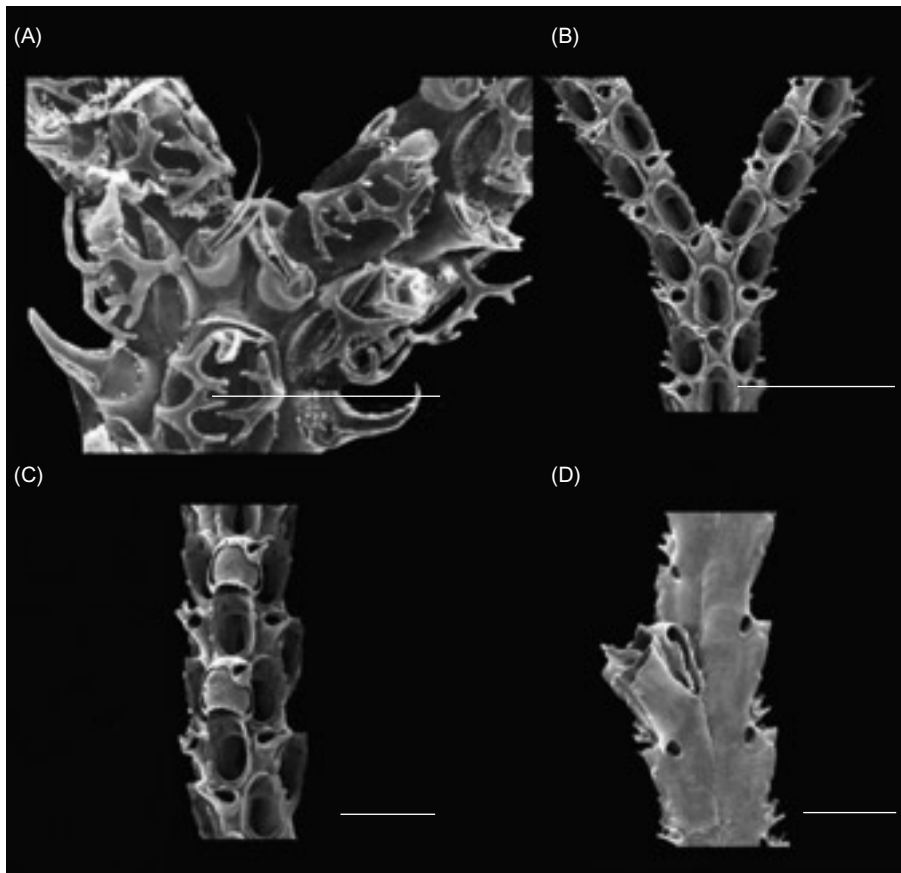


Fig. 4. *Amastigia tricervicornis*, sp. nov. (A) Spines (scale bar = 0.5 mm); (B) opesia, frontal avicularia (scale bar = 1 mm); (C) zooids with ovicells (scale bar = 0.5 mm); (D) large avicularium on the abfrontal side of the bifurcation (scale bar = 0.5 mm). 8 Mar. 2000. Holotype: NHM 2003.11.18.2.

Family Candidae D'Orbigny**Genus *Amastigia* Busk****Type species: *Amastigia nuda* Busk, 1852*****Amastigia tricervicornis* sp. nov.**

(Figs. 4A-D)

Material: Holotype: NHM 2003.11.18.2.

Etymology: Latin, *tres* meaning 3, *cervus* meaning deer, and *cornus* meaning horn, referring to the complex, branching spines, each reminiscent of a deer's antler.

Description: Colony erect, bushy, branching, without joints, yellowish-white. Branches biserial in proximal part of colony, increasing to 5 rows of zooids prior to branch bifurcation; frontal branch surface convex; basal walls of 2 marginal zooid rows visible in abfrontal view. Zooids elongate, 0.53-0.64 x 0.20-0.27 mm, wider distally than proximally. Opesia oval, 0.28-0.34 x 0.18-0.24 mm, occupying 1/2 of zooidal length (Fig. 4B), bordered by a narrow, smooth cryptocyst. Gymnocyst smooth, obscured by ovicell of proximal zooid, when present (Fig. 4C). Each zooid with 3, rarely 2, branching spines, a pair in distal 1/2 of zooid and another more proximally, all curving over opesia (Fig. 4A). A single frontal avicularium situated on gymnocyst of each zooid (Fig. 4B); cystid rounded, rostrum short, curved, and truncate, directed laterally and projecting in marginal zooids; mandible long, setiform, finely denticulate; a single enlarged avicularium on abfrontal surface at each bifurcation (Fig. 4D), with long, proximally directed rostrum. Ovicell prominent, longer than wide, 0.32 x 0.28 mm, with a large area of endooecium exposed, surmounted by a single avicularium (Fig. 4C). A large pore situated proximally on abfrontal side of each zooid indicating origin of a rhizoid.

Remarks: *A. tricervicornis* is included in the genus *Amastigia* because of its characteristic

colony form, with typically pluriserial branches and a convex frontal surface where marginal zooids face laterally outwards. Ovicells have frontal fenestra, typical of the genus. *A. tricervicornis* resembles *A. funiculata* (MacGillivray 1886) (see Gordon 1986) but differs in lacking a scutum. *A. tricervicornis* differs from all other species assigned to this genus in its large branched spines and smooth cryptocyst.

Genus *Caberea* Lamouroux**Type species: *Caberea dichotoma* Lamouroux, 1816*****Caberea lata* Busk, 1852**

(Figs. 5A-C)

Caberea lata Busk 1852a: 378; 1852b: 39, pl. 47, figs. 1-3.*Caberea lata*: Harmer 1926: 360, pl. 24, figs. 7-9; Liu, 1984b: 271, fig. 16.*Material:* NHM 2003.11.18.3.

Description: Colony erect, fan-shaped, branching dichotomously. Branches biserial, triserial prior to bifurcations, non-articulated. Zooids subquadrangular, 0.30-0.34 x 0.11-0.14 mm, with oval membranous area occupying most of frontal surface. Cryptocyst well developed, wider proximally than distally, smooth; gymnocyst very narrow (Fig. 5B). Opesia oval, elongate, 0.22-0.32 x 0.07-0.15 mm. Scutum absent. One spine on each distal angle of each zooid; inner one often small or vestigial. Ovicells subglobular (Fig. 5A), 0.09-0.11 x 0.20-0.22 mm, with narrow, irregular crescentic fenestra near opening; distal to ovicells frontal avicularia with reversed orientation, with rostra facing proximally. Lateral avicularia tiny. Small frontal avicularia present, situated on proximal gymnocyst near wall of neighboring zooid; rostrum rounded triangular, perpendicular to frontal plane and facing distally. Vibracula large, rhombic, cov-



Fig. 5. *Caberea lata*. (A) Ovicells (scale bar = 0.5 mm); (B) autozooids with well-developed cryptocyst and narrow gymnocyst (scale bar = 0.2 mm); (C) vibracula (scale bar = 0.5 mm). 14 Mar. 2000. NHM 2003.11.18.3.

ering entire abfrontal surface of zooid (Fig. 5C). Setal groove very long, extending to median axis of branch. Seta very long and serrate.

Remarks: Described originally from northern Queensland, Australia (Busk 1852a), *C. lata* ranges northwards to Japan and westwards to the eastern Indian Ocean (Harmer 1926). Colonies are initially biserial, but become triserial or quadriserial when well grown. This species was well described and illustrated by Harmer (1926). Liu (1984b) figured material from China, but his illustration is unclear, as it does not display the distinctive, narrow ooeial fenestra which, together with the lack of a scutum, and very small frontal avicularia, characterizes the species.

***Caberea sinensis* sp. nov.**

(Figs. 6A-D)

Material: Holotype: NHM 2003.11.18.4.

Etymology: Latin, *siniae* meaning Chinese and *ensis* meaning belonging to.

Description: Colony erect, fan-shaped,

branching dichotomously. Branches non-articulated, biserial with alternating zooids. Zooids scarcely longer than wide, 0.13-0.17 x 0.13-0.16 mm, broadest proximally (Fig. 6D). Cryptocyst wider proximally than distally, smooth. Gymnocyst scarcely evident except for a narrow proximolateral band. Orifice 0.04-0.06 x 0.06-0.07 mm (Fig. 6C). Scutum with a stout peduncle, its distal edge straight, forming an apertural bar which closely abuts opposite distal corner of opesia (Fig. 6B); close to suture, on scutum, with a stout conical spike (Fig. 6C) projecting to front; proximal lobe well developed, covering much of opesia, leaving a narrow fish-hook-shaped opening (Fig. 6B). Two spines on outer, and one spine on inner distal angle. Frontal avicularia small, situated on gymnocyst adjacent to cryptocyst, with short, triangular rostrum facing proximally or to front and directed distally. Enormous frontal avicularia present regularly just before bifurcation, cystid as long as an autozooid, rostrum perpendicular to frontal plane, broadly triangular, with hooked tip (Fig. 6A). Lateral avicularia tiny. Ovicells subglobular, broad-

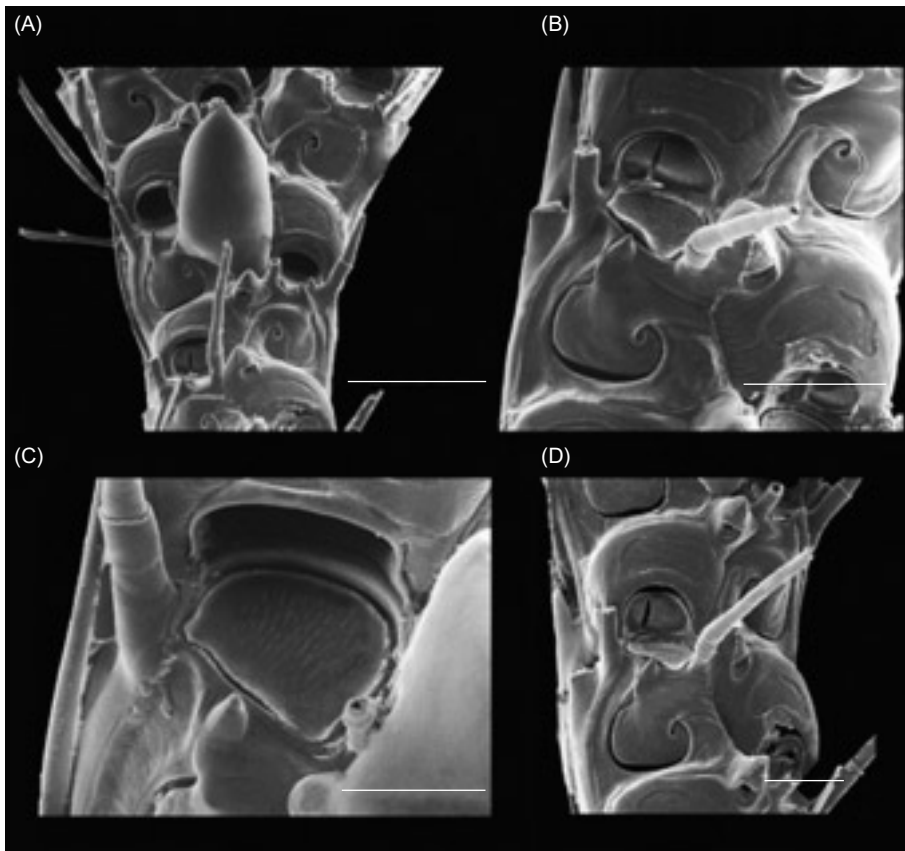


Fig. 6. *Caberea sinensis*, sp. nov. (A) Enormous frontal avicularia (scale bar = 0.2 mm); (B) scutum (scale bar = 0.1 mm); (C) orifice and conical spike (scale bar = 0.05 mm); (D) ovicells (scale bar = 0.1 mm). 13 Mar. 2000. Holotype: NHM 2003.11.18.4.

er than long, 0.06-0.13 x 0.13-0.15 mm, with a narrow fenestra near opening (Fig. 6D).

Remarks: This species is most similar to *C. boryi* (Audouin), which was originally described from the Mediterranean coast of Egypt (Audouin 1826) and has subsequently been ascribed a wide distribution along temperate and tropical coasts of the Atlantic and Indian Oceans, and in the western Pacific. Harmer (1926) was doubtful that northeast Atlantic specimens truly represented *C. boryi*, but considered that it was distributed eastwards to the Malay Archipelago and Japan. Gordon (1986), describing and figuring *C. boryi* from the western South I. of New Zealand, noted that Ryland and Hayward (1977) described the presence of spines in British specimens while his material, in common with that of Harmer (1926) and Hastings (1943), lacked spines. The material described herein is characterized by 3 large and prominent distal spines on each autozoid; its ovicell is proportion-

ally broader and more symmetrical than in material described and illustrated by those authors, and has a proportionally larger fenestra. A particularly distinctive feature of the Green I. species is the prominent conical spike at the distolateral corner of the scutum, a feature not previously reported for *C. boryi*. Liu (1984b: 281, fig. 24) described and figured "*Caberea boryi*" from China; his figure clearly shows prominent spines, and what appears to be a short protuberance on the distolateral corner of the scutum, and it is possible that it represents *C. sinensis*. However, all records of *C. boryi* should be reevaluated following reexamination of the specimens on which they are based.

Genus *Canda* Lamouroux

Type species: *Canda filifera* Lamarck, 1816

***Canda foliifera* Harmer, 1926**

(Figs. 7A-D)

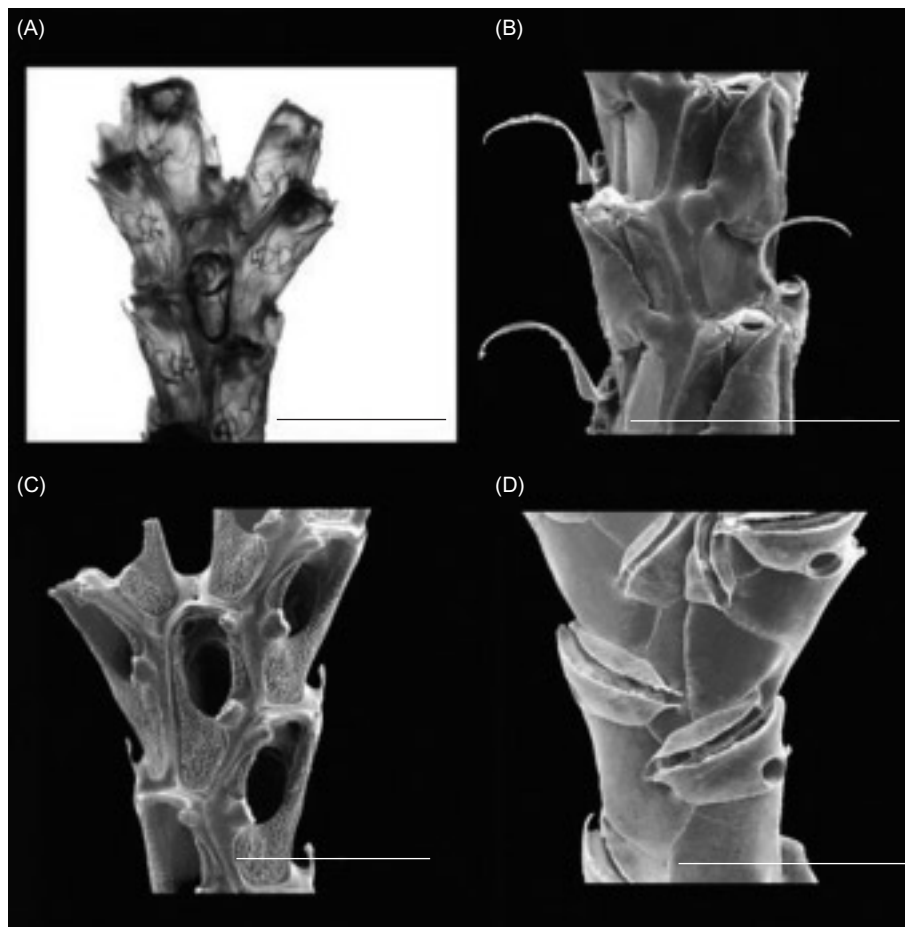


Fig. 7. *Canda foliifera*. (A) Growing point of the colony with the 3rd zooid interpolated at the bifurcation (scale bar = 0.5 mm); (B) scutum (scale bar = 0.5 mm); (C) granular cryptocyst and a single spine at each distal corner of the zooid (scale bar = 0.5 mm); (D) vibracula (scale bar = 0.5 mm). 17 Mar. 2000. NHM 2003.11.18.5.

Canda foliifera Harmer 1926: 386, pl. 26, figs. 21-23.

Material: NHM 2003.11.18.5.

Description: Colony erect, bushy, with adjacent branches joined by fine, thread-like connections. Branches biserial, with a 3rd zooid interpolated at bifurcations (Fig. 7A, C). Zooids rectangular, 0.42-0.46 x 0.21-0.25 mm, facing obliquely outward with their inner margins thus projecting, giving a keeled effect to branches. Cryptocyst granular (Fig. 7C), very wide proximally, narrow laterally, not present distally. Opesia, 0.17-0.25 x 0.08-0.12 mm, occupying 1/2 of zooidal length. Frontal membrane occupying entire length of zooid. Scutum large, covering entire opesia; with a thick base, originating from medial portion of inner lateral zooidal wall and occupying 1/4 of length of inner lateral zooidal wall; distal lobe acutely pointed, proximal lobe rounded (Fig. 7B). A single spine at

each distal corner (Fig. 7C). Female zooids in pairs, ovicells prominent, globe-shaped with a broad frontal area of exposed endooecium; a small avicularian cystid surmounting distal end of some ovicells. Frontal avicularia absent. Vibracula with long wide setal grooves enlarged at their extremities, and large radicular pore (Fig. 7D). One vibraculum per zooid occurring abfrontally, orientated obliquely proximally towards branched axis, alternating, with distal end visible adjacent to cryptocyst frontally. A pair of vibracula present at each bifurcation.

Remarks: *C. foliifera* is characterized by its extensive cryptocyst, with straight proximal edge, its lack of frontal avicularia, and especially by its large, asymmetrical scutum. It has been recorded from Zanzibar, the Seychelles, and Sri Lanka (Ceylon), as *C. retiformis* (Thornely 1905 1912, Waters 1913), and from 9 Siboga stations in the

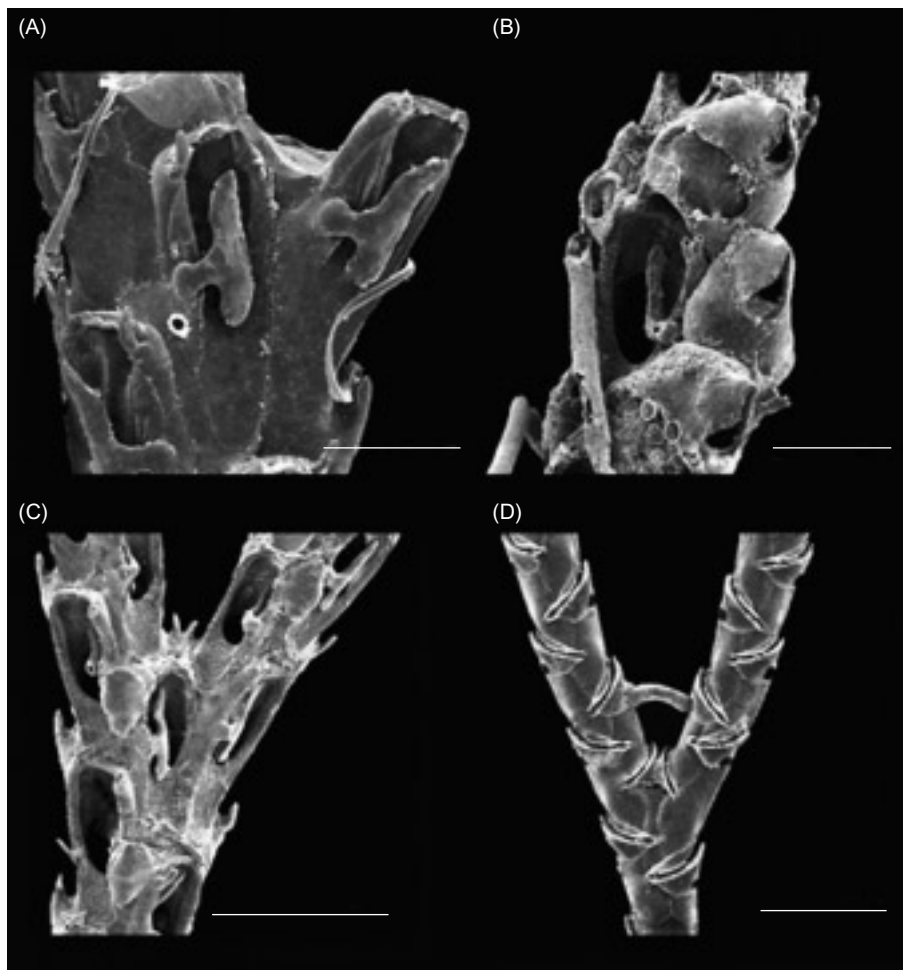


Fig. 8. *Canda pecten* var. *scutata*. (A) Scutum (scale bar = 0.2 mm); (B) ovicell with avicularium (scale bar = 0.2 mm); (C) granular cryptocyst, large avicularia on frontal side (scale bar = 0.5 mm); (D) axial vibracula (scale bar = 0.5 mm). 8 Mar. 2000. NHM 2003.11.18.6.

Indo-Malaysian region (Harmer 1926). It does not seem to have been reported since Harmer (1926) introduced the taxon, and this record from Taiwan represents a considerable extension of its geographical range.

***Canda pecten* var. *scutata* Harmer, 1926**
(Figs. 8A-D)

Canda pecten scutata Harmer 1926: 389, pl. 26, fig. 24;
Gordon 1984: 50, pl. 13, figs. D, E; Liu 1984: 295, fig. 41.

Material: NHM 2003.11.18.6.

Description: Colony erect, branches biserial, zooids facing obliquely outward, ramification occasioned by the formation of a supplementary medi-

an zooid. Zooids rectangular, 0.43-0.52 x 0.14-0.19 mm, with parallel-sided walls. Cryptocyst granular, very wide proximally, narrow on 1 side laterally, not present distally (Fig. 8C). Gymnocyst narrow if present, sometimes widening proximally. Opesia acutely tapering proximally, 0.24-0.26 x 0.06-0.07 mm. Scutum with narrow processes (Fig. 8A). A spine on either side of orifice, sometimes 2 spines on inner margin. Ovicells elongate, 0.23-0.30 x 0.21-0.27 mm, prominent, inclined towards branch axis, with a broad frontal area of exposed endooecium, distal ectooecium incorporating cystid of avicularium (Fig. 8B). Avicularia large, on frontal side of branch, sporadic in distribution, rostrum obliquely angled proximally toward branch angle, tapering, hooked distally (Fig. 8C). A smaller avicularium on distolateral edge of each



Fig. 9. *Scrupocellaria delilii*. (A) Ovicells with avicularium (scale bar = 0.5 mm); (B) autozooids with smooth, narrow cryptocyst and smooth, well-developed gymnocyst (scale bar = 0.2 mm); (C) large aquiline avicularium (scale bar = 0.1 mm); (D) 2 spines on the outer distal margin (scale bar = 0.2 mm). 16 Mar. 2000. NHM 2003.11.18.7.

ovicell, with triangular, hooked rostrum, distally directed (Fig. 8B). Vibracula large, obliquely orientated proximally towards branch axis, alternating, with wide grooves and curving setae that flex back across front of zooids. A pair of axial vibracula situated at each bifurcation (Fig. 8D). Rootlets emerging from vibracular chambers to form cross-connections with neighboring branches.

Distribution: West Pacific, including Sulade I., Sulu Arch. (Canu and Bassler 1929), China Sea (Liu 1984), Loyalty Is., West Irian, China Sea (Harmer 1926, Liu 1984), Kermadec Ridge (Gordon 1984).

Genus *Scrupocellaria* Van Beneden

Type species: *Sertularia scruposa* Linnaeus, 1758

***Scrupocellaria delilii* (Audouin, 1826)**
(Figs. 9A-D)

Scrupocellaria delilii Audouin 1826: 242; Harmer 1926: 370, pl. 25, figs. 12-15; Liu 1984: 285, fig. 28.

Material: NHM 2003.11.18.7.

Description: Colony erect, unilaminar; branching dichotomously, biserial, 2 rows of alternating zooids with a 3rd zooid interpolated at bifurcations. Zooids elongated, 0.33-0.38 x 0.16-0.17 mm; cryptocyst a smooth narrow ring around opesia, gymnocyst smooth, well developed proximally (Fig. 9B); opesia oval, 0.10-0.18 x 0.09-0.10 mm, occupying about 1/2 of frontal zooid surface. Scutum rounded proximally, tapered distally, covering most of opesia, thick stalk attached to inner margin of opesia. Two or 3 spines on outer distal margin, 1 on inner (Fig. 9D). Ovicell large, 0.21 x 0.25 mm, smooth, with a small oval fenestra (Fig. 9A). A large aquiline lateral avicularium present on each zooid (Fig. 9C); frontal avicularia not observed; a

small avicularium surmounting each ovicell (Fig. 9A), obliquely directed distally. Vibracula projecting little laterally, visible from frontal surface; vibracular chamber more or less triangular, raised, small, with obliquely directed groove; seta short, without teeth. Small radicular pore situated proximally in middle of vibraculum. Axillary vibracula paired.

Remarks: In *S. delilii* specimens from Green I., all zooids in the colony have an enlarged lateral avicularia with a trilobed rostrum and a mandible ending distally in 3 spikes. Material assigned to *S. delilii* by Liu (1984b) differs from that described here in lacking the 3 spikes and in having only distal spine modes of 1-1 and 1-2 rather than the more-diverse arrangements (1-1, 2-1, 2-1, 3-1, and 3-2) present in Green I. specimens.

Distribution: Described originally from the Red Sea, widely recorded in the Indo-West Pacific region, and in the West Pacific from the Great Barrier Reef to Japan. Also known from Madeira and the Mediterranean.

***Scrupocellaria maderensis* Busk, 1860**
(Figs. 10A-C)

Scrupocellaria maderensis Busk 1860: 280; 1861: 77, pl. 32, fig. 1; Harmer 1926: 372, pl. 25, figs. 16-19; Mawatari 1952: 276, fig. 11; 1963: 8; 1965: 628, fig. 82a, b; Gordon 1984: 47, pl. 12, figs. F, G; Liu 1984b: 284, fig. 27; Ryland and Hayward 1992: 237, fig. 8.

Material: NHM 2003.11.18.8.

Description: Colony erect, unilaminar. Branches dichotomous, biserial, with a 3rd zooid interpolated at bifurcations (Fig. 10A). Zooids box-shaped, 0.35-0.38 x 0.11-0.18 mm. Cryptocyst granular, developed as a narrow band around opesia. Gymnocyst smooth, well developed proximal-

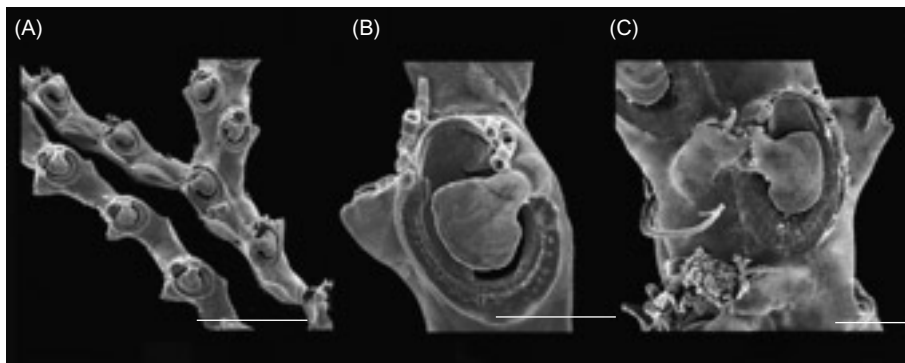


Fig. 10. *Scrupocellaria maderensis*. (A) Biserial branch with the 3rd zooid interpolated at the bifurcation (scale bar = 0.5 mm); (B) scutum (scale bar = 0.1 mm); (C) large aquiline avicularium (scale bar = 0.1 mm). 8 Mar. 2000. NHM 2003.11.18.8.

ly, occupying $> 1/2$ of entire zooid length. Opesia oval, 0.13×0.08 mm, occupying $< 1/2$ of frontal zooid surface. Scutum attached at distal corner of opesia, large, covering most of opesia, proximal lobe broad and rounded (Fig. 10B). Distal spines (3 or 4 outer, 2 inner) well developed. Ovicells not observed in Green I. specimens. Large aquiline lateral avicularia present on each zooid (Fig. 10C). Frontal avicularia occasionally present, somewhat columnar, arising proximal to cryptocystal rim and directed toward scutal peduncle of neighboring zooid. Vibracula projecting a little laterally, visible from frontal surface. Vibracular chamber triangular, with obliquely directed groove. Seta short. Axillary vibracula paired.

Remarks: *S. maderensis* is widely distributed in warm temperate and tropical waters of the eastern Atlantic and Indo-West Pacific regions. In the western Pacific, it ranges from southern New Zealand to Japan (Ryland and Hayward 1992).

Distribution: Loyalty Is., Timor, Indonesia,

China Sea, Japan, Sri Lanka, Madagascar, Madeira, Cape Verde Is. (Gordon 1984), Chinese Seas (Liu 1984), Mediterranean (Zabala and Maluquer 1988).

***Scrupocellaria unicornis* Liu, 1980**

(Figs. 11A-D)

Scrupocellaria unicornis Liu 1980: 179, figs. 1, 2.

Material: NHM 2003.11.18.9.

Description: Colony erect, delicate. Branches dichotomous, biserial, with a 3rd zooid interpolated at bifurcations (Fig. 11A). Zooids elongate, $0.32-0.35 \times 0.16-0.20$ mm. Cryptocyst smooth, developed as a narrow band around entire opesia. Gymnocyst smooth, well developed proximally; opesia elongate oval, $0.14-0.16 \times 0.09-0.12$ mm, occupying about $1/2$ of frontal zooid length (Fig. 11A). Scutum attached medially on inner margin of opesia, covering almost entire opesia, distal

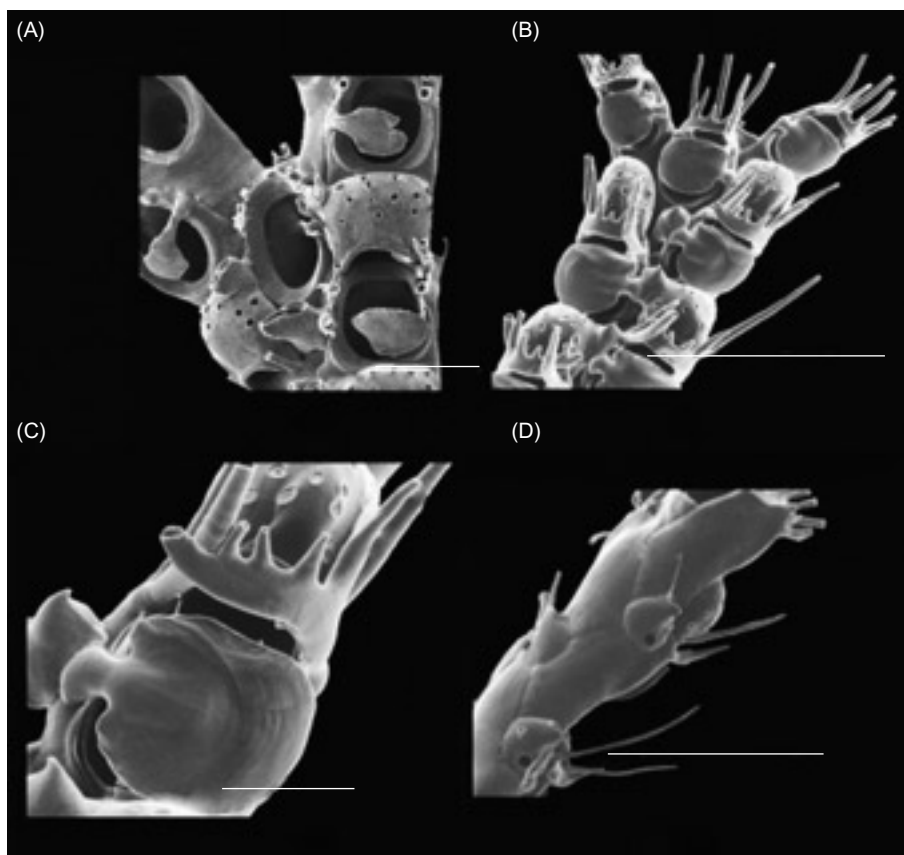


Fig. 11. *Scrupocellaria unicornis*. (A) Elongate zooids, cryptocyst and gymnocyst, smooth, elongate opesia and frontal avicularia present in axillary zooid (scale bar = 0.2 mm); (B) ovicells, distal spines (1 central distal, 3 outer lateral, 2 inner lateral, and robust outer lateral spine) (scale bar = 0.5 mm); (C) scutum (scale bar = 0.1 mm); (D) vibracula (scale bar = 0.5 mm). 2 Mar. 2000. NHM 2003.11.18.9.

edge straight, proximal lobe broadly rounded (Fig. 11C). Distal spines well developed: 1 central (lacking in fertile zooids), 3 outer lateral, and 2 inner lateral, proximalmost outer lateral one especially robust, flat and overarching zooid, its distal edge drawn out into 3 or 4 blunt processes, like tips of an antler (Fig. 11B). Ovicells subglobose, 0.12-0.13 x 0.13-0.19 mm, almost as wide as long, prominent, hyperstomial; frontal surface perforated by 10-15 small, round pores, and with fine radiating lines; capped on its inner distolateral edge by avicularium of succeeding autozooid (Fig. 11A, B). Frontal avicularia moderate in size, situated on proximal gymnocyst very close to inner margin of neighboring zooid, pointed toward middle of branch, rostrum triangular, tip hooked and directed alternately right and left. Frontal avicularia always present in axillary zooids, shortly columnar, wider distally than proximally, situated just below opesia (Fig. 11A). No lateral avicularia present. Vibracula moderate, situated on dorsal surface of zooid, not visible in frontal view; vibracular chamber triangu-

lar, raised, proximal side rounded, distal narrow, with short setal groove, seta short, lacking teeth. Large radicular pore present proximally in middle of vibracular chamber (Fig. 11D). A single axillary vibracum.

Remarks: In *S. unicornis* specimens from Green I., all zooids in the colony had ovicells, except for the median zooid at the bifurcation points. The scutum appears to vary in size, as is also evident from Liu's (1980) figure, obscuring the entire opesia in some autozooids but less than 1/2 of it in others. Measurements were ($n = 20$) zooidal length (from the distal edge of the ovicell of the measured zooid to the distal edge of the ovicell of the previous zooid) 0.37-0.42 mm, width, 0.20-0.21 mm; ovicell length 0.14-0.16 mm, width 0.20-0.21 mm; opesia (from the inner ring edges) length 0.15-0.16 mm, width 0.13-0.14 mm.

Distribution: Species recorded from Japan (Mawatari 1987), Daya Bay, the northern South China Sea (Liu 1992), and from Daya Bay and Hainan I. (China), northern South China Sea (Liu

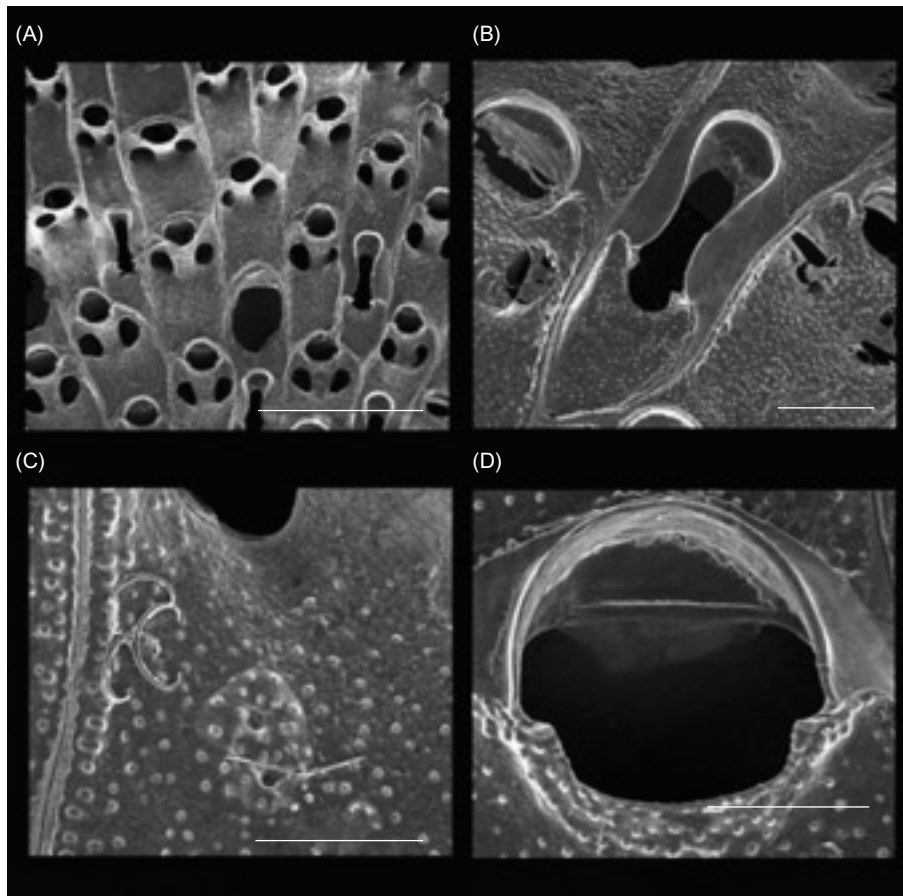


Fig. 12. *Thalamoporella tubifera*. (A) Flat unilaminar colony, zooids with large opesioles (scale bar = 1 mm); (B) vicarious avicularia (scale bar = 0.1 mm); (C) spicules (scale bar = 0.2 mm); (D) orifice (scale bar = 0.1 mm). 2 Mar. 2000. NHM 2003.11.18.10.

et al. 2001). An uncommon bryozoan fouler in coastal waters of southern China.

Superfamily Microporoidea Gray
Family Thalamoporellidae Levinsen
Genus *Thalamoporella* Hincks
Type species: *Flustra rozieri* Audouin, 1826
***Thalamoporella tubifera* Levinsen, 1909**
 (Figs. 12A-D)

Thalamoporella granulata var. *tubifera* Levinsen 1909: 189, pl. 6a, fig. 2a-e; Harmer 1926: 298, pl. 19, figs. 26, 27, pl. 20, fig. 1; Soule et al. 1992: 60, figs. 84-91.

Material: NHM 2003.11.18.10.

Description: Colony flat, forming an encrusting unilaminar sheet (Fig. 12A). Zooids rectangular, 0.58-0.77 x 0.39-0.48 mm, bounded by low mural rims. Cryptocyst with finely granulated surface, flat except proximally and laterally where it descends from opesiules, which are large, 0.08-0.12 x 0.12-0.14 mm, irregularly oval, and of unequal size (Fig. 12A). Orifice as long as wide, 0.14-0.22 x 0.14-0.22 mm, with a shallow broad sinus on proximal border (Fig. 12D). Ovicells not present. Avicularia vicarious, as long as autozooid, narrowly spatulate, rostrum occupying 1/2 of total length, with a narrow waist distal to condyles; granular proximal cryptocyst with a single round opesia (Fig. 12B). Neither sibling zooids nor those

adjacent to avicularium asymmetrical (torqued). Two kind of spicules present (Fig. 12C): widely opened compasses (0.08 mm) and smaller, C-shaped calipers (0.05 mm).

Distribution: Species with a very wide distribution within the Indo-West Pacific, from Tahiti and Tonga, to the Philippines and Indonesia, and eastwards to Maldive Is.

Suborder Ascophora Levinsen
Superfamily Cribrilinoidea Hincks
Family Cribrilinidae Hincks
Genus *Puellina* Jullien
Type species: *Lepralia gattyae* Landsborough, 1852
***Puellina egretta* Ryland and Hayward, 1992**
 (Figs. 13A-E)

Cribrilaria aff. *radiata* Ristedt 1985: 20, fig. 3e-h.

Puellina egretta Ryland and Hayward 1992: 244, fig. 11d, e; Tilbrook et al. 2001: 58, fig. 7C, D.

Material: NHM 2003.11.18.11.

Description: Colony encrusting, unilaminar. Zooids small, 0.28-0.33 x 0.17-0.23 mm, broadly oval, flat, separated by deep grooves. Gymnocyst minimally developed, inconspicuous. Frontal shield formed from 12-17 radiating series of costae (Fig. 13C). Operculum D-shaped. Secondary orifice wider than long, 0.02-0.03 x 0.06-0.07 mm

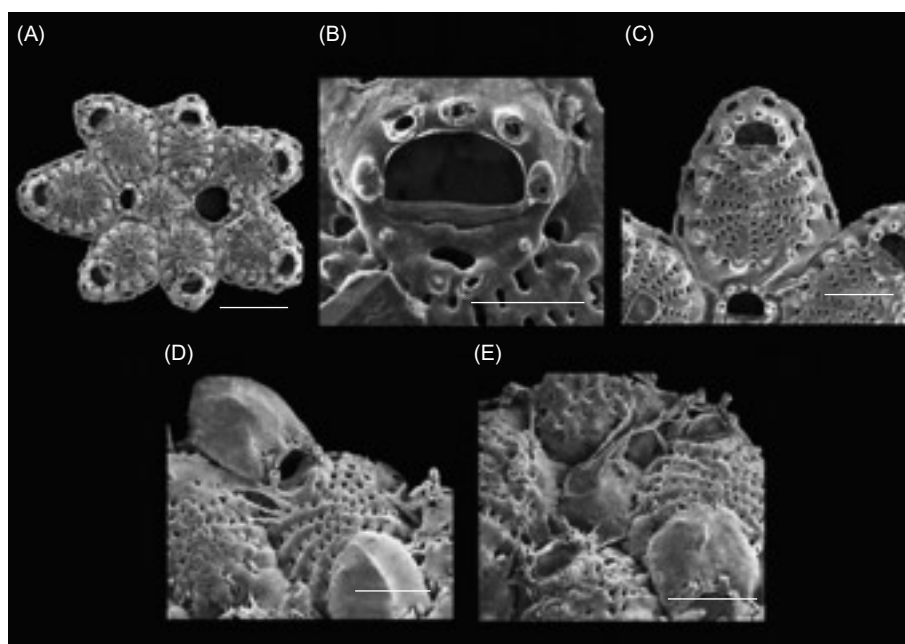


Fig. 13. *Puellina egretta*. (A) Tatiform ancestrula and periancestrular zooids (scale bar = 0.2 mm); (B) orifice with apertural bar, oral spines (scale bar = 0.05 mm); (C) frontal shield (scale bar = 0.1 mm); (D) ovicells (scale bar = 0.1 mm); (E) vicarious avicularium (scale bar = 0.1 mm). 8 Mar. 2000. NHM 2003.11.18.11.

(Fig. 13B). Apertural bar with medial thickening, and proximal to it a round lacuna, clearly longer than 1st intercostal pores. Five closely spaced oral spines present, 4 in ovicelled zooids (Fig. 13B). Ovicell longer than wide, 0.11-0.19 x 0.14-0.16 mm, prominent, with raised midline suture which resembles a keel (Fig. 13D). Avicularia frequent, cystid large, rounded, with broad, smooth gymnocyst, rostrum slender, elongate, finely denticulate, directed distomedially along margin of adjoining zooid (Fig. 13E). Ancestrula tatiform, 0.18 x 0.20 mm (Fig. 13A), membrane bordered by 11 spines; proximal spine flattened and bifurcate, curving over membrane.

Remarks: Ryland and Hayward (1992) stated that the frontal shield of *P. egretta* is formed from about 19 fused costae; in Green I. specimens, the maximum number of fused costae forming the frontal shield is 17. However, all other characters, such as the shape and size of the orifice, the number of oral spines, the form of the suborificial lacuna, and the morphology of the avicularium, which are all important in identifying species of *Puellina*, match Ryland and Hayward's description.

Distribution: Seychelles, the Philippines, Heron I., Great Barrier Reef (GBR; Ryland and Hayward 1992), Port Vila Harbour, Vanuatu (Tilbrook et al. 2001).

***Puellina flabellifera* (Kirkpatrick, 1888)**
(Figs. 14A, B)

Cribrilina radiata var. *flabellifera* Kirkpatrick 1888: 75, pl. 10, fig. 4.
Cribrilaria flabellifera: Ristedt 1985: 24, fig. 5a-g.
Puellina Cribrilaria flabellifera: Bishop and Househam 1987: 48, pl. 11, figs. 92, 93.

Material: XX colonies (since lost).

Description: Colony encrusting, forming broad, unilaminar patches. Zooids small, 0.23-0.39 x 0.19-0.22 mm, rhombic to oval, with costate frontal shield (Fig. 14A) consisting of 15 or 16 radiating series of costae, with small intercostal pores between points of fusion. Operculum D-shaped, closely fitting calcified secondary orifice, proximal edge of which is formed by fused 1st pair of costae; orifice wider than long, with 7 (4 in ovicelled zooids) closely spaced and very long oral spines situated around distal and lateral borders of orifice (Fig. 14A). Proximal to orifice, 1st pair of costae raised medially, forming a disk structure embracing a large suboral lacuna, and with a bicusped median umbo. Ovicell hyperstomial, helmet-like, 0.09 x 0.15 mm, with several irregularities, imperforate. Interzooidal avicularia common, with a characteristic hourglass rostrum, expanded at distal end; mandible greatly expanded distally, paddle-shaped (Fig. 14B). Mandible, 0.16-0.19 x 0.14-0.21 mm, and rostrum with key-lock configuration. Ancestrula tatiform, 0.23 x 0.19 mm.

Remarks: *P. flabellifera* was originally described from Mauritius (Kirkpatrick 1888), and subsequently ascribed a geographic distribution extending eastwards from the eastern Pacific through the Indo-West Pacific, and to the Mediterranean and Caribbean. Bishop and Househam (1987) selected a lectotype, and redescribed Kirkpatrick's species. They noted that its described geographical range probably encompassed those of several superficially similar species, and noted that Mediterranean and East Atlantic records did not belong to *P. flabellifera*. It is probably widely distributed in the Indo-West Pacific region but all records need to be reevaluated in the light of this taxonomic confusion.

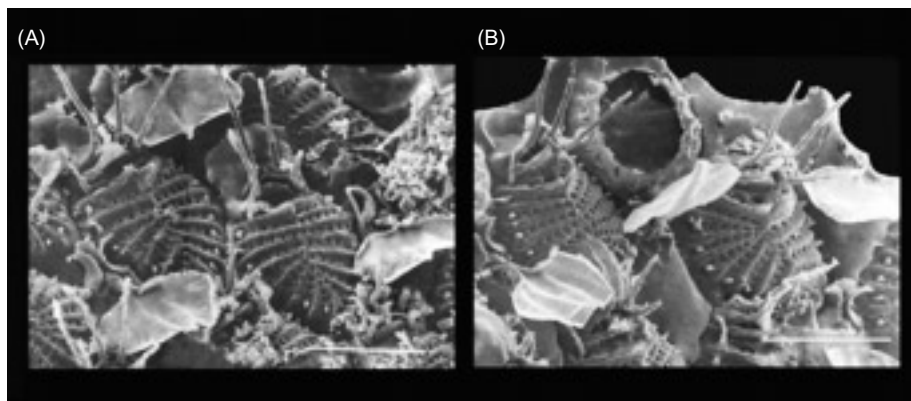


Fig. 14. *Puellina flabellifera*. (A) Frontal shield, long oral spines (scale bar = 0.2 mm); (B) vicarious avicularia (scale bar = 0.2 mm). 14 Mar. 2000. XX colonies (since lost).

Distribution: *P. flabellifera* known with certainty from Mauritius (Bishop and Househam 1987) and the Philippines (Ristedt 1985).

***Puellina vulgaris* Ryland and Hayward, 1992**
(Figs. 15A-D)

Puellina vulgaris Ryland and Hayward 1992: 244, fig. 12b, c; Tilbrook et al. 2001: 58, fig. 7E, F.

Material: NHM 2003.11.18.12.

Description: Colony encrusting, unilaminar. Zooids small, 0.19-0.41 x 0.14-0.30 mm, oval, slightly convex, separated by deep grooves. Gymnocyst present as a smooth border around zooid. Frontal shield formed from 12-18 radiating series of costae, intercostal pores large; a moderately sized lacuna present proximal to orifice (Fig. 15B). Orifice wider than long, 0.03-0.04 x 0.05-0.06 mm. Operculum D-shaped, 7 closely spaced oral spines present, 4 in ovicelled zooids (Fig. 15C). Ovicell spherical, wider than long, 0.09 x

0.12 mm (Fig. 15C). Avicularia frequent, especially on growing margin of colony (Fig. 15D), cystid small, with smooth gymnocyst, rostrum narrowly triangular, relatively short, finely denticulate; directed distally or distolaterally. Kenozooids sporadic, irregular in shape, with costate frontal wall. Ancestrula oval, 0.17 x 0.15 mm, tatiform, with almost-circular opesia bordered by 12 spines; the medioproximal spine slightly flattened, tapered distally, and curved over frontal membrane (Fig. 15A).

Remarks: *P. vulgaris* is distinguishable from *P. egretta* in having 7 rather than 5 oral spines and in its smaller avicularia. Ryland and Hayward (1992) noted that in *P. vulgaris* from Heron I. (GBR) avicularia were infrequent, while in Green I. specimens, they are abundantly present. Also, Ryland and Hayward described a small frontal umbo on the ovicell which was only obscurely developed in the Green I. specimens.

Distribution: Heron I., Great Barrier Reef (Ryland and Hayward 1992), Port Vila Harbour,

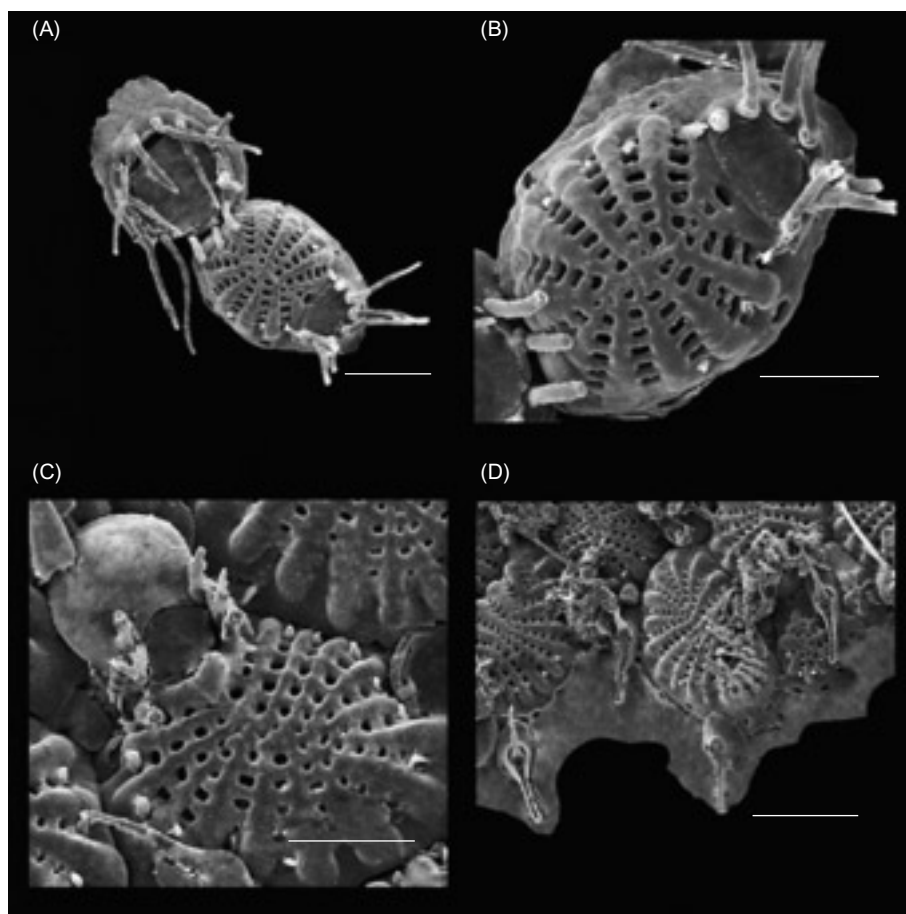


Fig. 15. *Puellina vulgaris*. (A) Tatiform ancestrula and 1st bud (scale bar = 0.1 mm); (B) frontal shield (scale bar = 0.05 mm); (C) ovicell (scale bar = 0.1 mm); (D) avicularia on the growing margin of the colony (scale bar = 0.2 mm). 17 Mar. 2000. NHM 2003.11.18.12.

Vanuatu (Tilbrook et al. 2001).

Superfamily Catenicelloidea Busk

Family Catenicellidae Busk

Genus *Catenicella* De Blainville

Type species: *Eucratea contei* Audouin, 1826

***Catenicella marceli* sp. nov.**

(Figs. 16A-C)

Material: Holotype: NHM 2003.11.18.13.

Etymology: Named for the grandfather of the 1st author, Marcel Gluhak (Zagreb, Croatia).

Description: Colony erect, branching, curled, jointed. Internodes unizoooidal, or bizoooidal units at branching points (Fig. 16A) and in fertile internodes. Zooid elongate, 0.44-0.61 x 0.12-0.17 mm, notably narrowed and tubular proximally, giving appearance of a stalk, widening and rounded toward distal end, curving forward so that entire autozooid seems to be humpbacked (Fig. 16B). Gymnocyst smooth, with a pair of narrow, elongate, frontolateral pore-chambers (vittae) extending for most of length of autozooid, each with a single series of pores (Fig. 16B). Two other much-smaller pairs of chambers situated near orifice (Fig. 16B), a teardrop-shaped pair facing distally situated just above orifice, and a rounded pair facing frontally situated just below distolateral avicularia, proximolateral to orifice. Primary orifice rounded, slightly longer than wide, 0.07-0.09 x 0.06-0.08 mm, with prominent, rounded condyles and gently concave proximal rim. A small avicularium protruding from each distolateral corner of autozooid, with distally directed semielliptical mandible. Fertile internodes bizoooidal (Fig. 16C). Distal zooid shorter and broader than proximal, brooding zooid, with much-broader orifice; ovicell

wider than long, 0.11 x 0.15 mm, with 2 large distal fenestrae. Proximal zooid of bizoooidal unit at bifurcation as large as a typical autozooid, distal one slightly shorter with wider proximal end than usual. Axial avicularium of proximal zooid suppressed, distal zooid with usual pair.

Remarks: *C. marceli* differs from all other species assigned to this genus in its pair of very narrow, elongate vittae with only 1 series of pores, in its very small, monomorphic avicularia, and the rounded ovicell with large, distinctive fenestrae.

***Catenicella uberrima* Harmer, 1957**

(Figs. 17A-C)

Catenicella uberrima Harmer 1957: 772, pl. 50, figs. 4, 5, 15.

Material: NHM 2003.11.18.14.

Description: Colony erect, branching, curly, jointed. Internodes consisting of single autozooids, or bizoooidal units at branching points (Fig. 17A, B). Single autozooid elongate, 0.52-0.63 x 0.17-0.20 mm (width measured at widest part of zooid from outer margins of vittae), slender proximally, widening in center, and than slender again distally. Gymnocyst smooth, with a pair of narrow, elongate, frontolateral pore-chambers (vittae) originating immediately below small chambers, extending for most of length of autozooid, each with 2 series of conspicuous pores (13 pores in each series, 26 pores overall in 1 vitta). A pair of small oval chambers facing laterally, situated just below distolateral avicularia, proximolateral to orifice, with only a few scattered small pores inside. Primary orifice as wide as long, 0.07-0.12 x 0.10-0.11 mm, with conspicuous condyles and concave proximal rim. Ovicells not observed. Avicularia paired, situ-

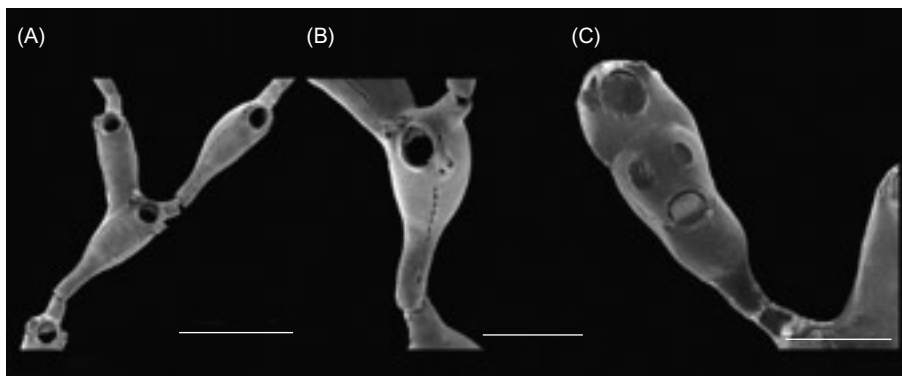


Fig. 16. *Catenicella marceli*, sp. nov. (A) Bizoooidal unit at the branching point (scale bar = 0.5 mm); (B) zooid, smooth gymnocyst with vittae, a pair of chambers, and lateral avicularia (scale bar = 0.2 mm); (C) fertile bizoooidal internode (scale bar = 0.2 mm). 8 Mar. 2000. Holotype: NHM 2003.11.18.13.

ated at distal end of autozoid, rostrum directed medially; dimorphic, one frequently much longer than other (Fig. 17C). Proximal zoid of bizooidal unit at bifurcation as large as single autozoid, distal one slightly shorter (Fig. 17B). Axial avicularium of proximal zoid suppressed, distal zoid with usual pair of avicularia.

Remarks: The internodes of *C. uberrima* are not always composed of a single autozoid as they are in the Green I. material, and the fertile internodes are usually made up of 2 or more autozooids. *C. uberrima* is especially characterized by its distally situated, dimorphic avicularia. One is often larger than the other, and may even assume gigantic proportions equivalent to almost 1/2 the length of the autozoid (Harmer 1957). Previously confused with *C. elegans* Busk, this species was shown by Harmer (1957) to be distributed from Algoa Bay, South Africa, and Zanzibar, westwards to the Torres Straits and the Northern Great Barrier Reef, and to be one of the most commonly occurring catenicellids in the Malayan region. This record from Green I. represents the northernmost occurrence of *C. uberrima* in the western Pacific.

Superfamily Arachnopusoidea Jullien

Family Arachnopusiidae Jullien

Genus *Poricella* Canu

Type species: *Poricella macconnica* Canu, 1904

***Poricella spathulata* (Canu and Bassler, 1929)**

(Figs. 18A-D)

Hiantopora spathulata Canu and Bassler 1929: 116, pl. 11, figs. 13, 14.

Arachnopusia spathulata: Harmer 1957: 657, pl. 68, figs. 22, 23, 25, 31.

Tremogasterina spathulata: Cook 1977: 136, text-figs. 1B, 5A, 8A, pl. 5A; Scholz 1991: 289, pl. 7, fig. 6; Ryland and Hayward 1992: 249, fig. 13e.

Poricella spathulata: Tilbrook et al. 2001: 65, fig. 10B.

Material: NHM 2003.11.18.15.

Description: Colony encrusting, forming small unilaminar patches. Zooids oval to pear-shaped, 0.54-0.63 x 0.31-0.41 mm, convex, separated by deep grooves. Frontal wall perforated with a variable number (10-20) of large, irregular crescentic fenestra, each with a broad, thick rim; marginal pores few and inconspicuous (Fig. 18B). Orifice slightly longer than wide, 0.17-0.18 x 0.16 mm, proximal edge more or less straight, thickened. Four to six distal oral spines, 2 in ovicelled zooids (Figs. 18A, D). Ovicells wider than long, 0.14 x 0.25 mm, finely granulated (Fig. 18D). Two types of avicularia present; smaller, ~0.3 mm long, developed on distolateral borders of autozooids, typically distally directed, rostrum raised, spatulate with straight distal edge (Figs. 18A, B); 2nd type occurring sporadically, longer, ~0.6 mm, directed distally or randomly, rostrum long, spatulate, with raised, curved, denticulate distal edge (Fig. 18C).

Remarks: Cook (1977) noted the rare presence of large vicarious avicularia, Tilbrook et al. (2001) stated that most colonies lack them, but when they are present within a colony, they are numerous; in specimens from Green I., their frequency is unusually high. *P. spathulata* seems to be common in shallow reef habitats whenever it is encountered.

Distribution: According to Cook (1977), the distribution of *P. spathulata* (as *Tremogasterina*) extending in tropical Indo-West Pacific from Red Sea to Great Barrier Reef. Scholz (1991) recorded it from the Philippine region, and Ryland and Hayward (1992) recorded it from Heron I. (GBR). Tilbrook et al. (2001) established the most easterly record from Vanuatu.

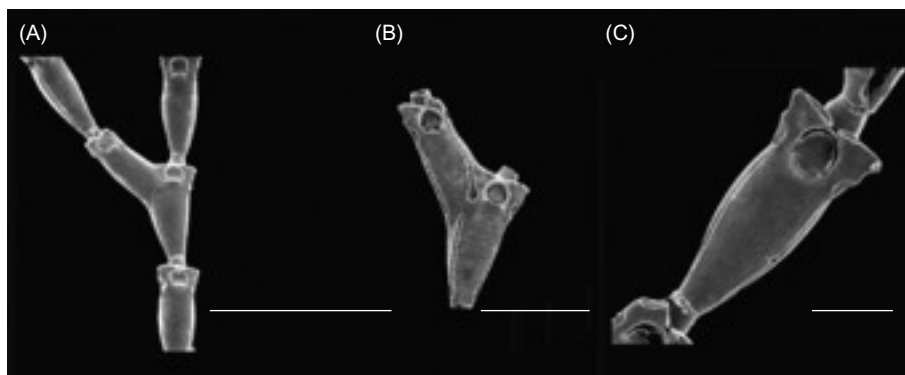


Fig. 17. *Catenicella uberrima*. (A) Colony (scale bar = 1 mm); (B) bizooidal unit at the branching point (scale bar = 0.5 mm); (C) lateral avicularia and vittae (scale bar = 0.2 mm). 16 Mar. 2000. NHM 2003.11.18.14.

Superfamily Lepralielloidea Vigneauxi

Family Lepraliellidae Vigneauxi

Genus *Celleporaria* Lamouroux

Type species: *Cellepora cristata* Lamarck, 1816

***Celleporaria* sp.**

(Figs. 19A-D)

Material: NHM 2003.11.18.16.

Description: A single specimen of *Celleporaria* found in collection from Green I. This small, damaged colony shows insufficient detail for a full determination. However, even though the full range of avicularian types, kind of ovicell and number of spines are unknown, the shape of the orifice and the large avicularium suggest that is a species of *Celleporaria*. Colony (Fig. 19A) young, encrusting, forming a small patch of fewer than 20 zooids, recumbent to erect or semi-erect, with convex, nodular, thickly calcified frontal wall and a single series of large, conspicuous marginal pores. Zooids 0.44-0.55 x 0.38-0.51 mm (Fig. 19B). Orifice wider than long 0.10-0.15 x 0.13-0.15 mm, with a thickened rim that is not very prominent

(Fig. 19D). Medially on proximal border a small, shallow U-shaped sinus. Usually 2 (in some zooids more) widely spaced distolateral oral spines (Fig. 19C, D). No avicularia present near orifice. Vicarious avicularia sporadic, long, narrow, and spatulate (Fig. 19A).

Remarks: *Celleporaria* is a widespread tropical-subtropical genus with many species, mostly poorly described. The Green I. specimen does not belong to any of the species recently illustrated by Gordon (1984 1989), Ryland and Hayward (1992), Hayward and Ryland (1995), Seo (1994 1998), or Tilbrook et al. (2001), but is inadequately developed for establishment of a new species.

Genus *Drepanophora* Harmer

Type species: *Rhynchopora incisor* Thornely, 1905

***Drepanophora gutta* Tilbrook, Hayward and Gordon, 2001**

(Figs. 20A-C)

Drepanophora gutta Tilbrook et al. 2001: 74, fig. 10E, F.

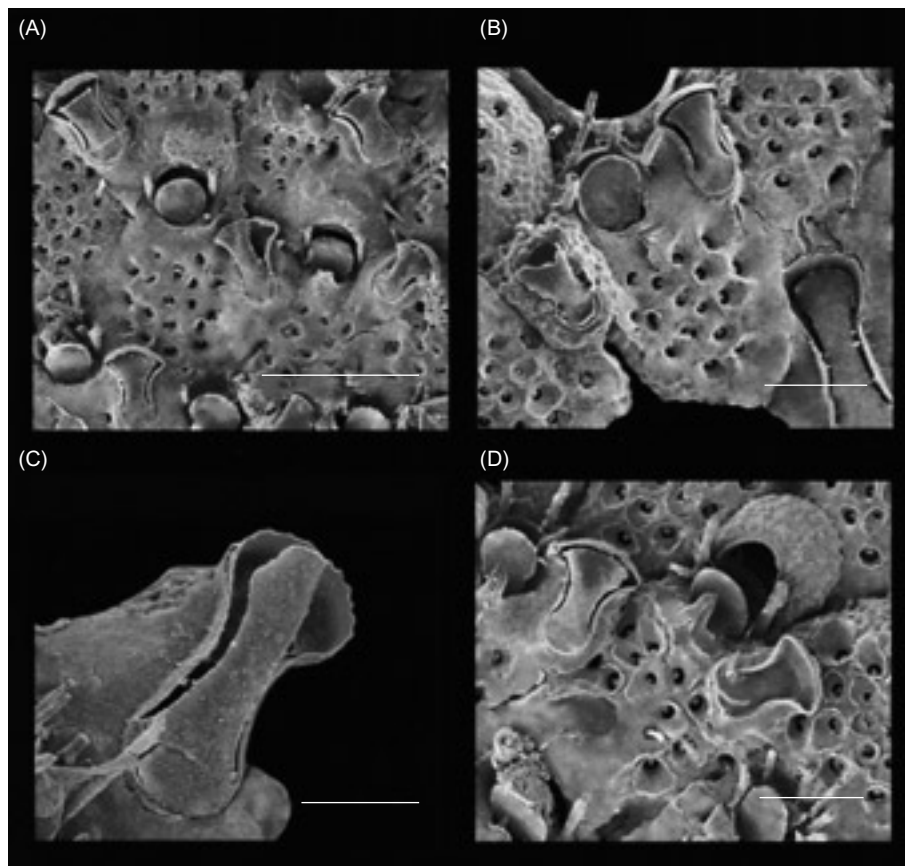


Fig. 18. *Poricella spathulata*. (A) First type of avicularia (scale bar = 0.5 mm); (B) frontal wall (scale bar = 0.2 mm); (C) 2nd type of avicularia (scale bar = 0.2 mm); (D) ovicell (scale bar = 0.2 mm). 17 Mar. 2000. NHM 2003.11.18.15.

Material: NHM 2003.11.18.17.

Description: Colony encrusting, unilaminar. Zooids oval, 0.28-0.42 x 0.14-0.26 mm, convex, separated by shallow grooves (Fig. 20C). Primary orifice as long as wide, 0.06-0.08 x 0.08-0.11 mm, widest distally, proximal border with a narrow, anvil-shaped lyrula (Fig. 20B). Peristome very long, especially in younger zooids (Fig. 20A), tubu-

lar, incomplete distally where orifice rim bears 2 oral spines, obscured in brooding zooids. In later ontogeny, peristome thicker and more robust. Ovicell prominent, 0.08-0.12 x 0.15-0.20 mm, globular, recumbent on distal zooid, initially smooth, developing a nodular ooecial cover; a small rounded foramen, on side of midline, distally situated (Fig. 20C). A single avicularium present on proximal rim of peristome (Fig. 20C), rostrum acute to

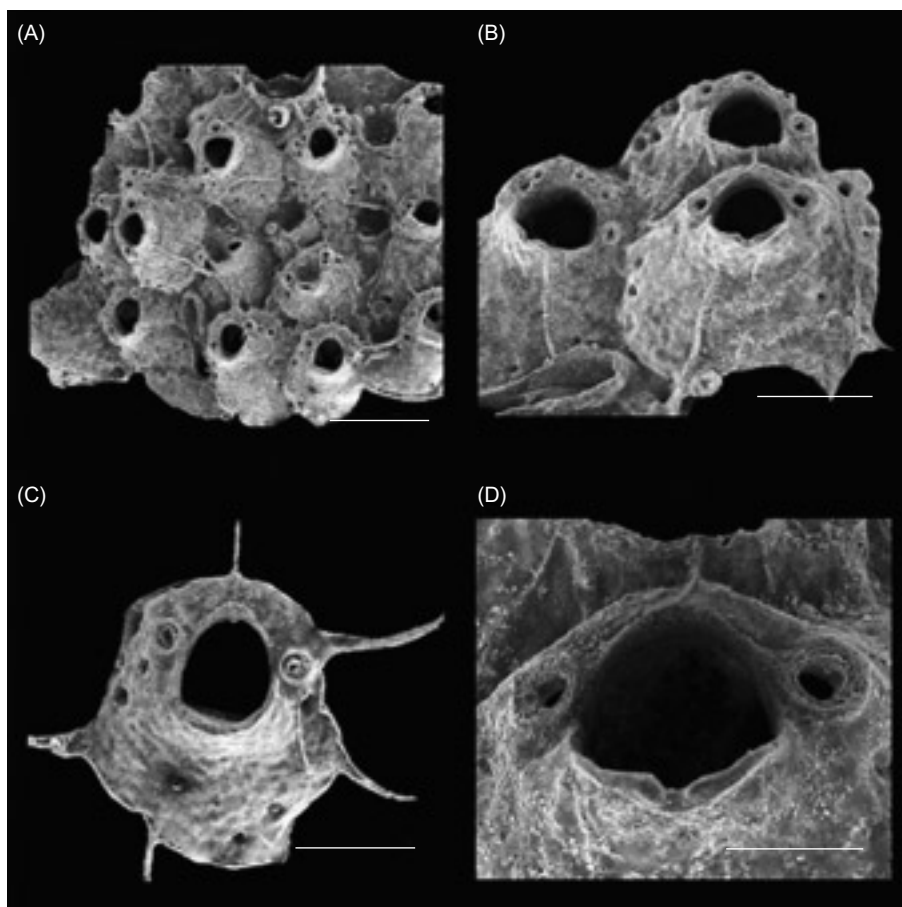


Fig. 19. *Celleporaria* sp. (A) Colony, vicarious avicularia (scale bar = 0.5 mm); (B) autozooids (scale bar = 0.2 mm); (C) oral spines (scale bar = 0.2 mm); (D) orifice (scale bar = 0.1 mm). 13 Mar. 2000. NHM 2003.11.18.16.

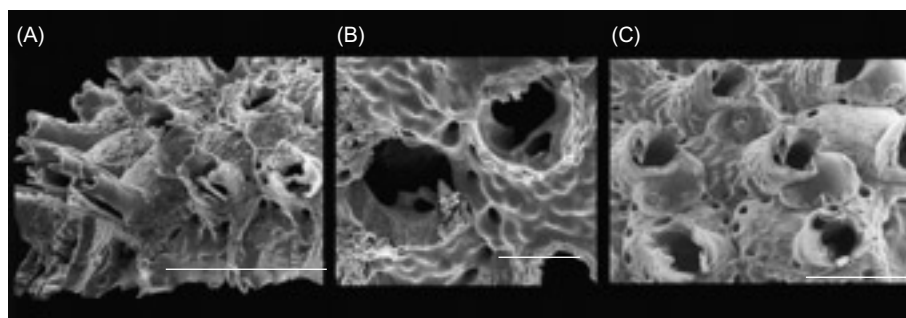


Fig. 20. *Drepanophora gutta*. (A) Tubular peristomes (scale bar = 0.5 mm); (B) orifice (scale bar = 0.1 mm); (C) ovicellate zooids (scale bar = 0.2 mm). 13 Mar. 2000. NHM 2003.11.18.17.

frontal plane, facing laterally, acute triangular. Frontal shield very slightly nodular, imperforate except for 4-7 large marginal pores situated along lateral walls and proximally.

Remarks: Specimens of *D. gutta* from Green I. differ slightly from those described by Tilbrook et al. (2001) in having longer, more-delicate peristomes and spines, and in the marginal pores which are not generally limited to the proximal side of the zooid but are also present laterally. These may simply be ontogenetic effects, as the Green I. specimens were young, actively growing colonies, and better preserved than the specimen described by Tilbrook et al. (2001). This record from Green I. represents only the 2nd record of this species.

Distribution: Described from Port Vila Harbour, Efate, Vanuatu by Tilbrook et al. (2001).

Superfamily Smittinoidea Levinsen

Family Smittinidae Levinsen

Genus *Hemismittoidea* Soule and Soule

Type species: *Hemismittoidea corallinea* Soule and Soule, 1973

***Hemismittoidea taiwanensis* sp. nov.**

(Figs. 21A, B)

Material: Holotype: NHM 2003.11.18.18.

Etymology: Named for the place of discovery, Taiwan.

Description: Colony encrusting. Zooids small, 0.28-0.35 x 0.19-0.28 mm, irregularly polygonal, separated by distinct sutures. Frontal wall convex, rugose, imperforate centrally, with marginal pores (Fig. 21A). Primary orifice, 0.09 x 0.08 mm, with a very broad lyrula on a proximal border occupying

most of its width, with a curved distal edge and cuspidate corners; distal rim of orifice very finely denticulate. A thin raised peristome present proximally and proximolaterally, with a median U-shaped sinus; 4-6 closely spaced oral spines around distal margin of orifice (Fig. 21A, B). A single laterally or medially situated oral avicularium present immediately proximal to peristome (Fig. 21A, B), directed proximally towards zooidal margin, with a tapering rostrum, acute and finely serrated rim. Ovicells not present in observed material.

Remarks: *H. taiwanensis* is attributed to *Hemismittoidea* because of its avicularium which is asymmetrically developed and may be median or lateral in position. However, *H. taiwanensis* differs from all other species assigned to this genus in having larger zooids, an especially large lyrula, and fewer oral spines than in either the type species, *H. corallinae* Soule and Soule, 1973 or the New Zealand species *H. hexaspinosa* (Uttley and Bullivant 1972). *H. ennea* Gordon and d'Hondt, 1997 has numerous, large, frontal marginal pores, 9 oral spines and proportionately larger avicularia than *H. taiwanensis*.

Genus *Parasmittina* Osburn

Type species: *Lepralia jeffreysi* Norman, 1876

***Parasmittina hastingsae* Soule and Soule, 1973**

(Figs. 22A, B)

Parasmittina hastingsae Soule and Soule 1973: 417, fig. 9C, D; Winston and Heimberg 1986: 26, figs. 59-63; Ryland and Hayward 1992: 268, fig. 21a-c; Hayward and Parker 1994: 63, fig. 4A-F; Tilbrook et al. 2001: 76, fig. 14C, D.

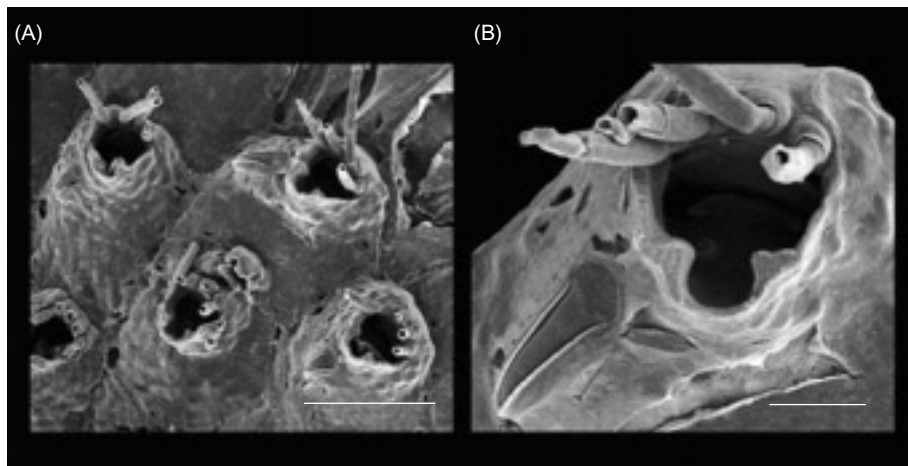


Fig. 21. *Hemismittoidea taiwanensis*, sp. nov. (A) Oral spines and adventitious avicularium (scale bar = 0.2 mm); (B) orifice (scale bar = 0.05 mm). 17 Mar. 2000. Holotype: NHM 2003.11.18.18.

Material: XX colonies (since lost).

Description: Colony encrusting, forming multilaminar sheets. Zooids irregularly polygonal, 0.47–0.70 x 0.36–0.50 mm, convex, separated by distinct sutures. Frontal shield finely nodular with large marginal pores (Fig. 22A). Primary orifice slightly wider than long, 0.10–0.15 x 0.13–0.15 mm, rounded; lyrula, 0.03–0.04 x 0.05–0.06 mm, occupying about 1/2 proximal orifice width; condyles thin, acute, down-curved (Fig. 22B). Peristome developed as paired lateral lobes. One to 4 distal oral spines, often absent. Ovicells not present. Avicularia sporadic, displaying polymorphism: most commonly a short oval type, proximolateral to orifice, directed proximally; less frequently a larger shoe-shaped type with elongate rostrum, generally proximolateral to orifice directed proximally.

Remarks: *P. hastingsae* samples from Green I. lack the large interzooidal type of avicularia,

mentioned previously by Ryland and Hayward (1992), but the morphological features of the primary orifice, in particular the thin, down-curved condyles, are in accord with those figured by Ryland and Hayward (1992) and also by Tilbrook et al. (2001). This material from Green I. represents a considerable extension of species geographical range.

Distribution: *P. hastingsae* described first from Hawaii, and subsequently reported from Victoria (Australia), Heron I. (GBR), Vanuatu, and Komodo.

***Parasmittina spiculata* sp. nov.**

(Figs. 23A, B)

Material: Holotype: NHM 2003.11.18.19.

Etymology: Latin, *spiculum*, meaning small point.

Description: Colony an encrusting, unilaminar

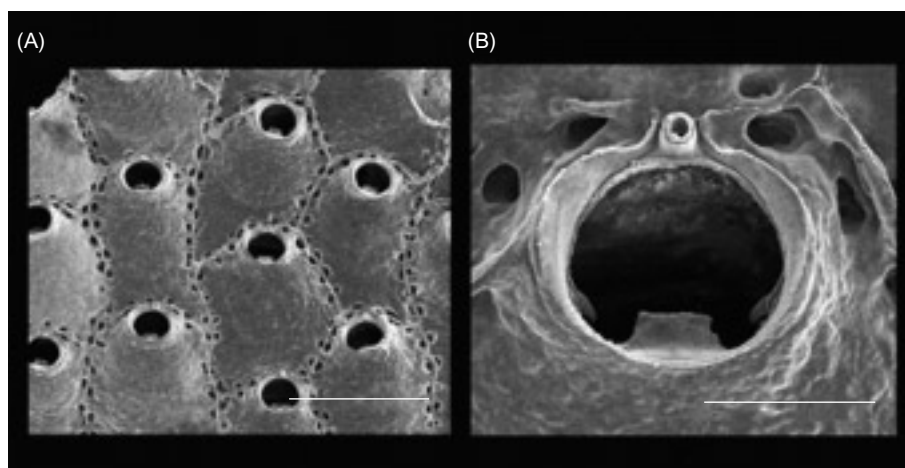


Fig. 22. *Parasmittina hastingsae*. (A) Frontal shield, marginal pores (scale bar = 0.5 mm); (B) orifice (scale bar = 0.1 mm). 13 Mar. 2000. XX colonies (since lost).

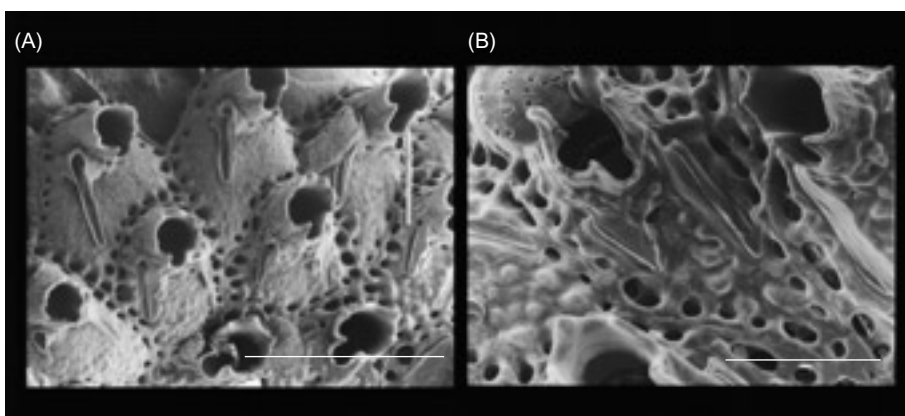


Fig. 23. *Parasmittina spiculata*, sp. nov. (A) Frontal shield with marginal pores, suboral avicularia (scale bar = 0.5 mm); (B) peristome in ovicelled zooid (scale bar = 0.2 mm). 2 Mar. 2000. Holotype: NHM 2003.11.18.19.

sheet. Zooids oval to irregularly polygonal, 0.34-0.48 x 0.27-0.41 mm, separated by indistinct sutures. Frontal shield coarsely nodular, with large and conspicuous marginal pores (Fig. 23A). Peristome tall, cylindrical, with a deep, medioproximal pseudosinus; its rim produced into short, blunt spikes, especially prominent on each side of pseudosinus. No oral spines observed. One or 2 lateral suboral avicularia directed proximally, parallel with zooidal wall, with slender parallel-sided rostrum and rounded tip; typically each zooid with 1 short avicularium, 2nd one twice as large as 1st (Fig. 23A, B). Ovicell small, wider than long, 0.14 x 0.18 mm, recumbent on frontal shield of distal autozooid, perforated with approximately 24 small pores (Fig. 23B); peristome incomplete distally in brooding zooids, forming paired, lateral flaps which extend over but do not fuse with frontal surface of each ovicell.

Remarks: *P. spiculata* most closely resembles *P. serrula* Soule and Soule (see Ryland and Hayward 1992), especially in its paired, unequal avicularia, but differs in lacking oral spines.

Superfamily Schizoporelloidea Jullien

Family Lanceoporidae Harmer

Genus *Calyptotheca* Harmer

Type species: *Schizoporella nivea wasinensis* Waters, 1913

***Calyptotheca* sp.**

(Figs. 24A, B)

Material: NHM 2003.11.18.20.

Description: Colony encrusting, growing as a unilaminar sheet. Zooids irregularly polygonal, 0.34-0.52 x 0.22-0.32 mm, flat to convex, separated by thick raised sutures. Frontal shield more or

less evenly, densely perforated, with low ridges between pores (Fig. 24A). Orifice wider than long, 0.07-0.09 x 0.10-0.14 mm, with a broad shallow sinus. No oral spines. Ovicells not present. Avicularia rare, dimorphic, proximolateral to orifice, minute, with a semielliptical rostrum directed medially (Fig. 24B); or proximal to orifice, median, with a larger, triangular rostrum acute to frontal plane and directed laterally.

Remarks: The Green I. specimen of *Calyptotheca* is most similar to *C. rupicola* described from Heron I. (GBR) (Hayward and Ryland 1995) but lacks the curved band of especially large tubercles which extends around the proximal and lateral borders of the orifice, constituting a distinct peristomial rim, and has distinctive, dimorphic avicularia. It perhaps represents an undescribed species but the single small colony, which lacks ovicells, is insufficient for adequate description.

Family Crepidacanthidae Levinsen

Genus *Crepidacantha* Levinsen

Type species: *Crepidacantha poissoni crinispina* Levinsen, 1909

***Crepidacantha carsioseta* Winston and Heimberg, 1986**

(Figs. 25A-D)

Crepidacantha carsioseta Winston and Heimberg 1986: 27, figs. 64-66; Ryland and Hayward 1992: 277, fig. 25d; Tilbrook et al. 2001: 92, fig. 16A.

Material: NHM 2003.11.18.22.

Description: Colony encrusting, unilaminar, irregular in shape. Zooids oval to quadrate, 0.29-0.46 x 0.22-0.33 mm; frontal wall smooth with ~22 inconspicuous marginal pores (Fig. 25D). Primary

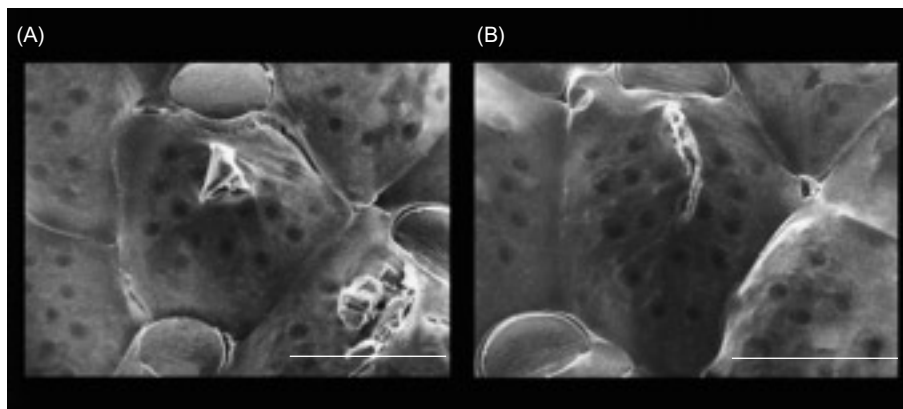


Fig. 24. *Calyptotheca* sp. (A) Frontal shield (scale bar = 0.2 mm); (B) minute avicularia (scale bar = 0.2 mm). 16 Mar. 2000. NHM 2003.11.18.20.

orifice longer than wide, proximal edge convex, with lateral lobes giving a trifoliate appearance (Fig. 25A). No oral spines, but ~12 marginal spines situated distally and distolaterally (Fig. 25D), present in zooids on growing edge of colony. Ovicell hyperstomial, 0.09 x 0.17 mm, spherical, closed by zooidal operculum, smooth, with a thin curved fenestra crossing frontal surface distally (Fig. 25C). Avicularia usually paired (Fig. 25B), placed proximolateral to orifice, orientated medially; mandible setiform.

Remarks: In *C. carsioseta* from Heron I. (GBR), Ryland and Hayward (1992) did not note the marginal spines, characteristic of the genus, or zooids with a single avicularium (only paired). In Green I. specimens, zooids occurred with either paired or single avicularia. The record of *C. carsioseta* from Green I. is the most remote from its type locality.

Distribution: Winston and Heimberg (1986) described this species from 2 localities in Indonesia. Ryland and Hayward (1992) reported it

from Heron I. (GBR), and most recently Tilbrook et al. (2001) figured it from Efate, Vanuatu.

Family Incertae Sedis

Genus *Escharina* Milne Edwards

Type species: *Eschara vulgaris* Moll, 1803

***Escharina pesanseris* (Smitt, 1873)**

(Figs. 26A, B)

Hippothoa pes anseris Smitt 1873: 43, pl. 7, figs. 159, 160.

Escharina pesanseris: Levinsen 1909: 326, pl. XVIII, fig. 1a-c;

Harmer 1957: 998, pl. 67, figs. 12-14, 18, 19; Winston

1984: 26, figs. 53-55; Gordon 1984: 84, pl.29, figs. A, B;

Tilbrook et al. 2001: 80, fig. 17A, B.

Material: NHM 2003.11.18.21.

Description: Colony encrusting. Zooids broad, 0.37-0.42 x 0.20-0.24 mm, irregular in shape, convex. Frontal wall finely granular and evenly perforated with tiny pores (Fig. 26A). Primary orifice much longer than wide, with a narrow, U-shaped sinus between broad condyles on proximal rim. Peristome smooth, moderately

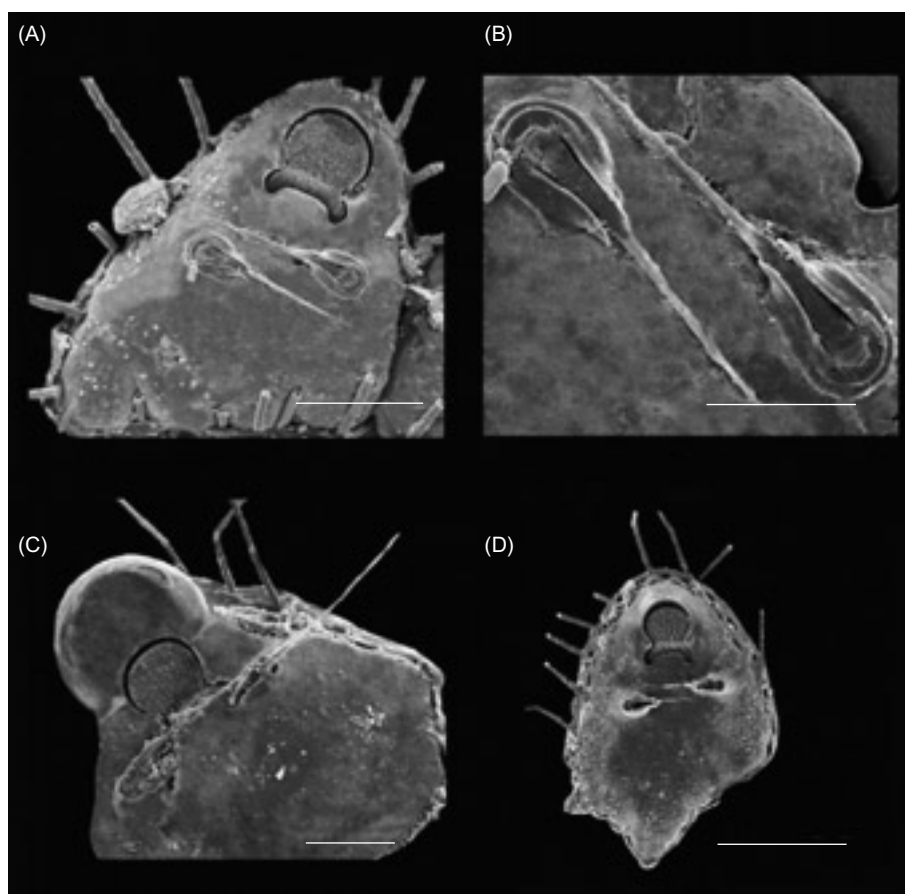


Fig. 25. *Crepidacantha carsioseta*. (A) Orifice (scale bar = 0.1 mm); (B) 2 adventitious avicularia (scale bar = 0.05 mm); (C) ovicell (scale bar = 0.1 mm); (D) zooid with ~12 marginal spines (scale bar = 0.2 mm). 8 Mar. 2000. NHM 2003.11.18.22.

prominent. Seven distal oral spines, 6 in ovicelled zooids (Fig. 26A, B). Ovicell small, wider than long, 0.12 x 0.21 mm, with a transverse frontal ridge, smooth (Fig. 26A). A pair of avicularia adjacent to orifice laterally, with duck foot-shaped mandibles directed distally (Fig. 26B).

Remarks: Ryland and Hayward (1992) described *E. pesansensis* from Heron I. (GBR) with 8 or 9 distal oral spines, while in Green I., specimens and those figured from Vanuatu by Tilbrook et al. (2001), only 7 oral spines were present (6 in ovicelled zooids). The specimen figured by Tilbrook et al. (2001) seems closely similar to the Green I. specimens, but *E. pesansensis* as figured by Gordon (1984) has a proportionately larger, narrower primary orifice, and shorter, broader avicularium mandibles.

Distribution: *E. pesansensis* a widely distributed pantropical species, well known from warm-temperate and tropical shallow waters. It has been reported from New Zealand, Three King Is.,

Indonesia, Central America, Gulf of Mexico (Gordon 1984), the Philippines (Scholz 1991), Heron I. (GBR), Port Vila Harbour, and Iririki I. (Tilbrook et al. 2001).

Superfamily Celleporoidea Johnston

Family Celleporidae Johnston

Genus *Celleporina* Gray

Type species: *Lepralia hassallii* Johnston, 1847

***Celleporina avicularidentata* sp. nov.**

(Figs. 27A-C)

Material: Holotype: NHM 2003.11.18.23.

Etymology: Latin, *avicularia*, meaning *avicularia*, *dentatus*, meaning serrate; alluding to the presence of the specific large vicarious avicularia with serrate rostrum noted only in this species of *Celleporina*.

Description: Colony an encrusting, multilaminar nodule, ~4 mm long by ~2 mm wide. Zooids recumbent to erect, irregular in arrangement;

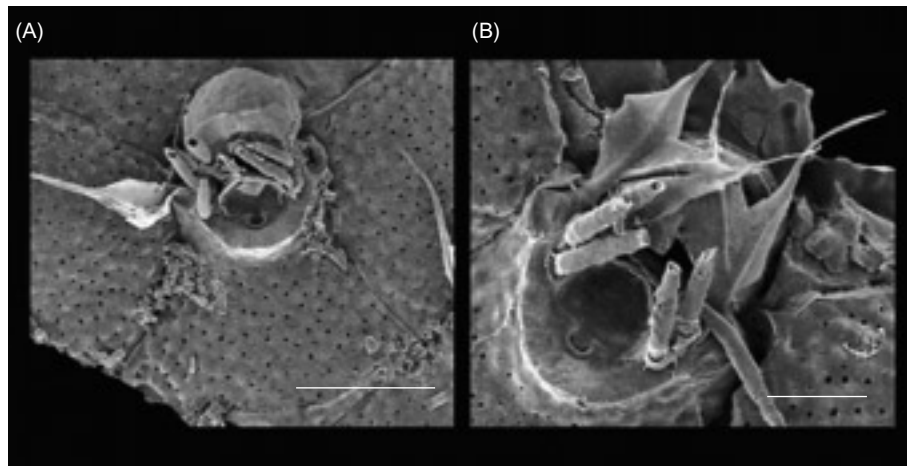


Fig. 26. *Escharina pesansensis*. (A) Frontal wall, ovicell (scale bar = 0.2 mm); (B) avicularia with duck foot-shaped mandibles (scale bar = 0.1 mm). 17 Mar. 2000. NHM 2003.11.18.21.

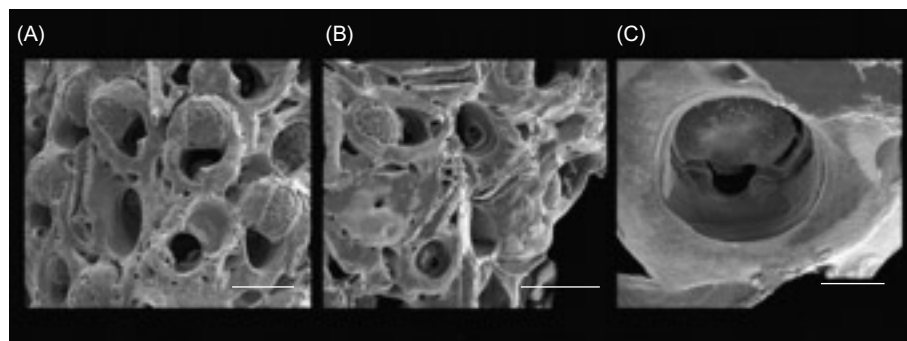


Fig. 27. *Celleporina avicularidentata*, sp. nov. (A) Vicarious avicularia (scale bar = 0.2 mm); (B) subglobular ovicell (scale bar = 0.2 mm); (C) orifice (scale bar = 0.5 mm). 8 Mar. 2000. Holotype: NHM 2003.11.18.23.

zooidal boundaries indistinct, without regular orientation (Fig. 27A, B). Frontal wall smooth to rugose, with few, large, irregularly scattered marginal pores. Primary orifice terminal, wider than long, 0.07 x 0.10 mm, with deep U-shaped sinus occupying about 1/2 width of proximal border (Fig. 27C). No oral spines. Peristome rounded, high suborally; a single small suboral avicularium present on proximal face of peristome, rostrum acute to orifice plane, facing laterally. Vicarious avicularia large, distinctive, with a long, slender and coarsely dentate rostrum (Fig. 27A). Ovicells subglobular, 0.13-0.16 x 0.21 mm, tabula with tiny pores around margin, and a few randomly scattered frontally (Fig. 27B).

Remarks: *C. avicularidentata* differs from other species assigned to this genus especially in the morphology of its vicarious avicularia. It is most similar to *C. cochlearia*, first described from Heron I. (Hayward and Ryland 1995), which also has just a single peristomial avicularium, and a vicarious avicularium with a long, slender rostrum, but the sinus is much broader in *C. cochlearia*, and its ovicells are proportionally larger with very large perforations around the margin of the tabula.

Family Phidoloporidae Grabb and Horn

Genus *Reteporellina* Harmer

Type species: *Retepora denticulata* Busk, 1884

***Reteporellina cruciformis* Gordon and d'Hondt, 1997**

1997

(Figs. 28A-C)

Reteporellina cruciformis Gordon and d'Hondt 1997: 66, figs. 185-187; Hayward 2000: 129, fig. 14.

Material: NHM 2003.11.18.24.

Description: Colony erect, branching dichotomously, attached to the substratum by an encrusting base. Branches 0.37-0.81 mm wide, 3 or 4 zooids in row, 5 prior to bifurcation. Zooids elongate, 0.36 x 0.21 mm, bottle-shaped, with distinct boundaries (Fig. 28A). Frontal shield convex, smooth, with 1 or 2 marginal pores present at proximal end of each zooid. Primary orifice suborbicular, hidden by deep, tubular, projecting peristome especially distinct in lateral zooids. Peristomial rim spout-like, with a distinct midproximal sinus and short spiked lateral processes (Fig. 28B). Peristomial sinus continuous with a vertical groove within peristome, and with a pair of stout cusps on both frontal and distal faces of peristome. Ovicell recumbent, 0.15-0.17 x 0.11-0.13 mm, egg-shaped, broadest distally; aperture with an elongate labellum and frontal median fissure extending for about 1/2 its length (Fig. 28C). Younger parts of colony may consist of zooids lacking ovicells and frontal avicularia. Mature parts of colony consisting of zooids with large, spatula-shaped labial avicularium, with rostral rim hooked and bicusped distally. Kenozooids building encrusting base of colony, each bearing 1 or 2 adventitious avicularia; kenozooidal frontal shield with 1-5 irregularly scattered pores.

Remarks: *R. cruciformis* was only recently described from New Caledonian waters (Gordon and d'Hondt 1997) and subsequently recorded from the reef flat at Suva, Fiji (Hayward 2000). This record from Green I. is thus only the 3rd, which considerably extends the range of the species.

Distribution: the Philippines, Mindoro Strait (Gordon and d'Hondt 1997), Fiji, Suva (Hayward 2000).

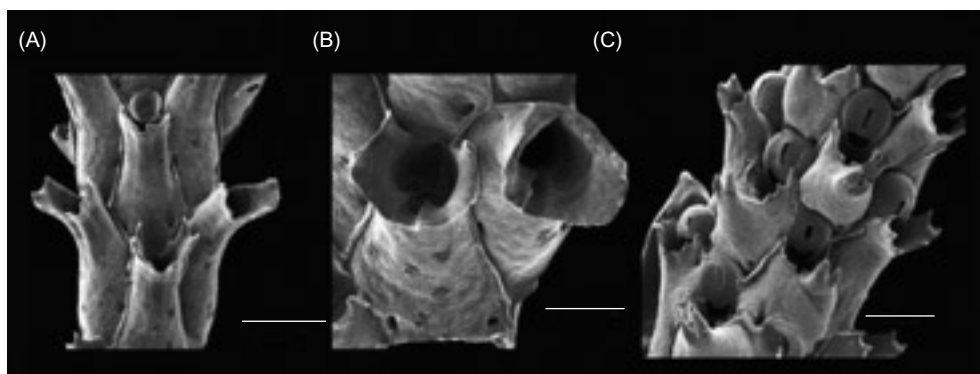


Fig. 28. *Reteporellina cruciformis*. (A) Colony branch (scale bar = 0.2 mm); (B) peristomial rim (scale bar = 0.1 mm); (C) ovicell (scale bar = 0.2 mm). 17 Mar. 2000. NHM 2003.11.18.24.

Genus *Rhynchozoon* Hincks

Type species: *Lepralia bispinosa* Johnston, 1847

***Rhynchozoon tubulosum* (Hincks, 1880)
(Figs. 29A-E)**

Mucronella (?) *tubulosa* Hincks 1880: 383, pl. 17, fig. 7.

Rhynchozoon tubulosum: Harmer 1957: 1064, pl. 65, figs. 16-19; Gordon 1984: 125, pl. 52, figs. C-E; Ryland and Hayward 1992: 294, fig. 32c-e; Gordon and d'Hondt 1997: 59, figs. 146, 147.

Material: NHM 2003.11.18.25.

Description: Colony encrusting, forming small unilaminar patches. Zooids recumbent, 0.42-0.44 x 0.25-0.27 mm, convex, separated by distinct sutures (Fig. 29A). Frontal wall almost smooth, but with fine longitudinal rugosities, with few, large widely-spaced marginal pores (Fig. 29A). Primary orifice wider than long, 0.07-0.09 x 0.12 mm, with broadly and shallowly concave proximal edge (Fig. 29C, E). Distal/distolateral denticulations (12-16 teeth) small and widely spaced (Fig. 29D, E). Proximal peristomial lip prominent, raised medially as a suboral mucro, very long, occasionally spinose, or distinctly bifid apically (Fig. 29C). Ovicell as wide as long, 0.12-0.14 x 0.13-0.15 mm, immersed, slightly flattened frontally, with a finely granular frontal endooecium, bordered by a

smooth margin of ectooecium (Fig. 29B). Suboral avicularium associated with peristome oriented transversely, situated on inner surface of mucro (Fig. 29D). Large frontal avicularia present sporadically with linguiform rostrum, orientated parallel to frontal plane and directed proximally (Fig. 29B). Tiny adventitious avicularia often developed towards tip of mucro.

Remarks: Green I. specimens of *R. tubulosum* differ from specimens described from the Kermadec Ridge (Gordon 1984) in several characteristics. Gordon stated that specimens from the Kermadec Ridge have "Marginal pores, four on each side, conspicuous", while in Green I. specimens, only 3 marginal pores occur on each side. Also, the primary orifice in specimens described by Gordon is more circular than in Green I. specimens. This record of *R. tubulosum* from Green I. constitutes a new northern limit of species distribution.

Distribution: In the Western Pacific *R. tubulosum* reported with certainty from the Kermadec Ridge (Gordon 1984), Heron I. (GBR) (Ryland and Hayward 1992), New Caledonia (Gordon and d'Hondt 1997), the Philippines (Scholz and Cusi 1991), and Indonesia (Harmer 1957). This record from Green I. constitutes a new northern limit. The species also known from Sri Lanka and Mauritius

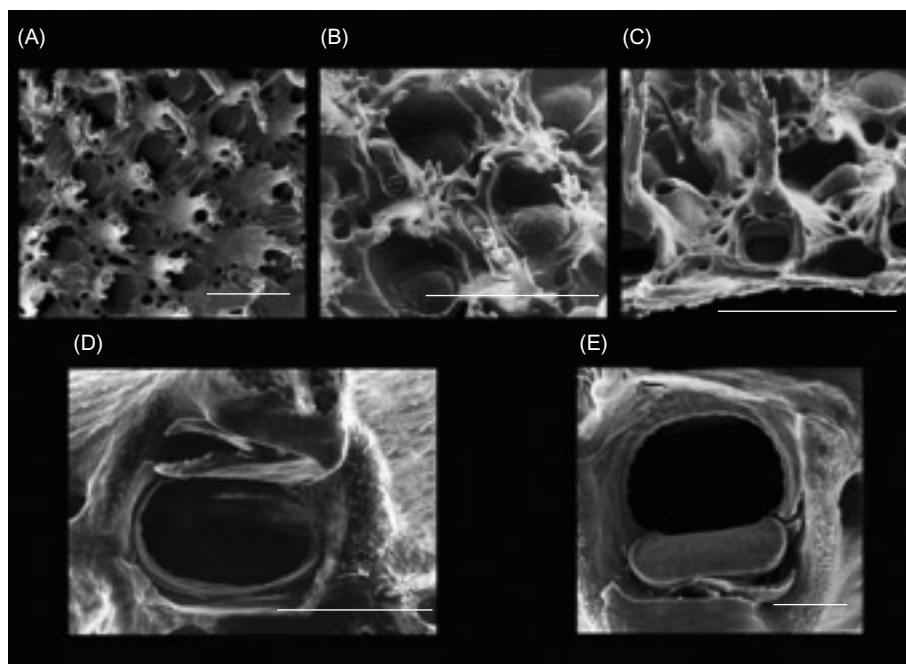


Fig. 29. *Rhynchozoon tubulosum*. (A) Zooids, marginal pores (scale bar = 0.5 mm); (B) large frontal avicularia, ovicells immersed (scale bar = 0.5 mm); (C) mucro (scale bar = 0.5 mm); (D) suboral avicularium (scale bar = 0.1 mm); (E) orifice with denticulations (12-16 teeth) (scale bar = 0.05 mm). 13 Mar. 2000. NHM 2003.11.18.25.

(Ryland and Hayward 1992).

Class Stenolaemata Borg
Order Cyclostomata Busk
Suborder Articulata Busk
Family Crisiidae Johnston
Genus *Crisia* Lamouroux

Type species: *Sertularia eburnea* Linnaeus, 1758
***Crisia* sp.**
 (Fig. 30A)

Material: NHM 2003.11.18.26.

Description: A *Crisia* colony found at Green I. has sterile internodes (Fig. 30A) which are 0.14 mm wide and comprise 8 tubular autozooids, arranged in 2 alternating symmetrical series, all

frontally facing, linked by black chitinous, tubular nodes. Apertural diameter 0.04–0.06 mm, distance between midpoints of adjacent apertures 0.19–0.25 mm. Short peristomes projecting from branch, giving internodes a saw-toothed appearance. Gonozooid not observed.

Remarks: As the sample is sterile, and the colony is too small for analyzing internode lengths, there is insufficient information to provide a full determination.

Suborder Rectangulata Waters
Family Lichenoporidae Smitt
Genus *Disporella* Gray

Type species: *Discopora hispida* Fleming, 1828
***Disporella* sp.**
 (Figs. 31A–C)



Fig. 30. *Crisia* sp. Internode (scale bar = 0.5 mm). 7 Mar. 2000. NHM 2003.11.18.26.

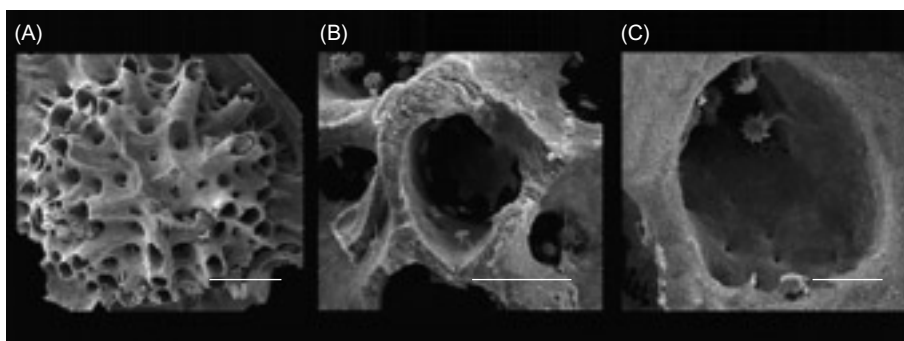


Fig. 31. *Disporella* sp. (A) Discoidal colony (scale bar = 0.2 mm); (B) spinules in autozooid (scale bar = 0.05 mm); (C) interior of alveolus with spinules (scale bar = 0.02 mm). 17 Mar. 2000. NHM 2003.11.18.27.

Material: NHM 2003.11.18.27.

Description: A single, small *Disporella* colony found at Green I.; encrusting, discoidal (Fig. 31A), 1.5 mm in diameter, with a thin, broad peripheral lamina. Autozooids occurring in radiating series linked by calcified struts defining irregular alveoli, progressively reduced by centripetal calcification, but not completely closing, those in colony center retaining a central foramen. Distance between midpoints of adjacent zooidal apertures 0.14-0.20 mm. Inner walls of alveoli (diameter 0.05-0.06 mm) perforated with irregularly scattered, minute pores (Fig. 31C). Small spinules with flat, flower-shaped heads (Fig. 31B) present on inner surfaces of both autozooids and alveoli, and especially common within latter.

Remarks: As there is no brood chamber present, and the colony is quite young, a full determination of this species cannot be attempted.

DISCUSSION AND CONCLUSIONS

This description of the bryozoan fauna of Green I. is the first of its kind from Taiwan, and all of the species listed here are new for Taiwan.

In comparing the 3 major groups, cheilostomes predominated, while only a few cyclostome taxa were recognized. No Ctenostomes were recorded. In total, 30 species of 22 genera were found, six of which are new to science (*Amastigia tricervicornis*, *Caberea sinensis*, *Catenicella marceli*, *Hemismittoidea taiwanensis*, *Parasmittina spiculata*, and *Celleporina avicularidentata*). It is worth noting the high diversity, not only at the species but also at the genus (22) and family (15) levels.

Even though new for Taiwan, the majority of the species described in this paper have previously been reported from other parts of the world, mostly from coral reef communities of tropical regions. Besides the tropical species, others such as *Synnotum aegyptiacum* (Liu 1984, Seo 1992, Rho and So 1984, Rho and Seo 1990), *Canda pecten* var. *scutata* (Liu 1984), *Scrupocellaria delillii* (Liu 1984), *S. maderensis* (Liu 1984), and *S. unicornis* (Liu 1980) reported from China seas and the South Sea in Korea, also seem to be common outside the tropics and may be cosmopolitan.

As the west coast of Taiwan is highly influenced by summer southeasterly monsoons which cause the coral colonies here to be much smaller than those on the east coast, it is expected that the bryozoan fauna of the west coast will have a differ-

ent species composition from that of the east coast, which has yet to be investigated.

New data on the bryozoan fauna from Green I., Taiwan, while incomplete, illustrate the taxonomic richness of the bryozoan fauna in the tropical western Pacific, but this biogeographic region still remains relatively poorly inventoried.

Acknowledgments: We would like to express our sincere appreciation to Dr. P.J. Hayward for his valuable comments on previous drafts of this manuscript and for help with the determinations. We are also greatly obliged to Dr. F.K. McKinney whose kind suggestions contributed to finalizing the written report of this work and to Dr. P.D. Taylor, Prof. D. Zavodnik, Dr. Ana Travizi, and I. Cvitković for all the encouragement, help, and advice. Thanks to National Taiwan Ocean Univ., Taiwan for financial and logistical support and to Dr. Young and Ms. Huang for access to the SEM.

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