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Shallow-Water Bryozoans of Carrie Bow Cay, Belize

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ABSTRACT

Four species of tubuliporate, two species of ctenostome, and 30 species of cheilostome bryozoans were identified from shallow-water habitats (20 m or less) in the vicinity of Carrie Bow Cay, Belize. This report, the first on bryozoan fauna of Belize, includes one new genus, four new species of cheilostomes, and three new records of bryozoans for the Caribbean.

INTRODUCTION

The barrier reef off Belize is the second largest reef in the world, yet until recently the study of its natural history has lagged behind that of other parts of the Caribbean. Bryozoans are one of the invertebrate groups whose distribution there has received no attention.

The western Atlantic tropical bryozoan fauna appears well-known compared with that of other regions. Schopf (1973) reported 278 species of cheilostomes. However, completed studies have covered only limited areas of the Gulf of Mexico and Caribbean and large areas still remain unstudied. Moreover, all previous studies in the Caribbean used dredging and limited shallow-water hand collection, thus species from coral reef environments are probably underrepresented.

There have been two reports on material from areas near Belize: Canu and Bassler (1928b) recorded material from more than 40 stations dredged by the United States Fisheries Commission Vessel *Albatross* in the Gulf of Mexico and Straits of Yucatan in 1883–1885. This collection included four stations in the area east of Yucatan, approximately 500 km north of Carrie Bow Cay. Banta and Carson (1977) reported on a small collection from Portete on the Caribbean coast of Costa Rica, taken from a patch reef and shallow-reef flat environment.

METHODS

STUDY AREA: According to Rützler and MacIntyre (1982) the barrier reef around

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Carrie Bow Cay can be divided into five major biological/geological units: lagoon, backreef, reef crest, inner forereef, and outer forereef. During a two-weeks' stay at Carrie Bow Cay in November 1980, observations and collections were made by SCUBA diving or snorkelling in all these areas. In addition, mangrove roots in the channel area at Twin Cays were also searched for bryozoans.

Bryozoans, once thought to be unimportant in reef environments have been found to be a major component of the cryptic reef community—those animals inhabiting coral undersurfaces, and caves and crevices in the matrix of the reef (Jackson and Winston, 1982; Winston and Jackson, 1984). Coral rubble was overturned, and undersurfaces of platy coral carefully examined. Photographs of living specimens were taken underwater or in the laboratory, and whenever possible observations were made on morphology of living colonies with regard to color, size, surface condition, presence of embryos, etc. A few specimens were fixed in formalin and preserved wet, but as cheilostome taxonomy depends on skeletal characters, most colonies were allowed to dry on their substrata and preserved dry.

In New York specimens were identified and measurements were taken on one to three colonies of each species. Measurements, given following species descriptions, included standard characters: Lz, Wz (zooid length and width); Lo, Wo (orifice length and width); Lop, Wop (opesia length and width); Lov, Wov (ovicell length and width); Lav, Wav (avicularium length and width), plus other measurements relevant to particular species. At least one specimen of each species was examined by SEM. For scanning specimens were treated with Clorox® to remove tissue and chitinous parts, ultrasonic cleaning, and sputter coating with gold. In a few cases air-dried specimens were coated without bleaching to illustrate characteristics of opercula or avicularian mandibles. The specimens illustrated (including holotypes) are deposited in the Department of Paleobiology, National Museum of Natural History, Smithsonian Institution (USNM).

Synonymies have been restricted to publications of major importance for recognition of the species and those that deal with Western Atlantic and Caribbean records for the species. They include only papers having illustrations and descriptions, not checklists. The classification used for Stenolaemata follows Brood (1972); the one used for Gymnolaemata follows Ryland (1982).

SPECIES LIST

Stenolaemata
- Tubuliporata
  - Family Pustuloporidae
    - *Pustulopora danziensis*
  - Family Tubuliporidae
    - *Proboscina robusta*
  - Family Lichenoporidae
    - *Disporella fimbriata*
    - *Lichenopora violacea*

Gymnolaemata
- Ctenostomata
  - Family Vesciculariidae
    - *Amathia vidovici*
    - *Zoobotryon verticillatum*
- Cheilostomata
  - Family Calloporidae
    - *Crassimarginatella tuberosa*
    - *Parellisina curvirostris*
    - *Parellisina latirostris*
  - Family Onychocellidae
    - *Smittipora acutirostris*
  - Family Steginoporellidae
    - *Steginoporella magnilabris*
    - *Steginoporella* sp.
    - *Labioporella granulosa*
  - Family Scrupocellariidae
    - *Canda simplex*
  - Family Cribrilinidae
    - *Cribrilaria flabellifera*
    - *Cribrilaria radiata*
  - Family Umbonulidae
    - *Hippopleurifera belizae,* new species
  - Family Adeonidae
    - *Reptadeonella costulata*
  - Family Celleporariidae
    - *Celleporaria albirostris*
  - Family Arachnopusiidae
    - *Tremogasterina mucronata*
  - Family Hippothoidae
    - *Trypostega venusta*
  - Family Hippoporinidae
    - *Hippoporina pertusa*
  - Family Hippopodinidae
    - *Hippopodina feegeensis*

Family Crepidacanthidae
Crepidacantha longiseta
Family Smittinidae
Parasmittina areolata
Parasmittina serrula
Family Schizoporellidae
Schizoporella ? serialis
Stylopoma spongites
Gemelliporida belikana, new species
Escharina pesanseris
Family Cleidochasmatidae
Cleidochasma porcellanum
Calyptooecia insidiosa, new genus, new species
Family Microporellidae
Microporella mayensis, new species
Family Reteporidae
Rhynchozoon verruculatum
Family Celleporidae
Trematooecia aviculifera
Rrematooecia turrita

SYSTEMATIC ACCOUNTS

ORDER TUBULIPORATA JOHNSTON, 1847
SUBORDER TUBULIPORINA MILNE-EDWARDS, 1838
FAMILY PUSTULOPORIDAE BROOD, 1972
GENUS *PUSTULOPORA* BLAINVILLE, 1834

Pustolopora danziensis Brood, 1976
Figure 1

Pustulopora danziensis Brood, 1976, p. 291.

DESCRIPTION: Colonies are erect with a short multiserial base, above which the distal ends of the autozooid tubes radiate like the rays of a flower around the bulbous brood chamber. Autozooid apertures are circular (when unbroken). The gonozooid (broken in illustrated specimen) encloses several peristomes of inner autozooids and has a central ooeciostome near the opening of one of them. Autozooid surfaces are marked by transverse wrinkles and faint pseudopores, the gonozooid surface by numerous pseudopores.

MEASUREMENTS	Range	Mean	N
Colony height	4.61–4.83	4.71	2
Brood chamber L	.673		1
Brood chamber W	.637		1
Zooid diameter	.055–.109	.079	10
Orifice diameter	.046–.100	.070	10

OCCURRENCE: The species was described from the undersides of corals from shallow water in East Africa. In Belize it was also found on the undersides of corals, particularly those undersurfaces dominated by calcareous algae, or *Gypsina,* rather than by bryozoans or sponges.

DISTRIBUTION: East Africa, Belize.

GENUS *PROBOSCINA* AUDOUIN, 1826

Proboscina robusta Canu and Bassler, 1928
Figure 2

Proboscina robusta Canu and Bassler, 1928b, p. 157. 1928a, p. 100.

DESCRIPTION: Colonies are encrusting, with only distal ends of short autozooid tubes free of the surface. These are arranged bi to triserially in the colonies collected. Tube openings are thin-walled (most have ends broken, as in specimen illustrated). Zooid walls have faintly demarcated pseudopores and transverse wrinkles. No gonozooids were found in these colonies.

MEASUREMENTS	Range	Mean	N
Lo	.064–.082	.072	9
Wo	.046–.064	.059	9
Distance between orifices	.273–.328	.309	7

OCCURRENCE: Outer Ridge, 15 m.

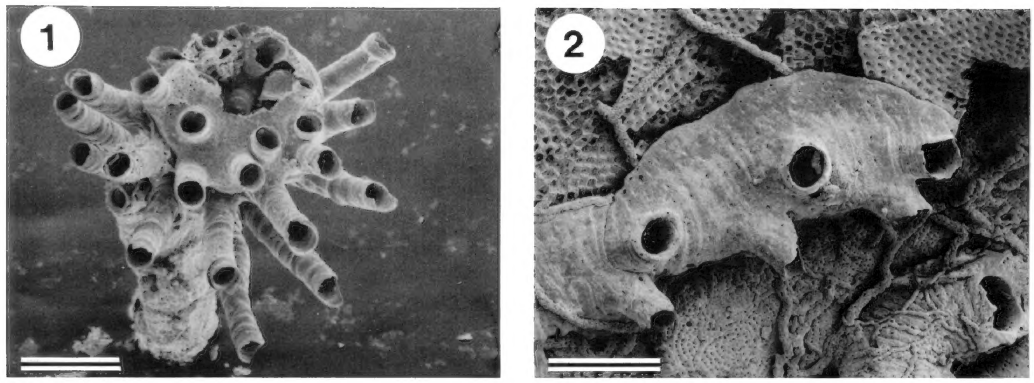
DISTRIBUTION: Gulf of Mexico. Caribbean. Bahia Bay, Brazil.

GENUS *DISPORELLA* GRAY, 1848

Disporella fimbriata (Busk), 1875
Figures 3, 5, 7

Discoporella fimbriata Busk, 1875, p. 32.
Lichenopora fimbriata Busk, 1886, p. 26. Waters, 1904, p. 96. 1905, p. 250. O'Donoghue and O'Donoghue, 1923, p. 15.
Disporella spinulosa, Jullien, 1888, p. 83.
Lichenopora buski? Canu and Bassler, 1928b, p. 163.
Disporella fimbriata, Borg, 1944, p. 229. Osburn, 1953, p. 709.

DESCRIPTION: The colony is white, discoid to ovoid, encrusting, with a flattened or saucer-like colony margin, an inner region consisting of raised rows of zooid tubes, and a central hollow. Zooids are connected only at their bases; their distal ends are drawn out



FIGS. 1–2. 1. *Pustulopora danziensis* (USNM 376772), whole colony with (broken) gonozooid. Scale = 400 μm. 2. *Probosina robusta* (USNM 376773). Scale = 200 μm.

into two or three delicate spines (often broken off in older regions of the colony). In contrast to the following species the surface texture is rough (fig. 7), all colony surfaces being speckled by tiny pustules of calcification. Cancelli are widely separated and heavily calcified. Brood chambers, one to four in number, fill in the central area. These are porous and have very short ooeciostomes without a flared lip.

MEASUREMENTS	Range	Mean	N
Colony diameter	4.23–5.84	4.92	3
Lo	.055–.091	.069	15
Wo	.109–.182	.150	15

DISCUSSION: I have followed the synonymy given by Osburn (1953), although the species may not actually be as widespread as the literature implies. *Disporella fimbriata* has not previously been reported in the Caribbean, but it appears to be an opportunistic species, colonizing every available bare space in cryptic reef habitats in Jamaica, and it could well be widespread in Caribbean waters. Examination of Canu and Bassler's and Osburn's *Lichenopora* specimens from the region showed that one specimen: USNM 7540, Canu and Bassler's *Lichenopora buski*? (1928b, p. 163) is actually a worn colony of this species.

OCCURRENCE: Spur and Groove Zone, Outer Ridge (15 and 20 m).

DISTRIBUTION: Southern South America, Cape Horn, Chile, Tristan Da Cunha, Australia, Tasmania, New Zealand, Azores, Cape Verde Islands, British Columbia, southern California.

GENUS *LICHENOPORA* (DEFRANCE), 1823

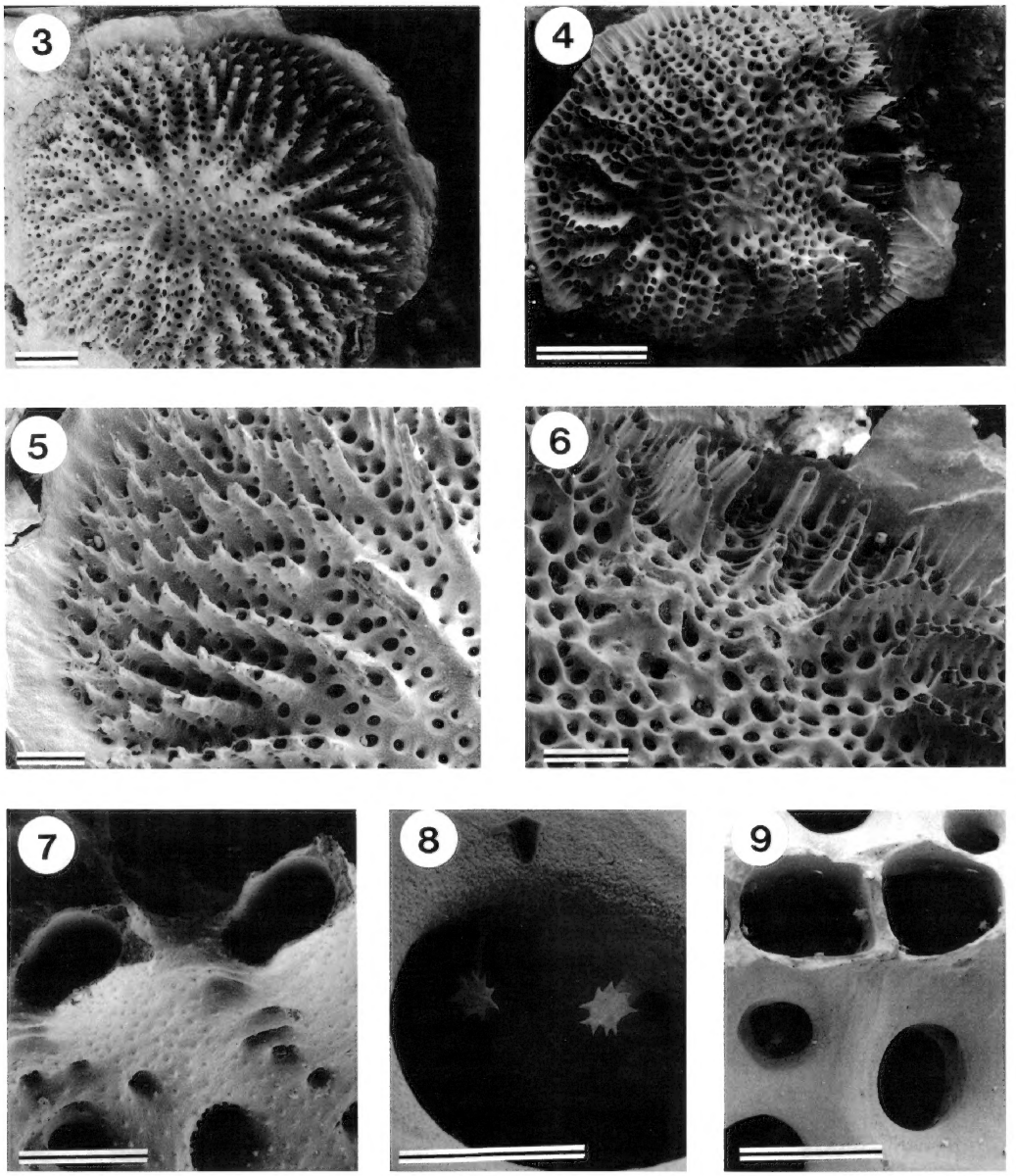
Lichenopora violacea
Canu and Bassler, 1927
Figures 4, 6, 8, 9

Lichenopora violacea Canu and Bassler, 1927, p. 43.

DESCRIPTION: Colonies are circular, with an outer saucer-shaped basal colony margin, an inner convex portion comprising radiating uniserial rows of zooids, and a concave center. The color of living colonies is light purple, that of dried specimens purple to brown, with a white to lavender colony margin. Zooids in this species are joined right to the rectangular orifices. Tapering ridges extend from developing zooids at the inner edge of the colony margin, giving a crimped edge to the margin. Calcification of both zooids and margin is smooth, without pustules. Cancelli are large and irregular in size and shape, with thick walls. No brood chambers were present in these specimens, but in Jamaican colonies a central brood chamber, having a short ooeciostome with a flared lip, has been observed.

MEASUREMENTS	Range	Mean	N
Colony width	3.69–4.61	4.15	2
Colony length	3.10–3.85	3.48	2
Lo	.073–.109	.091	10
Wo	.064–.091	.077	10

DISCUSSION: This is not the *Lichenopora*



FIGS. 3–9. 3. *Disporella fimbriata* (USNM 376774), whole colony. Scale = 1 mm. 4. *Lichenopora violacea* (USNM 376775), whole colony. Scale = 1 mm. 5. *Disporella fimbriata,* showing distal spines. Scale = 400 μm. 6. *Lichenopora violacea,* autozooids. Scale = 400 μm. 7. Close-up of *Disporella* surface showing pustules of calcification. Scale = 40 μm. 8. Spine in cancellus of *Lichenopora.* Scale = 40 μm. 9. Cancelli of *Lichenopora,* showing internal spines, and smooth texture of surrounding calcification. Scale = 100 μm.

radiata described by Canu and Bassler (1928b). It appears to have the greatest affinity with the species they described from the Hawaiian Islands. Examination of their holotype (USNM 8455) showed it to be indistinguishable from Belize specimens on the basis of external characteristics, including the still apparent purple color. However, only

a thorough biological study based on internal as well as external characteristics of as many species as possible will remove the confusion that now exists in the systematics of this family.

ORDER CTENOSTOMATA BUSK, 1852
SUBORDER CARNOSA GRAY, 1848
FAMILY VESCICULARIIDAE JOHNSTON, 1838
GENUS *AMATHIA* LAMOUROUX, 1816

Amathia vidovici (Heller), 1867
Figure 10

Valkeria vidovici Heller, 1867, p. 128.
Vesicularia dichotoma Verrill, 1873, p. 709.
Amathia dichotoma Osburn, 1912, p. 254.
Amathia vidovici Osburn, 1940, p. 340. 1952, p. 741. Winston, 1982, p. 110.

DESCRIPTION: Colonies are branching, semierect, light tan in color, attached to hard substrata. They consist of repeating groups of 4–8 zooids in a short spiral around the internode, interspersed with bare lengths of stolon. Zooids are short tubes; unlike those of some other *Amathia* species they are connected to each other for only part of their length.

MEASUREMENTS	Range	Mean	N
Stolon thickness	.182–.200	.191	3
Lz	.364–.546	.452	15
Wz	.109–.164	.143	15

OCCURRENCE: Twin Cays, attached to mangrove roots.

DISTRIBUTION: Western Atlantic: Massachusetts to Florida. Gulf of Mexico. Caribbean. Also reported from the Eastern Atlantic, Indian and Pacific Oceans.

GENUS *ZOOBOTRYON* EHRENBERG, 1831
Figure 11

Zoobotryon verticillatum (Delle Chiaje), 1828

Hydra verticillata Delle Chiaje, 1828, p. 203.
Zoobotryon pellucidum Ehrenberg, 1831, table 3. Marcus, 1937, p. 139. Osburn, 1940, p. 341.
Zoobotryon verticillatum Osburn, 1953, p. 742. Maturo, 1957, p. 25. Cook 1968, p. 229. Winston, 1982, p. 113.

DESCRIPTION: Colonies are bushy and flaccid, made up of trifurcately branching masses of stolons and zooids which may reach 30 cm or more, attached to hard substrata such as rock or mangrove roots. In young clean colonies stolons are transparent, whereas zooids appear whitish due to concentrations of white pigment spots. As colonies age, color becomes greenish or brownish due to accumulations of epizoic algae and sediment. Zooids are tubular and ovoid, grouped in clusters on the thick stolon. Polypides have a large gizzard and eight tentacles.

OCCURRENCE: Twin Cays, on mangrove roots.

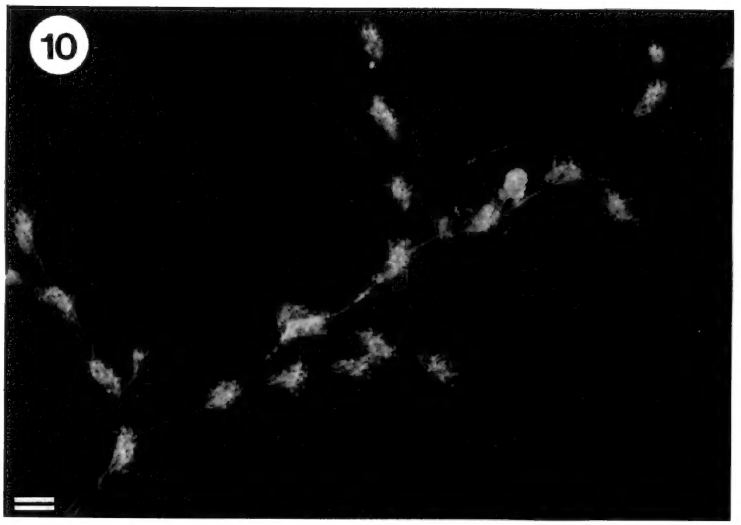
DISTRIBUTION: A well-known fouling species in warm waters. Western Atlantic: Beaufort to Brazil. Gulf of Mexico. Caribbean.

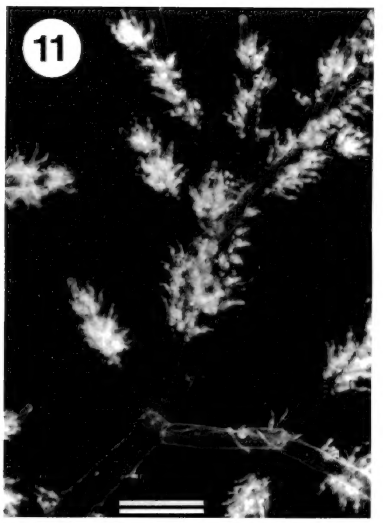
FAMILY CALLOPORIDAE NORMAN, 1903
GENUS *CRASSIMARGINATELLA* CANU, 1900

Crassimarginatella tuberosa Canu and Bassler, 1928
Figures 12, 13

Aplousina tuberosa Canu and Bassler, 1928b, p. 21.
Crassimarginatella tuberosa, Hastings, 1945, p. 85. Cheetham and Sandberg, 1964, p. 1017. Cook, 1968, p. 151.

DESCRIPTION: Colonies are encrusting, forming a lacy white to yellowish meshwork on dead coral surfaces. Autozooids generally ovoid and somewhat irregular in size and shape, reflecting underlying irregularities of the substratum. Zooids are separated from each other by distinct furrows. Most of frontal surface membranous, edged by a narrow band of underlying cryptocyst, bordered by smooth textured gymnocyst. Carrie Bow specimens lack the two distal tubercles described in this species by Cheetham and Sandberg (1964) and by Cook (1968). Avicularia are in the form of B-zooids containing functional polypides. The latter are as large or larger than autozooids and are usually more elongated, with two pivotal prongs and a distal shelf for the support of the enlarged toenail-shaped operculum. Ovicells are very small, roofed merely by rectangular pillows of calcification perched on the distal rim of fertile zooids.





FIGS. 10–11. 10. *Amathia vidovici* (USNM 376776), portion of a colony, showing branching stolons with clusters of zooids (scale = 1 mm). 11. *Zoobotryon verticillatum* (USNM 376777), portion of colony, showing trifurcately branching stolons and zooids (scale = 1 mm).

MEASUREMENTS	Range	Mean	N
Autozooids			
Lz	.410–.637	.547	15
Wz	.300–.419	.360	15
Lo	—	—	—
Wo	.137–.218	.155	10
Lop	.473–.546	.511	5
Wop	.300–.355	.317	5
Lov	.055–.073	.064	2
Wov	.146–.182	.164	2
B-zooids			
Lz	.592–.828	.726	8
Wz	.319–.400	.364	8
Loperc	.309–.410	.367	6
Woperc	.246–.319	.293	6

DISCUSSION: Cheetham and Sandberg (1964) have pointed out the respects in which this species is intermediate between *Aplousina* and *Crassimarginatella*. The B-zooid avicularia are considered to link it with *Crassimarginatella*, whereas the ovicells are more similar to those of *Aplousina*. The avicularia differ somewhat from those in West African specimens described by Cook (1968), and are much fewer in number per colony (some colonies having none).

OCCURRENCE: Spur and Groove Zone, Outer Ridge (15 and 20 m). One of the most abundant species in terms of number of colonies collected. However, colonies were often in poor condition, partially scraped away by grazers, or covered by foulers, and colony life expectancies may be relatively short compared to those of the other abundant species.

DISTRIBUTION: Gulf of Mexico. Caribbean. West Africa.

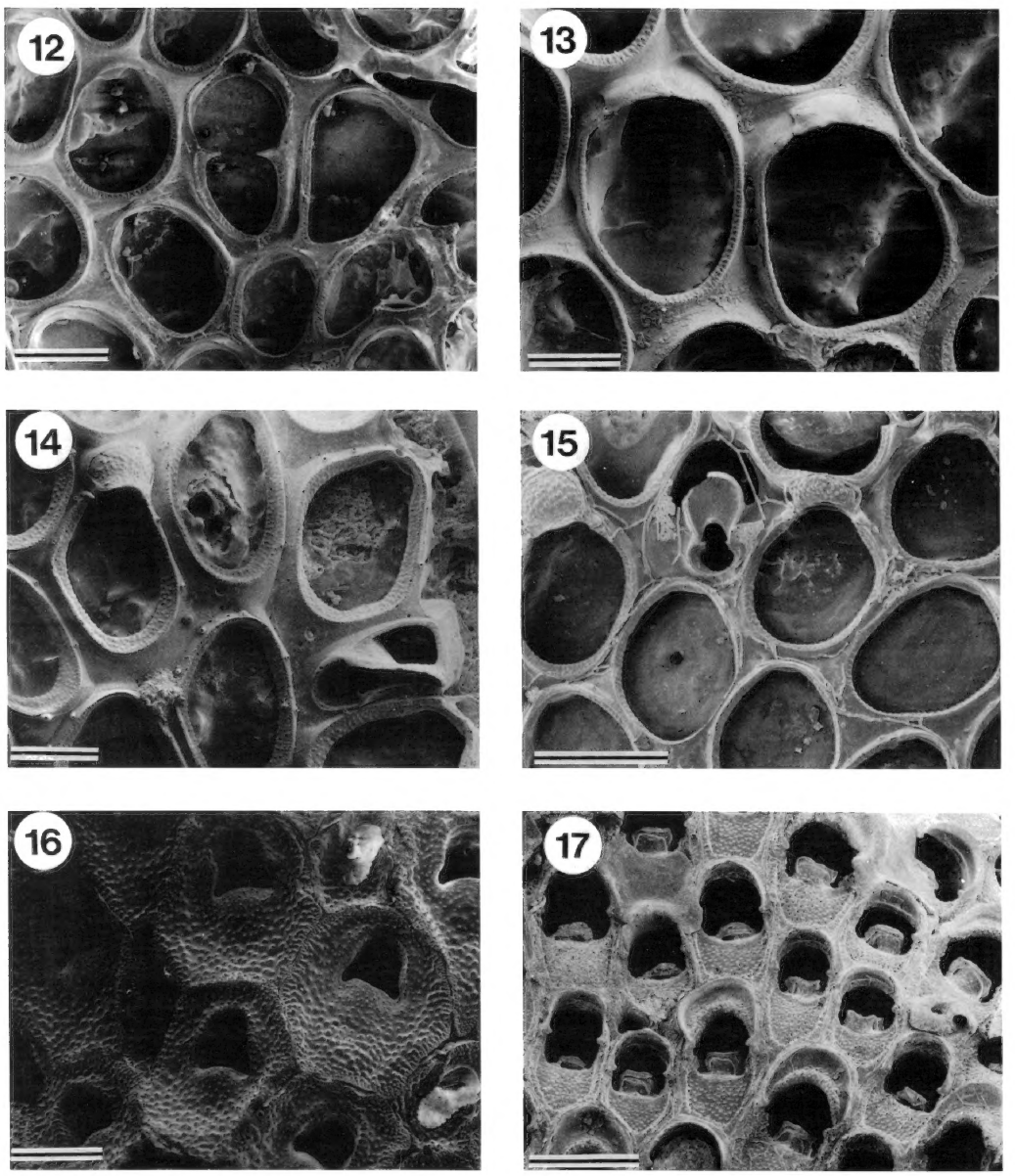
GENUS *PARELLISINA* OSBURN, 1940

Parellisina curvirostris (Hincks), 1862

Figure 14

Membranipora curvirostris Hincks, 1862, p. 29.
Ellisina curvirostris, Harmer, 1926, p. 228. Hastings, 1930, p. 711.
Callopora curvirostris, Canu and Bassler, 1928b, p. 32.
Parellisina curvirostris, Osburn, 1940, p. 361. Cheetham and Sandberg, 1964, p. 1020. Cook, 1968, p. 156. Ryland and Hayward, 1977, p. 102.

DESCRIPTION: Colonies are encrusting, forming a white to yellowish single layered meshwork that may cover several cm^2 of substratum, though large colonies are often fouled or partially overgrown by other organisms. Living colonies can be distinguished from those of *P. latirostris* by polypide color. Polypides of *P. curvirostris* are yellow with



FIGS. 12–17. 12. *Crassimarginatella tuberosa* (USNM 376778), showing avicularium. Scale = 400 μm. 13. *Crassimarginatella tuberosa*, ovicelled zooids. Scale = 200 μm. 14. *Parellisina curvirostris* (USNM 376779), zooids and avicularium. Scale = 200 μm. 15. *Parellisina latirostris* (USNM 376780), zooids and avicularium. Scale = 400 μm. 16. *Smittipora acutirostris* (USNM 376781), zooids and avicularia of different shapes. Scale = 200 μm. 17. *Steginoporella magnilabris* (USNM 376782), A- and B-zooids. Scale = 1 mm.

brownish yellow tentacles and introvert. Zooids are variable in size and shape, ovoid to subtriangular (narrowed distally), with a smooth gymnocyst and a narrow beaded cryptocyst. Avicularia are bipartite, with distal kenozooid and curved rostrum. Ovicells are small and globose, the surface beaded and imperforate, and are not closed by the oper-

culum. They consist of an outer fold calcified distally and laterally and an inner fold calcified proximally and medially. Embryos are peach colored.

MEASUREMENTS	Range	Mean	N
Lz	.382–.523	.430	5
Wz	.291–.309	.298	5
Lo	.046–.073	.058	5
Wo	.091–.118	.102	5
Lov	.164		1
Wov	.109		1
Laz	.319–.382	.350	2
Waz	.137–.164	.150	2
Lav	.282–.328	.305	2
Wav	.091–.118	.105	2

OCCURRENCE: Outer Ridge 20 m.

DISTRIBUTION: Worldwide in tropical and subtropical waters. Western Atlantic: Cape Hatteras to the Gulf of Mexico and Caribbean.

Parellisina latirostris Osburn, 1940
Figure 15

Parellisina latirostris Osburn, 1940, p. 361. Lagaaij, 1963, p. 175. Long and Rucker, 1970, p. 19. Banta and Carson, 1977, p. 388. Winston, 1982, p. 123.

DESCRIPTION: Colonies are encrusting; in living specimens skeletons are whitish, whereas the transparent frontal membrane covers dark green polypides. Zooids are irregularly ovoid in shape, with opesia filling most of the frontal area. There is a narrow beaded cryptocyst, which widens slightly at the proximal end and a smooth slightly inflated gymnocyst (which may also be elongated proximally). Small spines may occur on either side of the orifice. Sparsely distributed avicularian zooids consist of two parts—a distal arrow-shaped kenozooid connected to a narrow more calcified unit with a spatulate distally directed rostrum. Rostrum with submandibular palate area surrounded with cryptocyst. Ovicells are prominent, bonnet-shaped, with a beaded surface, constructed similarly to those of *P. curvirostris*. Embryos are orange in color.

MEASUREMENTS	Range	Mean	N
Lz	.291–.501	.398	10
Wz	.282–.428	.350	10
Lo	.055–.091	.075	5
Wo	.082–.137	.099	9
Lov	.137–.173	.158	6
Wov	.137–.227	.199	6
Lop	.355–.464	.413	5
Wop	.294–.373	.339	5
Wav	.273–.428	.357	10
Wav	.182–.291	.247	10

OCCURRENCE: Spur and Groove Zone. Outer Ridge (15 and 20 m).

DISTRIBUTION: Off southeastern U.S. Gulf of Mexico. Caribbean.

FAMILY ONYCHOCELLIDAE JULLIEN, 1881
GENUS *SMITTIPORA* JULLIEN, 1881

Smittipora acutirostris (Canu and Bassler), 1928
Figure 16

Vellumella acutirostris Canu and Bassler, 1928a, p. 64.

Smittipora acutirostris, Marcus, 1949, p. 10.

DESCRIPTION: Colonies are encrusting, forming a single layer, the color when living greenish yellow with brown specks. Zooids are subhexagonal, separated by distinct grooves, with bell-shaped opesia and beaded frontal calcification (more strongly beaded at edges). Interzooecial avicularia (onychocellaria) are usually rhombic and curved at the distal tip, but more ovoid shapes may occur as well (see fig. 16). These have the same beaded calcification as the zooids, and ovoid to a figure-eight-shaped opesia. Mandibles, like opercula, are dark brown in color. They are about as long as zooids, and pointed with a central spine hooked at the tip, and narrow membranous wings which extend from the hinge line about one-quarter of the way down the mandible. Ovicells are narrow hoodlike expansions of the frontal wall above the operculum. In fertile zooids opesiae appear enlarged, and the dark opercula appear to float on the surface of the frontal membranes, beneath which the orange embryos are visible.

MEASUREMENTS	Range	Mean	N
Lz	.473–.655	.558	15
Wz	.255–.464	.377	15
Lo	.091–.155	.134	15
Wo	.100–.173	.130	15
Lm	.127–.573	.445	8
Laz	.355–.592	.442	11

Wavz	.182–.237	.220	11
Lav	.137–.346	.236	11
Wav	.082–.137	.119	11

DISCUSSION: Caribbean specimens of *Smittipora* fall into two size classes with regard to autozooids. "Large zooid" specimens have zooids up to 1 mm in length and 0.5 mm in width. They have ovoid avicularia with figure-eight-shaped opesiae, and golden brown opercula. In at least some cases the membranous wings are wider and extend further down the ridge of the mandible than in the "small zooid" form described above. This "large zooid form seems identifiable with *Smittipora levinseni.* Only the "small zooid" form occurred at Carrie Bow Cay. I have identified it with *S. acutirostris,* described from the coast of Brazil by Canu and Bassler (1928a). In other areas (e.g., Jamaica) both forms occur, and it appears that Caribbean records of *Smittipora* need reexamination.

OCCURRENCE: Most abundant in Spur and Groove Zone, also found on Outer Ridge (15 and 20 m).

DISTRIBUTION: Brazil, Jamaica, Belize, and probably other Caribbean localities.

FAMILY STEGINOPORELLIDAE
BASSLER, 1953
GENUS *STEGINOPORELLA* SMITT, 1873

Steginoporella magnilabris (Busk), 1854
Figures 17, 18

Membranipora magnilabris Busk, 1854, p. 62.
Steginoporella elegans Smitt, 1873, p. 15, not *Eschara elegans* Milne-Edwards, 1836, p. 337.
Steganoporella magnilabris Osburn, 1914, p. 196. Canu and Bassler, 1923, p. 64. Canu and Bassler, 1928b, p. 64. Osburn, 1940, p. 375. Marcus, 1955, p. 284. Cook, 1964a, p. 53. Long and Rucker, 1970, p. 19. Powell, 1971, p. 769.
Steginoporella magnilabris, Shier, 1964, p. 618. Pouyet and David, 1979, p. 784.

DESCRIPTION: Colonies are encrusting to foliaceous, pink to red to brownish in color. Zooids are large and dimorphic, mostly of the smaller A-zooid type, with larger B-zooids interspersed. Zooids are elongate in shape with raised granular proximal margins and a round distal rim marking the distal edge of the orifice. The bottom half of the frontal surface is covered by porous cryptocyst which dips sharply downward and then rises again, with a tongue-like polypide tube separated from the lateral walls by a deep notch. A-zooids have a semicircular operculum, reinforced by an inverted U-shaped sclerite and bordered by a rakelike chitinous teeth. B-zooid opercula are larger and more rounded, their sclerites an inverted Y shape and their marginal teeth larger. No ovicells occur; embryos are brooded in zooids.

DISCUSSION: Jackson is presently revising the Caribbean species of *Steginoporella*; most of the records for *magnilabris* in the Caribbean probably consist in part of other species, thus correction of synonymies awaits his revision. At Carrie Bow Cay, as in the vicinity of Discovery Bay, Jamaica, *Steginoporella magnilabris* is far less abundant than *Steginoporella* species.

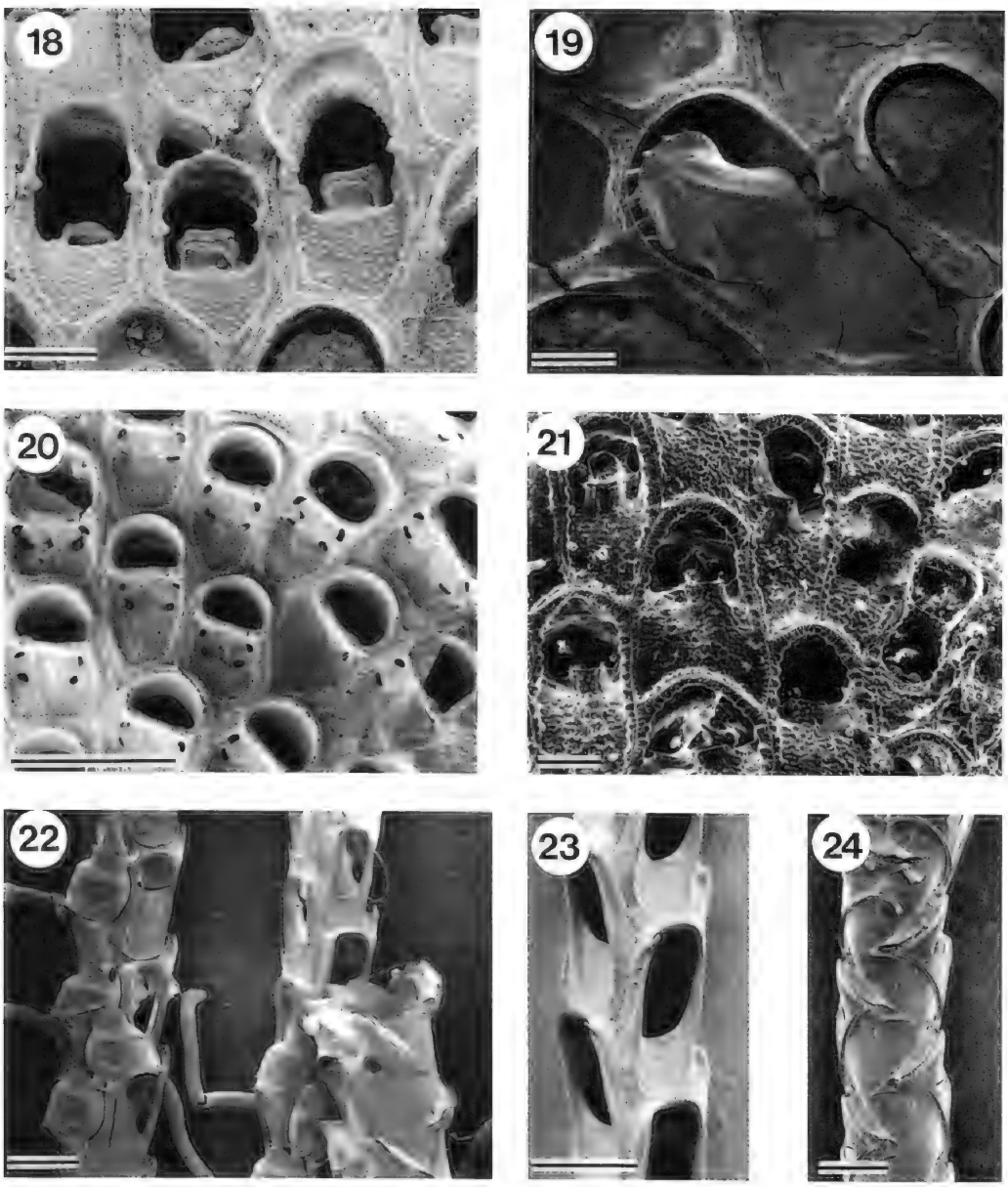
MEASUREMENTS	Range	Mean	N
Lz	.736–1.067	.941	15
Wz	.405–.736	.583	15
Lo	.313–.460	.379	5
Wo	.386–.497	.357	5
L operculum	.276–.368	.331	10
W operculum	.350–.534	.436	10
B-zooids			
L	1.086–1.711	1.408	15
W	.570–.920	.749	15
L operculum	.552–.773	.705	10
W operculum	.515–.810	.662	10

OCCURRENCE: Outer Ridge, 15 m.

DISTRIBUTION: Southwestern Atlantic: Georgia, Florida, Gulf of Mexico and Caribbean. According to Cook (1964a) and to Pouyet and David (1979) this species is found in tropical and subtropical waters all over the world.

Steginoporella species
Figures 19, 20

DESCRIPTION: Colonies are encrusting to erect and platey, crimson to brownish, forming large snakeskin textured patches in cryptic habitats and sometimes also on open reef surfaces. Zooids large and dimorphic. They are curved distally, with a large semicircular orifice, and rectangular proximally. In A-zooids the proximal frontal surface is covered by a concave, finely porous cryptocyst



FIGS. 18–24. 18. *Steginoporella magnilabris,* A- and B-zooids. Scale = 400 μm. 19. *Steginoporella* sp., opercula of A- and B-zooids. Scale = 300 μm. 20. *Steginoporella* sp. (USNM 376783), A- and B-zooids. Scale = 1 mm. 21. *Labioporella granulosa* (USNM 376784), zooids and an avicularium. Scale = 200 μm. 22. *Canda simplex* (USNM 376785), branches of colony, showing ovicelled zooids with terminal avicularia, and cross-radicles connecting branches. Scale = 200 μm. 23. *Canda simplex,* autozooids. Scale = 200 μm. 24. *Canda simplex,* back of branch, showing vibracula. Scale = 200 μm.

with two sets of opesiules and a tonguelike central polypide tube. In B-zooids the opesiules may be joined in a slit on each side of the polypide tongue. B-zooids are also distinguished by their usually larger size, larger operculum (occupying about a half rather than a third of the frontal surface), and by the enlargement of the calcified shelf on which the

operculum rests when closed. Opercula are golden brown, well chitinized and strong, with reinforcing ribs in an inverted V (B-zooids) or U (A-zooids) pattern, and with a row of rakelike teeth around the distal margins. There are no ovicells. The red embryos are brooded in the zooids.

MEASUREMENTS	Range	Mean	N
Lz	.754–1.196	1.013	15
Wz	.552–.736	.632	15
Lo	.276–.442	.359	15
Wo	.368–.626	.473	15
B-zooids			
Lz	1.196–1.509	1.368	9
Wz	.644–.828	.744	9
L operculum	.497–.773	.638	9
W operculum	.497–.736	.605	9

DISCUSSION: *Steginoporella* species are abundant on many Caribbean reefs, and because of their large colonies, bright red color, and occasional occurrence on open as well as cryptic surfaces they are one of the few bryozoans commonly noticed by SCUBA divers (for example, see p. 317, bottom plate, in Colin, 1978). This species is the most common *Steginoporella* and one of the most successful bryozoans in many reefs in the Caribbean. It is now being described (Jackson, in prep.).

OCCURRENCE: One of the most abundant species in all three forereef areas (Spur and Groove Zone, Outer Ridge, 15 and 20 m).

DISTRIBUTION: Belize, Jamaica. Probably widespread in the Caribbean.

GENUS *LABIOPORELLA* HARMER, 1926

Labioporella granulosa
(Canu and Bassler), 1928
Figure 21

Siphonoporella granulosa Canu and Bassler, 1928a, p. 69. 1928b, p. 69.
Labioporella granulosa Cheetham and Sandberg, 1964, p. 1023.

DESCRIPTION: Colonies are encrusting and unilaminar. Zooids are subrectangular, with straight lateral walls and curved end walls, and with a raised beaded mural rim. The cryptocyst is flat and granular, perforated by funnel-shaped pores, with a large opesia, the wavy distal margin of which has a central or somewhat excentrically placed, tongue-shaped polypide tube. Avicularia are interzooidal, similar to small autozooids in size and skeletal structure, but for an elongated opesia, retaining a vestigial polypide tube, but lacking an internal septum and cryptocystal pores. Ovicells are lacking.

MEASUREMENTS	Range	Mean	N
Lz	.510–.683	.590	5
Wz	.273–.391	.311	5
Lo	.209–.273	.242	5
Wo	.218–.355	.255	5
Lavz	.592–.646	.626	4
Wavz	.209–.246	.232	4
Lav	.355–.419	.373	4
Wav	.182–.228	.205	4

DISCUSSION: This species has been discussed by Cheetham and Sandberg (1964), Cook (1964a) and Banta and Carson (1977). Banta and Carson suggest that *Labioporella sinuosa* Osburn (1940) may be synonymous with *L. granulosa,* the name *L. sinuosa* being applied to specimens that lack avicularia. Their specimens from Costa Rica had no avicularia, thus were referred to *sinuosa.* On the basis of the similarity of the specimen they illustrate with Belize specimens (which do possess avicularia) they are probably correct.

OCCURRENCE: Spur and Groove Zone.

DISTRIBUTION: Cape Hatteras to Brazil. Gulf of Mexico. Caribbean.

SCRUPOCELLARIIDAE VAN BENEDEN, 1845
GENUS *CANDA* LAMOUROUX, 1816

Canda simplex Busk, 1884
Figures 22, 23, 24

Canda simplex Busk, 1884, p. 26. Osburn, 1940, p. 388.

DESCRIPTION: Colonies forming flat or ruffled pinkish brown fans up to 6 cm or more in length, attached to coral undersurfaces. Though large older colonies may form ruffled masses raised from the substratum, young colonies start with erect growth, but soon become attached to the substratum by radicles, the ancestrula region is broken, and the flat branching fans grow out parallel to the substratum and attached to it at many points by radicles. Branches are square in cross-section, two adjacent sides bearing zooids, the

other two barren of zooids, but with vibracula evenly spaced along them, their curved setae about as long as zooids. Branches are straight, narrowly spaced, and strengthened at intervals by thick cross-radicles. Zooids are rectangular with rounded edges, and with one short spine at the inner distal angle. The opesia extends about two-thirds the length of the zooid, its outer edge almost straight, its inner edge curving inward. The calcified frontal surface has a slightly granular texture. Ovicells occur in bands across the colony, they are globose, with bean-shaped marginal fenestra. Each ovicell (fig. 23) bears a sessile avicularium on its summit. Embryos are bright red.

MEASUREMENTS	Range	Mean	N
Lz	.319–.419	.375	15
Wz	.100–.164	.141	15
Lop	.173–.234	.220	8
Wop	.100–.127	.115	12
Lo	.073–.091	.085	7

DISCUSSION: The species has been reported only twice from Caribbean collections. This may be because the lightly calcified branches are too brittle to survive dredging operations except as very small fragments (cf., Busk, 1884). It is, however, one of the most common bryozoans on Caribbean reefs. The brownish fans of *Canda* colonies, often coated with white coral mud and debris, are commonly observed by SCUBA divers. (See, for example p. 320 and 321 in Colin, 1978.) I have seen specimens from the Florida Keys (Carysfort Reef), Cayman, Jamaica, Belize, Panama and Colombia. Two other species have been reported: *C. retiformis* (Pourtalès, 1867) and *C. carabaica* Levinsen, 1909—but I have not observed either.

OCCURRENCE: Outer Ridge (15 and 20 m).

DISTRIBUTION: Florida Keys. Caribbean.

FAMILY CRIBRILINIDAE HINCKS, 1880
GENUS *CRIBRILARIA*
CANU AND BASSLER, 1928

Cribrilaria flabellifera (Kirkpatrick), 1888

Figures 25, 26, 27

Cribrilina radiata var. *flabellifera* Kirkpatrick, 1888, p. 75.

Puellina radiata flabellifera Canu and Bassler, 1929, p. 239.

Colletosia radiata flabellifera Soule, 1959, p. 48.

Colletosia radiata, Harmer, 1926, p. 475 (in part).

Cribrilaria flabellifera Harmelin, 1970, p. 94. Banta and Carson, 1977, p. 392.

DESCRIPTION: Colonies are encrusting and inconspicuous, transparent silver-pink in color when unfouled, but usually fouled to a greenish or brownish color by algae, so that they look almost indistinguishable from an algal film on the substratum surface. Zooids are ovoid to rhomboidal in shape. Calcification of the frontal surface is composed of five to eight pairs of radiating ribs or of costae, separated by evenly spaced perforations. In older well-calcified regions the first pair of costae may develop a central thickening, which in Belize specimens becomes a bifid shield over the orifice (fig. 26). The orifice is semicircular with six or seven spines along its distal and lateral borders (fewer on ovicelled zooids). Avicularia are interzooecial, their calcification smooth and imperforate, the calcified rostrum narrow at the base and flaring at the tips. As figure 27 shows, however, this rostrum supports only the narrow stem of the leaf-shaped mandible. Ovicells are helmet-shaped and imperforate, with very slight keels.

MEASUREMENTS	Range	Mean	N
Lz	.319–.391	.369	5
Wz	.218–.273	.249	5
Lo	.046–.055	.051	5
Wo	.064–.091	.073	5
Lov	.109–.137	.121	4
Wov	.146–.164	.157	4
Lav	.146–.182	.160	5
Wav	.027–.036	.031	5

DISCUSSION: The identity of this species and variation of Caribbean and Mediterranean forms is discussed by Banta and Carson (1977).

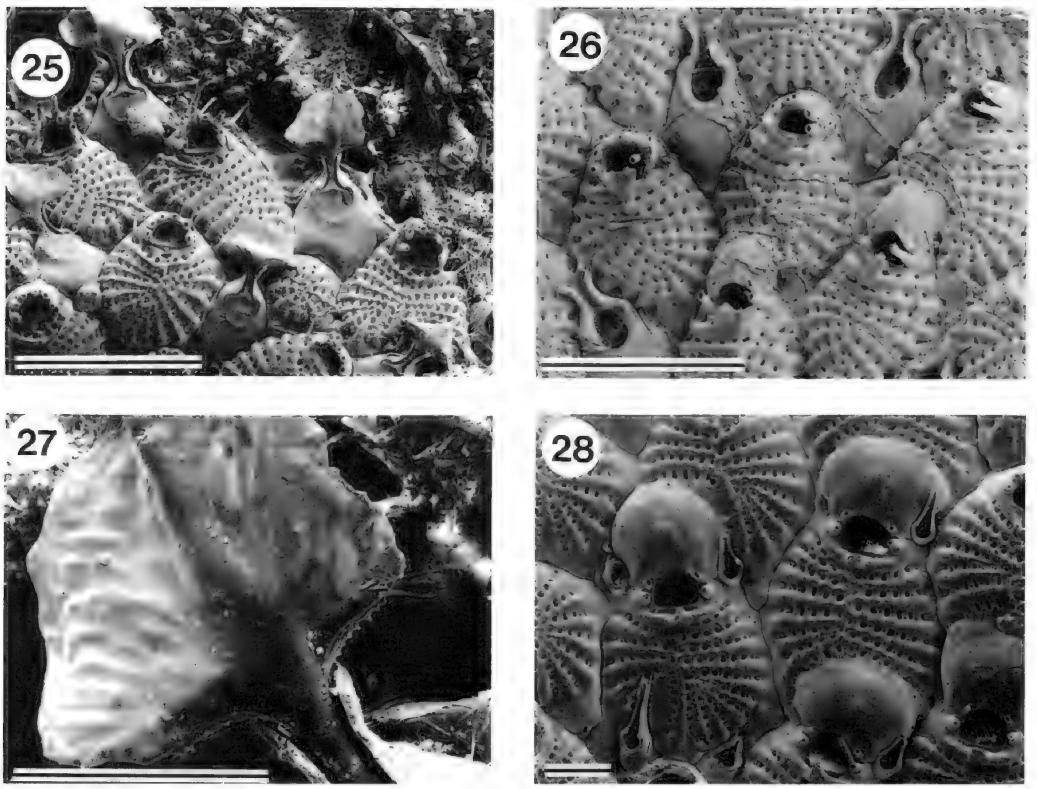
OCCURRENCE: Spur and Groove Zone. Outer Ridge, 15 and 20 m.

DISTRIBUTION: Mediterranean. Caribbean. Indian Ocean and tropical east and west Pacific.

Cribrilaria radiata (Moll), 1803

Figure 28

Eschara radiata Moll, 1803, p. 63.



FIGS. 25–28. 25. *Cribrilaria flabellifera* (USNM 376786), showing paddle-shaped avicularian mandibles. Scale = 400 μm. 26. *Cribrilaria flabellifera,* bleached specimen, showing avicularian skeletons. Scale = 400 μm. 27. *Cribrilaria flabellifera,* close-up of avicularian mandible. Scale = 100 μm. 28. *Cribrilaria radiata* (USNM 376787). Scale = 100 μm.

Cribrilina radiata, Smitt, 1873, p. 22.
Puellina radiata, Canu and Bassler, 1928b, p. 73. Osburn, 1940, p. 406.
Colletosia radiata, Marcus, 1937, p. 73. Maturo, 1957, p. 48. Shier, 1964, p. 625.
Cribrilaria radiata, Cheetham and Sandberg, 1964, p. 1026. Cook, 1967, p. 333. 1968, p. 172. Long and Rucker, 1970, p. 19. Winston, 1982, p. 133.

DESCRIPTION: Colonies are encrusting, forming tiny patches on coral substrata. Unfouled colonies are pale pink in color, but living colonies are usually fouled green by algae. Zooids are ovoid, broadest proximally, with frontal surfaces composed of five to 12 pairs of radiating ribs (costae), separated by evenly spaced pores. A slightly larger pore may occur just below the orifice and there may be a tubercle of calcification below it as well as at the distal ends of the costae. The orifice is semicircular and surrounded distally and laterally by five to seven spines (four on ovicelled zooids). Interzooecial avicularia have a rounded body and triangular mandible and rostrum. Ovicells are helmet-shaped, and imperforate, with several bumps or an irregular keel. Embryos are rose pink in color.

MEASUREMENTS	Range	Mean	N
Lz	.255–.364	.347	15
Wz	.173–.309	.248	15
Lo	.036–.091	.056	15
Wo	.046–.100	.067	15
Lov	.118–.146	.130	4
Wov	.127–.164	.148	4
Lavz	.182–.473	.323	15
Wavz	.073–.200	.144	15
Lav	.073–.182	.137	15
Wav	.046–.137	.076	15
Lm	.091–.209	.129	6
Wm	.109–.191	.149	6

OCCURRENCE: Outer Ridge, 20 m.
DISTRIBUTION: Cosmopolitan. Western At-

lantic: Cape Hatteras to Brazil. Gulf of Mexico. Caribbean.

FAMILY UMBONULIDAE CANU, 1904
GENUS *HIPPOPLEURIFERA*
CANU AND BASSLER, 1924

Hippopleurifera belizae, new species
Figures 29, 30

DIAGNOSIS: Colonies are encrusting. Zooids are rhomboidal, with a row of marginal pores and with additional pores occurring proximal and lateral to the orifice. The frontal calcification forms transverse ridges in the area of the accessory pores and is thickened into tubercles proximally. The orifice is hoof-shaped and is surrounded by a flattened margin from which six to eight spines arise. Triangular avicularia are lateral, usually paired and directed proximolaterally, but their number and position is variable. Ovicells are prominent, globular, and perforated by small pores arranged in a radiating pattern.

HOLOTYPE: USNM 376788.

ETYMOLOGY: Named for the country of Belize in which the species was found.

DESCRIPTION: The colony is encrusting, forming a small patch on coral rubble. Zooids are rhomboidal, with a row of marginal pores. The proximal part of the frontal surface is thickened by calcified tubercles. Lateral to the orifice there are additional pores, the innermost row elongated so that several transverse ridges are formed just below the orifice. The orifice is hoof-shaped, rounded anteriorly, with two large condyles and a broad, shallow posterior portion. It is surrounded by a flattened margin bearing six to eight spines, laterally and distally. Avicularia are suboral, with cross-bars and a triangular mandible. They are paired, placed at midlength, and directed proximolaterally on most zooids; on some zooids a single avicularium occurs at midlength and an additional single, distolaterally directed avicularium is lateral to the orifice on the opposite side of the zooid; on a very few zooids, paired lateral avicularia only are present. The ovicells are globular, thickly calcified, with perforations arranged in more or less radial rows.

MEASUREMENTS	Range	Mean	N
Lz	.644–.902	.762	5
Wz	.442–.570	.478	5
Lo	.166–.184	.173	5
Wo	.129–.166	.144	5
Lav	.092–.110	.099	5
Wav	.055–.074	.059	5
Lov	.313–.386	.359	4
Wov	.442–.552	.478	4

DISCUSSION: This species appears to be a Recent representative of the genus *Hippopleurifera,* a genus with a number of species in the Tertiary of the S.E. United States (Cheetham, 1963). *Hippopleurifera belizae* most closely resembles the Eocene-Oligocene species *Hippopleurifera crassicollis* (Canu and Bassler, 1920). It differs from *H. crassicollis* in that avicularia and areas of thickest calcification are shifted proximally, and areas with the greatest numbers of pores and grooves are distal and suboral rather than proximal.

OCCURRENCE: Spur and Groove Zone.

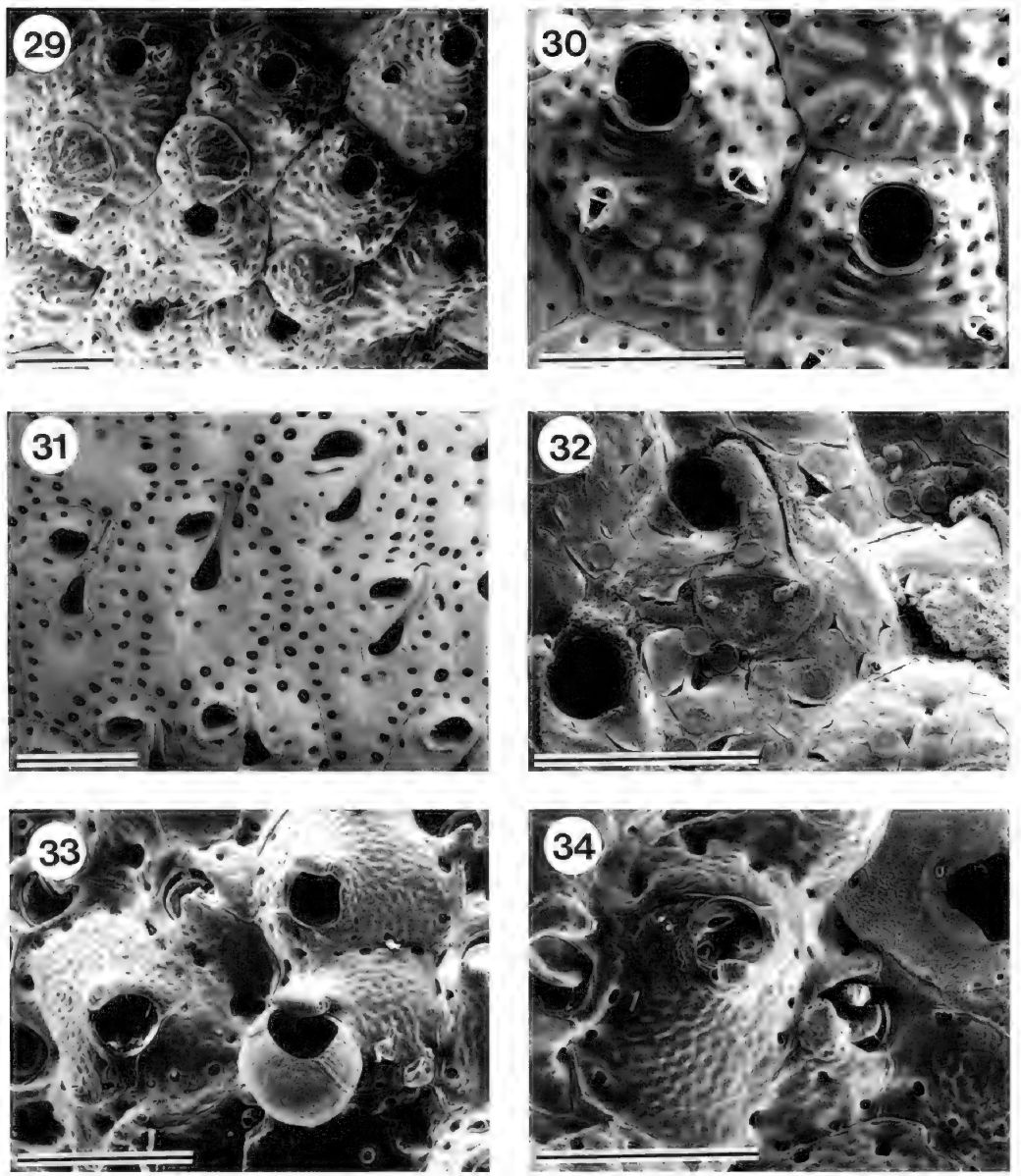
DISTRIBUTION: Carrie Bow Cay, Belize.

FAMILY ADEONIDAE JULLIEN, 1903
GENUS *REPTADEONELLA* BUSK, 1884
Figures 31, 32

Reptadeonella costulata
(Canu and Bassler), 1928

Adeona costulata Canu and Bassler, 1928a, p. 94.
Adeona plagiopora Canu and Bassler, 1928b, p. 126 (in part).
Adeona violacea, Osburn, 1940, p. 445 (in part).
Not *Adeona costulata* in Winston, 1982, p. 137.

DESCRIPTION: Living colonies are encrusting and iridescent brownish purple in color, forming patches up to several cm in size, often lobulate in shape. Autozooids are ovoid to subhexagonal, with a marginal row of pores and separated from each other by a distinct line of calcification. The frontal surface is thick, bumpy, and granular with few pores surrounding the operculum and the centered part indented around the round spiramen. The secondary orifice is semicircular, on a hoodlike peristome. An adventitious avicularium begins distal to the spiramen and runs distally and diagonally past the orifice. The autozooid mandible is rather flimsy in construction. Avicularian zooids are occasionally present, especially in sunken portions of the colony. They are broader than autozooids and have an enlarged avicularium with a much enlarged and more strongly chitinized



FIGS. 29–34. 29. *Hippopleurifera belizae* (USNM 376788), showing ovicells. Scale = 400 μm. 30. *Hippopleurifera belizae,* showing orifice spines and position of avicularia. Scale = 400 μm. 31. *Reptadeonella costulata,* showing autozooids, gonozooids and avicularian zooid (USNM 376789). Scale = 400 μm. 32. *Reptadeonella costulata,* mandibles of autozooid and avicularian zooid. Scale = 400 μm. 33. *Celleporaria albirostris* (USNM 376790), zooids and ovicells. Scale = 400 μm. 34. *Celleporaria albirostris,* showing raised suboral spine with avicularium in base. Scale = 400 μm.

mandible (fig. 32), with a spatulate tip. The avicularia may distort and even occlude the zooid orifice. Gonozooids are also broader than autozooids and are teardrop-shaped, with a widened crescent-shaped orifice, and often an additional row of areolae around the

distal margin. Embryos are orange, the ripe embryos visible, like setting suns, behind the operculum.

Measurements	Range	Mean	N
Lz	.648–1.044	.846	15
Wz	.450–.540	.478	15
Lo	.090–.144	.110	15
Wo	.180–.126	.142	15
Lav	.342–.540	.404	15
Wav	.090–.162	.124	15
Avicularian zooids			
Lz	.720–.990	.859	11
Wz	.540–.810	.638	11
Lo	.108–.144	.126	10
Wo	.072–.126	.103	10
Lav	.360–.504	.445	11
Wav	.180–.252	.214	11
Gonozooids			
Lz	.810–.990	.778	5
Wz	.522–.720	.583	5
Lo	.054–.108	.083	5
Wo	.180–.216	.191	5
Lav	.378–.432	.320	5
Wav	.090–.144	.126	5

Occurrence: Spur and Groove Zone (third in abundance), Outer Ridge, 15 and 20 m (first and second in abundance, respectively).

Distribution: Caribbean, Brazil.

Discussion: The systematics of Caribbean *Reptadeonella* species is now undergoing revision (Winston, in prep.). Problems in the systematics of this genus in the Caribbean arose when early workers synonymized forms with perpendicular avicularia with the Recent European species *Reptadeonella violacea,* and forms with diagonal avicularia with the Pliocene Coralline Crag species *Reptadeonella plagiopora.* Osburn (1914) thought that he saw intergradations between the two in one specimen and so made them all *violacea.* I have reexamined his material and found no such intergradation. *Reptadeonella hastingsae,* described from the Gulf of Mexico by Cheetham and Sandberg (1964) also occurs on the Atlantic coast of Florida (where it was called *costulata* by Winston, 1982), but, examination of all specimens involved has shown that the species are distinct. *Reptadeonella costulata* differs from *Reptadeonella hastingsae* in size, spiramen shape, and degree of polymorphism. It is the only *Reptadeonella* species found thus far at Carrie Bow Cay.

FAMILY CELLEPORARIIDAE HARMER, 1957
GENUS *CELLEPORARIA* LAMOUROUX, 1821

Celleporaria albirostris (Smitt), 1873
Figures 33, 34

Discopora albirostris Smitt, 1873, p. 70.
Holoporella albirostris Osburn, 1914, p. 215. Canu and Bassler, 1918, p. 120. Osburn, 1927, p. 130. Canu and Bassler, 1928b, p. 142. Osburn, 1940, p. 455.
Celleporaria albirostris Long and Rucker, 1970, p. 20.

Description: Living colonies range in color from white to pink, wine red, or deep cerise, and have a prickly appearance caused by the sharp-pointed suboral spines. They are encrusting to massive and multilaminar with regularly patterned excurrent monticules, which are often white even on deeply pigmented colonies. Zooids are square (in the primogenial layer) to irregular in shape (in frontally budded areas), erect and conical with the orifice in the center of the cone, whose peak is the point of the suboral umbo. Calcification is thick, wavy, and granular. The frontal surface is imperforate except for a scattering of marginal pores. The orifice is subcircular, with a shallow and only slightly narrowed sinus. A vertically directed adventitious avicularium with a serrated rostrum is at the base of the suboral spine. Such spines are short in young zooids, ending at the level of the avicularium rostrum, but they become greatly elongated with increasing calcification, especially in the vicinity of excurrent monticules which bristle with spines in all directions. Ovicells are globular hoods, covered by a thinner and less granular calcification than zooids, and showing sutures marking the intersections of contributing zooids; their openings are partially blocked by the umbo and avicularium (see fig. 33). A few larger spatulate-mandibled interzooecial avicularia also occur between zooids. Embryos are orange-red. The bright color of living colonies is not skeletal, but lies within the star-shaped pigment cells located just under the cuticle, which form dark blotches against a cream-colored background. The

color of polypides ranges from white to pinkish orange depending on the intensity of pigmentation of the colony.

MEASUREMENTS	Range	Mean	N
Lz	.276–.681	.551	15
Wz	.423–.662	.494	15
Lo	.074–.202	.135	15
Wo	.092–.202	.136	15
Lav	.202–.552	.118	7
Wav	.055–.110	.087	7
Lov	.184–.221	.198	4
Wov	.258–.294	.276	4
Interzooecial avicularia			
Wav	.405–.552	.460	7
Lav	.221–.368	.281	7
Wz	.294–.460	.373	7
Lz	.552–.736	.636	7

OCCURRENCE: Spur and Groove Zone. Outer Ridge, 15 m.

DISTRIBUTION: Cape Hatteras to Florida, Gulf of Mexico and Caribbean. Also reported from the Indian Ocean and the tropical Pacific.

FAMILY ARACHNOPUSIDAE JULLIEN, 1888
GENUS *TREMOGASTERINA* CANU, 1911

Tremogasterina mucronata (Smitt), 1873
Figures 35, 36

Escharipora (?) *mucronata* Smitt, 1873, p. 24.
Tremogasterina truncatorostris Canu and Bassler, 1923, p. 244.
T. granulata Canu and Bassler, 1928b, p. 45.
T. ventricosa Canu and Bassler, 1928b, p. 47.
T. malleolus Canu and Bassler, 1928b, p. 48.
T. sparsipora Canu and Bassler, 1928b, p. 50.
T. mucronata Powell and Cook, 1967, p. 9. Banta and Carson, 1977, p. 394.

DESCRIPTION: Colonies are encrusting. Zooids are rhomboidal, with frontal calcification roughly granular around the edges and smooth and flat in the center, where it is punctured by about half a dozen variously-shaped (chiefly kidney-shaped) pores. The orifice is semicircular though its lower border may appear indented due to the projection of a large suboral mucro. The distal and lateral margins of the orifice in the specimen collected are surmounted by six or seven spines. Ovoid avicularia are located between zooids. The rostrum is raised at a high angle to the surface and has a serrate tip, while the mandible tip is rounded. Ovicells are longer than wide, imperforate, and covered with the same rough granular calcification as the outer portions of the frontal wall.

DISCUSSION: This variable species has been examined by Powell and Cook (1967) and Banta and Carson (1977). Their synonymy is followed here.

MEASUREMENTS	Range	Mean	N
Lz	.437–.592	.501	5
Wz	.228–.410	.319	5
Lo	.118–.173	.149	5
Wo	.091–.228	.162	5
Lov	.200		1
Wov	.255		1
Lav	.164–.182	.175	5
Wav	.118–.209	.151	5
Lm	.127–.155	.140	5
Wm	.082–.109	.096	5

OCCURRENCE: Spur and Groove Zone.

DISTRIBUTION: Gulf of Mexico and Caribbean.

FAMILY HIPPOTHOIDAE, LEVINSEN, 1909
GENUS *TRYPOSTEGA* LEVINSEN, 1909

Trypostega venusta (Norman), 1864
Figures 37, 38

Lepralia venusta Norman, 1864, p. 84.
Gemellipora glabra forma *striatula* Smitt, 1873, p. 37.
Trypostega venusta Osburn, 1914, p. 198. 1940, p. 409. 1952, p. 280. Canu and Bassler, 1928b, p. 77. Marcus, 1938, p. 35. Shier, 1964, p. 627. Cook, 1968, p. 177. Winston, 1982, p. 151.

DESCRIPTION: Colonies are encrusting and single layered, the surface calcification smooth, glassy and yellowish, almost transparent, but generally fouled greenish or brown by algae. Colonies often are distinguishable from an algal film only by the localization of algal cells in the depressions over the regularly spaced pores, which give the colony a polka-dotted appearance. Zooids are rhomboidal, with small pores and longitudinal striations over the entire surface. Autozooids are interspersed with dwarf zooids or zooeciules, which ordinarily are found at the distal end of each autozooid, but which may be much more irregularly placed in instances of injury and regeneration (e.g., fig. 38). Autozooid orifices are keyhole-shaped, circular distally, with

proximally directed condyles and a v-shaped sinus proximally. Zooeciule orifices are simple, but also rounded distally, with a moderate sinus proximally. Ovicells are embedded, covered with the same small evenly spaced pores, and covering the proximal portions of zooeciules. Embryos are reddish orange.

MEASUREMENTS	Range	Mean	N
Lz	.410–.601	.460	15
Wz	.273–.364	.297	15
Lo	.064–.100	.087	15
Wo	.055–.091	.077	15
Zooeciules			
Lz	.073–.137	.101	15
Wz	.055–.146	.094	15

OCCURRENCE: Spur and Groove Zone and Outer Ridge (15 m).

DISTRIBUTION: Cosmopolitan in warmer waters. Western Atlantic: Cape Hatteras to Brazil. Gulf of Mexico. Caribbean.

FAMILY HIPPOPORINIDAE BASSLER, 1935
GENUS *HIPPOPORINA* NEVIANI, 1895

Hippoporina pertusa (Esper), 1796
Figures 39, 40

Cellepora pertusa Esper, 1796, p. 149.
Lepralia pertusa Hincks, 1880, p. 305.
Hippodiplosia pertusa, Canu and Bassler 1928b, p. 106.
Hippoporina pertusa, Cook, 1964b, p. 5. Cheetham and Sandberg, 1964, p. 1041. Hayward and Ryland, 1979, p. 92.

DESCRIPTION: The colony is encrusting. Zooids are irregularly hexagonal, separated by raised threads of calcification, the frontal wall surface convex, thick, roughened, perforated by small pores and by somewhat larger marginal pores. The orifice is semicircular distally, and separated by two pointed condyles from the shallow proximal sinus. It is surrounded by a blunt, broad, and imperforate peristome. Avicularia are adventitious and rare. In the Carrie Bow material they are narrowly triangular and directed transversely inward across the frontal surface (fig. 40). Ovicells are large, globular, and irregularly perforated, with thickened margins, and sometimes with an irregular ridge of calcification on the surface.

MEASUREMENTS	Range	Mean	N
Lz	.460–.699	.615	5
Wz	.368–.515	.467	5
Lo	.166–.184	.173	5
Wo	.147–.202	.177	5
Lav	.184–.221	.202	2
Wav	.055–.055	.055	2
Lov	.294–.313	.304	2
Wov	.331–.423	.377	2

DISCUSSION: Only one colony was found in Carrie Bow collections. It most closely resembles the specimen illustrated by Cheetham and Sandberg (1964, fig. 54, p. 1042), in its robust zooids, lack of a mucro, the presence of some large marginal pores, and the heavily calcified border and diagonal ridge on the ovicell. These American specimens differ from the European forms (as illustrated by Hayward and Ryland, 1979, fig. 31, p. 93) on the basis of those features. Avicularia are supposedly rare in *H. pertusa.* Our specimen had suboral avicularia with triangular mandibles unlike the elliptical ones described by Hincks (1880, p. 305).

OCCURRENCE: Outer Ridge, 15 m.

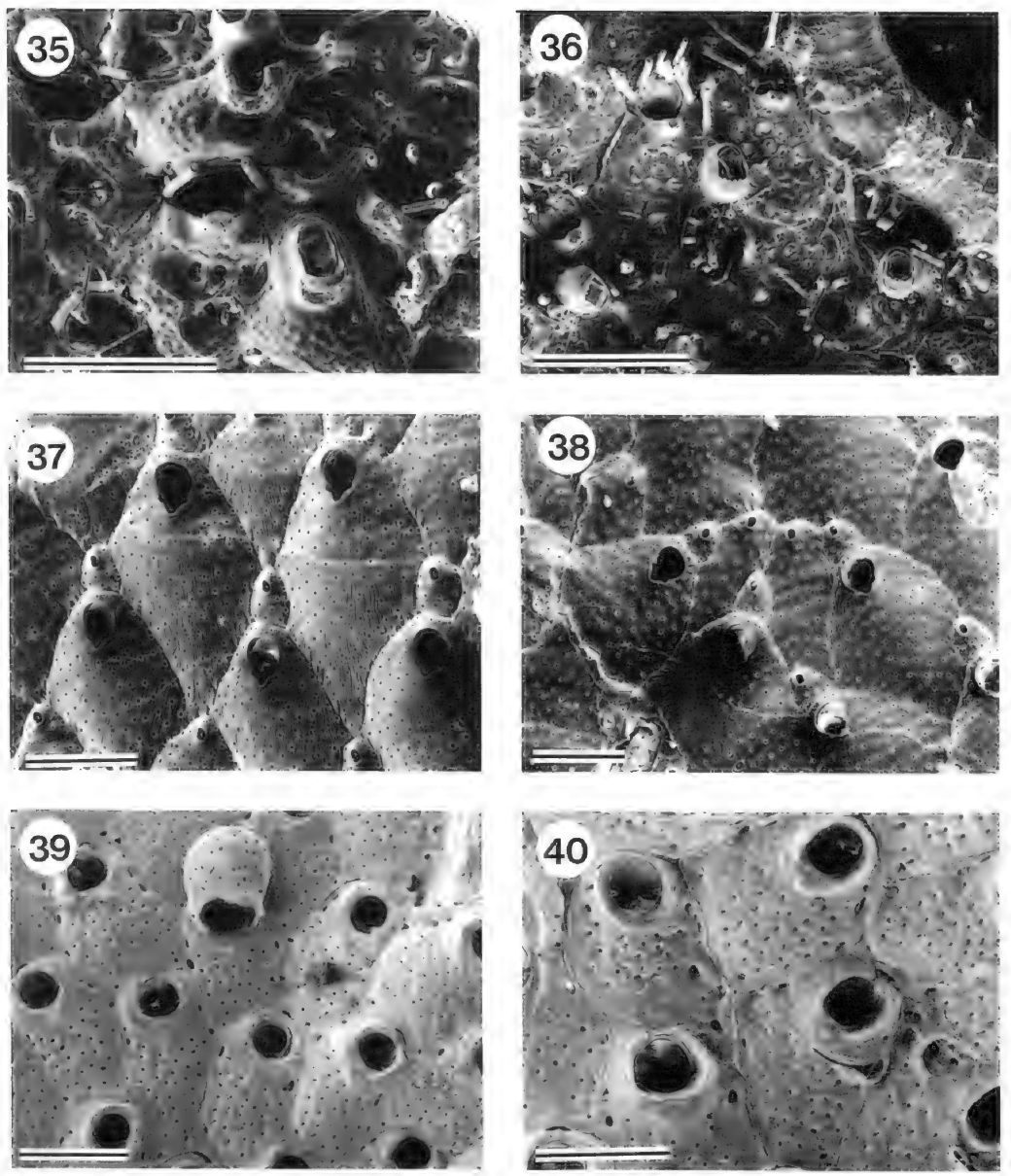
DISTRIBUTION: Western Atlantic: Gulf of Mexico, Straits of Florida. Caribbean. Europe: Southern and western England to Mediterranean and West Africa.

FAMILY HIPPOPODINIDAE
LEVINSEN, 1909
GENUS *HIPPOPODINA* LEVINSEN, 1909

Hippopodina feegeensis (Busk), 1884
Figure 41

Lepralia feegeensis Busk, 1884, p. 144.
Hippopodina feegeensis Osburn, 1927, p. 130. Hastings, 1930, p. 729. Osburn, 1940, p. 412. Powell, 1971, p. 771. Banta and Carson, 1977, p. 413.

DESCRIPTION: Colonies are encrusting, forming a single pearly, light orange layer of large evenly spaced zooids. Zooids are rectangular, separated by a well-defined groove, the frontal surface convex, frontal calcification beaded, and perforated by numerous small evenly spaced pores. The orifice is hoof-shaped, with a rounded anterior portion and a flattened, broad proximal portion. Paired avicularia with curved triangular mandibles directed transversely inward occur above the



FIGS. 35–40. 35. *Tremogasterina mucronata* (USNM 376791). Scale = 400 μm. 36. *Tremogasterina mucronata,* showing spined zooids at growing edge. Scale = 400 μm. 37. *Trypostega venusta* (USNM 376792), zooids and zooeciules. Scale = 200 μm. 38. *Trypostega venusta,* zooids and zooeciules in a damaged and regenerated area. Scale = 200 μm. 39. *Hippoporina pertusa* (USNM 376793), zooids and ovicell. Scale = 400 μm. 40. *Hippoporina pertusa,* zooid with avicularium. Scale = 400 μm.

orifice on most zooids except ovicelled zooids. Ovicells are large, round, and flattened, and embedded in the frontal wall of the distal zooid. They are covered by porous honeycomb-textured calcification.

MEASUREMENTS	Range	Mean	N
Lz	.828–1.288	1.083	15
Wz	.589–.883	.762	15
Lo	.221–.313	.260	15
Wo	.221–.313	.265	15

Lav	.221–.331	.282	9
Wav	.055–.092	.072	9
Lov	.442–.570	.494	6
Wov	.589–.644	.629	6

DISCUSSION: Banta and Carson (1977) concluded that Atlantic and Pacific material differs in several respects, and that two or more species may actually be involved. Our specimens agree with their Caribbean material and with other material described from the Caribbean.

OCCURRENCE: Spur and Groove Zone. Outer Ridge (most abundant at 20 m).

DISTRIBUTION: Reported to be worldwide in tropical waters, but distribution records may actually involve more than one species.

FAMILY CREPIDACANTHIDAE LEVINSEN, 1909

GENUS *CREPIDACANTHA* LEVINSEN, 1909

Crepidacantha longiseta
Canu and Bassler, 1928
Figure 42

Crepidacantha longiseta Canu and Bassler, 1928b, p. 135.

DESCRIPTION: Colonies are encrusting, single-layered, and small. Zooids are subpentagonal, rounded distally, and angular proximally, their calcification smooth and imperforate except for marginal areolae. Ten to 12 long marginal spines radiate outward from the curved distal margins of zooids. These have been lost in the bleached specimen illustrated, except for their round bases are visible between the areolae. The secondary orifice, which at the end of the short hoodlike peristome, is horseshoe-shaped, with a broad concave posterior sinus. Level with the top of the orifice are two proximally directed triangular avicularia, which in life have setiform mandibles. The ovicell is globular, with a less-calcified central area; it is placed just above the orifice of the fertile zooid and closed by the operculum.

MEASUREMENTS	Range	Mean	N
Lz	.382–.546	.477	15
Wz	.328–.455	.400	15
Lo	.064–.109	.093	15
Wo	.073–.109	.090	15
Lav	.027–.073	.053	14
Wav	.018–.036	.029	14
Lov	.127–.173	.141	4
Wov	.109–.200	.155	4

DISCUSSION: Osburn synonymized *Crepidacantha longiseta* (Canu and Bassler, 1928b) with *Crepidacantha setigera* (Smitt, 1873). However, Brown (1954) in his review of the genus *Crepidacantha* considered *longiseta* a valid species. There are differences in orifice shape (the posterior portion is convex in *setigera* rather than concave) in the shape and position of the avicularia (which in *setigera* are located at mid-orifice level and have a figure-eight-shaped rather than a triangular opening), and in the frontal calcification (which is more granular in *setigera*).

OCCURRENCE: Outer Ridge, 15 and 20 m.

DISTRIBUTION: Caribbean.

FAMILY SMITTINIDAE LEVINSEN, 1909

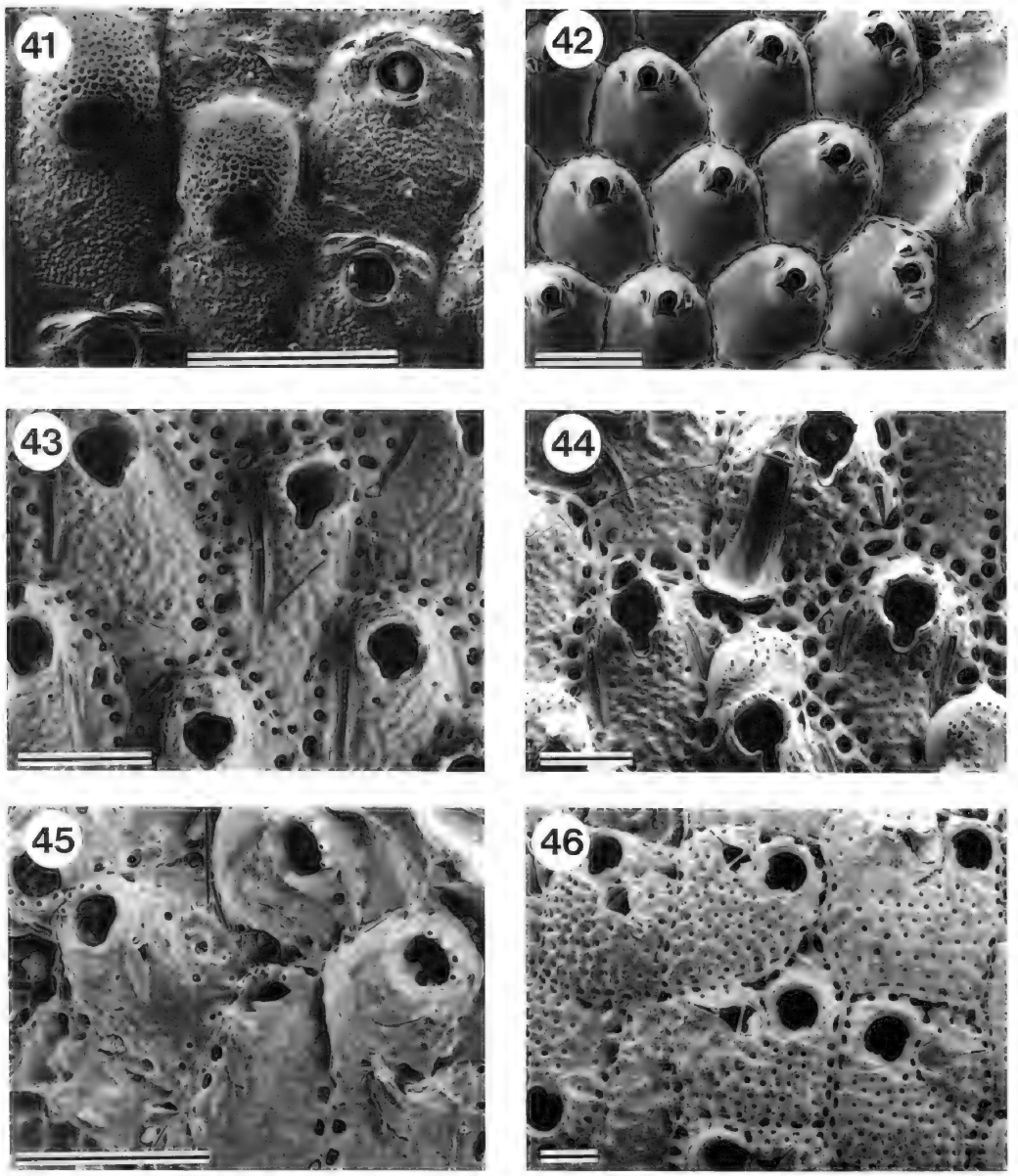
GENUS *PARASMITTINA* OSBURN, 1952

Parasmittina areolata
(Canu and Bassler), 1927
Figures 43, 44

Smittina areolata Canu and Bassler, 1927, p. 392. 1928a, p. 87.

Parasmittina areolata, Soule and Soule, 1973, p. 392.

DESCRIPTION: Colonies are encrusting, white to beige in color, forming small patches on coral substrata. Zooids are rectangular to irregularly polygonal, with a row of large marginal areolae, plus some additional arealace near the orifice. The rest of the frontal surface is granular, with a few scattered small pores. The secondary orifice is pyriform, the raised peristome, with jagged edges and a deep U-shaped proximal sinus, obscuring the primary orifice which is horseshoe shaped with a narrow central denticle. Newly formed zooids may have up to six oral spines; these are lost with the increasing calcification of the peristome. Adventitious avicularia are of two types. Long narrow, proximally directed avicularia occur on either side of the orifice, they are usually paired, but one of the pair is generally larger than the other. Additional small avicularia oriented in various directions, may occur on the frontal surface. Occasional giant avicularia develop in the lat-



FIGS. 41–46. 41. *Hippopodina feegeensis* (USNM 376794), showing zooids with avicularia and ovicells. Scale = 1 mm. 42. *Crepidacantha longiseta* (USNM 376795). Scale = 400 μm. 43. *Parasmittina areolata,* showing narrow avicularia. Scale = 400 μm. 44. *Parasmittina areolata* (USNM 376796), showing giant spatulate avicularium. Scale = 200 μm. 45. *Parasmittina serrula* (USNM 376797), showing avicularia with serrated edge. Scale = 200 μm. 46. *Schizoporella ?serialis* (USNM 376798). Scale = 200 μm.

eral-oral position (fig. 44). These have long spatulate mandibles and a deep concave rostrum with a broad spoon-shaped tip. Ovicells are small, do not become immersed in zooid calcification, and are smooth except for a crescent of small pores. The proximal brim of the ovicell may also bear a small avicularium.

MEASUREMENTS	Range	Mean	N
Lz	.428–.728	.556	15
Wz	.319–.546	.386	15
Lo	.127–.200	.169	15
Wo	.109–.164	.132	15
Lov	.118–.164	.138	6
Wov	.182–.218	.199	6
Spatulate avicularia			
Lav	.246–.419	.358	12
Wav	.109–.191	.143	12
Long oral avicularia			
Lav	.228–.428	.311	15
Wav	.018–.046	.033	15
Short oral avicularia			
Lav	.137–.191	.153	14
Wav	.018–.064	.034	14

DISCUSSION: Belize specimens are very similar to those described from Hawaii by Soule and Soule (1973), differing only in the greater elaboration of the bulbous tip of the giant avicularium rostrum. As they remark, the species seems to be very similar to *Parasmittina spathulata* (Smitt), 1873. It may turn out to be synonymous with this species, but because several species appear to have been confused under the name *spathulata,* it seems best to identify Belizean specimens with *areolata* until detailed study of all Caribbean material can be made.

OCCURRENCE: Spur and Groove Zone, Outer Ridge, 15 m.

DISTRIBUTION: Hawaii, Brazil, Jamaica, Belize, and possibly other parts of the Caribbean as well.

Parasmittina serrula Soule and Soule, 1973
Figure 45

Parasmittina serrula Soule and Soule, 1973, p. 386.

DESCRIPTION: Colonies are encrusting and unilaminar, forming small glistening white to yellow-white patches on coral substrata. Zooids range from hexagonal to irregular in shape, with one row of marginal areolae, and granular frontal calcification. The secondary orifice has a tubular peristome which is ovoid, broader than long, and with a U-shaped central sinus. The primary orifice, with a narrow denticle and two large cardelles, is visible inside the peristome. Four oral spines occur distal to the orifice. Single or paired adventitious avicularia are found below or one side of the peristome, extending proximolaterally. They have elongate triangular mandibles, and rostra which develop leaflil ɔ serrated edges. Occasionally these avicularia become very large. Ovicells are large, broader than long, with rough side walls and an ovoid frontal area over which are scattered a dozen or so irregular pores. Embryos are yellow-orange.

MEASUREMENTS	Range	Mean	N
Lz	.319–.592	.434	15
Wz	.182–.328	.274	15
Lo	.082–.137	.103	15
Wo	.091–.127	.103	15
Lav	.036–.127	.093	15
Wav	.018–.027	.024	15
Lov	.109–.137	.118	3
Wov	.191–.209	.200	3

DISCUSSION: This species can be distinguished from *areolata* by the serrate edges of the avicularian rostra, by the smaller and less numerous areolae, and by the fact that the denticle of the primary orifice is more easily observed inside the flatter broader peristome of *serrula.* The species was described by Soule and Soule (1973) as one of the most common and widely distributed species in the Hawaiian Islands. In Jamaica the species was common on panels, particularly in the Port Royal Cays, but rare on natural coral substrata. Jamaican studies showed it grew, reproduced, and disappeared from the community rapidly; it may be found to be more widely distributed in tropical waters as an opportunistic fouling species.

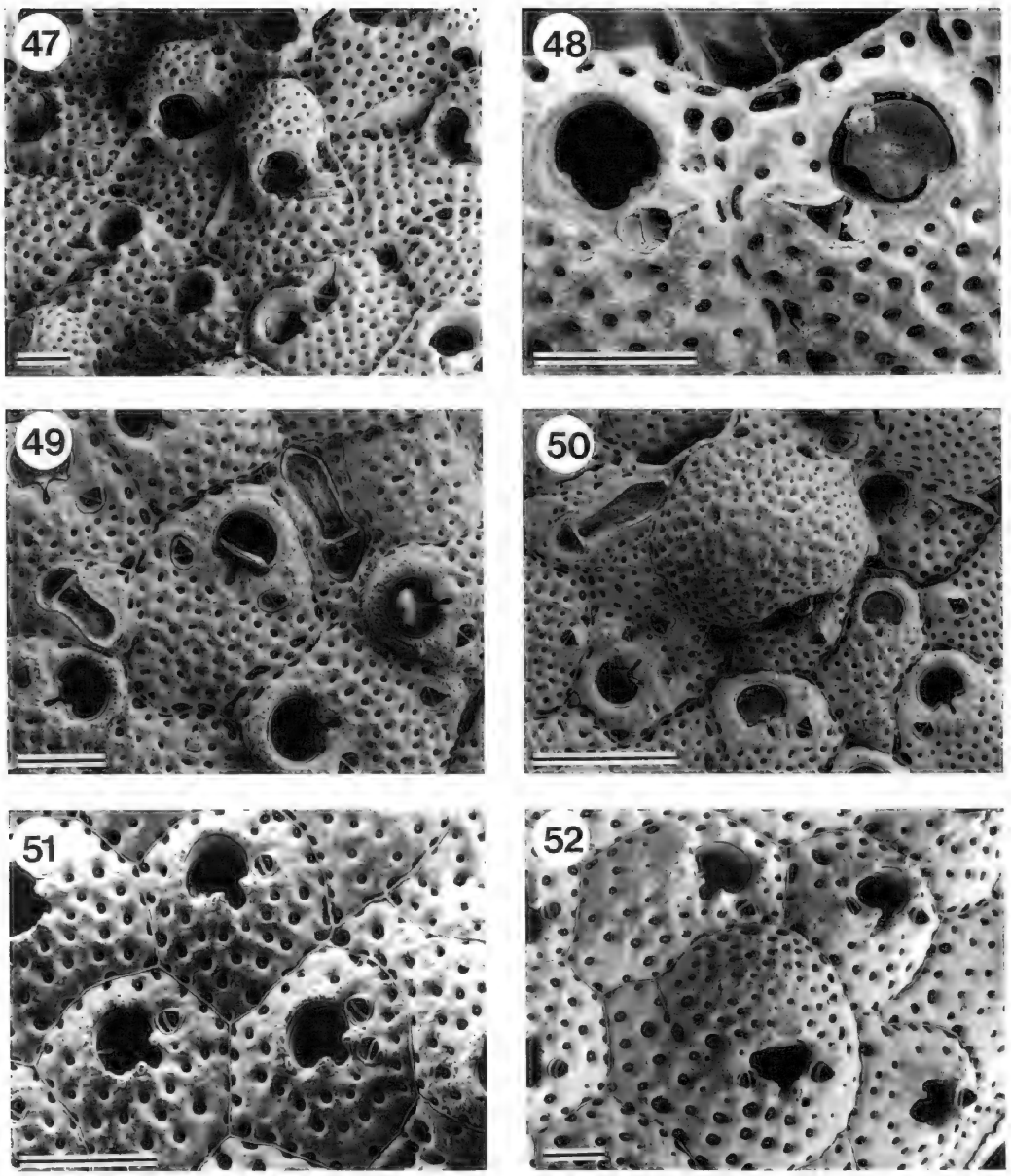
OCCURRENCE: Spur and Groove Zone. Outer Ridge, 15 m.

DISTRIBUTION: Hawaii, Belize, Jamaica.

FAMILY SCHIZOPORELLIDAE JULLIEN, 1882
GENUS *SCHIZOPORELLA* HINCKS, 1887

Schizoporella ?serialis (Heller), 1867
Figures 46, 47, 48

Lepralia serialis Heller, 1867, p. 104.
Lepralia errata Waters, 1879, p. 11.
Schizoporella errata Gautier, 1962, p. 149. Hayward and Ryland, 1979, p. 170.
Schizoporella violacea Canu and Bassler, 1930. Pouyet, 1971, p. 185.



FIGS. 47–52. 47. *Schizoporella ?serialis,* showing zooids and ovicells. Scale = 200 μm. 48. *Schizoporella ?serialis,* close-up of orifice, and operculum. Scale = 200 μm. 49. *Stylopoma spongites* (USNM 376799), showing two types of avicularia. Scale = 200 μm. 50. *Stylopoma spongites,* showing large ovicell. Scale = 400 μm. 51. *Gemelliporidra belikina* (USNM 376800). Scale = 400 μm. 52. *Gemelliporidra belikina,* showing ovicelled zooid (center). Scale = 200 μm.

Schizoporella ?serialis, Banta and Carson, 1977, p. 395.

DESCRIPTION: Colonies are encrusting, forming unilaminar to multilaminar masses, cylindrical tubes (e.g., around mangrove roots), or foliaceous ruffles (e.g., attached to hanging lines). Color when living ranges from pinkish white to violet-brown. Living Belize colonies are a deep brownish purple in color, lightening to orange-brown at growing edges. When colonies are feeding, the expanded lophophores create a bluish haze over the

colony surface, interrupted by a regularly spaced pattern of dark stars, marking the raised excurrent areas where no lophophores are expanded. Zooids are rectangular to irregular in shape, those from primogenial layers being regular and almost square, those in frontally budded or regenerated areas being more irregular. The frontal surface may be flat to somewhat convex; the frontal wall is thick and roughened. Borders of zooids are marked by a fine line of calcification and row of areolae, while about 40 somewhat smaller circular pores (which may become occluded with increasing calcification) are distributed over the frontal surface. Belize specimens do not show development of a suboral umbo, but zooids sometimes develop a low peristome around the orifice with increasing calcification. The orifice is semicircular anteriorly, with cardelles inset like steps, and a shallow U-shaped sinus. It is located in the distal corner of the zooid and is usually slightly tilted. Avicularia are single, placed just below and to one side of the orifice, and directed more or less laterally. Mandibles are delicate and triangular in shape. These avicularia come in a range of sizes, the largest ones seem to be associated with the raised zooids of excurrent monticles. Ovicells are globular and prominent, perforated by numerous pores. Embryos are bright orange and visible through the pigment of the ovicell when mature.

MEASUREMENTS	Range	Mean	N
Lz	.592–.728	.659	5
Wz	.482–.710	.601	5
Lo	.155–.173	.164	5
Wo	.146–.200	.182	5
Lav	.164–.255	.202	5
Wav	.064–.127	.098	5

DISCUSSION: Banta and Carson (1977) discussed the confusion surrounding the taxonomy of the *Schizoporella* complex. I have followed their synonymy here to indicate that Belize specimens, as well as Jamaican specimens I have seen, agree with their material from the Pacific coast of Costa Rica.

OCCURRENCE: Twin Cays, on mangrove roots (where it was an important component of the community) and on fouling panels.

DISTRIBUTION: Caribbean. Pacific coast of Panama. Probably widely distributed in warm waters, but exact distribution unknown until taxonomy is revised.

GENUS *STYLOPOMA* LEVINSEN, 1909

Stylopoma spongites (Pallas), 1766
Figures 49, 50

Eschara spongites Pallas, 1766, p. 45 (part).
Hippothoa spongites Smitt, 1873, p. 42.
Schizoporella spongites Osburn, 1914, p. 207.
Stylopoma spongites Osburn, 1927, p. 128. Canu and Bassler, 1928a, p. 78. 1928b, p. 91. Hastings, 1930, p. 721.
Stylopoma informata Marcus, 1937, p. 91 (not Lonsdale, 1845). 1955, p. 296. Osburn, 1940, p. 424. 1952, p. 336. Shier, 1964, p. 631.
"*Stylopoma spongites*" (Levinsen) Cheetham and Sandberg, 1964, p. 1031.
Stylopoma spongites (Levinsen) Long and Rucker, 1970, p. 19.
Stylopoma spongites (Pallas) Thomas and Hastings, 1967, p. 316. Winston, 1982, p. 145.

DESCRIPTION: Colonies are encrusting, light peach to bright orange in color, forming large rounded patches on coral substrata. Zooids are quadrangular to polygonal. The frontal surface is rather flat, the frontal wall calcification granular, perforated by numerous small pores. Zooid boundaries are marked by a thick thread of calcification. The orifice, located at the distal end of the zooid, is asymmetrically placed, semicircular proximally, with cardelles that almost reach the entrance of the central sinus. Three types of avicularia are present. Small adventitious avicularia with short triangular mandibles are found on the frontal surface of zooids and on ovicells, large spatulate avicularia are found between zooids, as are avicularia with curved triangular mandibles. Ovicells are very large, globular, and porous, completely covering fertile zooid. Embryos are red.

MEASUREMENTS	Range	Mean	N
Lz	.501–.683	.581	15
Wz	.309–.501	.393	15
Lo	.100–.137	.124	15
Wo	.091–.182	.146	15
Lav	.046–.109	.062	14
Wav	.027–.055	.042	14
Lov	.455–.637	.557	4
Wov	.491–.619	.553	4
Spatulate avicularia			
Lav	.291–.546	.405	10
Wav	.100–.209	.142	10

Lavz	.364–.637	.475	10
Wavz	.164–.364	.280	10
Curved avicularia			
Lav	.546–.910	.746	5
Wav	.109–.228	.180	5

DISCUSSION: *Stylopoma* is another very abundant bryozoan in Caribbean reef environments, colonies commonly covering areas several square centimeters in size on rubble or under coral surfaces. To the naked eye it may be difficult to distinguish from other species with similar coloration, but the regular bricklike arrangement of the small zooids is often clear, and in large colonies the pimpling of the surface by the large round ovicells (some of them usually red with contained embryos) gives a positive identification immediately.

OCCURRENCE: Spur and Groove Zone, most abundant species. Outer Ridge, 15 and 20 m; fifth most common species at both depths.

DISTRIBUTION: Western Atlantic: Cape Hatteras to Brazil. Gulf of Mexico and Caribbean. Galapagos.

GENUS *GEMELLIPORIDRA*
CANU AND BASSLER, 1927

Gemelliporidra belikina, new species
Figures 51, 52

DIAGNOSIS: Colonies are encrusting and multilaminar, forming a thick crust on coral substrata. Zooids are irregularly polygonal in shape, with thick granular calcification, and are perforated by regularly spaced small pores. The primary orifice has a horseshoe-shaped anterior portion and a semicircular posterior portion; the raised secondary orifice is semicircular and has a U-shaped sinus with beaded edge. Small triangular avicularia, usually single, occur lateral to the orifice, with mandibles directed laterally or proximolaterally. The ovicell is large, flattened, perforated by small pores and is closed by the operculum.

ETYMOLOGY: The species name is from a Belizean beverage, popular among scientists relaxing after a hard day's work and dreaming of new discoveries.

HOLOTYPE: USNM 376800.

DESCRIPTION: The colony is encrusting, unito multilaminar, purple in color when dried. Zooids, formed by frontal budding are irregularly polygonal in shape and irregularly oriented. Zooid surfaces are convex, thickened, and granular, perforated by regularly spaced small pores, with a distinct raised thread of calcification marking zooid boundaries. The primary orifice has a horseshoe-shaped anterior portion and a smaller semicircular posterior portion. The secondary orifice is raised and semicircular, with a U-shaped sinus. Beads of calcification are found at the edge of the sinus and around its upper margins. A small triangular avicularium occurs, lateral to the orifice with its rostrum raised diagonally, and directed laterally or proximolaterally. One ovicell was present on the colony collected, it was large, flattened, closed by the operculum and perforated by pores which were slightly smaller and more closely spaced than those on the zooid surface.

MEASUREMENTS	Range	Mean	N
Lz	.510–.819	.683	5
Wz	.546–.637	.566	5
Lo	.237–.273	.249	5
Wo	.200–.237	.224	5
Lav	.055–.082	.069	5
Wav	.046–.064	.058	5
Lov	.400		1
Wov	.690		1

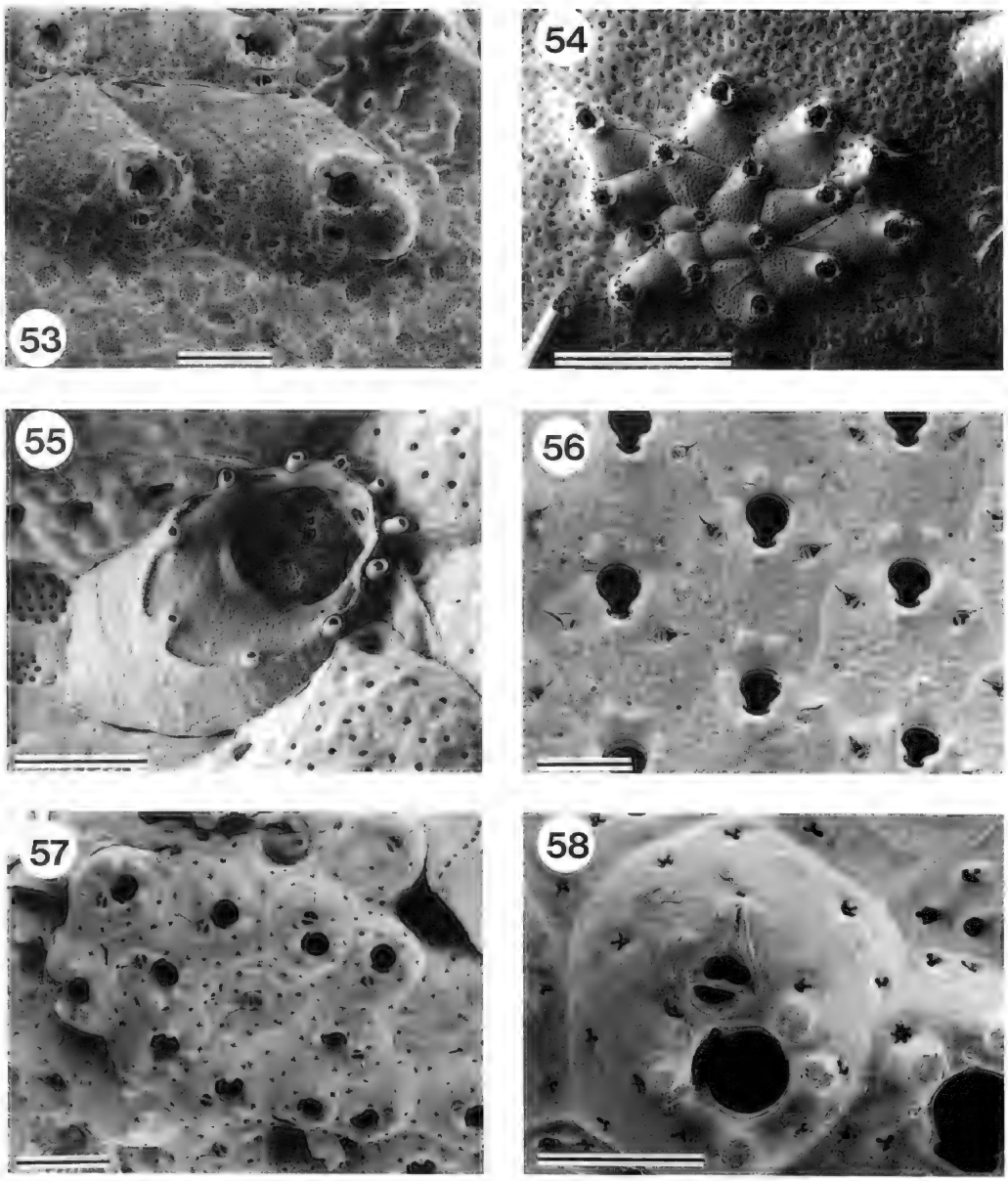
OCCURRENCE: Spur and Groove Zone.
DISTRIBUTION: Carrie Bow Cay, Belize.

GENUS *ESCHARINA* MILNE-EDWARDS, 1838

Escharina pesanseris (Smitt), 1873
Figures 53, 54, 55

Hippothoa pesanseris Smitt, 1873, p. 43.
Escharina pesanseris Osburn, 1914, p. 207.
Mastigophora pesanseris Osburn, 1927, p. 130. 1940, p. 452. 1952, p. 479. Canu and Bassler, 1928b, p. 133. Hastings, 1930, p. 722. Marcus, 1939, p. 142.
Escharina pesanseris Cook, 1968, p. 195. Long and Rucker, 1970, p. 19. Winston, 1982, p. 145.

DESCRIPTION: Colonies encrusting and single-layered, never becoming more than a few square millimeters in size, a translucent greenish white color in life. Zooids are polygonal, broadest proximally and tapering distally, frontal surface granular, perforated with fine pores that may become filled in as calcification continues. The orifice is semi-



FIGS. 53–58. 53. *Escharina pesanseris* (USNM 376801), showing ovicelled zooid. Scale = 200 μm. 54. *Escharina pesanseris,* whole colony. Scale = 1 mm. 55. *Escharina pesanseris,* ancestrula. Scale = 100 μm. 56. *Cleidochasma porcellanum* (USNM 396802), showing zooids with developing ovicells. Scale = 200 μm. 57. *Calyptooecia insidiosa* (USNM 376803), showing large part of nodular colony. Scale = 400 μm. 58. *Calyptooecia insidiosa,* showing cross and star-shaped pores. Scale = 200 μm.

circular, with a narrow central sinus, and is surrounded by a broad, flat-topped peristome, bearing six to eight spines. Paired avicularia occur on either side of the orifice. They have a distally directed opening with a cross-bar and a rostrum narrowing diagonally to a groove to support the stem of the fin-shaped mandible. Ovicells are small, produced by the third generation of zooids outward, semiglobular, and imperforate.

MEASUREMENTS	Range	Mean	N
Lz	.501–.637	.544	5
Wz	.337–.464	.393	5
Lo	.109–.137	.124	5
Wo	.100–.109	.104	5
Lav	.055–.055	.055	5
Wav	.027–.036	.033	5
Lov	.091–.100	.093	4
Wov	.127–.164	.146	4

DISCUSSION: Two types of ancestrulae have been recorded for this species (Harmer, 1957). *Escharina pesanseris* like many ascophorans actually has a tatiform ancestrula (figs. 54, 55) with a well-developed cryptocyst, gymnocyst, and 10 spines, but as the second zooid of the colony is of similar size, it is easy to see how (as Cook, 1968, suggests) the true ancestrula may decay or be overgrown in mature colonies, leaving that second zooid as the apparent initiator of the colony.

OCCURRENCE: Outer Ridge, 20 m.

DISTRIBUTION: Circumtropical. Western Atlantic: Cape Hatteras to Brazil. Caribbean. Gulf of Mexico.

FAMILY CLEIDOCHASMATIDAE
CHEETHAM AND SANDBERG, 1964
GENUS *CLEIDOCHASMA* HARMER, 1957

Cleidochasma porcellanum (Busk), 1860
Figure 56

Lepralia porcellana Busk, 1860, p. 283.
Lepralia cleidostoma Smitt, 1873, p. 63.
Hippoporina cleidostoma Canu and Bassler, 1928b, p. 104.
Hippoporina porcellana Hastings, 1930, p. 721. Marcus, 1937, p. 96. Osburn, 1940, p. 428. 1952, p. 344. Shier, 1964, p. 633.
Cleidochasma porcellanum Cheetham and Sandberg, 1964, p. 1032. Cook, 1964b, p. 11. 1968, p. 198. Long and Rucker, 1970, p. 19. Powell, 1971, p. 771. Winston, 1982, p. 148.

DESCRIPTION: Colonies encrusting, often becoming multilayered, pinkish white to peach-colored when live. Zooids are hexagonal in shape, the frontal surface granular, with three to five small round pores near the slightly indented margins and occasionally developing one or two proximal bumps with increasing calcification, as shown in specimen illustrated (fig. 56). The orifice is keyhole-shaped, with proximally directed cardelles and a flattened sinus. Avicularia in this species have a triangular mandible with a trifoliate opening. In Belize specimens they are located just below the orifice, directed distolaterally, and generally paired. Ovicells are hyperstomial, imperforate, covered also by granular calcification, and often imbedded in the calcification of the distal zooid. The opening is not closed by the operculum. Embryos are reddish pink.

MEASUREMENTS	Range	Mean	N
Lz	.328–.501	.403	15
Wz	.309–.419	.352	15
Lo	.100–.164	.138	15
Wo	.091–.137	.103	15
Lav	.073–.137	.108	15
Wav	.036–.055	.046	15
Lov	.118–.146	.132	6
Wov	.155–.228	.185	6

OCCURRENCE: Spur and Groove Zone. Outer Ridge 15 and 20 m. One of the more common species occurring at Carrie Bow Cay.

DISTRIBUTION: Probably circumtropical. Western Atlantic: Cape Hatteras to Brazil. Gulf of Mexico. Caribbean.

GENUS *CALYPTOOECIA*, NEW GENUS

DIAGNOSIS: Colonies are encrusting and multilaminar. Zooids are erect and roughly hexagonal, the frontal surface calcified and perforated by cross-shaped pores. The orifice is rounded anteriorly and has a very shallow V-shaped sinus. No ovicells occur. Embryos are brooded in zooids; brooding zooids have smaller orifices and less frontal area than nonbrooding zooids.

TYPE SPECIES: *Calyptooecia insidiosa*, new species.

Calyptooecia insidiosa, new species
Figures 57, 58

DIAGNOSIS: Colonies are encrusting and multilaminar, forming small hemispherical or mushroom-shaped mounds in cryptic reef habitats. Zooids are erect, in the initial layer hexagonal in shape, in frontally budded layers more irregularly polygonal. The frontal surface is perforated by pores which, rather than being round as in most cheilostomes, vary in shape from trefoils, to crosses, to asterisks. The orifice is rounded anteriorly, narrowing to two proximally directed condyles, and with a shallow posterior sinus. The species can be distinguished from *Cleidochasma porcellanum* by the broader and shallower sinus

of the primary orifice, by the presence of the variously shaped pores, and by its unique method of brooding embryos.

HOLOTYPE: USNM 376803.

PARATYPES: AMNH 581, and 582.

ETYMOLOGY: The species name is from the Latin *insidiosum,* meaning "cunningly deceitful" in honor of its close resemblance to *Cleidochasma porcellanum.*

DESCRIPTION: Colonies are encrusting and multilaminar, forming pinkish mounds a few millimeters in size on coral undersurfaces and in reef caves and overhangs. Initial zooids are hexagonal in shape, but frontal budding in this species is initiated early, and the colony grows upward more rapidly than outward, forming a jumbled mound of zooids. Zooids are erect, roughly hexagonal, with a central orifice surrounded by three or four solid flat-topped tubercles. The frontal surface is thickly calcified and perforated by marginal and a few scattered surficial pores. These pores vary in shape from trefoils to asterisks, but the majority are in the form of crosses. In living colonies these pores are sparkling white. The orifice is round anteriorly, with two cardelles, and broad posteriorly, with a very shallow sinus. An adventitious avicularium with a cross-bar and a triangular mandible is placed just below and to one side of the orifice.

DISCUSSION: There appear to be two classes of zooids. One has a smaller orifice and a smaller frontal surface area, but seems as deep as other zooids. Opercula in these zooids are a clear golden color and sometimes bright orange masses are seen beneath the operculum. When such zooids are dissected they are found to contain orange embryos which fill one-half to three-fourths the zooid cavity. It is hard to say whether or not there are really two zooid types, the zooids that have the smaller orifices are all heavily calcified and in positions where they are starting to become overgrown by younger frontally budded zooids; older zooids may reproduce before being overgrown.

MEASUREMENTS	Range	Mean	N
Lz	.328–.537	.466	15
Wz	.373–.519	.442	15
Lo	.109–.146	.124	15
Wo	.091–.137	.106	15
Lav	.109–.218	.164	15
Wav	.073–.109	.090	15

OCCURRENCE: Spur and Groove Zone. Outer Ridge (15 and 20 m).

DISTRIBUTION: Carrie Bow Cay, Belize. Also found in cryptic reef habitats on the north coast of Jamaica.

FAMILY MICROPORELLIDAE HINCKS, 1880
GENUS *MICROPORELLA* HINCKS, 1877

Microporella mayensis, new species
Figures 59, 60

DIAGNOSIS: The colony is encrusting and multilaminar. Zooids are large and ovoid, with a beaded calcification penetrated by numerous small pores and by marginal areolae, as well as by the small lunate ascopore. The orifice is semicircular with a slightly convex proximal edge and is bordered by six marginal spines. Single triangular avicularia with long setiform mandibles are located below the orifice and directed diagonally outward.

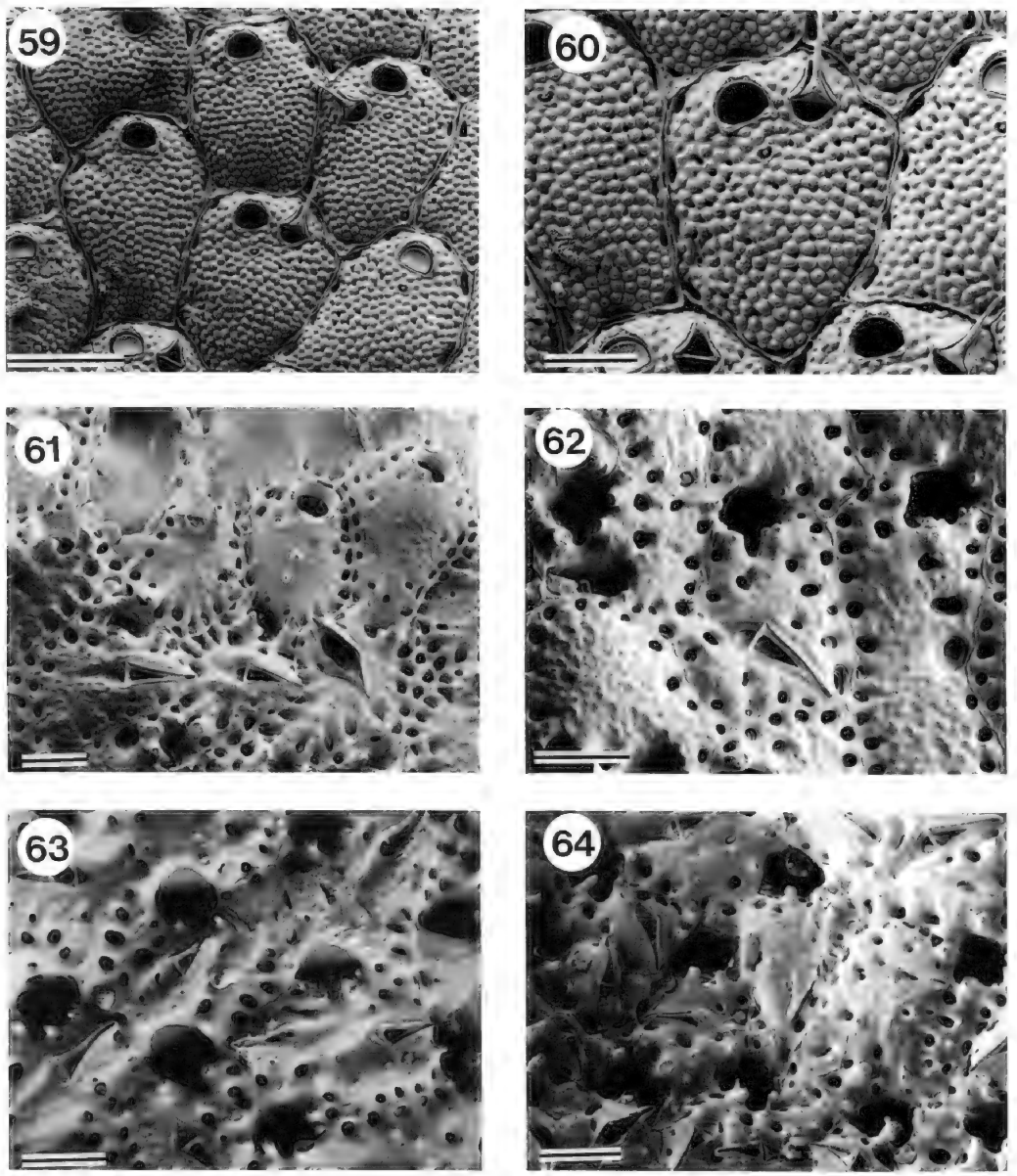
HOLOTYPE: USNM 376804.

ETYMOLOGY: The species is named *mayensis* in honor of the Mayan Mountains that overlook Carrie Bow Cay.

DESCRIPTION: The colony is encrusting. Zooids are ovoid, the frontal surface slightly inflated but lacking any umbo, the calcification beaded, with numerous small pores, narrow marginal areolae, and a raised border. The ascopore is small relative to zooid size and lunate, with a slightly raised collar and a serrated opening. The orifice is semicircular, two articulation points in its proximal margins giving the proximal border a convex rather than straight shape. It is bordered by six marginal spines which become covered up with increasing calcification. Avicularia are triangular, single, located below the orifice but above the ascopore, and projecting diagonally outward. The avicularian mandible is setiform and moderately long. No ovicells were present in the colony collected.

MEASUREMENTS	Range	Mean	N
Lz	.619–.673	.645	5
Wz	.446–.519	.497	5
Lo	.064–.082	.076	5
Wo	.109–.118	.115	5
Lav	.164–.237	.205	4
Wav	.064–.100	.080	4
Lascopore	.018–.018	.018	5
Wascopore	.018–.027	.025	5

DISCUSSION: The zooids of this species are



FIGS. 59–64. 59. *Microporella mayensis* (USNM 376804). Scale = 400 μm. 60. *Microporella mayensis,* showing avicularia, ascopore, and areolae. 61. Scale = 20 μm. *Rhynchozoon verruculatum* (USNM 376805), zooids at growing edge. Scale = 200 μm. 62. *Rhynchozoon verruculatum,* zooids near growing edge. Scale = 200 μm. 63. *Rhynchozoon verruculatum,* ovicelled zooids. Scale = 200 μm. 64. *Rhynchozoon verruculatum,* zooids in an old region of colony, showing increased calcification and proliferation of avicularia. Scale = 200 μm.

considerably larger than those of *M. umbracula* or *M. ciliata,* two species which have been recorded from the Caribbean. In its large zooids and long mandibled avicularia our specimens resemble *M. tractabilis,* described by Canu and Bassler from the Galapagos (1930), and by Cheetham and Sandberg (1964) from the Gulf of Mexico mudlump

fauna. However, there are differences in avicularian number and shape, in orifice shape, and in the areolae.

OCCURRENCE: Outer Ridge 15 m.

FAMILY RETEPORIDAE SMITT, 1867
GENUS *RHYNCHOZOON* HINCKS, 1895

Rhynchozoon verruculatum (Smitt), 1873
Figures 61, 62, 63, 64

Cellepora verruculata Smitt, 1873, p. 50. Osburn, 1914, p. 214.
Rhynchozoon verruculatum Canu and Bassler, 1928a, p. 88. Hastings, 1930, p. 728. Marcus, 1939, p. 153. Osburn, 1940, p. 444.
Rhynchozoon sp. 1(?) Banta and Carson, 1977, p. 402.

DESCRIPTION: Colonies are encrusting, forming small patches on coral substrata, and becoming greatly thickened with age. Zooids at growing edges are hexagonal with a row of ribbed marginal pores (fig. 61). The frontal surface is convex and granular with occasional larger tubercles. The orifice is semicircular anteriorly, with a margin of tiny beads of calcification, and U-shaped posteriorly, with a plain margin. It is surrounded by a peristome with proximolateral avicularium projecting vertically and which may have several other projections as well. Inward from the growing edge calcification becomes much thicker, some areolae become immersed in this calcification, and some are occluded entirely. The frontal surface becomes more granular and tuberculate in spots. Projecting tubercles around the aperture become larger, ranging from two to seven in number, jagged and irregular in shape, some with bifid or trifid tips. A large diamond-shaped avicularium develops below and beside the peristome, its mandible directed laterally or distolaterally. Additional avicularia seem to develop with age, older zooids often have two. Ovicells are embedded in the secondary thickening of the frontal wall, opening into the peristome. They are semicircular, with a semicircular to triangular less-calcified central plate (fig. 63).

MEASUREMENTS	Range	Mean	N
Lz	.455–.637	.514	15
Wz	.255–.510	.391	15
Lo	.137–.337	.193	15
Wo	.137–.218	.167	15
Lav	.127–.355	.252	15
Wav	.046–.118	.079	15
Lov			
Wov	.109–.137	.122	5

DISCUSSION: *Rhynchozoon verruculatum* is distinct from *R. rostratum* (Caribbean form) which does not develop the large avicularia, and which has an ovicell that does not become buried in the peristome. I agree with Banta and Carson that European forms may be different, but without further study I would be reluctant to synonymize them.

OCCURRENCE: Spur and Groove Zone. Outer Ridge 15 m.

DISTRIBUTION: Florida to Brazil. Caribbean.

FAMILY CELLEPORIDAE, BUSK, 1852
GENUS *TREMATOOECIA*, OSBURN, 1940

Trematooecia aviculifera
(Canu and Bassler), 1923
Figures 65, 66

Holoporella aviculifera Canu and Bassler, 1923, p. 179.
Holoporella turrita (Smitt) Osburn, 1914, p. 217. 1927, p. 131.
Trematooecia turrita (Smitt) Osburn, 1940, p. 458.
Trematooecia aviculifera Powell, 1971, p. 773.

DESCRIPTION: Colonies are encrusting, becoming multilaminar, often forming massive mounds (10–15 cm in diameter) on dead coral undersurfaces, or on open vertical surfaces. Color of living colonies when seen in shallow water or air is brick red. Due to some physical property of the calcification, at depths below about 7 m color appears to a diver as fluorescent lime green. The pink color of the skeleton remains even after treatment with bleach. In small colonies zooids are arranged in an orderly pattern, but frontally budded layers are initiated very early, causing irregular orientation of zooids. Zooids of the initial layer and the growing edge are rectangular, those of the upper layers irregularly polygonal. The frontal wall is heavily calcified, with scattered pores, mostly either at the zooid margin or near its center. The frontal surface juts upward into mounds or tubercles, usually best developed on either side of the semicircular orifice. A small oval laterally-

directed avicularium is present just below the straight proximal margin of the orifice in most zooids. Interzooecial avicularia occur more rarely between autozooids. These have large ovoid mandibles. Ovicells are round, with thick, granular, partially embedded side walls, but with a frontal circular membranous area through which the cherry red embryos are clearly visible. This central area may become calcified with age (fig. 65).

MEASUREMENTS	Range	Mean	N
Lz	.460–.957	.683	15
Wz	.460–.865	.601	15
Lo	.110–.294	.185	15
Wo	.202–.276	.242	15
Lav	.074–.147	.112	12
Wav	.055–.110	.081	12
Lov	.166–.368	.292	9
Wov	.202–.478	.306	9

OCCURRENCE: Lagoon Reef. Spur and Groove Zone. Outer Ridge (15 and 20 m). This species is one of the most abundant bryozoans in Caribbean coral reefs and one of those most likely to be noticed by divers because of its ability to compete with corals and sponges for space on vertical coral surfaces and open reef walls and because of its fluorescent green coloration. (See illustrations on the bottom of p. 321 in Colin, 1978).

DISTRIBUTION: Florida. Caribbean.

Trematooecia turrita (Smitt), 1873
Figures 67, 68

Lepralia turrita Smitt, 1873, p. 65.
Holoporella turrita Osburn, 1914, p. 277. 1927, p. 131. Canu and Bassler, 1928b, p. 145. Hastings, 1930, p. 732.
Cigclisula turrita Harmer, 1957, p. 1059. Banta and Carson 1977, p. 400. Winston, 1982, p. 147.
Trematooecia turrita Powell, 1971, p. 773.

DESCRIPTION: Colonies are encrusting, becoming multilayerd but never growing large, forming a small mound a few square millimeters in size on dead coral surfaces, pale pink when alive. Zooids are erect and deep-bodied and have irregularly polygonal borders, with a central orifice surrounded by four or five flat-tipped spinelike tubercles. The orifice is subcircular proximally and semicircular distally. Frontal calcification is thick and somewhat granular, with small pores scattered over the surface. Ovoid adventitious avicularia in two size classes occur on the frontal wall. Smaller ones are usually buried in the peristome calcification, between or at the ends of tubercles; these have serrated distal rostral margins. The larger avicularia have an enlarged, more spatulate mandible with a smooth rostrum. Ovicells are immersed in the calcification, open into the peristome and are visible only as a grid of four to eight larger pores adjacent to some of the orifices (fig. 68). Embryos are red.

MEASUREMENTS	Range	Mean	N
Lz	.391–.637	.535	15
Wz	.455–.601	.521	15
Lo	.173–.273	.214	15
Wo	.182–.237	.205	15
Lav	.046–.173	.117	12
Wav	.046–.164	.096	12
Lov	.164–.228	.200	6
Wov	.146–.182	.168	6

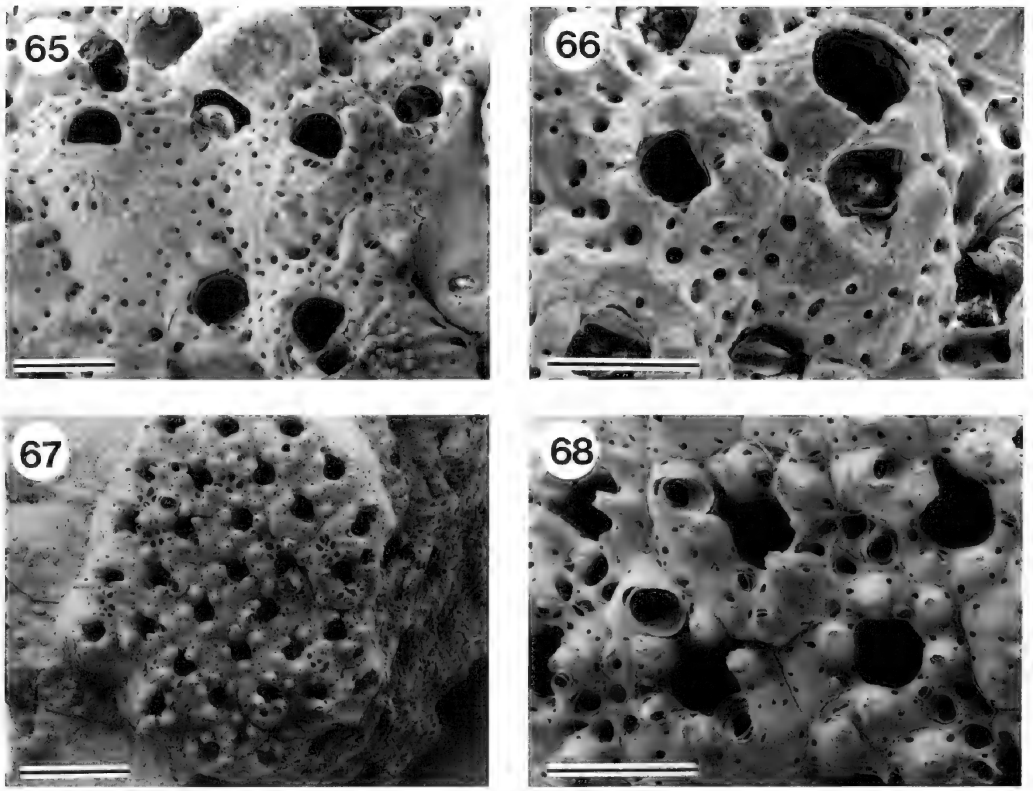
OCCURRENCE: Outer Ridge, 15 and 20 m.

DISTRIBUTION: Florida, Gulf of Mexico. Caribbean. Also reported from Pacific localities.

RESULTS AND DISCUSSION

In the back reef in front of the Cay only one bryozoan species, *Trematooecia aviculifera,* was found in coral rubble. Seagrass (*Thalassia*) was also examined, but no bryozoans were found. This was in contrast to observations made in the Indian River area in Florida where species were found on seagrasses, but was in accordance with observations made on the north coast of Jamaica. It may be that in waters of less than full salinity, bryozoans are able to settle and even dominate seagrass blades, whereas in areas of full salinity, other organisms, e.g., epiphytic algae, particularly encrusting coralline algae, outcompete bryozoans (e.g., Young and Young, 1982 showed that the majority of *Thalassia* blades in the Carrie Bow lagoon were encrusted with epiphytic coralline algae during their sampling period).

In the lagoon reef to the west and southwest side of the island coral heads and coral rubble, particularly flat pieces of *Acropora palmata* rubble, which rested on other rubble and formed small caves and crevices, were



FIGS. 65–68. 65. *Trematooecia aviculifera* (USNM 376806). Scale = 400 μm. 66. *Trematooecia aviculifera,* ovicelled zooid. Scale = 400 μm. 67. *Trematooecia turrita* (USNM 376807), whole colony. Scale = 1 mm. 65. *Trematooecia turrita,* zooids with ovicells (marked by cluster of pores). Scale = 400 μm.

examined for bryozoans. Cryptic organisms appeared to be more abundant than they are in waters of similar depth in the backreef lagoon at Discovery Bay, perhaps because fish are more numerous in Belize and (thus?) algal growth is less; the lack of filamentous algae was particularly striking. In addition to bryozoans there were numerous encrusting sponges and ascidians, and the foraminiferans *Homotrema* and *Gypsina.* In areas 1 m or less in depth *Trematooecia aviculifera* was the only bryozoan found. In areas 1 to 2 m in depth three species: *Trematooecia aviculifera, Hippopodina feegeensis,* and *Steginoporella* species occurred.

The other areas surveyed were all on the forereef. No bryozoans were found on the coral rock surfaces of the reef crest. In this area some platy coral was present, but the undersurfaces were covered only by calcareous algae, *Homotrema* and *Gypsina.* Most of the inner forereef consists of a spur and groove zone (water depth 5 to 10 m). In this area buttresses of coral, chiefly *Agaricia tenuifolia,* alternate with sand channels or grooves. The interstices and dead lower vertical and diagonal surfaces of *A. tenuifolia* provided a variety of microhabitats suitable for bryozoans. Twenty-two species (20 cheilostomes and two tubuliporates) occurred. The five most abundant species (in terms of numbers of colonies collected) were *Stylopoma spongites, Crassimarginatella tuberosa, Reptadeonella costulata, Steginoporella* sp. and *Smittipora acutirostris.*

At Carrie Bow Cay the inner forereef is separated from the outer forereef by a sand trough averaging 23 m in depth, parallel to it is an outer ridge of coral, with a framework of massive, branching and platy corals; the

depth at the top of the ridge is 12–14 m. From the ridge top the forereef slope drops steeply away to a deep forereef wall, which finally grades into the lime-mud continental slope bottom at about 200 m depth. Bryozoans were collected from coral rubble undersurfaces (mostly *Acropora cervicornis* rubble here) from near the ridge top (15 m) and from platy coral undersurfaces a short distance down the forereef slope (20 m). Twenty-four species (22 cheilostomes and two tubuliporates) were collected at 15 m. *Reptadeonella costulata, Cleidochasma porcellanum, Crassimarginatella tuberosa,* and *Stylopoma spongites* were the most abundant species. At 20 m 19 species (16 cheilostomes and three tubuliporates) were collected: *Crassimarginatella tuberosa, Reptadeonella costulata, Hippopodina feegeensis, Steginoporella* sp. and *Stylopoma spongites* were most abundant.

In addition to the survey of reef environments, the mangrove-root environment at Twin Cays was also studied. Three species: two ctenostomes, *Amathia vidovici* and *Zoobotryon verticillatum,* and one cheilostome, *Schizoporella ?serialis* were found on mangrove roots.

It is difficult to compare the bryozoan fauna of Carrie Bow Cay with that of other Caribbean reef environments, as this collection was neither quantitative or exhaustive, but a few generalizations may be made. The Carrie Bow Cay fauna shows strong similarities with that of Rio Bueno on the north coast of Jamaica. Winston and Jackson (1984) listed 26 species of cheilostomes occurring under corals at Rio Bueno. Of these, 14 have been found thus far at Carrie Bow Cay. The chief differences between the two areas appear to be the much greater abundance of *Crassimarginatella tuberosa* (which was in fact described from one of the Albatross localities mentioned in the introduction), the absence at Carrie Bow Cay of several species found at Rio Bueno, e.g., *Reptadeonella bipartita, Gephyrophora rubra,* and the presence of others, e.g., *Hippopodina feegeensis,* not reported there. The encrusting species most abundant at Rio Bueno: *Steginoporella* sp., *Stylopoma spongites,* and *Reptadeonella costulata,* were also abundant at Carrie Bow, as were the less cryptic *Trematooecia aviculifera* and *Canda simplex.*

Eight of the 12 species described by Banta and Carson (1977) from the Caribbean coast of Costa Rica were also found at Carrie Bow.

Four of the species described here from Carrie Bow Cay have a cosmopolitan distribution, 11 species a circumtropical and/or subtropical distribution; five others are known from the western Atlantic (SE coast of the United States to Brazil) Gulf of Mexico and the Caribbean, and seven have an essentially Caribbean distribution. Three species are here reported for the first time from the Caribbean, though known from other areas. Four species are described here for the first time. One of these species, *Calyptooecia insidiosa,* is also common in cryptic habitats in Jamaica; the other three species are not known from elsewhere at present.

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