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DISCUSSION

- PICHON: Did you find species of sponges such as those of genera *Pharetronides* and *Astrosclera* in the darkest parts?
- RÜTZLER: Not there, I think.

BORING SPONGES OF THE REEFS OF GULF OF MANNAR
AND PALK BAY

P. A. THOMAS

(Central Marine Fisheries Research Institute, Mandapam Camp, India)

ABSTRACT

Boring sponges from a major group among the marine organisms causing considerable destruction to the reef system. The bores made by the sponges weaken the entire reef, making it more susceptible to the wear and tear caused by waves.

A systematic account of the major coral-boring sponges of the fringing reefs of Gulf of Mannar and Palk Bay, based on a study over a period of three years, is presented in this paper. Other aspects like intensity of boring, pattern of growth are also briefly discussed.

INTRODUCTION

Boring into objects like rock, shell, wood or coral, for food or protection, is a marked activity among many marine organisms. The borers make extensive galleries inside the substrate rendering it more susceptible to disintegration. In the Gulf of Mannar and Palk Bay, boring sponges cause considerable destruction to the dead and living corals. This problem gains considerable significance in view of the increasing value of corals for industrial purposes as also of the possible protection given by the fringing reefs to these areas from sea erosion. A systematic study of these coral-boring sponges together with their mode of destruction as been undertaken by the author and an account of the species collected from the reef environment is presented herein. Of the total of 20 species discussed in this paper, 6 are new records to the Palk Bay and 5 to the Gulf of Mannar. One species, i.e., *Spirastrella aurivilli* Lindgren, is recorded for the first time from Indian Ocean and another *Aka minuta* is new to science.

MATERIAL AND METHODS

The material for the present study was collected from the fringing reefs of Gulf of Mannar and Palk Bay in South east India. They were brought to the aquarium in living condition and kept there for several days. Measurements of oscules and pores were taken, in most cases, from living specimens.

Hand sections, wherever possible, were taken from the different morpho-zones. Cleaning was done by carbol-xylool and subsequently by xylool. Staining with basic fuchsin and surranin also proved useful. Mounting was done in canada balsam; but glycerine and water were utilised for temporary mounts. The

method adopted by Old (1941) was followed for spicular preparations. The dimensions of spicules are expressed in mm, based on measurements of 10 spicules in each category and a pattern - lower limit, upper limit, mean - is followed throughout.

Descriptions of some species, which have not been collected by the present author but were recorded from this region by previous workers are also incorporated for the completeness of this account.

DISTRIBUTION AND ABUNDANCE OF SOME COMMON SPECIES

The coral-boring sponges are quite rich and varied. Specimens collected belong to 4 families, i.e. Spirastrellidae Ridley and Dendy; Clionidae Gray; Jaspidae de Laubenfels and Halinidae de Laubenfels. There are altogether 20 species of boring sponges now known from the Gulf of Mannar and Palk Bay, falling into 9 genera.

The most conspicuous genus is *Cliona* both in number of species and in distribution. The commonest species of this genus, *Cliona celata* is widely distributed in tidal pools and subtidal waters, possibly because of its ability to withstand the environmental fluctuations to a greater extent. Previous workers have described this species as entering into a 'free-living' stage after disintegrating the substratum totally. But this form of growth has not been observed either in the Gulf or in the Bay. Another cosmopolitan species found here is *C. vastifica*. This species, as indicated by Hartman (1958) is more tolerant of exposure to low salinities than *C. celata* and this is the reason for its spreading into brackish water environments as shown by Annandale (1915C), who found it to be the commonest species in the littoral zone of Indian seas. This is true in the Gulf of Mannar and Palk Bay also; but samples collected from the reefs include this species but rarely. The most favourite substratum for this species appears to be shells found at greater depths (10-30 metres) but rarely does it occur on coralline algae down to a depth of 2 metres. *C. orientalis*, another species widely distributed in Indo-Pacific, is also usually found in abundance in this area. It spreads on the substratum extensively and in some places occupies an area of more than 2 metres in diameter. Such extensive growth is usually seen in shallow regions ranging from 2 to 3 metres in depth. The other species represented in this collection are rarely met with in this region.

Three species of the genus *Spirastrella* are found boring into coral rocks in this area. Of these *S. cuspidifera* and *S. inconstans* grow to a massive size after disintegrating the substratum to the maximum. The third species *S. aurivilli* enjoys a wide distribution in this area and is often seen in competition with *C. celata* in the littoral zones of Palk Bay and Gulf of Mannar.

Two species belonging to the family Halinidae of the Order Carnosida are also represented in the present collection. Both these species are widely distributed in the Indo-Pacific but never form extensive galleries inside coral rocks and hence are not much destructive.

TABLE 1. General distribution of the species considered in this paper

| Sl. No. | Species | Atlantic Ocean | Mediterranean Sea | Red Sea | Indian Ocean | Australian region | Pacific Ocean | Elsewhere |
|---------|---|----------------|-------------------|---------|--------------|-------------------|---------------|-----------|
| 1 | <i>Spirastrella inconstans</i> (Dendy) | — | — | X | X | X | X | — |
| 2 | <i>Spirastrella cuspidifera</i> (Lamarck) | — | — | X | X | X | X | — |
| 3 | <i>Spirastrella aurivilli</i> Lindgren | — | — | — | X | — | — | — |
| 4 | <i>Amorphinopsis excavans</i> Carter | — | — | — | X | — | — | — |
| 5 | <i>Aka diagonoxes</i> Thomas | — | — | — | X | — | — | — |
| 6 | <i>Aka minuta</i> n. sp. | — | — | — | X | — | — | — |
| 7 | <i>Cliona celata</i> Grant | X | X | X | X | X | X | Antarctic |
| 8 | <i>Cliona vastifica</i> Hancock | X | X | — | X | X | — | — |
| 9 | <i>Cliona quadrata</i> Hancock | X | X | — | X | X | — | — |
| 10 | <i>Cliona viridis</i> (Schmidt) | X | X | X | X | — | — | — |
| 11 | <i>Cliona ensifera</i> Sollas | — | — | — | X | — | — | — |
| 12 | <i>Cliona mucronata</i> Sollas | — | — | — | X | — | — | — |
| 13 | <i>Cliona orientalis</i> Thiele | — | — | X? | X | X | — | — |
| 14 | <i>Cliona margaritiferae</i> Dendy | — | — | — | X | — | — | — |
| 15 | <i>Theoco socialis</i> (Carter) | — | — | — | X | — | — | — |
| 16 | <i>Deflectona higgini</i> (Carter) | — | — | — | X | — | — | — |
| 17 | <i>Dotona pulchella</i> (Carter) | X | — | — | X | — | — | — |
| 18 | <i>Jaspis penetrans</i> (Carter) | — | — | — | X | — | — | — |
| 19 | <i>Halina plicata</i> Schmidt | — | X | — | X | — | — | — |
| 20 | <i>Sannius anonynta</i> Gray | X | — | — | X | X | X | — |

X - present; — absent.

THE CORAL-BORING SPONGE FAUNA OF THE AREA

The species dealt with in the paper are classified according to the following outline. Those marked with an asterisk are new records for the Gulf of Mannar and those with a 'x' mark are new records to Palk Bay. Their geographical distribution is shown in Table. I.

LIST OF SPECIES

Order HADROMERIDA Topsent

Family SPIRASTRELLIDAE Ridely and Dendy

Genus SPIRASTRELLA Schmidt.

- x 1. *S. cuspidifera* (Lamarck)
 x 2. *S. inconstans* (Dendy)
 3. *S. aurivilli* Lindgren

Family CLIONIDAE Gray

Genus AMORPHINOPSIS Carter

- *x 4. *A. excavans* Carter

Genus AKA de Laubenfels

5. *A. diagonoxea* Thomas
 6. *A. minuta* n. sp.

Genus CLIONA Grant

- x 7. *C. celata* Grant
 *x 8. *C. vastifica* Hancock
 9. *C. quadrata* Hancock
 *10. *C. viridis* Schmidt
 *11. *C. ensifera* Sollas
 12. *C. mucronata* Sollas
 x*13. *C. orientalis* Thiele
 14. *C. margaritiferae* Dendy

Genus THOOCE de Laubenfels

15. *T. socialis* Carter

Genus DELECTONA de Laubenfels

16. *D. higgini* Carter

Genus DOTONA CARTER

17. *D. pulchella* Carter

ORDER EPIPOLASIDA SOLLAS

FAMILY JASPIDAE de Laubeneels

Genus JASPIS Gray

18. *J. penetrans* (Carter)

ORDER CARNOSIDA CARTER

FAMILY HALINIDAE de Laubenfels.

Genus HALINA Bowerbank

19. *H. plicata* Schmidt

Genus SAMUS Gray

20. *S. anonyma* Gray

Key to the identification of the boring sponges of Palk Bay and Gulf of Mannar.

1. Only tylostyle as spicule *Cliona quadrata*
2. Megascleres only oxeas 9
3. Megascleres only styles 10
4. Spicules tylostyles and spirasters. 11
5. Spicules tylostyles, granulated oxeas and spirasters 12
6. Megascleres polytylote strongyles and toxiform oxeas and spirasters *Delectona higgini*
7. Spicules amphistasters and discs *Thooce socialis*
8. Spicules with tetraxonid modifications 13
9. A.
 - i) Oxeas with two distinct curves and chambers inside coral large (2 cm or even more in diameter) *Aka diagonoxea*
 - ii) Oxeas with a curve at the centre. Chambers inside coral small; not more than 5 mm in diameter *Aka minuta*
- B With larger oxeas (0.5 x 0.021 mm) and small styles *Amorphypopsis excavans*
- C. With large oxeas (0.4 mm) microxeas and asteriod microsccleres. *Jaspis penetrans*
10. And with peculiar spirasters bearing anular spines and small straight spirasters. *Dotona pulchella*
11. A Papillae growing into massive of finger shaped structures and cavity inside the substratum extensive (2-5 cm)
 - i) with one type of spiraster *Spirastrella inconstans*
 - ii) Papille dark brown with 4-6 canals running vertically up, Spirasters with considerable variations in size and shape. *Spirastrella cuspidifera*
- B. Papillae flush with the surface or slightly protruding.
 - i) with stout tylostyles (width up to 0.04 mm) and spirasters with long often branching spines. Sponge brick red in colour and cavity inside the coral large, as in A. *Spirastrella aurivilli*
 - ii) Hair like oxeas included. *Cliona celata*
 - iii) Spirasters thin, with 3 to 5 bends and spines spirally arranged. *Cliona viridis*
- C Uniformly spreading; deep brown in colour. Spirasters 'C' or 'S' shaped; spines on one side. *Cliona orientalis*
- D. With mucronate spicules *Cliona mucronata*
- E. With ensiform spicules *Cliona ensifera*
12.
 - i) Microxeas with a central swelling, granulated in varying degrees, size 0.010-0.121 x 0.002-0.006mm *Cliona vastifica*
 - ii) Microxes bend in the middle or cylindrical. Size 0.06 x 0.002 mm merging into spirasters gradually. *Cliona margaritiferae*
13. Dichotriaenes and streptasters *Halina plicata*
 Amphistasters and sigmas *Samus anonyma*

SYSTEMATICS

Genus SPIRASTRELLA SCHMIT.

This genus was established by Schmidt (1868) the type being *Spirastrella cunctatrix* possessing a peculiar kind of spicule, now called spinispirae after Vosmaer (1902). Megascleres tylostyles; more or less radially arranged. Body compact and surface armoured with monacts. Microscleres are represented by spirasters.

Some species belonging to this genus, as those of the Genus *Cliona*, bore into calcium carbonate matter and later enter into a massive phase, leaving the substratum. Because of this mode of living several authors have transferred some of its species to the genus *Cliona*. The species commonly met with in the reef are the following:-

1. *S. cuspidifera* (Lamarck)
2. *S. inconstans* (Dendy)
3. *S. aurivilli* (Lindgren)

Of the three species, the first and the second enter into a massive phase in advanced stages of their development, whereas the third is confined to the substratum throughout its life.

Spirastrella cuspidifera (Lamarck)

(Pl. 1, Figs. 2, 2A, 2B, 2C).

Spirastrella cuspidifera Burton, 1959, P.208 (Synonymy)

Material: Several specimens from the reefs of Gulf of Mannar and Palk Bay.

Description: Cavities are in a vertical line, and the maximum diameter may come up to 0.5 mm. The papillae formed are digitate and there may be a number of them arising from the same mass in the interior.

In some cases, the sponges in a later stage seem to develop a massive form after the disintegration of the substratum. This is brought about by the lateral fusion of the papillae.

Colour of the specimen, in living state, is yellowish grey, changing to yellow after death. Excurrent openings are situated often at the tips. Five excurrent canals are seen in a cross-section of the papilla, the central one being broader than the others. Pores are minute 0.04 mm in diameter, and are situated in low depressions on the surface of the body. There is no clear-cut demarcations between the ectosome and endosome. A pigment zone is quite clearly found towards the outer part. Smaller tylostyles are arranged radially on the outer part of the body.

Main skeleton of the papillae consists of vague bundles of tylostyles running vertically up along the interior and projecting out from the peripheral parts. Fusion is quite common and hence the arrangement is very much confused.

Spicules: 1. Tylostyles-Straight or slightly curved. Head, in most cases, is well developed, oval, irregular or trilobed. Length varies from 0.188 to 0.662 mm (0.523 mm average) and width from 0.004 to 0.016 mm (0.013 mm average).

2. Spirasters, Two types-slender and robust, are seen. In the first case they can be ordinary spiral type, or zig-zag with spines jutting from the angles, or straight with spines on either end, or semi-circular. Total length varies from 0.008 to 0.067 mm and width from 0.001 to 0.002 (excluding spines). Robust forms are usually with two bends and with spirally arranged spines. Length up to 0.033 and width 0.005 mm.

A sexual reproduction by budding from the distal parts of the papillae is quite common.

Distribution: Red Sea, Indian Ocean, Australian region, and Pacific Ocean.

Spirastrella inconstans (Dendy)

(Pl. 1, Figs. 1, 1A, 1B).

Suberites inconstans var. *globosa*, var. *meandrina* and var. *digitata*.

Dendy, 1887, p.154-157, pl. 9, Fig. 1, 1a, 2; pl. 10, fig. 1.

Spirastrella inconstans: Thiele, 1889, p.10-11, pl.1, fig. 3, 3a, pl. 5, fig. 4, Burton, 1934, p. 570. Rao, 1941, p.427. Thomas, 1968, (unpub).

Cliona arndti. de Laubenfels, 1936, p. 152.

Material: Several specimens from Coral rocks.

Description: The three growth forms described by Dendy, viz., *globosa*, *meandrina* and *digitata*, are common in the Gulf of Mannar and Palk Bay. The first two growth forms are predominantly met with in the coral reef environment and the third in sandy bottom. The sponge fills the interior of the coral rock, disintegrating it to the maximum, and the papillae, jutting out through the surface, spread gradually along the surface in the form of a thick disk with crenulated margin. These papillae spreading laterally may assume a massive form after the destruction of the coral rock and this may give rise to a form bearing close resemblance to either *globosa* or *meandrina*.

Common pattern of boring: As Burton (1934) showed this species passes through a boring stage in its early life and its whole life-history is similar to that of *Cliona celata* or any other typical boring sponge. It is noted, in many cases, that the formation as well as distribution of the papillae is very peculiar. The mass found in the coral rock never put forth branches inside the coral unlike in *Cliona*, and the number of papillae communicating to the exterior is quite limited. Normally the incurrent ones are located at a place where there is protection from silt.

The cavities found inside the corals are mainly confined to a peripheral zone 5 to 20 cm deep. The mass inside the coral may attain a width of 5 to 10 cm at the maximum. Since lateral growth by stolon is not usual, further growth and spreading inside the substratum is retarded to a greater extent. The papillae may grow laterally spreading further on the surface in the form of a funnel first and at a later stage may assume a massive meandrine appearance. It is found that some specimens after disintegrating the substratum may enter into a free life, as in some species of *Cliona*.

Oscules, with diameter varying from 2 to 10 mm, are oval, circular or slit-like in living condition and are protected by sphincters. Pores minute, scattered in groups. Diameter up to 0.2 mm.

A definite cortex is wanting. Spirasters are abundant in the outer part and small tylostyles are seen radially at the surface.

For details of the skeletal arrangement see Dendy (1887).

Spicules-1. *Tylostyles*: Slightly curved and sharply pointed. Length varies from 0.121 to 0.631 mm (0.528 mm average) and width, 0.004 to 0.023 mm (0.018 mm average).

2. *Spirasters*- Slender with 2 to 5 bends. Spines blunt or sharply pointed. Size 0.008 to 0.033 mm and width about 0.002 mm.

Distribution: Red Sea, Indian Ocean, Australian Region and Pacific Ocean.

Depth: 1-3m.

Spirastrella aurivilli Lindgren

(Pl. I, Fig. 4, 4A, 4B, 4C)

Spirastrella aurivilli Lindgren, 1897, p. 484., Lindgren, 1898, p. 322, pl. 17, fig. 11, pl. 18, fig. 4 Vosmaer, 1911, p. 21. Burton, 1934, p. 571, Bergquist, 1965, p. 182.

Cliona aurivilli de Laubenfels, 1936, p. 154.

Material: Several coral rocks riddled by this species.

Description: This species makes extensive galleries inside the corals. The cavities formed inside the coral are bigger than those of the other species of this genus, and may come up to 4 x 6 x 5 mm in size. The mass found inside the coral produces several hollow branches ranging in diameter from 1 to 4 mm and these run to the surface in straight channels, ending in the surface in rounded or hemispherical papillae. Larger papillae bear a single opening at their tips (excurrent) and the smaller bear 2 to 6 openings (incurrent). The excurrent papillae always project considerably out of the surface of the coral (2 to 8mm) whereas the incurrent ones usually are flush with the surface.

Colour of the specimen, in living state, is pinkish red, turning grey on drying.

Texture of the papillae is hard, and the mass in the interior is leathery. Surface of the papillae hispid due to the presence of smaller tylostyles arranged in a brush-like pattern as in the other members of the genus.

Skeletal arrangement agrees with that described by Lindgren (1897, 1898) and Bergquist (1965). Spirasters are totally absent in some specimens examined.

Spicules: 1. *Tylostyles*-. Two types are seen. (a) Larger forms, constituting the bulk, may be straight or slightly curved; sharply pointed or blunt (3%). Head spherical; 0.02 mm in diameter or trilobed. Length varies from 0.511 to 0.679 mm (0.600 mm average) and width from 0.015 to 0.042 mm (0.027 mm average). Greatest width in the distal half. (b) Smaller forms of the dermal region. Straight or slightly curved. Average size 0.311 x 0.012 mm.

2. *Spirasters*—Large spirasters with long spines; spines bifid usually. Shaft slender. Size when well developed, 0.06 mm and width 0.003 mm.

This species is quite abundant both in the Gulf of Mannar and in the Palk Bay, below the low tide level along with *Cliona celata*. This is the first record of this species from Indian region.

Distribution: Indian Ocean, Australian region, Pacific, Ocean. *Depth*: 1-2m.

Family CLIONIDAE Gray.

Boring sponges of the family Clionidae have received considerable attention since Grant (1826) described a *Cliona* (*C. celata*) living on oyster shell. This is a widely distributed family consisting of about 15 genera, including the most destructive and widespread genus *Cliona*, with about 165 species.

de Laubenfels (1936) divided this family into two (Subdivisions) based on the nature of spicules; the first one includes *Thoosa* and allied genera possessing elaborate and fancy microscleres and the other *Cliona* and allied forms with a simpler microscleres.

Species of the *Cliona* group are fairly common in this area.

Genus AMORPHINOPSIS Carter

Clionidae in which the skeleton is composed of irregular reticulation of oxeas and styles. Spongin rarely seen. Type *Amorfinopsis excavans* Carter, 1887.

Amorfinopsis excavans Carter

(Pl. II, Fig 3)

Amorfinopsis excavans Carter, 1887, p. 77, pl. 5., figs. 12-15. Thomas, 1968 (unpublished).

Material: Specimens from several massive corals.

Description: Dermal skeleton is a somewhat well developed reticulation of oxeas. Spongina quite conspicuous in the dermal part.

Colour of the specimen is pale white when alive. Oscules circular, 1 to 1.5 mm in diameter, and usually arranged in groups of 2 to 6. Outline oval or elliptical and diameter from 0.02 to 0.07 mm.

Extosome is well developed. Endosomal skeleton irregular. Oxeas are arranged in irregular bundles at the peripheral parts.

Boring pattern: The substratum beneath presents a tessellated appearance.

Apertures irregular, 1 to 2 mm in total width.

Spicules: 1. Oxeas—Usually with a distinct angle at the centre. Malformations are rarely noted. Stylote modifications are common. Size 0.188 to 0.547 mm (0.451 mm average) x 0.006 to 0.021 mm (0.015 mm average).

2. Styles—Quite abundant in the dermal region. Average size 0.166 x 0.005 mm.

Distribution: Indian Ocean, Australian region. *Depth:* 2-5m.

Genus AKA de Laubenfels

Clionidae with only oxeas. Incurrent and excurrent pores on papillae. Type species *Acca insidiosa* Johnson (1899).

X *Aka diagonoxes* Thomas
(Pl. I, Fig. 9, 9A)

Aka diagonoxea Thomas 1968 (unpublished).

Material: Specimens from three coral rocks from Gulf of Mannar.

Description: Sponge boring, chambers found inside the sub-stratum large (20 mm) and irregular in outline. Fistules projecting from the substratum of length 20 to 50 mm and diameter 2 to 4 mm. They divide dichotomously or polychotomously. Pore-bearing fistules short and stumpy. Pores terminal, 0.046 mm average diameter. Oscules terminal, single, 2 to 3 mm in diameter.

Chambers found inside the substratum communicate with adjacent ones by two types of openings. (1) Wide openings of about 3 mm diameter and (2) small openings, 0.1 to 0.5 mm in diameter, in groups. It is observed that in some advanced stages these openings are located on pillar-like structures projecting into the interior of the chamber in a radial pattern, which is brought about by the partial dissolution of calcareous matter just around the pore.

Colour of fistule is pale brown or pale white. Pulpy mass inside the chamber is yellow. Fistules hard and breakable.

Dermal membrane thin and transparent. Brown pigment granules are present in some places. Oxeas are tangentially arranged. Spongina not present. Main skeleton of the fistule consists of stout fibres running longitudinally up through the interior. They may fuse together towards the basal part and form compound fibres, while they become weak at the terminal parts. Average diameter of a fibre is 0.75 mm; mesh size 0.207 mm. Spongina visible and pale yellow in colour. Total thickness of the fistular wall is 0.8 mm. Spicular arrangement of the pulpy mass of the interior is rather vague. Calcareous particles of about 0.005 mm diameter are present crowded together at certain places inside the pulpy mass.

Spicules: Oxeas—sharply and abruptly pointed. Strongly lute (3%) and stylote (8%) modifications are also seen. Length varies from 0.109 to 0.130 mm (0.123 mm average) and width from 0.007 to 0.008 mm.

The nearest relative of this species is *Aka labyrinthica* (Hancock, 1849) boring into the shells of *Tridacna gigas* from unknown locality.

Depth: 1-2 m.

Aka minuta n. sp.

(Pl. II, Fig. 4, 4A)

Materials: Specimens from two colonies of *pocillopora damicornis* (Linnaeus) and one massive coral.

Description: Chambers formed inside the coral are irregular. Wall between adjacent chambers is very thin and the interconnection is reduced to a mere pore of about 1 mm in diameter on the wall. Outline of the chamber is irregularly oblong, 5x 4 mm average diameter. A number of openings with a diameter of 1.5 mm average are found on the surface of the coral. They may represent the openings through which the excurrent and incurrent papillae project out. Branches of coral infested with this sponge show a stunted growth.

Soft parts, lining the chambers uniformly act as a diaphragm at the opening between the chambers. Oxeas are arranged in an ill-defined manner. Microscleres are wanting.

Spicules: Oxeas—sharply and gradually pointed; with a sharp curve at the centre. Measurements are given below.

| Material | Host | Length (Oxea) | Width (Oxea) |
|-----------------|----------------------|---------------------|---------------------|
| CMFRI No. 135 | <i>P. damicornis</i> | 0.096-0.126 (0.119) | 0.002-0.007 (0.005) |
| CMFRI No. 136 | <i>P. damicornis</i> | 0.085-0.130 (0.118) | 0.001-0.007 (0.005) |
| CMFRI No. 136A. | Coral rock | 0.109-0.130 (0.121) | 0.001-0.007 (0.005) |

The nearest relative of this species is *Aka nodosa* (Hancock, 1849) boring into shells of *Tridacna gigas*. In the absence of thick streptasters this present species differs from *Donotella acustella* (Annandale, 1915) and from *A. diagonoxea* mentioned above in the following respects.

- (a) small size of chambers.
- (b) Oxeas in this case with a sharp angle at the centre.
- (c) Pores between chambers never lead into long canals.

Locality: C.M.F.R.I. No. 135 (type) 6-9-65, C.M.F.R. No. 136-26-11-65, C.M.F.R.I. No. 136-6-11-65 (Gulf of Mannar).

Depth: 2-3 m.

Genus CLIONA Grant

Megascleres, tylostyles and microscleres spirasters to which microxeas may be added. In later life members of this genus grow into massive forms outside the substratum. Type species *Cliona celata* Grant (1826).

Cliona celata Grant

(Pl. I, Fig. 5, 5A, 5B, 5C)

Cliona celata: Topsent, 1900, p. 32, pl. 1, figs. 5, 6-9; pl. 2, fig. 1, (Synonymy). Annandale, 1915, p. 7. Thomas, 1968 (unpublished)

Material: Specimens from several coral rocks.

Description: perforations formed in the surface are of two types. Small openings through which the incurrent papillae protrude out, with diameter varying between 1 and 2 mm, and larger openings of the excurrent papillae with diameter from 2 to 5 mm.

The incurrent and excurrent papillae are seen flush with the surface or protruding (2 to 6 mm in living condition on coral rocks). Pores at the tip of incurrent papillae in groups; diameter from 0.018 to 0.045 mm. Excurrent openings large, diameter up to 3 mm highly contractile.

Galleries formed inside the substratum are large, 2 to 5 mm in diameter, and adjacent cavities communicate with one another through large openings of 1 to 2 mm in diameter. Extension of the colony inside the substratum is effected by stolon formation and they may spread irregularly on the peripheral part of the coral rock. In some cases the ramifications of the sponge may be seen up to a depth of 30 cm or even more. The interior of the burrow presents an etched appearance under high magnification.

General morphology, anatomy, physiology and development of this species have been extensively worked out by previous workers (Topsent, 1900; George and Wilson, 1919; Hartman, 1958; Goreau and Hartman, 1963).

Colour of the living specimens varies from green to golden yellow.

Spicules: Many authors (Topsent, 1900; Annandale, 1915; Arndt, 1935; Hopkins 1956) have reported the presence of spirasters in this species. But the present author, like Old (1941) and Little (1963), could see no spirasters regardless of the different stages of growth. Diactinal megascleres were present in some specimens examined. They are very minute and with hair-like dimensions, sometimes in bundles.

1. Tylostyles.- Smooth and slightly curved; usually sharply pointed but some with blunt tips. Length varies from 0.207 to 0.320 mm (0.283 mm average). Width of the body 0.006 to 0.013 mm (0.010 mm average) and that of the head 0.005 to 0.010 mm (0.009 mm averages).

2. Oxeas-Size from 0.147 to 0.201 mm Hair-like.

This species is quite abundant in the subtidal region of the Gulf of Mannar and the Palk Bay, together with *Spirastrella aurivilli* Lindgren. It is noted that the borings made on the coral rocks are always larger than those produced on the molluscan shells.

This species is reported to enter a "free living" stage after disintegration of its original shelter which has not been observed by the present author. But it is seen that in some cases both the excurrent and incurrent papillae may grow certain lateral expansions and by their fusion a continuous plate is formed on the surface of the coral rock.

Distribution: Cosmopolitan.

Depth: up to 5 m.

Cliona vastifica Hancock

(Pl. I, Figs 3, 3A, 3B)

Cliona vastifica: Hancock, 1849, pl. 342, pl. 15, Fig. 12, Hartman, 1958, p. 21. fig. 5 Thomas 1968 (unpublished).

Material: Several specimens.

Description: Openings found on the outer part of the substratum small and usually in a straight line. But in some places especially at the thicker parts of the substratum, they are generally confused. Diameter of these openings varies from 0.5 to 1 mm and the openings are situated at a distance of 1.5 mm.

The morphology of this species has been worked out in detail by previous workers (Lendenfeld, 1898; Topsent, 1900; Vosmaer, 1933). Hartman (1958)

has contributed, substantially to our knowledge of the salinity and temperature tolerance of this species. According to Hartman (1958) this species is more tolerant to low salinity than *C. celata* and hence this can inhabit areas of low salinity where *C. celata* cannot grow luxuriantly. Annandale (1915C), Hopkins (1956) and several other workers have recorded this species from estuarine environments.

Spicules: 1. Tylostyles—Straight or slightly curved. Head well developed and spherical. Length varies from 0.163 to 0.210 mm (0.189 mm average). Width of the body 0.001 to 0.004 mm and that of the head 0.007 to 0.008 mm.

2. Oxeas—Microspined in varying degrees or smooth. Swellings may or may not be present at the central part. Sometimes stylote. Size 0.046 to 0.121 mm (0.095 mm average) x 0.001 to 0.006 mm (0.003 mm average).

3. Spirasters—With 3 to 6 angulations. Spines only at the angle or entirely microspined. Smooth forms are rarely noted.

Distribution: Cosmopolitan.

Depth: 2 to 3 m.

Cliona ensifera Sollas

(Pl. I, Fig 7, 7A, 7B, 7C)

Cliona ensifera Sollas, 1878, p. 61, pl. 1, figs. 1, 18, pl. 2, fig. 10-25. Thomas, 1968 (unpublished).

Material: Specimens from two coral rocks.

Description: Chambers spherical in most cases, 2 to 3 mm in diameter. Canals found in between the chambers not very narrow, 0.2 to 1 mm in diameter. The openings of incurrent and excurrent papillae are seen on the surface of the coral, 0.5, to 1 mm in diameter.

Spicules: 1. Ensiform spicules—Slightly curved, head spherical. Tip of the spicule, in most cases, is abruptly pointed or, rarely, blunt. Length varies from 0.294 to 0.359 mm (0.320 mm average) and width from 0.012 to 0.021 mm (0.016 mm average).

2. Slender stylostyles—Shaft slightly curved, head globular or trilobed. Not so abundantly represented as the former type. Length varies from 0.245 to 0.283 mm (0.271 mm average) and width from 0.003 to 0.008 mm (0.004 mm average). Head 0.010 mm average.

3. Spirasters—Rarely represented. Usually with 3 to 5 sharp bends. Spines at the angles only, pointed or blunt. Total length 0.038 mm and width 0.001 mm.

Distribution: Indian Ocean

Depth: 2-3 m.

Cliona mucronata Sollas

(Pl. I, Fig. 8, 8A, 8B, 8C, 8D)

Cliona mucronata Sollas, 1878, p. 54, pl. 1, figs. 1 2-7, 9, 10, 15, 17, pl. 2 figs. 1-9. Thomas, 1968 (unpublished).

Material: Specimens from a colony of *Pocillopora damicornis*. (Gulf of Mannar).
Description: It is abundantly seen inside the branches of the coral. Chambers irregular in outline, 3 to 5 mm in greatest diameter. Connections between the chambers slender and provided with diaphragm. Small openings on the surface of the coral may represent the pores through which the incurrent and excurrent papillae protrude.

The skeletal arrangement, physiological significance of the diaphragm and other details have been well described by Sollas (1878).

Spicules: 1. Tylostyles—Straight or slightly curved. Head spherical or trilobed. Greatest width of the spicule slightly beyond the central portion. Length varies from 0.151 to 0.182 mm (0.168 mm average) and width from 0.003 to 0.005 mm (0.004 mm average). Diameter of the head 0.008 mm.

2. Mucronate spicules—Head spherical or trilobed, with a stout and short shaft. They may end blindly or in a mucrone of about 0.004 mm. Axial canal well developed in some. Total length of the spicule varies from 0.063 to 0.084 mm (0.07 mm average), width of the shaft from 0.006 to 0.025 mm (0.018 mm average), and that of the head from 0.008 to 0.025 mm (0.021 mm average).

No microscleres were seen in the present specimen. Spherules of about 0.008 mm diameter were abundantly present.

Branches infested by this sponge often exhibit stunted growth.

Distribution: Indian Ocean, Australian region.

Depth: 2 m.

Cliona orientalis Thiele

(Pl. II, Fig. 2. 2A, 2B)

Suberites coronarius Carter, 1887, p. 74, pl. 7, figs. 4-5.

Not *Suberites coronarius* Carter- (1882).

Cliona coronaria Dendy, 1916, p. 132.

Cliona orientalis Thiele, 1900, 0.71, pl. 3, fig. 24. Annandale, 1915, p.13.

Levi, 1958, p. 18, fig. 13. Thomas, 1968 (unpublished).

Material: Specimens from six coral rocks.

Description: It usually spreads on the surface of the coral rock in all directions and never grows beyond the surface to a massive form. The substratum beneath presents a highly disintegrated appearance. In some parts, sponge tissue is seen to a depth of 120 mm. Chambers found inside are very small, 1 to 2 mm in width and usually extend vertically downwards.

Colour of the surface always deep brown with pale yellow interior. Oscules are scattered irregularly on the surface; their outline irregular, with a distinct sphincter. Diameter, 2 to 5 mm and highly contractile.

Surface hispid on account of the brushes of tylostyles. Main skeleton consists of dense irregular bands of tylostyles running towards the surface. At the outer part they project out in a brush-like pattern.

Spicules: 1. Tylostyles—Straight and sharply pointed. Head spherical. Length varies from 0.182 to 0.431 mm (0.366 mm average) and width of the shaft from 0.004 to 0.16 mm (0.013 mm average), head 0.015 mm in average diameter.

2. Spirasters—Resemble the "bent fragments of broken fretsaws" (Dendy, 1916). Most of them are 'C' shaped but rarely 'S' shaped forms are also noted. Spines blunt and on the convex surface only. Length up to 0.024 mm.

This species is quite abundant in the Gulf of Mannar and Palk Bay at a depth of 1-3 metres. It is usually seen spreading on the upper part of the coral rocks and sometimes may occupy an area of even 2 metres in diameter. The colour is so characteristic and hence the presence of this sponge can be easily detected from a distance.

Distribution: Red Sea, Indian Ocean, Australian region.

Depth: 1-4 m.

Cliona margaritiferae Dendy

(Pl. III, Fig. 1)

Cliona margaritiferae Dendy, 1905, p. 128, pl. 5, fig. 9 Hentschel, 1909, p. 367. Annandale, 1915, p. 9

Description: Chambers rounded or oval in form, connected with one another by narrow tunnels. From the inner side of the chambers slender, elongated conical canals radiate at various angles towards the interior. The walls of the excavations have a finely granulated appearance. Vertical canals opening at the surface have a diameter of 0.65 mm. The incurrent and excurrent pores are supported by both mega and microscleres.

Spicules: 1. Tylostyles—Straight, slender, gradually sharply pointed. Size about 9.25×0.004 mm Head globular 0.006 mm in diameter. They are

distributed irregularly and abundant in the neighbourhood of incurrent and excurrent pores.

2. Spined microxeas—Angulated in the middle. Size 0.06×0.0027 mm. Gradual transition between spirasters and microxeas is quite interesting.

3. Spirasters—Usually with about 4 angulations. Fairly stout and abundantly but rather minutely spinous. Size $0.024 \text{ mm} \times 0.004 \text{ mm}$.

Annandale (1915) recorded this species infesting madreporarian coral from Palk Bay (Tondi; 51/2 fathom).

Distribution: Indian Ocean, Australian region.

Cliona quadrata Hancock

(Pl. III Fig. 2)

Cliona quadrata Hancock, 1849, p. 344, pl. 15, fig. 6. Annandale, 1915a p. 462. Burton, 1956, p. 122.

Cliona warreni Carter, 1880, p. 370, pl. 18, fig. 6.

Description: Original description reads:—"Sponge composed of large irregularly quadrate lobes 1/6th of an inch wide, with the angles obtuse, connected without apparent order by several small, cylindrical stems passing irregularly from all sides, occasionally in pairs; sometimes enlarged and flattened and arising from a depression in the side of the lobe: terminal twigs rather stout, fine and linear; papillae not very numerous, about 1-24th of an inch in diameter, and placed rather far apart."

The diameter of the chambers found inside the substratum (*Melobesia*) varies from 1.5 to 3 mm (Carter 1880). The colour of the specimen is dark brown when dry. The squareness of the excavations is the most characteristic feature of this species.

Spicules: Tylostyles—Head spherical, shaft large and fusiform; sharp-pointed at the tip. Length 0.4 mm and width 0.015 to 0.017 mm.

This species was first recorded from the shells of *Tridacna gigas* and later Carter (1880) obtained this species from the Gulf of Mannar "growing under *Melobesia*".

Distribution: Mediterranean Sea, South Atlantic, Indian Ocean.

Cliona varidis (Schmidt)

(Pl. II, Fig. 1)

Cliona varidis Hechtel, 1965 p. 61 (Synonymy).

Material: One coral rock infested with this species.

Description: Papillae small, 1 to 3 mm in diameter and 1 to 3 mm high. Galleries found inside the coral, 3 to 10 mm, irregular in outline. Colour is yellow when alive.

Papillae hard and leathery. Refracting granules are abundant in the surface, 0.006 mm in diameter. In the interior of the chambers spirasters and tylostyles are arranged in an irregular pattern.

Spicules: 1. Tylostyles—Straight or slightly curved. Head ovoid with greatest diameter nearer the terminus, gradually and sharply pointing. Length varies from 0.210 to 0.373 mm (0.287 mm average) and width from 0.002 to 0.014 mm (0.008 mm average).

2. Spirasters—Quite well represented, with 4 to 5 curves. Spines long (0.008 mm) conical and at the convex parts. Straight forms are also rarely met with. Length varies from 0.030 to 0.048 mm and shaft is 0.001 to 0.002 mm wide.

Distribution: Atlantic Ocean, Mediterranean Sea, Red Sea, Indian Ocean, Australian region, Pacific Ocean.

Depth: 3 m.

The other group of Clionid sponges, i.e. *Thoosa* group, is not widely distributed, unlike the *Cliona* group, in the Gulf of Mannar and Palk Bay. The present survey failed to record any species, but genera and species which are recorded by previous workers are as follows:—

Genus THOOCE de Laubenfels

de Laubenfels created this genus in 1936 with the type *Thoosa socialis* Carter (1880). The characteristic feature of this genus is the total absence of *megascleres*. *Microscleres* found here are similar to those characteristic of the genus *Thoosa* Hancock.

Thoosa socialis (Carter)

(Pl. III, Fig. 5)

Thoosa socialis Carter, 1880, p. 56, Pl. 5, fig. 23.

Carter collected this species from *Melobesia*. Spicules are of two types.

1. Amphistyls—Consisting of a central shaft upon which are arranged ten globular microspined projections which finally by their enlargement obscure the shaft. Size about 0.032 x 0.020 mm

2. Discs—Circular in outline, compressed, rough or irregularly microspined and wrinkled. Size about 0.020 x 0.016 mm

Distribution: Indian Ocean.

Genus DELECTONA de Laubenfels

This genus was created by de Laubenfels (1936) with type *Alectona higgini* Carter (1880). Here three types of spicules are present (not one type as mentioned by de Laubenfels (1936, p. 156). They are (1) rhabd with subspherical swellings, (2) toxiform oxeas and (3) peculiar asters with 8 or more capitate rays.

Delectona higgini (Carter)

(Pl. III, Fig. 4.)

Alectona higgini Carter, 1880, p. 58, Pl. 5, figs. 25.

According to Carter (1880) "this is essentially an excavating sponge; for the whole nodule is honeycombed by it; and the largest cavity exposed is one sixth of an inch in diameter, fenestrated towards the surface and in the direction of the other cavities which surround it, so that there can be no doubt of its nature".

Genus DOTONA Carter

Main megascleres styles and microscleres spirasters of two types. Type *Dotona pulchella* Carter, 1880.

Dotona pulchella Carter

(Pl. III, Fig. 3.)

Dotona pulchella Carter, 1880, p. 57, Pl. 5, Fig. 24. Topsent, 1904, p. 108, pl. 12, fig. 2.

Description: Boring sponge making extensive galleries inside calcareous substratum; diameter of chambers varies from 3 to 5 mm

Spicules: 1. Styles—Slender, smooth, length 0.08 mm

2. Spirasters—with cylindrical and curved shaft, head microspined and with spiral ridge running throughout the surface. Length 0.048 mm and width 0.0045 mm

3. Spirasters—Shaft straight with a central whorl of spines and tips with diverging spines. Total length 0.006 mm

D. pulchella, recorded from Azores (Topsent, 1904), has larger spicules. Measurements are, styles, 0.100 x 0.003 mm; spirasters, 0.110 to 0.120 x 0.006 mm, spirasters, 0.006, to 0.008 x 0.002 to 0.003 mm.

Distribution: Indian Ocean, Atlantic Ocean.

Family JASPIDAE de Laubenfels

Megascleres monaxon and astrose microscleres. This family, based on the possession of different types of microscleres is divided into two subfamilies. In the first subfamily Rhabdistiinae de Laubenfels, streptasters are also included

with the typical spiculation of the family. Subfamily Jaspinae de laubenfels has only euasters.

Genus JASPIS

Jaspis penetrans (Carter)

(Pl. I Fig 6, 6A, 6B)

Tisiphonia penetrans Carter, 1880, p. 141, pl. 7, fig. 44.*Coppatias* (*Tisiphonia*) *penetrans* Dendy, 1905, p. 231*Coppatias penetrans* Annandale, 1915, p. 459

Material: This species is collected from coral rocks infested with other boring sponges.

Description: There is no definite shape for the galleries made by this species and in most cases the sponge is found along with other species of *Cliona*.

The skeleton consists of large oxeas strewn irregularly intermingled by microxeas. Asters are very small and are distributed irregularly throughout the tissue.

Spicules: 1. Large oxeas—Gradually and sharply pointed. Length varies from 0.339 to 0.603 (0.47 mm average) and width from 0.004 to 0.012 mm.

2. Microxeas—Evenly curved or slightly biangulated. Average size 0.063 x 0.004 mm.

3. Oxyasters—With 6 rays usually. Rays conical and microspined. Size 0.008 to 0.014 mm.

Spicular measurements of the present specimen, especially of larger oxeas, are slightly larger than those observed by Carter (1880). In the present specimen the length of oxea reaches up to 0.603 mm. The similarity between the spicules of this species and those of the subspecies of *Zaplethea digonoxea* (ssp. *diastra* Vacelet and Vasseur, 1965) is quite striking. The variety *diastra* is represented in the Gulf of Mannar also (Thomas, 1968). But the subspecies *diastra* never enters into a boring stage, and spicules have greater dimensions.

Distribution: Indian Ocean.

Depth: 1-5 m.

Order CARNOSIDA Carter

Family HALLINIDAE de Laubenfels

Fleshy Demospongiae lacking radiate structure. Calthrops present, and generally microscleres also. This family is divided into two subfamilies — Halininae de Laubenfels and Corticiinae Vosmaer. In the former streptasters are common whereas in the latter, euasters.

Subfamily HALININAE de Laubenfels

Genus HALINA Bowerbank

Calthrops with dichomodifications and streptasters straight. Type *H. bucklandi* Bowerbank (S. D. de Laubenfels, 1936).

Halina plicata (Schmidt)

(Pl. II, Fig. 6, 6A, 6B)

Stoeba plicata

Annandale, 1915a, p. 458 (Synonymy).

Material: Specimens from one coral rock.

Description: Chambers found inside the substratum small, 1 to 3 mm in diameter; circular or oval in outline. Shape of the sponge tissue exactly the same as the outline of the chamber. From such masses cylindrical branches are given off in different direction. Each branch given off from a mass inside the chamber in the initial stage is conical in outline. Branches formed may vary in diameter from 0.01 to 0.1 mm, outline circular or flattened. Rarely branchlets are given off from such branches at irregular intervals. Tip portion of each branch gets expanded after a short distance and this part forms the 'nucleus' of a future chamber.

Small slender spicules figured by Topsent (1896, pl. 22, o'd') were not present in any of the slides examined.

The dichotriaenes are arranged with their shafts pointing towards the inner side of the chamber. Streptasters are distributed densely at the outer part of such masses.

Spicules: 1. Dichotriaenes—Shaft conical, 0.063 mm average length, and width up to 0.016 mm. Clads rarely trifid; malformations of clads quite common. Measurements are:—Protoclad: 0.033 x 0.021 mm; deuteroclad: 0.079 x 0.016 mm; chord: 0.21 mm.

2. Streptasters—Straight, spines at both ends and with two or more whorls at the centre of the shaft. In some, spines are distributed irregularly. Length from 0.008 to 0.014 mm and width of the shaft 0.002 mm (excluding spines).

This species, according to Annandale (1915a), is common in dead coral in Indian Seas associated with some species of *Cliona*. The excavations made by this sponge on coral rock is quite characteristic and in such excavations no species of *Cliona* is found.

Distribution: Mediterranean Sea, Indian Ocean, Australian region.

Subfamily CORTICIINAE Vosmaer

Genus SAMUS Gray

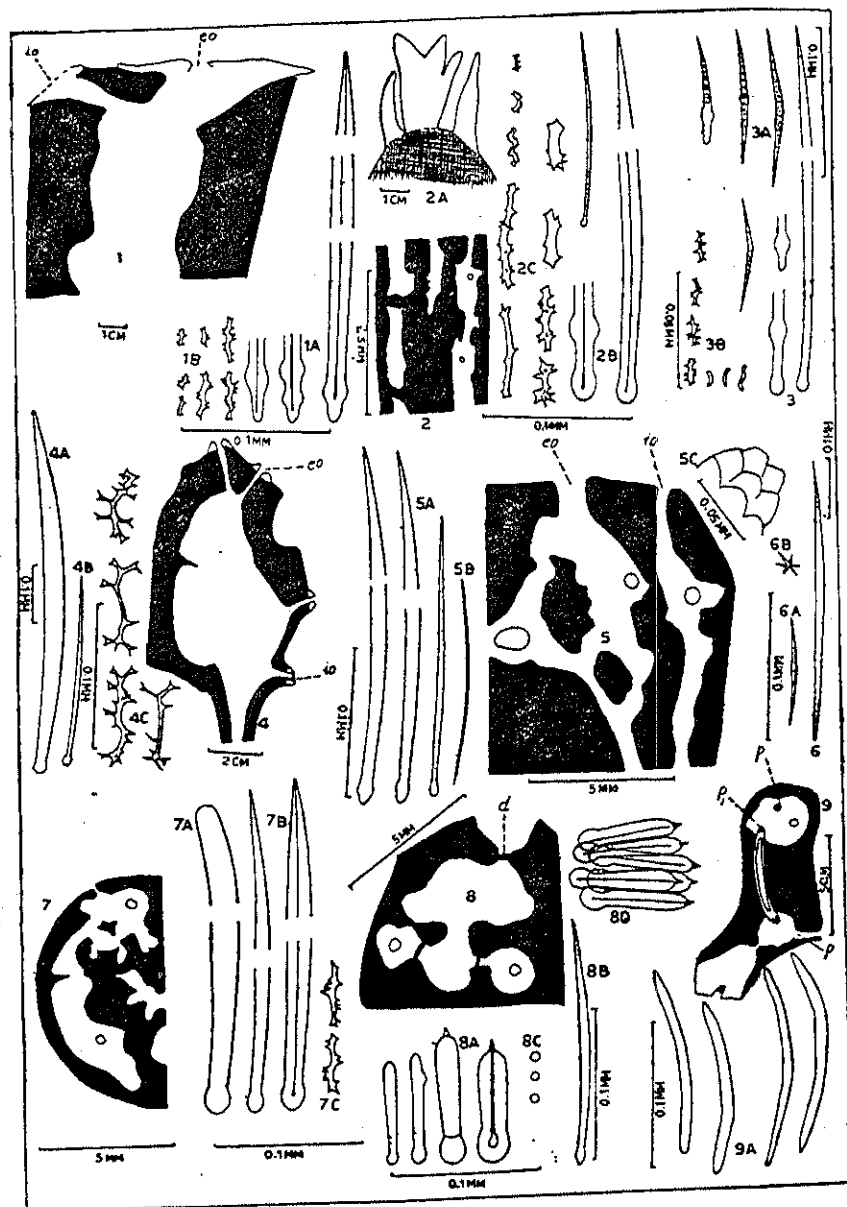


PLATE 1.

EXPLANATION TO PLATE 1.

Spirastrella inconstans (Dendy)

1- Boring pattern. 1A- Tylostyles. 1B- Spirasters

Spirastrella cuspidifera (Lamarck)

2- Boring pattern. 2A- Papillae. 2B- Tylostyles. 2C- Spirasters

3- *Cliona vastifica* Hancock

3- Tylostyles. 3A- Oxeas. 3B- Spirasters

Spirastrella aurivilli Lindgren

4- Boring pattern. 4A- Tylostyle (Large). 4B- Tylostyle (Small) 4C- Spirasters.

Cliona celata Grant

5- Boring pattern. 5-A Tylostyles. 5B- Oxea. 5C- Microscopic structure of the inner surface of the galleries.

Jaspis penetrans (Carter)

6- Oxea (Large) 6A- Microoxea. 6B- Oxyaster.

Cliona ensifera Sollas.

7- Boring pattern. 7A- Ensiform spicule. 7B- Tylostyles. 7C- Spirasters

Cliona mucronata Sollas

8- Boring pattern. 8A- Mucronate spicules. 8B- Tylostyle. 8C- Sphaerules 8D- Arrangement of mucronate spicule in the diaphragm.

Aka diagonoxea Thomas

9- Boring pattern. 9A- Oxeas

d-Diaphragm

eo- Excurrent openings

ieo- Incurrent openings

p- Pores

p -Pores situated on pillar like structures radiating to the chambers.

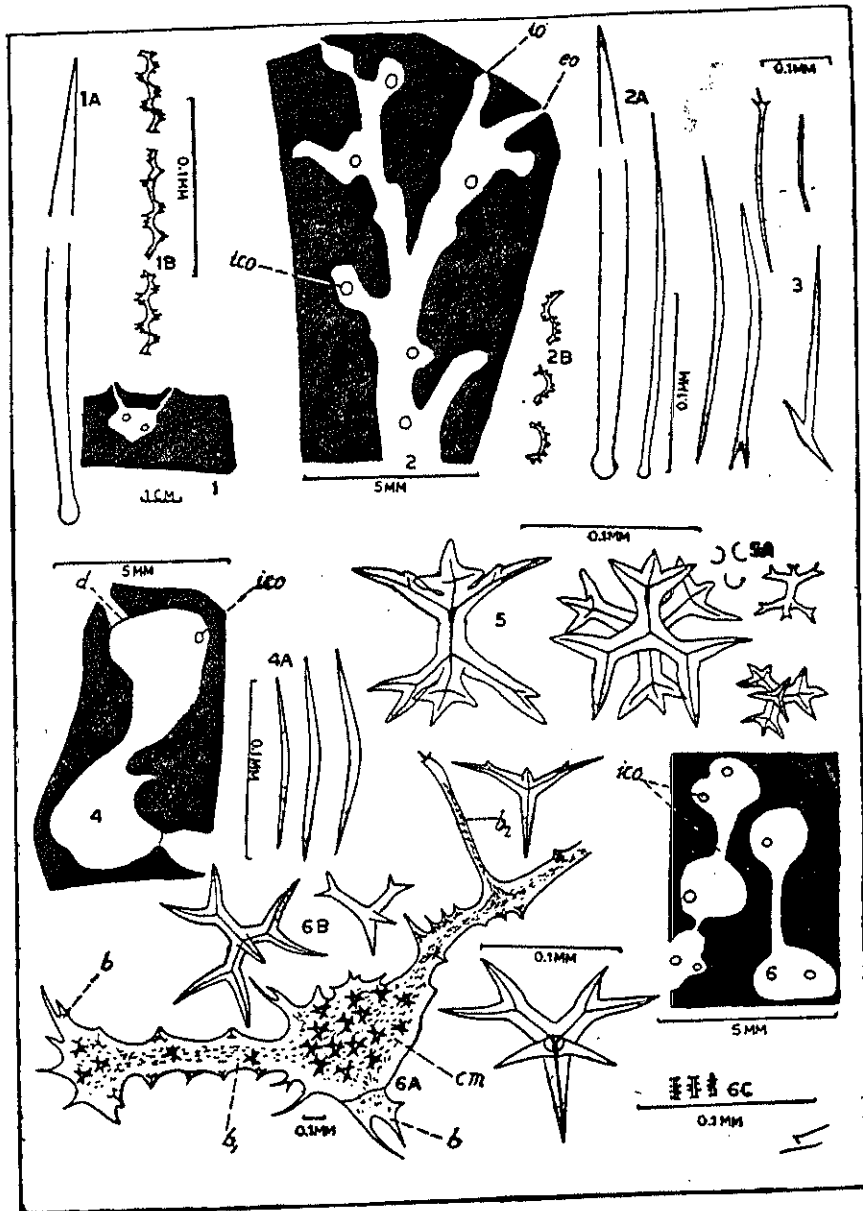


PLATE 2.

EXPLANATION TO PLATE 2.

Cliona viridis (Schmidt)

1- Boring pattern. 1A- Tylostyle. 1B- Spirasters

Cliona orientalis Thielei

2- Boring pattern. 2A- Tylostyles. 2B- Spirasters

Amorphinopsis excavans Carter

3- Spicules

Aka minuta n. sp.

4- Boring pattern 4A- Oxeads.

Samus anonyma Gray

5- Amhitriaenes. 5A- Sigmas

Halina plicata (Schmidt)

6- Boring pattern. 6A- Structure of the sponge occupying the chamber.

6B- Dichotriaenes-different stages.

b Stolon- initial stage

b'- Stolon- advanced stage, giving rise to a "nucleus" at its extremity.

b2- Branchlet given off from a stolon.

cm- Central mass inside a chamber.

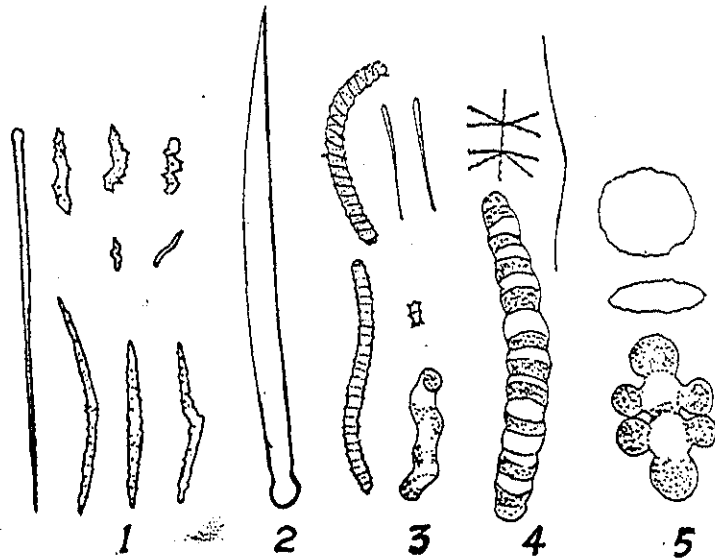
d- Diaphragm.

eo- Excurrent opening.

io- Incurrent opening.

ico- Inter chamberal opening.

PLATE III



- 1- Spicules of *Cliona margaritiferae* Dendy
 2- Spicules of *Cliona quadrata* Hancock
 3- Spicule of *Dotona pulchella* Carter
 4- Spicules of *Delectona higgini* (Carter)
 5- Spicules of *Thooce socialis* (Carter)

Spiculation of this genus is peculiar in that there are sigmas along with ambhithriaenes. Type *Samus anonyma* Gray, 1867.

Samus anonyma Gray

(Pl. II, Fig. 5, 5A)

Samus anonyma Gray 1867, p. 526.

The author, like many previous workers, failed to locate a specimen *in situ* in coral rock. But the presence of this species is quite conspicuous, because any spicule preparation for *Cliona* species contains several of these peculiar spicules characteristic of *Samus*.

Spicules: 1. Amphithriaenes—Characteristic of this species. In well developed forms protoclad, 0.021 x 0.12 mm and deuteroclad, 0.033 x 0.008 mm. Clads bifid or trifid. Total length 0.050 to 0.132 mm.

2. Sigmas—C shaped 0.008 to 0.010 mm chord length.

Distribution: Atlantic Ocean, Indian Ocean, Australian region, Pacific Ocean.
Depth: 2 to 5 m.

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DISCUSSION

- PICHON: Is the activity of the sponges same in the different parts of the reef? Do you also find the same species of sponges occurring in the different parts of the reef?
- THOMAS: The activity is almost same. And in the shallow fringing reefs investigated, most of the species are found throughout the width of the reef.

- BAKUS: Boring sponges attack the bases of branching type of corals and weaken them so much that during times of turbulence the corals are broken easily allowing for the massive forms to thrive. Have you found such occurrence?
- THOMAS: The role of boring sponges in this particular aspect here was not ascertained, though they are found in plenty at the basal portions of branching species.
- PICHON: Did you find incidence of attack of sponges more on branching or non-branching types of corals?
- THOMAS: The incidence is comparatively more on the non-branching corals in this area, probably due to their abundance.
- BAYNE: Have you made any observations as to the depth of penetration of the sponges inside the corals?
- THOMAS: I have seen sponges penetrating to about 7.5 cm in massive *Porites*.
- MCCLOSKEY: Have you observed sponges colonising channels or passages made by other borers. Do they show any preference to such channels?
- THOMAS: Not necessarily. In the genus, *Samus*, I have noticed them in channels made by *Cliona*.

QUANTITATIVE AND QUALITATIVE ASPECTS OF THE NEMERTEAN FAUNA IN TROPICAL CORAL REEFS*

ERNST KIRSTEUER

*Department of Living Invertebrates, The American Museum of Natural History,
New York, N. Y., U. S. A.*

ABSTRACT

Collection of substrate samples by diving and use of a new method for extracting all nemerteans from these samples made it possible for the first time to obtain information on the composition of the nemertean fauna in coral reefs. Based on 40 quantitative samples taken along a transect through the fringing reef of Tanikely, near Nossi Be, Madagascar, the distribution of nemerteans in the collecting area is presented. The influence of surface configuration and internal cavity systems of the substrate on the faunal composition is shown by the example of 6 selected coral species exhibiting different growth patterns. The proportions of living to dead coral material in the samples and the correlated fluctuations of the population density is discussed and interpreted as an indication of a further edaphic factor governing the distribution of nemerteans. By also using additional data from field work in the Red Sea and Caribbean Sea, the general systematic character of the nemertean fauna in coral reefs is evaluated and compared with the nemertean fauna of other marine biotopes.

INTRODUCTION

The nemertean fauna of tropical coral reefs remained for almost two centuries virtually unknown. Out of approximately 450 faunistic and ecological papers published until 1960 only 20 refer occasionally to species collected in reef areas. As far as the Indian Ocean is concerned 73 species of benthic marine nemerteans became known; however, only for 11 species the data indicate their occurrence "in reefs" or "on corals". These species are represented by conspicuously large forms incidentally obtained when coral heads were broken up into pieces, a fact which clearly indicates that the main reason for our insufficient knowledge of reef-inhabiting nemerteans was a lack of proper methods for collecting them.

METHODS AND RESULTS

Considering the complex surface structure of a coral reef, it becomes quite obvious that conventional collecting gears can not be effectively employed and the

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