

Proceedings of the
FIRST WORKSHOP ON SCIENTIFIC RESULTS OF
FORV SAGAR SAMPADA

5-7 June, 1989, Cochin

Sponsored by

DEPARTMENT OF OCEAN DEVELOPMENT
&
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI

Organized by

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
&
CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY
COCHIN

OCTOBER, 1990

Published by

Dr. P.S.B.R. JAMES

DIRECTOR

Central Marine Fisheries Research Institute

COCHIN - 682 031

Edited by

Dr. K.J. MATHEW

Central Marine Fisheries Research Institute

COCHIN - 682 031

DISCOVERY OF A DEEP WATER GORGONID BED OFF BOMBAY AND ITS QUALITATIVE APPRAISAL

P. A. THOMAS AND RANI MARY GEORGE

Central Marine Fisheries Research Institute, Cochin - 682 031

ABSTRACT

During the 22nd cruise of FORV *Sagar Sampada* (1-10 - '86 to 18 -10 -'86) a survey of the bottom fauna, especially of fishes, was made along the northwest coast of India between Lat. 18°N and 23°N, from 10 stations (*Sagar Sampada* St. Nos. 777-786) at depths varying between 65 and 130 m. Of these 10 stations, gorgonids were present at two stations (St. Nos. 783, Lat. 19°00'N and Long. 71°00'E; 784, Lat. 19°00'N and Long. 72°00'E) in appreciably good numbers.

The sample obtained from station 783 (depth: 86 m) was quantitatively and qualitatively richer with 8 species referable to 5 genera and 4 families, and was dominated numerically by two species, viz. *Gorgonella umbella* (Esper) and *Parisia fruticosa* Verrill. Samples from station 784 (depth: 68 m) included the above two species only indicating that both *G. umbella* and *P. fruticosa* are widely distributed in the depth range 68 to 86 m.

Two species, *Muricella nitida* Verrill and *Acanthogorgia turgida* Nutting are here reported from the Arabian Sea, and *Muricella dubia* Nutting from the Indian Ocean. It is also worth mentioning in this context that both *G. umbella* and *P. fruticosa* are not common in the near-shore areas, and when present never form extensive beds. Hence, the presence of these two uncommon species in extensive areas off Bombay is significant.

The information on the deepwater gorgonid bed presently gathered should never be used to indiscriminately exploit and export this rare commodity of our waters. Instead, attempts may be initiated to ascertain if the above two common and wide-spread species could form the source of any life-saving drugs, as are common in some other gorgonids. Since deepwater gorgonids from Indian waters are poorly known, the salient features of each species collected, together with suitable illustrations, are also presented in this paper.

INTRODUCTION

During the 22nd cruise of FORV *Sagar Sampada* an exhaustive survey of the bottom fauna, was made along the northwest coast of India from 23°N to 18°N . Out of 7 BTR (Bottom trawling) stations surveyed, gorgonids were collected from two stations (Nos. 783 and 784) situated at a distance of 1°. The gear employed for their collection was HSDT-1, the High Speed Demersal Trawl developed by C. I. F. T, Cochin, and the depth of operation varied from 65 to 130 m.

The species dealt with in the present account were collected from station No. 783 (10°00'N and 71° 00'E; depth: 86m), but 2 species, *Gorgonella umbella* (Esp.) and *Parisia fruticosa* Verrill, were also observed to be luxuriant in Stn. No. 784. This extended availability to Station No. 784 (19° 00'N and 72° 00'E; depth: 68 m) indicates their wide distribution in depth zone varying between 68 and 86 m off Bombay. Numerically speaking, *G. umbella* formed the dominant species followed by

P. fruticosa in Stn. No. 783. All the other species were represented by one or two specimens each; and the total number of species recorded from this deep-water bed is eight inclusive of four species that are new to the Arabian Sea. The present discovery of *Muricella nitida* (Verrill) and *Acanthogorgia ceylonensis* Thomson and Henderson, from the Arabian Sea has extended their distribution considerably in the Indian Ocean since both of them were known in the past from Sri Lanka waters only. *Muricella dubia* Nutting and *Acanthogorgia turgida* are here recorded from the Indian Ocean.

The general classification adopted here is that of Bayer (1963). Detailed descriptions and illustrations of the available species have been furnished here for their easy identification. Some ecological notes on the species, especially on the colony structure, as compared to their counterparts inhabiting the shallow water realms, have also been given along with each species to indicate the possible limiting effect of the depth factor on the colony structure in gorgonids.

The following species were present in this deep-water bed:-

LIST OF SPECIES

Order : Gorgonacea Lmx.

Suborder : Scleraxonia Studer

Family : Parisididae Aurivillius

1. *Parisis fruticosa* Verrill

Suborder : Holaxonia Studer

Family : Paramuriceidae Bayer

2. *Muricella nitida* (Verrill)

3. *M. dubia* Nutting

4. *Echinomuricea indica* Thomson and Simpson

Family : Acanthogorgiidae Gray

5. *Acanthogorgia turgida* Nutting

6. *A. ceylonensis* Thomson and Henderson

Family : Ellisellidae Gray

7. *Gorgonella umbraculum* (Ell. & Sol.)

8. *G. umbella* (Esper)

SYSTEMATICS

Order : Gorgonacea Lmx.

Suborder : Scleraxonia Studer

Axial part with spicules that are bound together either by horny or by calcareous material. Cortical spicules quite different from those of axial part.

Family : Parisididae Aurivillius

Arborescent monomorphic forms possessing internodal tuberculae spicules and nodal lobate rods; cortical spicules coarse plates; branches originate from calcareous internodes.

Genus: *Parisis* Verrill

Colonies branched in one plane; branches originate from calcareous internodes. Spicules thick and irregular with a median constriction and often beset with verrucae. Type, *Parisis fruticosa* Verrill.

1. *Parisis fruticosa* Verrill

(Fig. 1a: 1-9, Pl. 1G)

Parisis fruticosa Wright and Studer, 1889, p. 182, pl. 41; Thomson and Simpson, 1909, p. 176, figs. 74, 75; Nutting, 1911, p. 54; Kukenthal, 1924, p. 83 (Synonymy). *P. indica* Thomson and Henderson, 1905, p. 23, pl. 4, figs. 4, 5, 8, 9.

Material : Several specimens from stations 783 and 784.

Description : All specimens exhibit the same pattern of growth and branching. Basal attachment zone is not preserved well in any of the specimens examined. Branches and branchlets divide freely in one plane forming a more or less triangular expanse. Fusion of branches /branchlets not common. The main stem may measure upto 2.5 mm in diameter and is circular in cross section, but at places may show a tendency to get flattened in the plane of the colony. The ultimate branches may come upto 1 mm in diameter (excluding calyces). The largest specimen obtained had a height of 12.5 cm with an expanse of 4.7 cm for its lamella.

Calyces arranged laterally in a serial pattern; they are conical to dome-shaped and tilted to the distal end of the branch/branchlet, measure 0.6 mm in height and are distributed at distances of 1.3 mm on an average. Though the above given arrangement may be taken as the normal pattern, in older parts of the colony the calyces have been observed around the stem in an irregular pattern. But such calyces are fewer in number and placed well apart.

The axial skeleton is distinctly segmented with calcareous internodes and horny nodes (Fig. 1a: 5). The length of these internodes varies considerably from place to place within a range of 2-7 mm and are striated longitudinally (Fig. 1a: 6,7,9) , and these striae may continue through the nodes also. The diameter of the nodes may be the same as that of internodes in the main stem, while on branches and branchlets it may be slightly smaller; division is always from the internodes only (Fig. 1a: 5, 8).

The general surface, including that of calyces, is ornamented minutely with tubercles arising from cortical plate-like spicules. The coenenchyme is slightly thicker on the lateral parts of branches/branchlets.

Spicules : 1) Cortical plate-like spicules. With coarse tubercle - bearing mammiform protuberances from the surface; circular, oval or irregular in shape. Size upto 0.37 mm in diameter (Fig. 1a: 1). Nutting (1911) reported large plate-like spicules measuring upto 0.6 mm, but in all the present specimens they were smaller in size. 2) Quadriradiate, multiradiate or cruciform spicules. Size 0.028 to 0.080 mm (Fig. 1a: 2). 3) Spiny rods of internodes.

These spicules, in advanced stages, fuse to form a dense axial condensation, and is difficult to separate any single spicule from the internode when fully developed. Some young spicules could be separated and are figured in Fig. 1a: 3. At this young stage they may measure 0.18 - 0.33 X 0.008 - 0.020 mm (excluding spines). 4) Lobate rods of axial nodes. Curved with lobulations; size 0.12 X 0.004 mm (Fig. 1a: 4).

Biological notes : Earlier workers have reported the presence of associates like sponges and *Palythoa* on the specimens examined by them from different parts of the Indian Ocean. But all the present specimens were free from such associates.

Colour : Pink when alive, turning to white or yellow on dying. Those dried under direct sunlight turned white while those dried under diffused sunlight yellow. Internodes are white in colour while nodes, pale yellow. Spicules colourless.

Distribution : Widely distributed in the Indo-Pacific.

Depth : Littoral to deep-sea. Present specimens came from a depth range of 68 to 86 m off Bombay.

Order : *Holaxonia* Studer

The central axis, in this order, is made of horny material only, and may be reinforced with calcareous matter in varying degrees.

Family : *Paramuriceidae* Bayer

Central chord wide and chambered; polyps retractile within protruding calyces and with an armature of strong points of *en chevron* spicules usually resting on a transverse collaret; cortical spicules usually spindles, but modified 'thorn-scales' with or without the addition of other forms may also be included.

Genus : *Muricella* Verrill

Colonies branch in one place, branches may or may not anastomose. Calyces distinct and are in the form of truncated cones. Rind spicules in two layers; mostly spindles to which clubs or discoidal forms may be added. Tentacular operculum very distinct. Type, *Muricella nitida* (Verrill).

2. *Muricella nitida* (Verrill)

(Fig. 1b : 1-3, Pl. 1A)

Muricella nitida Thomson and Henderson, 1905, p. 302;

Kuken thal, 1924, p. 172 (synonymy).

Material : One specimen from station No. 783.

Description : Colony fan shaped; branches/branchlets show no sign of fusion. Branching irregularly dichotomous in the lower 2/3rd and branches / branchlets formed at this part are of unequal size, one being stouter than the other. Dichotomous division at the distal 1/3rd of the colony produces branchlets of equal size and dimensions. Diameter of the stalk is 2 mm and of branchlet, about 1 mm (excluding calyces). Height of the specimen is 9.8 cm and breadth, about 7 cm.

Calyces are arranged more abundantly towards the lateral parts of the branches/branchlets, leaving the front and back surfaces bare. At some places the calyces are arranged in an alternating manner; they are tubular to truncate in shape measuring 0.9 - 1.3 mm in height.

Spicules : 1) Warty spindles. Straight or slightly curved; size upto 1.6 X 0.18 mm (Fig. 1b: 1) 2) Small spindles of operculum. Size 0.37 X 0.037 mm (Fig. 1b: 2), 3) Crosses. Two arms may or may not be longer than others, when longer they may attain a size of 0.169 X 0.03 mm (Fig. 1b : 3).

Colour : Colony crimson red, axis brown and tentacular operculum, yellow. Spicules crimson red except those which are in their early stage of development.

Distribution : Known from Japan and Ceylon (=Sri Lanka), and is here reported from the Arabian Sea, off Bombay.

Depth : Upto 631 m; the present specimen was collected from a depth of 86 m.

3. *Muricella dubia* Nutting (Fig. 1c: 1-3; Pl. 1 F)

Muricella dubia Nutting, 1910, p. 34; Kukenthal, 1924, p. 173.

Material : Two specimens from Station 783.

Description : Colonies subflabellate and branched in one plane; branches simple or divide dichotomously without any trace of fusion. The basal attachment zone is retained in both specimens. Size of the first specimen, 3 X 2 cm and of the other, 5.8 X 3 cm.

Calyces are borne on both sides as also along the front and back portion of the stem and branches, they are globular in shape with a size of 0.6 X 1 mm

(height X diameter), and covered with warty spindles which are irregularly placed. Polyps retractile completely, operculum is usually sunk and is made of longitudinal spindles arranged *en chevron* over the tentacular base. Diameter of the stalk is 0.75 mm and that of branches about 0.5 mm.

Spicules : 1) Warty spindles, tuberculated, short and stout; one end broader than the other in some. Size upto 0.35 X 0.16 mm (Fig. 1c : 1). 2) Smaller spindles and crosses are also common in both specimens (Fig. 1c : 2, 3).

Colour : Colony light brown, axis dark brown fading to light brown in branches, spicules colourless.

Distribution : Known previously from Flores Sea and is here reported from the Arabian Sea.

Depth : 73 to 86 m.

Genus : *Echinomuricea* Verrill

Characteristic spicules of the genus are 'thorn-scales' with a single median spine bearing several root-like tuberculated structures from the basal part. Colonies branched in one plane and often reticulate. Thorn-scales are distributed over the calyces and general surface alike and their presence gives a characteristic appearance to the general surface. Type, *Nephthya coccinea* Stimpson

4. *Echinomuricea indica* Thomson and Simpson (Fig. 1d: 1-4; Pl. 1H)

Echinomuricea indica Thomson and Simpson, 1909, p. 204, pl. 3, figs. 2, 3; pl. 8, fig. 4; Kukenthal, 1924, p. 188, fig. 17; Thomas and Rani Mary Jacob, 1987, p. 23, fig. 1g, 2A; Thomas and Rani Mary George, 1987a, p. 104, Fig. 1i: 1-5.

Material : One specimen from Station 783.

Description : Colony complete except for its partly denuded skin on the basal branches and stalk portion. The attachment zone is well preserved in the specimen obtained and the stem is continued as the main branch up to a height of 2.5 cm. Smaller branches are given off from both sides of the stem and they divide as they go in one plane. There is no sign of anastomosis and the branchlets end bluntly. Size of the specimen, 6 X 5.5 cm (height X width).

The other details tally well with those of the specimens described from the Indian seas by Thomas and Rani Mary Jacob (1987).

Spicules : 1) Thorn scales. Thorn-like part is

well developed and robust; may measure upto 0.21 X 0.016 mm when well developed. The entire spicule may come upto 0.43 X 0.33 mm when well developed (Fig. 1d: 1). Other spicules include spindles (Fig. 1d: 2), multiradiates (Fig. 1d: 4) and crosses (Fig. 1d: 3).

Ecological notes : This species forms an important item of the 'black type' gorgonid now exported from India which is abundant at depths varying between 5 and 8 m in the Gulf of Mannar. Specimens collected from the Gulf of Mannar show that anastomosis of branches appears at an early stage, even before attaining the size of the present specimen. Simple branches, free from anastomosis as seen in the present case, may be a growth pattern induced by the depth factor.

Colour : Colony light yellow when collected, axis black and spicules colourless.

Distribution : Indo-Australian.

Depth : Upto 86 meters.

Family : *Acanthogorgiidae* Gray

Axis horny with wide-chambered axial chord; rind thin and polyps non retractile; calyces prominent, tubular with spindles arranged *en chevron* and in characteristic crown-like fashion along the margin. Spicules include bent spindles (thorn-like spindles) ordinary spindles, multiradiates etc.

Genus : *Acanthogorgia* Gray

Typical genus of the family with type *Acanthogorgia hirsuta* Gray.

5. *Acanthogorgia turgida* Nutting (Fig. 1e: 1-4; Pl. 1C)

Acanthogorgia turgida Nutting, 1910, p. 21, pl. 1, fig. 2; Kukenthal, 1924, p. 241.

Material : One specimen from Station 783.

Description : Colony fan shaped; branches and branchlets show no signs of fusion. Basal attachment zone is well developed. The lateral branches are given off from the stalk at about 1 cm above the attachment disc. Several lateral branches may be also seen arising above its first division on both sides of the main stalk in an alternating fashion. The size of the specimen is 14 cm (height) X 8.2 cm (width). Stalk about 1.5 mm in diameter and branchlets about 0.5 mm.

Polyps are arranged on all sides of the stem,

branches and branchlets. They are cylindrical in shape and may measure upto 1.6 mm in height with a diameter varying 1-1.5mm. The crown of thorn quite distinct on the polyps that are seen along the actively growing parts of the colony. The rim of the calyces are generally darker than the rest of the calyces. *En chevron* arrangement of spicules give a distinct appearance to the calyx margin.

Spicules : 1) *Acanthogorgia* type of spicule with smooth pointed distal end and a warty basal portion. Size, 0.42 X 0.029 mm on an average (Fig. 1e: 1). 2) Large warty spindles. Slightly curved or even 'S' shaped. Size upto 1.13 X 0.09 mm (Fig. 1e: 2). 3) Small spindles. Size upto 0.37 X 0.029 mm (Fig. 1e: 3). 4) Multiradiates. Diameter up to 0.1 mm (Fig. 4e: 4).

Colour : Colony brown, axis golden brown and spicules colourless.

Distribution : Known only from Malay Peninsula and is here recorded from the Arabian Sea.

Depth: Upto 520 m.

6. *Acanthogorgia ceylonensis* Thomson and Henderson
(Fig. 1f: 1-3; Pl.1D)

Acanthogorgia ceylonensis Thomson and Henderson, 1905, p. 290; Nutting, 1910, p. 19; Kukenthal, 1924, p. 240.

Material: : Two specimens from Station 783.

Description : Colonies flabellate; basal attachment disc rather prominent. The stem and basal parts are mostly denuded. Division of the colony in one plane giving rise to an oval outline to the specimens. Main branches arising from the stalk are traceable upto 2/3rd of the colony; branchlets are given off in an opposite and alternate manner. The diameter of the stalk portion is about 1 mm while that of branches and branchlets vary from 0.4 - 0.6 mm. The larger specimen at hand is about 8.6 cm high and 9.8 cm wide.

Calyces small, tubular to conical in shape depending on the degree of contraction and measure about 0.6 - 1 mm in height and 0.6 mm in average diameter. They are sparsely distributed with a tendency to get arranged laterally on branches/branchlets. The crown of spines is conspicuous in almost all calyces and their presence gives a characteristic bristle-like appearance under magnification. The calyces at their basal parts are covered with spindles arranged horizontally. Coenenchyme,

which is rather thin, is densely charged with tuberculated spindles, stars and crosses. Rind and calyces deciduous in dry condition.

Spicules : 1) *Acanthogorgia* type of spicules; one end smooth and pointed and the other tuberculated in varying degrees. Their basal parts remain buried inside the calyx wall. Size upto 0.45 X 0.029 mm (Fig. 1f: 1). 2) Spindles. Straight or slightly curved; size upto 0.28 X 0.025 mm (Fig. 1f: 2). 3) Multiradiates. Size upto 0.16 mm (Fig. 1f: 3).

Colour : Calyces light yellow to white when dry, axis golden brown fading to white or yellow distally; spicules colourless.

Distribution : This was first reported from Ceylon (=Sri Lanka) and then from Malay Archipelago. It is here reported from the Arabian Sea.

Depth : Upto 112 m.

Family : Ellisellidae Gray

Colonies unbranched or sparingly branched and with or without anastomosis. Axis strongly calcified. Spicules small, consisting of characteristic dumb-bells, some modified into clubs or double spindles.

Genus : *Gorogonella* Val.

Colonies flabellate and often reticulate, calyces veruciform; cortex with double heads and double spindles to which others like crosses and stars may be added. Type, *Gorogonella umbraculum* (Ell. & Sol.)

7. *Gorogonella umbraculum* (Ell. & Sol.)
(Fig. 1g: 1-3; pl.1E)

Gorogonella umbraculum Nutting, 1910, p.8 (synonymy); Kukenthal, 1924, p. 381 (synonymy); Thomas and Rani Mary George, 1987a, p. 109, fig. 1s: 1-3.

Material : Two specimens from Station 783.

Description : Colonies flabellate and profusely branching in one plane; branches may rarely get interconnected. Calyces small and measure upto 0.5 mm in height and are densely distributed towards the actively growing parts of the colony, but may be lateral at other places. Height of the larger specimen, 14 cm with a lateral spread of 21 cm. The stalk portion is 3.2 mm in diameter and branchlets, 1.1 mm in diameter on an average.

Other details tally well with those of the specimens recorded from the shallower areas of the

southwest coast of India where they are exploited commercially (Thomas and Rani Mary George, 1987a).

Spicules : 1) Spindles. Size 0.06 - 0.1 X 0.024 mm (Fig. 1g: 1). 2) Dumb-bells. Size 0.06 X 0.02-0.03 mm (Fig. 2g: 2). 3) Small dumb-bells. Size 0.04 X 0.02 mm (Fig. 1g: 3).

Ecological notes : This species is widely distributed along the southwest and southeast coasts of India contributing considerably to the gorgonid fishery (of 'red-type') in these areas. Specimens in the aforementioned areas are collected from shallower depths (5 to 8 m) where they grow luxuriantly attaining a size of 100 X 80 cm or even more (Thomas and Rani Mary George, 1987a). The specimens dealt with here, when compared with those collected from the southwest and southeast coasts of India, appear rather frail with poorly developed branches and branchlets. The anastomosis of branches and branchlets were also very weak and a closely reticulated lamellar structure, as a rule, is wanting. It is also difficult to sort out specimens of *Parisita fruticosa* Verrill (*Vide supra*) that coexist with the present species, based on morphological differences. Whether the depth factor has anything to do with the morphology or not has to be ascertained by comparing several specimens from different depth zones.

Colour : Colony light orange, axial part pale white and spicules light yellow.

Distribution : Indian Ocean and Red Sea.

Depth : Upto 100 m.

8. *Gorgonella umbella* (Esper) (Fig. 1h: 1-3; Pl.1B)

Gorgonella verriculata Hickson, 1905, p. 816. *Gorgonella flexuosa* and *G. umbella* Thomson and Simpson, 1909, p. 372. *G. umbella* Kukenthal, 1924, p. 382.

Material : Several specimens from both stations.

Description : The stalk portion is not retained in some. Colonies flabellate and usually divide in one plane; but occasionally additional lamella may be seen arranged at an angle to the original one. Branches and branchlets, soon after their emergence, may curve out and grow, which results in the formation of curved or sinuous branches and branchlets. Branches end blindly and no sign of fusion could be noted. The largest specimen in the

collection had a height of 13 cm and a width of 11.6 cm.

Calyces distributed on all sides but their size and shape depend upon the degree of contraction; in some areas they may be conical and truncated while in others they may be flush with the surface. When conical, height upto 0.7 mm. Coenenchyme is thick and densely packed with warty spindles. Polyps fully contractile. Stem 4 mm and branchlets 3 mm in average diameter.

Spicules : 1) Spindles. Size upto 0.092 X 0.037 mm (Fig. 1h: 1). 2) Dumb-bells. Size upto 0.071 X 0.046 mm (Fig. 1h: 2). 3) Crosses. Diameter upto 0.05 mm (Fig. 1h: 3).

Colour : Colony white or pale yellow, axis black and spicules, colourless.

Distribution : Known only from the Indian Ocean.

Depth : Upto 495 m.

DISCUSSION

The occurrence of 8 species of gorgonids, of which two (*Gorgonella umbella* and *Parisita fruticosa*) in moderately good numbers, off Bombay in depth zone 68 to 86 m, is quite interesting. The above mentioned two species are not represented in any of the inshore areas.

The information gathered here on the distribution and abundance of the above mentioned two species should never be utilised to exploit them commercially for export.

The commercial exploitation of gorgonids initiated in 1975 has resulted in the depletion of many of our erstwhile rich gorgonid grounds. The average size of specimen fished out from the inshore areas has come down considerably in recent years, and hence a ban on the export of this commodity will only help in enriching our gorgonid beds (Thomas and Rani Mary George, 1987b).

Since many of the chemicals extracted from Gorgonids (Prostaglandins and the like) have biodynamic properties, we have suggested in the above paper that attempts should be initiated in India to extract various 'life saving drugs' from the raw material available in our inshore areas.

The bed now discovered off Bombay is rich, atleast in the case of the above mentioned species. Therefore, attempts may be initiated to ascertain if

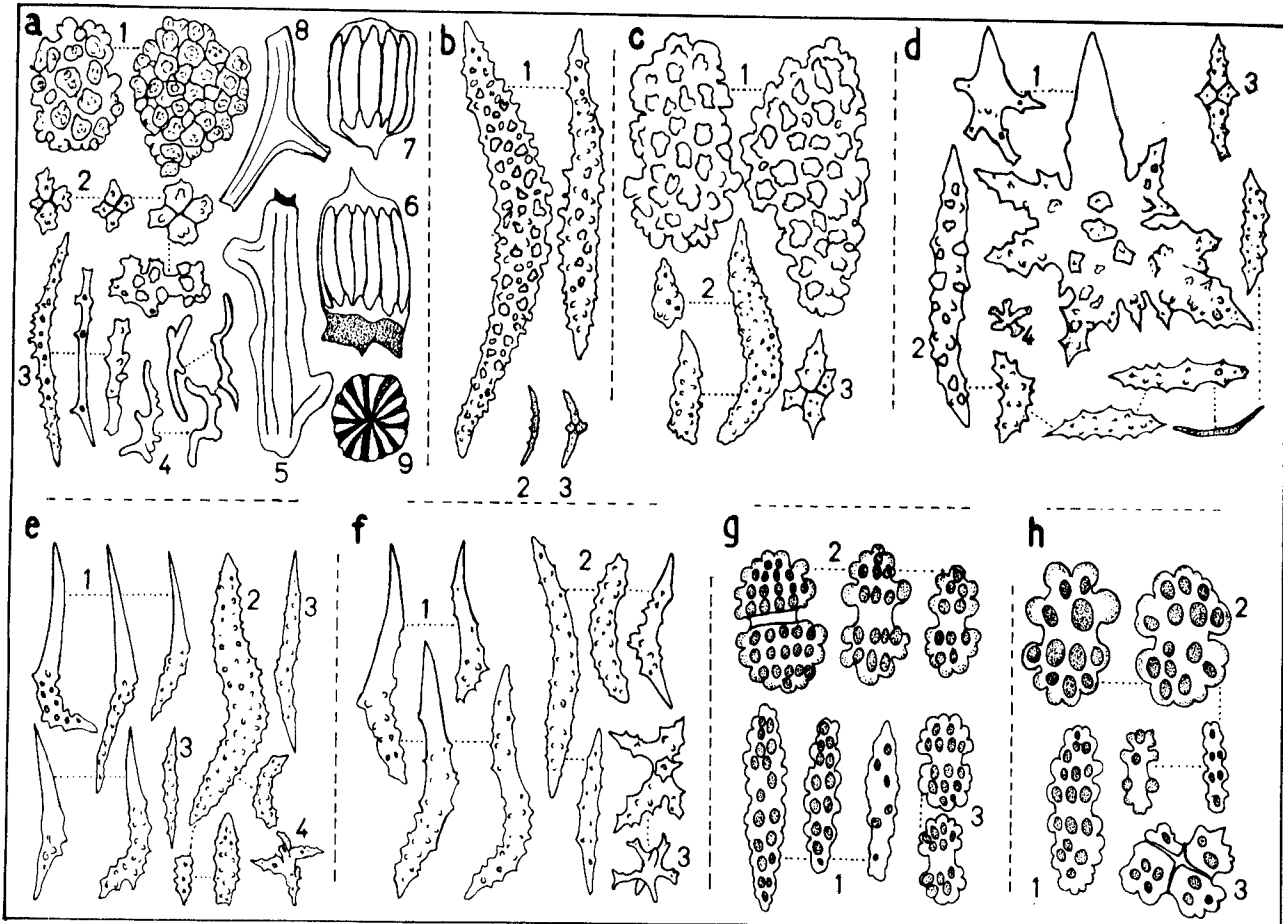


Fig. 1. a) *Parisia fruticosa* : 1. Plate-like spicules of cortex, 2. Quadriradiate and cruciform spicules, 3. Spiny rods of internodes, 4. Lobate rods of axial nodes, 5. Axial skeleton, 6 and 7. Nodes and internodes, a magnified view, 8. Axial skeleton showing the branch formation, 9. Enlarged view of the internode showing the surface ornamentation.
 b) *Muricella nitida*: 1. Warty spindles, 2. Small spindles, 3. Cross.
 c) *Muricella dubia*: 1. Warty stout spindles, 2. Small spindles, 3. Cross.
 d) *Echinomuricea indica*: 1. *Echinomuricea* type spicules, different growth stages. 2. Spindles, 3. Cross, 4. Multiradiate.
 e) *Acanthogorgia turgida*: 1. *Acanthogorgia* type spicules, 2. Large warty spindles, 3. Small spindles, 4. Multiradiate.
 f) *Acanthogorgia ceylonensis*: 1. *Acanthogorgia* type spicules, 2. Spindles, 3. Multiradiates.
 g) *Gorgonella umbraculum*: 1. Spindles, 2. Dumb-bells, 3. Small dumb-bells.
 h) *Gorgonella umbella*: 1. Spindle, 2. Dumb-bell, 3. Cross.

the above species could form the source of any 'life saving drugs' as are common in some other gorgonids.

ACKNOWLEDGEMENTS

We are grateful to Dr. P. S. B. R. James, Director, C. M. F. R. Institute for giving us the opportunity to go onboard FORV *Sagar Sampada*, to collect and study the material and also to publish the findings. It is a special pleasure to acknowledge the helpful suggestions and criticism of Shri C.

Mukundan, Scientist (Retd.), C. M. F. R. I., that we received during the preparation of this paper. We also wish to acknowledge the enthusiasm that has been shown by various crew members, especially S/Shri. Thomas Teles and Nirmal Mathews, Fishing Masters, in sorting out the trawl catches after every operation.

The photographs presented in Plate 1 have been prepared by Shri. Raghavan, Artist Photographer, C. M. F. R. I., and we wish to record our appreciation for this courtesy.

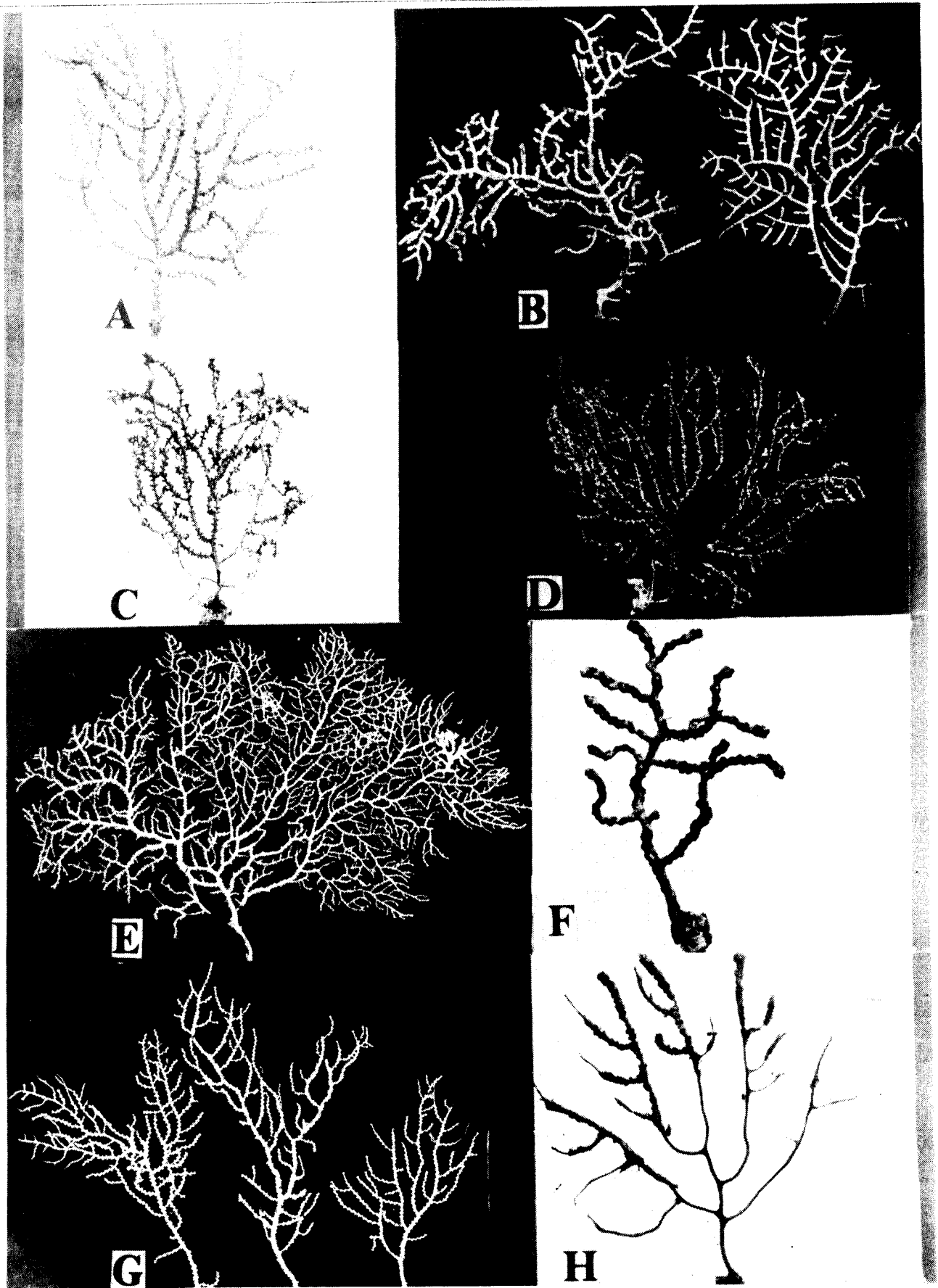


Plate 1. A. *Muricella nitida*, B. *Gorgonella umbella*, C. *Acanthogorgia turgida*, D. *Acanthogorgia ceylonensis*, E. *Gorgonella umbraculum*, F. *Muricella dubia*, G. *Parisis fruticosa*, H. *Echinomuricea indica*.

REFERENCES

- BAYER, F. M. 1963. Octocorallia. In : *Treatise on Invertebrate Palaeontology*. R. C. Moore (Ed.), Part F, Geological Society of America and University of Kansas Press, F 194-F 294.
- HICKSON, S. J. 1903. Alcyonaria of the Maldives. Part 1. In : Gardiner, J. S. (Ed.), *The fauna and Geography of the Maldive and Laccadive Archipelagoes*. Cambridge Univ. press, 473 - 503.
- HICKSON, S. J. 1905. The Alcyonaria of Maldives. Part 3, *Ibid.*, 807-826.
- KUKENTHAL, W. 1924. Gorgonaria. *Das Tierreich*, 47 : 1-478.
- NUTTING, C.C. 1910. The Gorgonacea of the Siboga Expedition. III. The Muriceidae. *Siboga Exped.*, 13 b : 1- 108.
- NUTTING, C. C. 1910 a. The Gorgonacea of the Siboga Expedition. VI. The Gorgonellidae. *Siboga Exped.*, 13b³ : 1- 39.
- NUTTING, C. C 1911. The Gorgonacea of the Siboga Expedition. VIII. The Scleraxonia. *Siboga Exped.*, 13 b⁵ : 1-62.
- STIASNY, G. 1937. Die Gorgonacea der Siboga Expedition . Suppl. II Revision der Scleraxonia. *Siboga Exped.*, 13 b⁶ : 1-138.
- THOMAS, P. A. AND RANI MARY JACOB 1987. On five species of commercially important gorgonids new to Indian seas. *Indian J. Fish.*, 34 (1) : 20-27.
- THOMAS, P. A. AND RANI MARY GEORGE 1987a. A systematic appraisal of the commercially important gorgonids of the Indian seas. *J. mar. biol. Ass. India*, 28 (1&2) : 96 - 112.
- THOMSON, J. A AND W. D. HENDERSON 1905. Report on the Alcyonaria collected by Prof. Herdman, at Ceylon, in 1902. *Rep. Govt. Ceylon Pearl Oyster Fish.*, *Gulf of Mannar*, 3 : 269-328.
- THOMSON, J. A. AND J. J. SIMPSON 1909. *An Account of the Alcyonarians Collected by the R. I. M. S. 'Investigator' in the Indian Ocean*. Pt. 2 The Alcyonareans of the littoral area. Trustees of the Indian Museum, Calcutta, 1-318.
- WRIGHT, E. P. AND TH. STUDER, 1889. Report on the Alcyonaria collected by by H. M. S. 'Challenger' during the years 1873-'76. *The Voyage of H. M. S. 'Challenger'*, *Zoology*, 31.