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A SYSTEMATIC APPRAISAL OF THE COMMERCIALLY IMPORTANT GORGONIDS OF THE INDIAN SEAS

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ABSTRACT

The discovery of prostaglandins in gorgonids and their clinical possibilities initiated a general interest in this group as an easily available source of several 'wonder drugs'. The exploitation of gorgonids on a commercial basis from the Indian Seas since 1975 may be said to be a part of this world-wide 'hunt' for raw materials. These organisms are now being exported to several countries at an average rate of 3.6 tonnes per year under rough commercial grouping of 'black', 'red', 'monkey tail' and 'flower' types.

During the present survey specimens were examined both from the fishing centres and export samples. This study indicated that 22 species of gorgonids are being exploited from the Indian Seas at present and these are referable to 7 families and 15 genera. Among the families, the Paramuriceidae Bayer is well represented in the commercial landings with 9 widely distributed species under 5 genera. This is followed by Ellisellidae Gray with 7 species under 5 genera. Species such as *Echinomuricea indica* Thomson and Simpson, *Heterogorgia flabellum* (Pallas), *Gorgonella umbraculum* (Ell. and Sol.), *Leptogorgia australiensis* Ridley and *Juncella juncea* (Pallas), form the mainstay of the export in the order of abundance,

Detailed descriptions of all species, their classification, distribution, size attained, etc. are presented in this paper with sketches of spicular complements to facilitate easy identification.

INTRODUCTION

INDIA stepped up the commercial exploitation of gorgonids during 1975 and the material is now being exported to countries like France, West Germany, Belgium, U. S. A., and Netherlands, to mention a few. The total quantity exported from India during the period 1974 to 1984 was estimated at 36.4 tonnes valued at Rs. 9.33 lakhs.

Though the reason behind such imports by the above countries is not clear, it is inferred that the discovery of prostaglandins (PGE, PGF, PGF_2, PGF_2—alpha, PGF_2—beta and the like) in 1969 by Weinheimer and Spraggins from *Plexaura homomalla* (Esper), a Caribbean species, triggered of a world-wide 'hunt' for the species or its congeners. Prostaglandins, or derivatives thereof, now serve as 'wonder drugs' for many a systemic disease in man and animal and enamoured of their clinical possibilities several pharmaceutical firms have stepped up their production on a commercial basis. The present demand for gorgonids of Indian waters may be said to be a part of this world-wide 'hunt' for raw materials.

In order to conduct resource surveys for the availability, abundance and distribution of different species of gorgonids from selected centres a project was initiated by the Central Marine Fisheries Research Institute, Cochin in 1980 and the salient findings that emerged from this survey are being published elsewhere (Thomas and Rani Mary George, 1986, 1986 a).

The present communication, which formthe third one in the series, deals with the systematics of 22 species of gorgonids which are being exported from India. These 22 species are referable to 7 families and 15 genera.

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The gorgonids exported from India are commercially classified under 4 heads or 'types': 'Black', 'Red', 'Flower' and 'Monkey tail'. The examination of export data from some places indicates that another type by name 'White' was included at some centres in the past. This 'type' is nothing but the name given to the skeleton of under sized 'Red' type gorgonids from which the outer coloured cortex (or skin) has been removed. The commercial classification, thus, is based mainly on colour and body form and no genetic affinity, whatsoever, is taken into consideration. The natural classification of commercially esteemed species of the Indian seas is given below. Those which are marked with an asterisk (*) are new records to the Indian seas.

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SYSTEMATICS

Order: GORGONACEA Lmx.

Suborder: SCLERAXONIA Studer

Axial zone with spicules which are bound together either by horny or calcareous material. Cortical spicules quite different from those in the axial part.

Family: *Anthothelidae* Broch

Cortex separated from the medulla by longitudinal boundary canals.

Subfamily: *Semperininae* Aurivillius

Calyces hemispherical. Axial sclerites long and slender; cortical sclerites thorny and tuberculated.

Genus *Solenocaulon* Gray

Stem tubular and stalk solid; colonies adhere to the substratum either by spreading holdfast or by spatular expansions originating from the stem. Polyps chiefly on twigs, clavate or terminally fistulose. Axial spicules long and slender needles, cortical spicules thorny and tuberculated spindles. Type: *Solenocaulon tortuosum* Gray.

Solenocaulon tortuosum Gray (Fig. 1 a: 1-7)

Solenocaulon tortuosum Kukenthal, 1924, p. 24). (synonymy); Stiasny, 1937, p. 54, fig. Q (synonymy).

Material: Several specimens collected off Cape Comorin from a depth varying between 50 and 60 m, by trawl net.

Description: The total height of the specimens varied from 10 to 20 cm and the diameter from 8 to 15 mm. Specimens resemble broken twigs in general appearence. The basal part (stalk) is perfectly circular in outline while the terminal parts show a tendency to get flattened slightly. The stem seldom branches, but stumpy twigs may be noted at irregular intervals in a whorled fashion. The stem is tubular except at its stalk portion and the cavity inside communicates with the exterior through openings situated at or near the annular projections on the stem. These may represent 'houses' made by other animals, mainly crustaceans.

Spicules comprise (1) Slender and spiny needles of stalk medulla (Fig 1 a: 5) measuring 0.30 - 0.6 X 0.008 - 0.025 mm. (2) Needles of branch medulla (Fig. 1 a: 4) measuring 0.1 - 0.37 X 0.002 - 0.014 mm. (3) Spindles

of branch cortex: two types are noted, (a) smaller (Fig. 1 a: 1) measuring 0.1 mm and b) larger measuring up to 0.4 mm (Fig. 1 a: 2). (4) Spheres of stalk cortex (Fig. 1 a: 3), measuring up to 0.08 mm and (5) 'Y' shaped spicules at different growth stages (Fig. 1 a: 6, 7) found in deeper parts of the cortex with a maximum size of 0.3 mm.

Colour: Colour may vary from pink to cream when alive, spicules may also be coloured accordingly.

General distribution: This is a widely distributed Indo-Pacific species and had already been reported from the Indian Seas by several authors (Hickson, 1903 from Maldives; Thomson and Simpson, 1909 from Bay of Bengal). Littoral.

Local distribution: This species is quite common off Cape Comorin at depths varying between 50 and 60 metres.

Size attained: Height up to 20 cm.

Commercial name: Rarely represented in commercial catches from the southwest coast of India, but when available included in the 'Flower' type.

Family: *Subergorgiidae* Gray

Genus *Subergorgia* Gray

Colonies upright, reticulate or branching freely. Medullar region with spicules partly fused to form a compact axial skeleton. The cortex is well developed and separated from the axial part by a ring of longitudinal canals (boundary canals) of which two may be larger than the others. Axis devoid of a central chord. Type: *Gorgonia suberosa* Pallas.

Subergorgia suberosa (Pallas) (Figs. 1 b: 1-2; 2b)

Suberogorgia suberosa Kukenthal, 1924, p. 43 (synonymy); Stiasny, 1937, p. 87, pl. 6, fig. 45, T. fig. CC (synonymy).

Material: Several specimens.

Description: Colonies branched in one plane or irregularly; branches and branchlets, with a sunken groove running longitudinally, and divide dichotomously but rarely fuse; oval in cross section since the groove bearing sides are slightly flattened in outline.

Cortex thin, smooth and may peel off easily. Polyps retractile fully and inconspicuous when dry; orifice slit - like, 0.5 - 0.8 mm in greater diameter. Longitudinal canals beneath the sunken groove larger than the rest.

Medullar region with partly to completely fused spicules; spicules long, sinuous and smooth; shorter rods may also be present. Cortical spicules are mostly belted types measuring up to 0.12 X 0.068 mm (Fig. 1 b: 1) when well developed. Medullar spicules are of two types-sinuous and tuberculated, the former often fused together to form a compact axial skeleton (Fig. 1 b: 2) The individual spicules in the former type may measure up to 0.29 X 0.028 mm while in the latter type it may measure about half the size of the former.

Colour: Colony light brown when alive; spicules coloured accordingly.

General distribution: This is a widely distributed Indo-Pacific species. Littoral.

Local distribution: This species is abundantly distributed in the Gulf of Mannar especially in the area between the islands and the mainland at depths of 3 to 15 m.

Size attained: Height up to 1 m.

Commercial name: Larger specimens are classified under 'Red' type while smaller ones under 'Flower' type.

Subergorgia reticulate (Ell. and Sol.)
(Fig. 1 c: 1-3)

Suberogorgia reticulata Stiasny, 1937, p. 101, pl. 7, fig. 48, T. fig. GG (synonymy).

Material: Several specimens.

Description: Subergorgiidae with reticulated body pattern, colonies often divide in the same plane (fan-shaped growth) or in different planes. Meshes of the reticulum 3-5 mm in size in older parts, while towards the growing tips they may become slightly larger, about 5-7 mm; meshes polygonal in shape. Branches originating from the stalk are clearly discernible up to the edge of the colony in older specimens.

Cortex does not peel off easily; medullar region with fused spicules.

Calyces inconspicuous and arranged only on one side of the colony, diameter from 0.2 to 0.5 mm and may be contiguous. Sunken groove, so characteristic in the other species of the genus, is never present in this species.

Spicules consist of disc and belted spindles in the cortex and sinuous, smooth spindles in the medulla. (1) Disc spindles. Button-like, size 0.03 - 0.05 mm (Fig. 1 c: 1). (2) Belted spindles. Size up to 0.134 X 0.033 mm (Fig. 1 c: 2). (3) Smooth spicules of medulla. Rarely with annulations, may fuse to form a compact structure; size up to 0.18 X 0.020 mm (Fig. 1 c: 3).

Colour: Light pink when alive, may turn white after death; spicules colourless.

General distribution: Indo-Pacific. Littoral.

Local distribution: Gulf of Mannar (Tuticorin, Kelakarai and Rameswaram) and Bay of Bengal (off Madras).

Size attained: Specimens measuring up to 60 cm (height) and 40 cm. (width) are common in the Gulf of Mannar.

Commercial name: 'Red' type.

Remarks: This species is often confused with *Gorgonella umbraculum* (Ell. and Sol.) in the field since both have more or less the same morphology and colour. For the general morphology of *S. reticulata* see Thomas and Rani Mary George, 1986 a).

Suborder: HOLAXONIA Studer

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

Family: *Plexauridae* Gray

Polyps completely retractile. Colony fruticose or not; branches divide dichotomously or pinnately. Axis with central chord, base of the colony heavily calcified; cortex thick.

Genus *Plexauroides* Wright and Studer

Stem and branches cylindrical, divide dichotomously. Cortex with two distinct layers of spicules, an inner row of stellate forms covered externally with characteristic 'leaf-clubs' (Blattkeulen). Axis with a distinct central chord, base of the colony heavily calcified. Type: *Plexaura praelonga* Ridley

Plexauroides praelonga (Ridley) (Fig. 1 d: 1-4)

Plexaura praelonga var. typica and var. *elongata* Thomson and Henderson, 1905, p. 304.

Plexauroides praelonga Thomson and Simpson, 1909, p. 262, pl. 9, fig. 13; Nutting, 1910 a, p. 10 Kukenthal, 1924, p. 125 (synonymy).

Material: Several specimens.

Description: Colonies bushy with branches in one or more planes; diameter of branch, 2-5 mm; divide sparingly but if dividing, often in a dichotomous pattern at long intervals.

Calyces inserted without any orifice, evenly distributed on branches and 1 mm apart, with

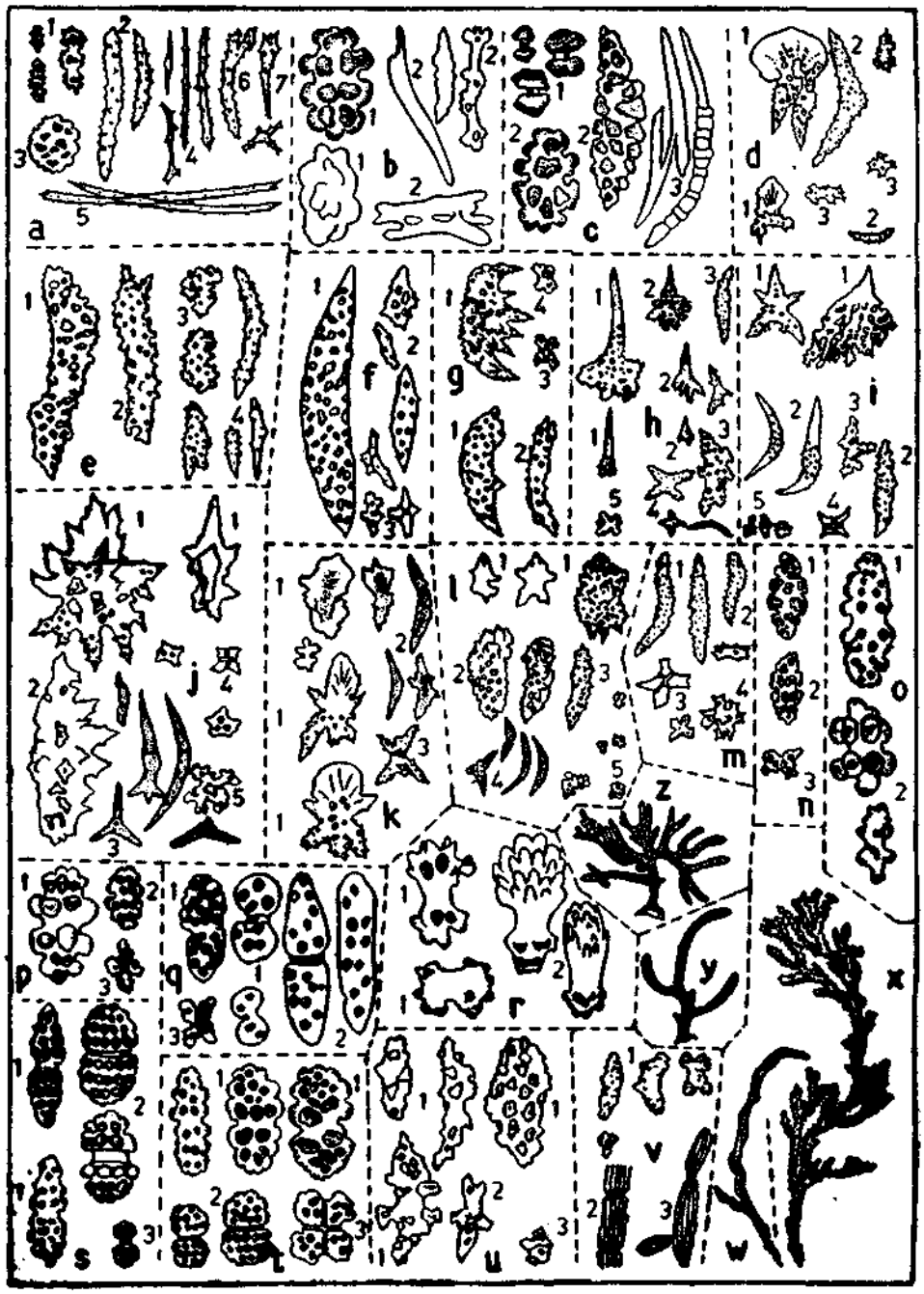

Fig. 1 a. *Solenocaulon tortuosum:* 1. Small spindles of branch cortex. 2. Large spindles. 3. Spheres of stalk cortex. 4. Needles of branch medulla. 5. Slender and spiny needles of stalk medulla. 6 and 7. 'Y' shaped spicules, different types; b. *Subergorgia suberosa:* 1. Belted spicules

(Contd. on facing page)

a greater diameter of 1 mm. Cortex somewhat thick and with an outer covering of leaf clubs set at right angles to the surface. Spicules of the inner layer are stellate forms. The medullar region is black in colour and with a white calcareous core. Peripheral canals are conspicuous.

Spicules are represented by (1) Leaf clubs. These spicules are quite characteristic with only one leaf which may be serrated or not (this type of spicule is called 'schuppenkule' by Kolliker). The basal part of the spicule has 2-4 root - like tuberculated processes (Fig. 1 d: 1). Size, when well developed, 0.42 X 0.28 mm. (2) Spindles. Size up to 0.45 X 0.0.075 mm; may be spiny or warty (Fig. 1 d: 2). (3) Stars and multiradiates. Size up to 0.067 mm. (Fig. 1 d: 3, 4).

Colour: Colony bright crimson when alive; axis black to greenish brown, spicules bright red.

General distribution: Indo-Australian. Littoral.

Local distribution: Gulf of Mannar, common at 4 to 8 m depth.

Size attained: Up to 15 cm.

Commercial name: 'Red' type; smaller specimens are often included under 'Flower' type.

Family *Paramuriceidae* Bayer

Central chord, in this family, is wide and chambered; polyps retractile, calyces protruding and with an armature of strong points *en chevron*. Cortical spicules usually spindles, but modified thorn scales or other types may also be met with.

This family is well represented in the commercial landings of India with a total of 9 widely distributed species under 5 genera.

Genus *Muricella* Verrill

Colonies divide in one plane and branches fuse rarely. Calyces prominant, low and verruciform. Cortical spicules in two distinct layers; they are mostly spindles but clubs may also be included occasionally. Type: *Muricea nitida* Verrill (SD Nutting, 1910).

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of the cortex. 2. Sinuous and tuberculated medullar spicules; c. *Subergorgia reticulata:* 1. Disc spindles. 2. Belted spindles. 3. Small spindles of medulla (two types). d. *Plexauroides praelonga:* 1. Leaf - clubs (different growth forms). 2. Spindles. 3. Stars and multiradiates; e. *Muricella umbraticoides:* 1. Spindle. 2. Spindle with bifurcated tip. 3. Multiradiate spicules. 4. Regular spindles; f. *Muricella complanata:* 1. Large spindle. 2. Small spindles. 3. Multiradiates; g. *Thesea flava:* 1. Toothedspi cules (*Thesea* type). 2. Regular spindles. 3. Quadriradiate. 4. Multiradiate; h. *Echinomuricea indomalaccensis:* 1. *Echinomuricea* type spicules (different growth forms), with long spine. 2. *Echinomuricea* type spicules (different growth forms) with small spine. 3. Spindle. 4. Cross. 5. Multiradiates; i. *Echinomuricea indica:* 1. *Echinomuricea* type of spicules, two different growth forms. 2. Spindles. 3. Triradiates. 4. Cross. 5. Multiradiates; j. *Echinogorgia reticulata:* 1. Leaf - clubs, different growth forms. 2. Spindles. 3. Triact. 4. Tetract. 5. Multiradiate; k. *Echinogorgia flora:* 1. leaf - club, different growth forms. 2. Spindles. 3. Tetraradiate; l. *Echinogorgia complexa:* 1. Leaf - club, different growth forms. 2. Ordinary clubs. 3. Toothed spindle. 4. Granulated spindles. 5. Multiradiates; m. *Heterogorgia flabellum:* 1. Large spindles. 2. Bent spindle. 3. Tetraradiate spicules. 4. Multiradiate; n. *Leptogorgia australiensis:* 1. Straight spindle. 2. Curved spindle. 3. Cross; o. *Ellisella andamanensis:* 1. Spindle. 2. Dumbbells; p. *Ellisella maculata:* 1. Spindle. 2. Dumbbell. 3. Cross; q. *Nicella dichotoma:* 1. Dumbbells. 2. Bean-shaped spicules. 3. Cross; r. *Juncella juncea:* 1. Dumbbells. 2. Clubs; s. *Gorgonella umbraculum:* 1. Spindles. 2. Dumbbells. 3. Small dumbbell. t. *Gorgonella rubra:* 1. Spindles. 2. Dumbbells. 3. Cross. u. *Scirpearia filiformis:* 1. Spindles. 2. Cross. 3. Multiradiate; v. *Isis hippuris:* 1. Spicules, different types. 2. Axial skeleton magnified. 3. Decorticated terminal part of branch, magnified; w. *Scirpearia filiformis,* tip of branch magnified to show the general arrangement; x. *Nicella dichotoma:* general appearance; y. *Echinogorgia flora*: general appearance and z. *Thesea flava:* general appearance.

Muricella umbraticoides (Studer) (Fig. 1 e: 1-4)

Muricella umbraticoides Kukenthal, 1924, p. 178 (synonymy).

Material: One specimen from Kovalam (Madras).

Description: Colony divided in one plane and without any anastomosis. Specimen at hand is poorly preserved and hence other details could not be studied.

Spicules are represented by (1) Spindles. Size up to 0.75 X 0.05 mm (Fig. 1 e: 1). (2) Spindles. With bifurcated tips (Fig 1 e: 2). (3) Multiradiates (Fig. 1 e: 3). (4) Small spindles of regular shape (Fig. 1 e: 4).

Colour: Cortex pale white, axis light brown and spicules, colourless.

General distribution: Indo - Australian. Up to 100 metres.

Local distribution: Madras (Kovalam). This is here reported for the first time from the Indian seas.

Size attained: Up to 2.5 cm.

Commercial name: Not exploited commercially.

Muricella complanata Wright and Studer (Fig. 1 f: 1-3)

Muricella complanata Thomson and Henderson, 1905, p. 303; Kukenthal, 1924, p. 172 (synonymy).

Material: Several specimens.

Description: Colonies flabellate, often divide in one plane; branches free and terminal portion devoid of polyps; branches flattened in the plane of the colony and the diameter may vary from 2-3 mm.

Calyces subalternate, more in the front part of the colony; tubular or truncated, height 1-1.2 mm and diameter 2 mm on an average, at the base.

Spicules are all spindles of different sizes, to which quadriradiates or multiradiates may be added. Larger spicules are common in the coenenchyme. Spicules are (1) Large spindles. Irregular, warty and may measure 1.4 X 0.15 mm (Fig. 1 f: 1). (2) Small spindles. Size up to 0.5 X 0.08 mm (Fig 1 f: 2). (3) Multiradiates; rare (Fig. 1 f: 3).

Colour: Colony pink when alive, this colour fades off slightly after death. Axis light violet; large spindles, pink; smaller spindles light yellow and quadriradiates often colourless.

General distribution: Indo-Pacific. Up to 631 metres.

Local distribution: Tuticorin, Cape Comorin and Kadiapattanam. Up to 56 metres.

Size attained: Up to 10 cm.

Commercial name: 'Red' type

Genus *Thesea* Duch. and Mich.

Colonies branched in one plane, calyces low and verruciform; wall filled with thorn - like spicules whose concave side is provided with larger spines (called *Thesea* type). These spicules are imbricately arranged at the surface. Type: *Thesea excerta* (Ell. and Sol.).

Thesea flava Nutting (Fig. 1 g: 1-4, z)

Thesea flava Nutting, 1910, p. 52, pl. 8, figs. 1, 1;a Thomas and Rani Mary George, 1986 (in press).

Pseudothese a flava Kukenthal, 1924, p. 228.

Material: Several specimens.

Description: Colonies divide in one plane and without any sign of anastomosis. Bran-

ching is almost symmetrical and may divide in a vague dichotomous pattern; branches and branchlets end blindly, emerging part of branch less wide than the apical portion.

For further details see Thomas and Rani Mary George, 1986 (in press).

Spicules are: (1) *Thesea* type. Size up to 0.56 X 0.033 mm including spines (Fig. 1 g: 1). Spines may have an average length of 0.08 mm. (2) Regular spindles (Fig. 1 g: 2). (3) Quadriradiates (Fig. 1 g: 3). (4) Multiradiates. (Fig. 1 g: 4).

Colour: Colony greenish yellow to pink; spicules coloured accordingly.

Biological associates: Barnacles often form galls on branches.

General distribution: Indo - Australian. Littoral.

Local distribution: This species is quite common off Vedalai (Gulf of Mannar) where it is collected from shallower areas (3-4 m.).

Size attained: Up to 10 cm.

Commercial name: 'Flower' type.

Genus *Echinomuricea* Verrill

Characteristic spicule, in this genus, is 'thorn scale' (or *Echinomuricea* type as it is called), with a single strong spine supported at the base by several root - like structures. These spicules ornament the surface. Spindles with or without strong outer processes may be noted. Colonies may be branched in one plane and may be reticulate. Type: *Nephthya coccinea* Stimpson.

Euchinomuricea indomalaccensis Ridley
(Fig. 1 h: 1-5)

Echinomuricea indomalaccensis Thomson and Henderson, 1905, p. 291; Thomson and Simpson, 1909, p. 199; Nutting, 1910, p. 57; Kukenthal, 1924, p. 190.

Material: One specimen from Kovalam (Madras).

Description: Colonies flabellate and loosely reticulate; main branches originating from the stalk are traceable up to the edge of the colony; tips of branches swollen and without terminal polyp. Branches and branchlets flattened in the general plane of the colony ; flattened side may measure up to 5 mm and other side about 3 mm on an average.

Calyces low, 0.5 mm high and 1.5 mm in average diameter; oval in outline with larger diameter parallel to the long axis of the branch/ branchlet. Calyces densely distributed all over, 0.5 - 1 mm apart, their margin often with radiating throns (of thorn-scale).

Spicules of this species are represented by (1) Thron-scales (*Echinomuricea* type). Two categories could be noted: the former type (Fig. 1 h: 1) has long spine (or thorn) measuring up to 0.56 mm in length when well developed, while in the other case (Fig. 1 h: 2) the spine is only 0.25 mm in length. In both cases the spines are provided with erect spinules towards the distal half (ie. the pointed end) and tubercles on the proximal half; but cases where there are no such ornamentation could also be noted. The basal part, in both cases, is provided with tuberculated root - like structures. The total length of the former type may come up to 0.8 mm. (2) Spindles. These may be with long spines on one side (as in *Thesea* type) or not. Size up to 0.6 X 0.084 mm (Fig. 1 h: 3). (3) Crosses. (Fig. 1 h: 4), rare. (4) Multiradiates (Fig. 1 h: 5).

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

General distribution: Indo-Australian. Up to 37 metres.

Local distribution: Bay of Bengal (Kovalam, near Madras).

Size attained: 15 cm.

Commercial name: 'Red' type

Echinomuricea indica Thomson and Simpson (Fig. 1 i: 1-5)

Echinomuricea indica Thomson and Simpson, 1909, p. 284, pl. 3, figs. 2-3, pl. 8, fig. 4; Kukenthal, 1924, p. 188; Thomas and Rani Mary George, 1986 (in press).

Material: Several specimens.

Description: For general appearance and description see Thomas and Rani Mary George, 1986 (in press).

Spicules are: (1) Thorn scale (or *Echinomuricea* type). Spines sharp and conical, base with 6 or less tuberculated root-like structures. Size, when well developed, 0.39 X 0.39 mm (Fig. 1 i: 1). (2) Spindles. (Fig 1 i: 2). (3) Tri, tetra, or multiradiate spicules (Fig. 1 i: 3-5).

Colour: Cortex brown, axis dark brown and spicules colourless.

General distribution: The original description of this species was based on the material collected at a depth of 24 metres off Arakan coast and the species was reported from the Indian Seas by Thomas and Rani Mary George (in press). This species is fairly well represented all along the southwest and southeast coasts of India and is fished in large quantities at Rameswaram and Tuticorin (Gulf of Mannar). It is well distributed up to a depth of 25 metres in the Gulf of Mannar, but is abundant only at depths varying between 5 and 8 metres.

Size attained: Maximum size noted is 80 cm (height) with a lateral expansion of about 70 cm

Commercial name: 'Black' type

Genus *Echinogorgia* Kolliker

The characteristic spicule represented in this genus is the 'leaf- club' (also called Blattkeulen after Kolliker). The other types include spindles (sometimes *Thesea* type), tetracts, crosses and multiradiates. Cortex somewhat thick and calyces crowded in their arrangement. Type: *Echinogorgia reticulata* (Esper) (=*Gorgonia sasappo reticulata* Esper).

Echinogorgia reticulata (Esper) (Fig. 1 j: 1-5)

Echinogorgia pseudosassapo Thomson and Henderson, 1905, p. 292; Thomson and Simpson, 1909, p. 213, pl. 3, fig. 9.

Echinogorgia reticulata Kukenthal, 1924, p. 202 (synonymy).

Material: Several specimens.

Description: Colonies reticulate, branches originating from the stalk traceable up to the middle of the colony where they lose their identity. These branches divide and redivide to form the main expanse of the lamella. Main branches slightly compressed in cross section; tips of branches club-shaped.

Calyces closely packed, small, diameter 1 mm and height 0.5 mm; walls ornamented with 'leaf-clubs'. Polyps retractile.

Spicules are represented by: (1) Leaf - clubs. These are provided with petaloid expansions on one side and with tuberculated root-like structures on the other. Size, when well developed, 0.42 mm (Fig. 1 j: 1). (2) Spindles. *Thesea* type, size up to 0.51 mm (Fig. 1 j: 2). Other spicules represented are triacts, tetracts and multiradiates (Fig. 1 j: 3-5).

Colour: Colony deep crimson, axis deep brown and spicules, scarlet.

General distribution: Indo-Australian. Littoral.

Local distribution: Tuticorin, Rameswaram and Mandapam (Gulf of Mannar) and Madras (Bay of Bengal).

PLATE I A. *Isis hippuris* Linnaeus and B. *Subergorgia suberosa* (Pallas).

Size attained: Up to 32 X 30 cm.

Common name: 'Red' type.

Echinogorgia flora Nutting (Fig. 1 k: 1-3, y)

Echinogorgia flora Nutting, 1910, p. 66, pl. 11, figs. 2, 2a; pl. 21, fig. 10; Kukenthal, 1924, p. 200, fig. 123; Thomas and Rani Mary George, 1986 (in press)

Material: Two specimens.

Description: Colonies bushy and branches in one plane, division of branches often in an irregularly dichotomous pattern. Branches circular in outline, diameter may vary from 2-3 mm, tips blunt: stalk, branches and branchlets may have more or less the same diameter.

Calyces distributed all over, contiguous and flush with the surface; polyps retractile. Calyce wall and the general surface armoured with leaf - clubs.

Spicules are: (1) Leaf - clubs. Leaf - club of this species differs from that of other specics of *Echinogorgia* in that there is only a single leaf - like structure as against several noted in all other species. The leaf - like expansion, in the present case, is oval, orbicular, transparent and may have tubercles or striations ornamenting it (Fig. 1 k: 1). (2) Spindles, angulated or not; size up to 0.25 mm (Fig. 1 k: 2). The other spicules include tetraradiate form or modifications thereof (Fig. 1 k: 3).

Colour: Colony yellow, axis dark brown and spicules colourless.

Biological associates: Pteria sp. was found attached to a specimen examined.

General distribution: This species was originally reported from the littoral zone of New Guinea.

Local distribution: It was recorded from the southwest coast of India (south of Vizhinjam) in mussel beds at a depth of 4 metres (Thomas and Rani Mary George, 1986, *in* press).

Size attained: Up to 8 cm.

Commercial name: 'Flower' type.

Echinogorgia complexa Nutting (Fig. 1 l: 1-5).

Echinogorgia complexa Nutting, 1910, p. 67, pl. 11, figs. 1, 1a; pl. 21, fig. 11; Kukental, 1924, p. 200; Thomas and Rani Mary George, 1986 (in press).

Material: Several specimens.

Description: Colonies reticulate, often forming circular to oval expansions. Stalk, which is rather robust, continued further as main branches and may be traced up to the peripheral part of the lamella. For a detailed account of the general pattern of branching and also for a general appearance of the specimen see Thomas and Rani Mary George, 1986.

Calyces disttributed uniformly and contiguous, diameter up to 1 mm and height, 0.5 mm. Polyps completely contractile but collaretts rest above the calyx margin. Wall of the calyx and general surface ornamented with leaf - clubs.

Spicules are: (1) Leaf - clubs. With several leaf - like expansions from one side and with root - like tuberculated processes from the other (Fig. 1 l: 1). (2) Ordinary clubs. Size, 0.33 X 0.126 mm (Fig. 1 l: 2). (3) Toothed spindles. Size up to 0.94 X 0.07 mm (Fig. 1 l: 3). (4) Granulated spindles. Different types may be noted (Fig. 1 l: 4). (5) Multiradiates. (Fig. 1 l: 5).

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

General distribution: Originally reported from New Guinea at a depth of 73 metres.

Local distribution: The first record of this species from the Indian seas is that of Thomas and Rani Mary George (1986, in press). This species is distributed both in the southwest and southeast coasts of India.

Size attained: Up to 20 cm.

Commercial name: 'Black' type.

Genus *Heterogorgia* Verrill

Cortex thin, spicules mostly warty irregular spindles to which others such as crosses, capstans etc. may be added. Anthocodia with stout, bent spicules; calyces verruciform. Type: *Heterogorgia verrucosa* Verrill (SD Nutting, 1910).

Heterogorgia flabellum (Pallas) (Fig. 1 m: 1-4)

Heterogorgia reticulata Nutting, 1910, p. 93, pl. 17, figs. 2, 2a; pl. 22, fig. 17.

Heterogorgia flabellum Kukenthal, 1924, p. 234 (synonymy); Thomas and Rani Mary George, 1986 (in press).

Material: Several specimens.

Description: Colonies flabellate, stalk which is rather robust divides into main branches which are traceable up to the middle of the colony from where they divide into smaller branchlets. The main expanse of the colony may be circular, ovate or obovate. Stalk roughly circular or rectangular in cross section but the main branches are distinctly flattened with their larger sides at right angles to the plane of the colony. Ultimate branchlets originating directly from the periphery of the meshes may curve out and grow at right angle to the plane of the lamella.

For other details and also for the photograph of the specimen, see Thomas and Rani Mary George, 1986 a.

Spicules: (1) Large spindles. Size, 1.5 X 0.22 mm (Fig. 1 m: 1). (2) Bent spindles. of operculum (Fig. 1 m: 2). (3) Tetraradiate spicules (Fig. 1 m: 3). (4) Multiradiates (Fig. 1 m: 4).

Colour: Colony dull brown when alive and pale white when dry; axis dark brown and spicules colourless.

General distribution: Indo-Australian. Littoral.

Local distribution: The first record of this species from the Indian seas is that of Thomas and Rani Mary George (1986, in press). It is widely distributed in the southeast and southwest coasts of India and forms the bulk of the 'Black' type gorgonids now exported from India.

Size attained: Height up to 100 cm and lateral expansion about 80 cm.

Commercial name: 'Black' type.

Family *Gorgoniidae* Lmx.

Axis horny, central chord narrow and chambered. Polyps fully retractile. Cortex thick, anthocodial armature weak. Spicules spindles or modifications thereof. Colonies may be unbranched, pinnately branched or reticulate.

Genus *Leptogorgia* M. Edw.

Colonies in one plane or bushy, branches slender, long and whip-like, branches with a median groove on either side. Belted spindles noted in this genus are two types - longer and shorter. Type: *Gorgonia viminalis* Pallas (SD Verrill, 1868)

Leptogorgia australiensis Ridley (Fig. 1 n: 1-3)

Leptogorgia australiensis, var. *flavotincta,* and var. *perflava* Thomson and Henderson, 1905, pp. 308, 309, pl. 4, fig. 10.

Material: Several specimens

Description: Colonies flabellate and variously branched, branches/ branchlets may fuse but never form a reticulum. Colonies divide in one plane and branches may become narrower towards their tips; diameter 2- 3 mm. Stem and branches with a median groove on either side.

Calyces evenly distributed, height 0.5 mm on an average and diameter up to 1 mm; orifice small, 0.3 mm on an average and inconspicuous.

Spicules are: (1) Spindles. These may be of two types; (a) straight and (b) curved (Fig. 1 n: 1, 2) and may measure 0.08 X 0.014 to 0.013 X 0.058 mm. (2) Crosses. Diameter up to 0.075 mm (Fig. 1 n: 3).

Colour: Specimens are beautifully coloured: cream, red, orange, yellow and so on. Some may have even patches or lines. Axis coloured brown but this colour may fade off towards the extremities. Spicules are coloured accordingly.

General distribution: Indo - Australian. Littoral.

Local distribution: Common all along the southwest and southeast coasts of India. Littoral.

Size attained: Up to 20 cm.

Commercial name: 'Flower' type. This is the most common species of this type.

Family *Ellisellidae* Gray

Axis strongly calcified, calcification in concentric lines. Central chord not soft and chambered. Colonies unbranched, sparingly branched or sometimes reticulate. Spicules small, usually dumbbells to which clubs and double spindles may be added.

This family is represented in commercial landings of India by 5 genera and 7 species and in this respect stands next to the family Paramuriceidae Bayer.

Genus *Ellisella* Gray

Branches whip - like and few. Calyces biserially disposed. Spicules include double spindles in calyces and double heads or dumbbells in the cortex. Type: *Gorgonia elongata* Pallas (SD Nutting, 1910).

Ellisella andamanensis (Simpson)
(Fig. 1 o: 1-2)

Verrucella stellata Nutting, 1910 c, p. 13, pl. 2, figs. 1, 1a; pl. 10, fig. 3.

Scirpearia regia Nutting, 1910c, p. 26, pl. 8, figs. 1, 1a; pl. 10, fig. 5.

Ellisella andamanensis Kukenthal, 1924, p. 367.

Material: Several specimens.

Description: Colonies subflabellate and often branch dichotomously; branches 4-5 mm in diameter. Cortex thin; calyces arranged uniformly or spirally at places; dome-shaped and 1.5 mm in diameter, height 0.5 mm on an average.

Spicules are represented by spindles (Fig. 1 o: 1) and dumbbells (Fig. 1 o: 2); and may measure 0.063 X 0.025 mm and 0.04 X 0.021 mm retpectively.

Colour: Colony reddish brown to yellow when alive; axis pale white. Larger spicules are amber coloured and smaller ones often colourless.

General distribution: Previously known from Andamans and Japan, and is here recorded

from the inshore waters of the mainland. This species is distributed up to 75 m.

Local distribution: Kelakarai (Gulf of Mannar) and Kadiapattanam (Southwest coast of India, Arabian Sea). Upto 7 m.

Size attained: Only bits could be collected.

Commercial name: Larger bits are classified under 'Monkey tail' type while the smaller bits under the 'Flower' type.

Ellisella maculata Studer (Fig. 1 p: 1-3)

Scirpearia furcata and var. Hickson, 1905, p. 822, figs. 8, 9.

Scirpearella aurantiaca and *Scirpearella* sp. Thomson and Henderson, 1905, pp. 311, 313, pl. 4, figs. 1, 7; pl. 5, figs. 15, 16.

Ellisella maculata Kukenthal, 1924, p. 367 (synonmy).

Material: Several bits from commercial landings.

Description: Colonies subflabellate, branches divide dichotomously; diameter of branches may vary from 3-4 mm. Calyces evenly distributed on all sides or may be irregular, spiral or in rows at places; they may be conical or truncate with a height of 1.5 mm and diameter of 2 mm at the base. Older parts may be devoid of calyces. Polyps retractile.

Cortex thick and granular; very thin in older parts. Spicules are: (1) Spindles. Size up to 0.084 X 0.04 mm (Fig. 1 p: 1). (2) Dumbbells. Size, 0.063 X 0.04 mm (Fig. 1 p: 2). (3) Crosses. (Fig. 1 p: 3).

Colour: Colony yellow, axis pale white, spindles are light yellow and dumbbells colourless.

General distribution: Indo - Pacific. Upto 275 meters depth.

Local distribution: Kadiapattanam (Southwest coast of India, Arabian Sea).

Size attained: Only bits could be collected.

Commercial name: Larger specimens are included under 'Monkey tail' type and smaller ones under 'Flower' type.

Genus *Nicella* Gray

Colonies ramify in one plane; polyps biserially arranged with hemispherical to conical calyces. Cortex with an outer layer of dumbbells and an inner layer of bean - shaped spicules. Type: *Scirpearia dichotoma* Gray.

Nicella dichotoma (Gray) (Fig. 1 q: 1-3, x)

Nicella coralloides Nutting, 1910 c, p. 28, pl. 9, figs. 2, 2a; pl. 11, fig. 1.

Nicella dichotoma Kukenthal, 1924, p. 378 (synonmy).

Material: One specimen from an export sample.

Description: Colony flabellate, branches often in a helicoid pattern, main stem about 3 mm in diameter at its base; median groove visible at places.

Calyces alternate, lateral and about 1.8 mm apart; conical in shape with a height of 1.2 mm and a basal diameter of 1 mm.

Cortex thin and axis calcareous; branches and branchlets break off easily.

Spicules are: (1) Dumbbells. Size 0.050 X 0.033 mm (Fig. 1 q: 1). (2) Bean - shaped spicules. Quite characteristic, size 0.126 X 0.029 mm (Fig. 1 q: 2). (3) Crosses. Diameter up to 0.037 mm (Fig. 1 q: 3).

Colour: Colony coral red, axis greenish and spicules colourless.

General distribution: Indo-Pacific. Up to 220 m.

Local distribution: This species is here recorded from the Indian Seas. Tuticorin (Gulf of Mannar).

Size attained: 10 cm.

Commercial name: 'Flower' type.

Genus *Juncella* (Pallas)

Colonies simple, occasionally dividing in a dichotomous pattern but never with signs of anastomosis. Calyces prominant, scattered or biserial. Cortex thick with an inner layer of dumbbells covered externally by a layer of flattened clubs. Axis with alternating layers of horny and calcaeous matter. Type: *Gorgonia juncea* Pallas (SD Nutting, 1910 c)

Juncella juncea (Pallas) (Fig. 1 r: 1-2)

Juncella juncea, J. flexilis and *J. elongata* (pars) Hickson, 1905, pp. 820, 821.

Juncella juncea, J. gemmacea and *Juncella fragilis* var. *rubra* Thomson and Henderson, 1905, pp. 313, 314, pl. 4, figs. 4, 5.

Juncella juncea Nutting, 1910 c, p. 18, pl. 3, figs. 1-4. Kukenthal, 1924, p. 365 (synonymy).

Material: Several specimens.

Description: Colonies usually unbranched and whip-like, rarely branched; when dividing often dichotomous. Diameter of the colony may vary from 3 to 7 cm. Colony with a median line on either side.

Calyces papillate and directed towards the growing tips; height 2 mm and diameter about 1 mm but subject to considerable variation from place to place; evenly distributed over the surface or rarely in rows; median line devoid of calyces. Polyps small. Clubs ornament the surface and dumbbells in deeper parts of the cortex.

Spicules are: (1) Dumbbells. Size up to 0.1 X 0.05 mm (Fig. 1 r: 1). (2) Clubs. Size as in the former (Fig. 1 r: 2).

Colour: Colony coral red when alive; axis white internally and pale brown externally. Dumbbells transparent and clubs light yellow.

General distribution: Indo-Pacific. Littoral.

Local distribution: This species is present in almost all stations along the southeast and southwest coasts of India, but is available in fishable magnitude only in the Gulf of Mannar area.

Size attained: Upto 2 m depth.

Commercial name: 'Monkey tail' type. This species constitutes the bulk of this type now exported. It is known as 'Sea rope' in some places.

Genus *Gorgonella* Val.

Colonies flabellate to reticulate; calyces low, dome-shaped or low truncated cones. Axis calcareous and devoid of horny lamellae. Cortex thin and with dumbbells and spindles, but other spicules such as crosses, stars etc. may also be added. Type: *Gorgonella umbraculum* (Ell. and Sol.)

Gorgonella umbraculum (Ell. and Sol.) (Fig. 1s: 1-3)

Verrucella flexuosa, var. *aurantiaca*, and var. *gallens* Thomson and Henderson, 1905, pp. 315, 317. pl. 3, figs. 4, 9; pl. 4, figs. 8, 13, pl. 4, figs, 8, 13; pl. 5, figs. 8, 11.

Nicella reticulata Thomson and Simpson, 1909, p. 266, pl. 4, fig. 5; pl. 8, fig. 12.

Gorgonella umbraculm Nutting, 1910 c, p. 8. Kukenthal, 1924, p. 381 (synonymy)

Material: Several specimens.

Description: Colonies fan shaped and closely reticulate. Stalk robust, often ridged and usually with an expanded attachment zone. In some the main branches originating from the stalk may be seen up to the tip of the lamella. Branchlets divide and redivide and get interconnected in a scalariform pattern producing small meshes of 4 x 5 mm on an average; meshes may be rectangular or polygonal in shape. The expanse of the lamella may be oval mostly but in larger specimens the lamella may show a tendency to get cut up into lobes. Branchlets forming the meshes are of uniform diameter, 1.5 to 2.5 mm, and appear a little flattened in the plane of the colony.

Calyces crowded at actively growing parts of the colony, conical to hemispherical in shape, diameter 1 mm and height 0.7 mm on an average; calyces small at older parts and may show some preference to lateral surfaces of the branchlets.

Coenenchyme granular. Spicules are (1) Spindles. Size, 0.084 X 0.025 mm (Fig. 1 s: 1). (2) Dumbbells size, 0.063 X 0.033 mm (Fig. 1 s: 2). (3) Smaller Dumbbells. Size, 0.025 X 0.021 mm (Fig. 1 s: 3).

Colour: Colony orange in colour when fresh and flesh coloured on drying Spicules light yellow and axial part pale orange.

General distribution: Indian Ocean and Red Sea, distributed up to 100 metres depth.

Local distribution: Common along the southwest and southeast coasts of India and Andamans.

Size attained: Height up to 100 cm and lateral expanse, about 80 cm.

Commercial name: 'Red' type. This is the most dominant species of this type and is well distributed in the Gulf of Mannar.

Gorgonella rubra (Thomson and Henderson) (Fig. 1 t: 1-3)

Verrucella rubra Thomson and Henderson, 1905, p. 314. Nutting, 1910 c, p. 11.

Material: Three specimens.

Description: Colonies feebly reticulate; secondary lamella often in different planes. Diameter of the stalk 3 mm on an average, branches and branchlets have almost the same diameter, about 2 mm; branches end blindly.

Calyces warty, 1 mm in diameter and with a height of 1.2 mm average, prominant on lateral surfaces of the branches and branchlets.

Spicules are: (1) Spindles. Size up to 0.084 X 0.029 mm (Fig. 1 t: 1). (2) Dumbbells. Size up to 0.04 X 0.021 mm (Fig. 1 t: 2). (3) Crosses. Diameter up to 0.052 mm (Fig. 1 t: 3).

Colour: Colony white to pale yellow; axis dark brown turning to pale yellow towards the growing tips. Spicules pale yellow or colourless.

General distribution: Indo-Australian, up to 73 m.

Local distribution: Tuticorin (Gulf of Mannar), Muttom and Kadiapattanam (Arabian Sea).

Size attained: Upto 10 cm.

Commercial name: 'Flower' type.

Genus *Scirpearia* Ehrenberg

Colonies simple, branches slender; calyces biserial and prominant. Spicules are represented by spindles in calyces and dumbbells in cortex. Type: *Scirpearia flagellum* (Johnson)

Scirpearia filiformis Toeplitz (Fig. 1 u: 1-3, w).

Scirpearlla moniliforme Thomson and Henderson 1906, p. 82.

Ellisella flava Nutting, 1910 c, p. 31, pl. 9, figs. 4, 4a; pl. 11, fig. 3.

Scirpearia filiformis Kukenthal, 1924, p. 370 (synonymy).

Material: Several bits.

Description: Colony rather inconspicuous, branches thread like and divide dichotomously; diameter of branches, 1 mm on an average.

Calyces subconical and arranged laterally in an alternating pattern; diameter about 1 mm and height 0.5 mm. Calyces well reinforced with regular spindles vertically. Cortex with a horizontal layer of larger spindles.

Spicules are: (1) Spindles. Densely tuberculated and irregular, size up to 0.21 X 0.1 mm (Fig. 1 u: 1). (2) Crosses (Fig. 1 u: 2). (3) Multiradiates (Fig. 1 u: 3).

Colour: Colony white when dry, axis light brown and spicules colourless.

General distribution: Andamans and Australia in 82 to 484 m.

Local distribution: Off Cape Comorin, 56 m. This species is here reported for the first time from the mainland.

Size attained: Only fragments could be collected.

Commercial name: Not exploited commercially at present.

Family *Isididae* Lmx.

Axial skeleton of horny nodes and calcareous, nonspicular internodes. Attachment to the substratum either by discs or by root like structures.

Subfamily *Isidinae* Lmx

Genus *Isis* Lin.

Colonies bushy, cortex thick and polyps fully retractile. Axis divisible into nodal and internodal divisions. Type: *Isis hippuris* Lin. (SD H. Milne Edw. and H, 1850).

Isis hippuris Lin. (Figs. 1 v: 1-3; 2 a)

Isis hippuris Nutting, 1910, p. 6, pl. 1, figs. 1, 1 a, 1 b; pl. 5, fig. 1 (synonymy); Kukenthal, 1924, p. 443 (synonymy).

Material: One specimen from Andamans.

Description: Colony branched more or less pinnately as in a feather. The main branch (median branch) is slightly thicker than the branchlets. No soft part is preserved intact.

Axis composed of nodal and internodal divisions, calcareuss internodes are fluted longitudinally. Nodes shorter and horny, they are narrower than the internodes; length up to 3 mm and are shaped like an 'hour - glass' (Fig. 1 v: 2, 3). Branches originate from internodes.

Spicules are (1) Tuberculated spindles, (2) Double spindles, (3) Dumbbells and (4) Crosses (Fig. 1 v: 1, after Bayer, 1963).

Colour: Colony brown, axis white and nodes dark brown.

General distribution: Indo - Pacific. Littoral.
Local distribution: Andamans.

Size attained: Specimen available is only fragmentary.

Commercial name: 'King coral' 'Ornament coral'. They are used for making ornaments.

References

BAYER, F. M. 1963. Octocorallia. In: R. C. Moore [Ed.] *Treatise on Invertebrate Palaeontology* Part. F. Geological society of America and University of Kansa Press, F. 166 - F. 230.

HICKSON, S. J. 1903. Alcyonaria of the Maldives. Part 1. In: Gardiner, J. S (Ed.) *The fauna and geography of the Maldives and Laccadive Archipelagoes.* Cambridge University Press; pp. 473-502.

———— 1906. The Alcyonaria of the Maldives Part 3. *Ibid.*, pp. 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.

———— 1910 a. The gorgonacea of the Siboga Expedition. IV. The Plexauridae. *Ibid.*, 13^{b1}: 1-20.

———— 1910 b. The gorgonacea of the Siboga Expedition. V. The Isidae. *Ibid.*, 13^{b2}: 1-23.

———— 1910 c. The gorgonacea of Siboga Expedition. VI. The Gorgonellidae. *Ibid.*, 13^{b3}: 1-39.

STIASNY, G. 1937. Die Gorgonacea der Siboga - Expedition, Suppl. II. Revision der Scleraxonia. *Ibid.*, 13^{b8}: 1-138.

THOMAS, P. A. AND RANI MARY GEORGE 1986. Studies on commercially important gorgonids in the Indian Seas. I. On five species new to Indian Seas (in press).

———— 1986 a. Gorgonid resources of India (in press).

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 Mannar*, **3**: 269 - 328.

———— 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 Alcyonaceans of the littoral area. Trustees of the Indian Museum, Calcutta. pp. 1-318.

WEINHEIMER, A. J. AND R. L. SPRAGGINS 1969. The occurrence of two new prostaglandin derivatives. *Tetrahedron Letters*, **59**: 5185 - 5188.