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ON A COLLECTION OF HYDROIDS FROM SOUTH INDIA[1]

I. SUBORDER ATHECATA

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INTRODUCTION

A LIMITED number of collections of hydroids has been made around the peninsular India, Ceylon, Andamans, Laccadives and Maldives by individual workers as well as by international expeditions.[3] On the whole there are only 171 records of hydroids from the continental shelf of the Indian region and these are referable to 126 species. Most of these collections were worked out by foreign experts, who had no opportunity to observe these animals in the live condition. As preservation distorts the original appearance of these animals, descriptions and illustrations have not always been accurate. During 1951-55, the present author made a detailed collection of the hydroids and the present paper is an attempt to describe the species collected. As a large number of families, genera and species require redescription, descriptions are given for all the groups represented. Keys have also been incorporated to facilitate easy identification of the hydroids known to occur in the Indian region, as there is no monographic study relating to the hydroids of this region. There is a good deal of confusion in the existing scheme of classification. In order to facilitate a future reclassification of the group, a critical estimation of the dependability of the characters usually employed in the classification[4] is given along with the descriptions of the major groups.

MATERIAL AND METHOD

The hydroids for the study were collected by the author from a number of stations along the Kerala and Madras States (see Map). Littoral collections were made from Cochin, Alleppey, Neendakara, Quilon, Thankassery, Trivandrum, Kovilam, Vizhinjam, Cape Comorin and Pamban, Krusadi and Shingle islands. Dredge collections were made from within the 15 fathom line from off Neendakara, Trivandrum, Vizhinjam, Cape Comorin and Pamban. A few specimens were obtained through the courtesy of the S.N. College, Quilon, and the Madras Christian College, Tambaram. Specimens were obtained for comparison from the Government Museum, Madras, Indian Museum, Calcutta and British Museum, London.

After a preliminary examination in the fresh state hydroids were killed and preserved in 10% formalin for later examination. Killing by gradual suffocation by pouring liquid paraffin over sea-water containing the expanded colony was found to be an effective method, although time consuming. Slow addition of fresh water to sea-water containing the expanded colony turned out to be a very efficient method applicable to nearly all species. Another method which was tried with partial success was the sudden pouring of hot, strong formalin on the expanded polyps kept in minimum quantity of sea water. Even though this is a quick method, sometimes polyps contract during fixation and become opaque due to heat coagulation.

[1] Formed part of the thesis *Studies on South Indian Hydroids* approved for the Ph.D. degree of the University of Kerala.

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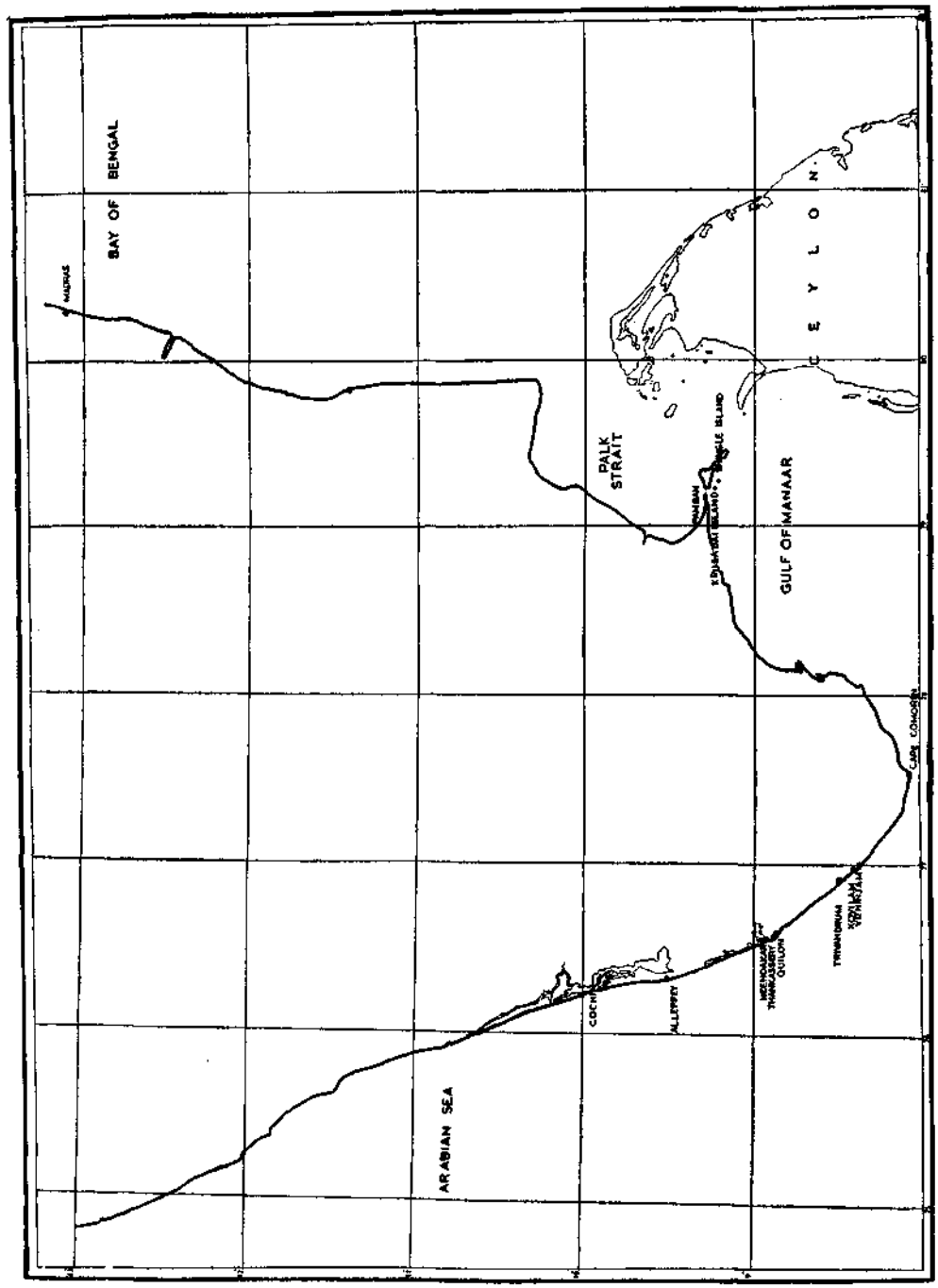
[3] Details of the collections so far made from the Indian region will be given as Appendix to Part III of this series.

[4] The classification of Stechow (1909, 1912, 1919) is taken as the basis in the present paper.



Map. 1. South India showing location of collection stations.

For the identification of species, it was sometimes necessary to rear hydroids in the laboratory. In the Marine Biological Laboratory, Trivandrum, Browne's continuous current tube with a slight modification was used. Instead of an open system operated by compressed air a closed system working on water suction pump was adopted (Fig. 1). At the S.N. College, Marine Station, Thankassery, a

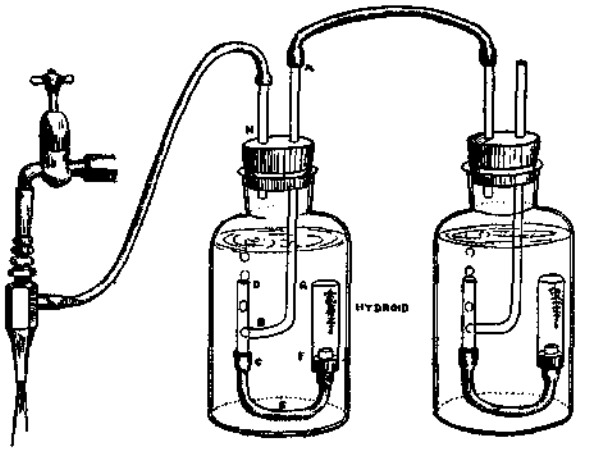


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Fig. 1. A modification of Browne's Continuous Current Tube.

modification of the apparatus devised by Rees and Russell (1938) was used. In this case the necessary power was supplied by an electric fan motor. The motor

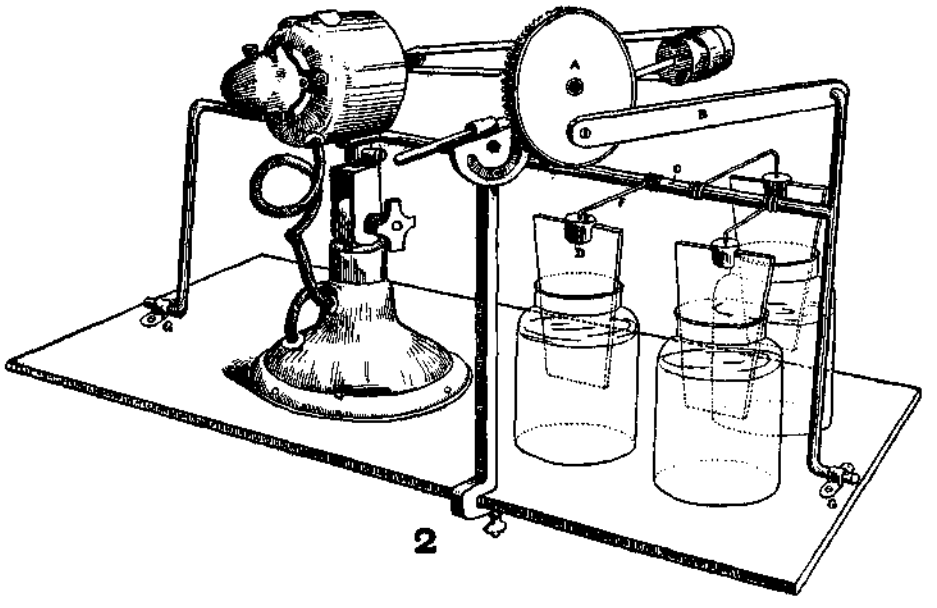

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Fig. 2. A modification of the apparatus devised by Rees and Russell (1938).

drives an Archemedes drill that acts as a reducing gear and provides the necessary rocking movement which is transmitted to glass plates resting on the mouth of glass jars (Fig. 2).

As the actual measurements are given in the description of each species, the sizes are not indicated on the figures.

SYSTEMATICS

Classified list of species

ORDER HYDROIDA

Suborder : ATHECATA

Family CLAVIDAE

Rhizogeton nudum Broch
Turritopsis dohrni (Weisman)

Family BOUGAINVILLIIDAE

Hydractinia epidocleensis Leloup
Leuckartiara octona (Fleming)
Rhizorhagium palori n.sp.
Bimeria vestita Wright
Garveia franciscana (Torrey)

Family CORYNIDAE

Coryne muscoides (Linnaeus)
Zanclea indica n.sp.
Sphaerocoryne bedoti Pictet

Family CLADOCORYNIDAE

Lobocoryne travancorensis n.gen. *et* sp.
Cladocorynopsis littoralis n.gen. *et* sp.

Family HALOCORDYLIDAE

Halocordyle pennaria (Cavolini) var. *australis* (Bale)

Family EUDENDRIIDAE

Eudendrium capillare Alder

Family TUBULARIIDAE

Ectopleura pacifica Thornely

Suborder : THECATA

Family LAFOEIDAE

Hebella corrugata (Thornely)
Hebella scandens (Bale)
Hebella thankasseriensis n.sp.

Family HALECIIDAE

Hydrodendron caciniformis (Ritchie)
Halecium tenellum Hincks

Family CAMPANULARIIDAE

Obelia bicuspidata Clarke
Obelia geniculata Linnaeus
Obelia commissuralis McCrady
Clytia gracilis Sars
Clytia brevicyathus n.sp.
Clytia hendersonae Torrey
Clytia johnstoni (Alder)
Clytia noliformis McCrady
Clytia liguliformis n.sp.
Clytia crenata n.sp.
Campanularia erythraea (Thornely)
Orthopyxis clytioides (Lamouroux)
Orthopyxis intermedia Stechow

Family THYROSCYPHIDAE

Thyroscyphus ramosus Allman
Thyroscyphus fruticosus (Esper)

Family SERTULARIIDAE

Calamphora campanulata (Warren)
Sertularella tenella Alder
Sertularella parvula n.sp.

Sertularella quadridens (Bale)
Sertularia west-indica (Stechow)
Sertularia densa Stechow
Sertularia distans Lamouroux var. *gracilis* (Hassall)
Sertularia palkensis (Thornely)
Sertularia marginata (Kirchenpauer)
Sertularia turbinata (Lamouroux)
Dynamena thankasseriensis n.sp.
Dynamena quadridentata (Ellis & Solander)
Dynamena crisioides Lamouroux
Idiella pristis (Lamouroux)
Salacia tetracythara Lamouroux
Nigellastrum mutulatum (Busk)
Nigellastrum digitale (Busk)

Family PLUMULARIIDAE

Pycnotheca mirabilis (Allman) race *travancorensis* n.race, n. var.
Ventromma halecioides (Alder) var. *minutus*
Antennella secundaria (Gmelin)
Schizotricha diaphana (Heller)
Plumularia warreni (Warren)
Plumularia indica n.sp.
Plumularia polycladia n.sp.
Monostaechas quadridens (McCrady)
Heteroplon siliculata n.sp.
Gymnangium eximium (Allman)
Gymnangium insigne (Allman)
Macrorhynchia phoenicea (Busk)
Macrorhynchia philippina (Kirchenpauer)
Macrorhynchia gravelyi n.sp.
Monoserius pennarius (Linnaeus)

Suborder : ATHECATA

The absence of a hydrotheca and a gonotheca is the distinguishing character of the subfamily, while the morphological and reproductive characters are the basis of further classification. Reproduction may be through medusae, medusoids or sporosacs. The medusa of athecates are all anthomedusae, characterised by hemispherical bell and gonads arising from the base of the manubrium. In certain cases the manubrium itself is transformed into a gonad. The athecate families recorded from the Indian region may be recognised by the following key.

I. Hypostome conical.

1. All tentacles filiform.

(i) Tentacles scattered in several irregular whorls. CLAVIDAE

(ii) Tentacles in a single whorl. BOUGAINVILLIIDAE

(iii) Tentacles in two whorls, an oral and an aboral. TUBULARIIDAE

2. Several irregular whorls of capitate tentacles and a single whorl of aboral filiform tentacles. HALOCORDYLIIDAE

3. All tentacles capitate.

(i) Simple capitate tentacles scattered or in several whorls. CORYNIDAE

(ii) A single whorl of oral capitate and one or more whorls of large fleshy aboral tentacles with capitulae arranged in distinct longitudinal rows. CLADOCORYNIDAE

II. Hypostome trumpet-shaped, club-shaped when contracted ; Tentacles filiform, in a single aboral whorl. EUDENDRIIDAE

Family CLAVIDAE McCrady

Hydroid solitary or colonial ; hydranth with fusiform body and conical hypostome ; tentacles filiform, scattered or arranged in several irregular whorls ; reproduction through free swimming medusae or fixed gonophores.

The clavid genera of the Indian region may be identified as follows :—

I. Gonophores fixed ; hydranths and gonophores arising directly from the hydrorhiza. *Rhizogeton* A. Agassiz

II. Gonophores develop into free swimming medusae, polyps and gonophores arising from hydrocaulus. *Turritopsis* McCrady

Rhizogeton A. Agassiz

Rhizogeton A. Agassiz 1892.

A hydrocaulus is absent ; hydranth and gonophores arising directly from the hydrorhiza, reproduction through fixed gonophores.

The only species of *Rhizogeton* known from the Indian region is *R. nudum* Broch.

? *Rhizogeton nudum* Broch

(Fig. 3)

Rhizogeton nudum Broch 1909, p. 139, fig. 1.
Rhizogeton nudum Ritchie 1910b, p. 827.

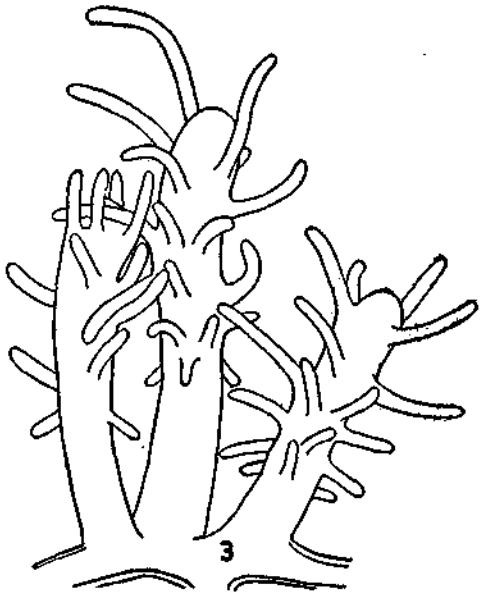

Fig. 3. *Rhizogeton nudum*

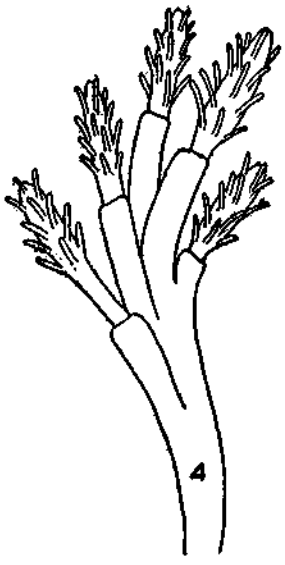

Fig. 4. *Turritopsis dohrni*

Hydrorhiza is ramifying ; perisarc distinct, reaching slightly below the base of the polyp ; tentacles filiform and scattered all over the body of the hydranth ; distal tentacles longer and wider apart.

Breadth of hydrorhizal stolon	0.10-0.12 mm.
Height of hydranth	0.98-1.20 mm.
Breadth of hydranth	0.18-0.24 mm.

Locality.—The material was collected from crevices of rocks, bases of Sargassam weeds and occasionally from dead molluscan shells from Thankassery.

Remarks.—*R. nudum* was originally recorded from the Arctic and subsequently from the Christmas island in the Indian region. The present collection is the first record of this species along the Indian coast. Only Broch (1909) has observed the gonosome and on the nature of its origin, he referred his specimens to *Rhizo-*

geton. The identification of the present material as well as those of Ritchie is based on the similarity of the trophosome with Broch's material. However, it is not unlikely that these two collections represent a species other than *R. nudum* Broch.

Turritopsis McCrady

Turritopsis McCrady 1856.

Hydrocaulus is branched ; perisarcal tubes partially adnate ; hydranth claviform, tentacles filiform, scattered or in several whorls ; gonophore develops into medusa characterised by ' eight or more simple marginal tentacles, stomach composed of vacuolated cells forming a peduncle-like base for the stomach, mouth studded with a row of nematocyst-bearing knobs, with ectodermal ocelli on the velar sides of the tentacles near the base ' (Mayer 1910).

Corydendrium, which has trophosome similar to those of *Turritopsis*, is distinguished by its reproduction through fixed gonophores. The two species of *Turritopsis* occurring in the Indian region may be identified as follows :

I. Hydrocaulus thin, branches adnate at their basal one-third only — *T. chevalense* Thornely

II. Hydrocaulus thick, adnate for more than two-thirds — *T. dohrni* (Weisman)

Turritopsis dohrni (Weisman)

(Fig. 4)

Dendroclava dohrni Weisman 1883, p. 26, Pl. XII, figs. 6-9.
Dendroclava dohrni Pictet 1893, p. 6, Pl. I, figs. 1-2.
Turritopsis nutricula Mayer 1910, p. 143.
Turritopsis dohrni Stechow 1919, p. 53.
Turritopsis dohrni Stechow 1924a, p. 53.
Turritopsis nutricula Fraser 1937, p. 24, Pl. I, fig. 6.

The hydrocaulus is thick, branched and fascicled, nature of branching characteristic, exactly as described by Pictet (1893) ; perisarcal tubes proximally narrow, widening distally, adnate forming a common fascicle except for a short distance where they separate ; hydranth clavate, rose coloured when fresh, whitish in preserved material ; tentacles filiform, arranged in whorls of four each or somewhat irregular ; gonosome not observed.

Height of colony	..	upto 9.2 mm.
Width of common fascicle	..	0.38-0.64 mm.
Length of perisarcal tube	..	0.40-0.53 mm.
Length of well expanded polyp	..	upto 1.30 mm.
Width of well expanded polyp	..	0.22-0.26 mm.

Locality.—A rich collection of this species was obtained from a recess surrounded by coral growth at Thankassery. The recess contained numerous eunicid tubes on which these hydroids were found to grow luxuriantly. It was invariably found on the sides of rocks protected from direct sunlight. This is the first record of this species along the Indian coast.

Family BOUGAINVILLIIDAE Allman

Hydrocaulus is solitary or colonial, hydranth not sharply demarcated from the rest of the polyp ; tentacles filiform, arranged in a single whorl (except in *Clavactinia* Thornely) ; reproduction through free swimming medusae or fixed gonophores.

The classification of this family has been revised several times. The latest classification available is of Russell (1953). This classification is based on the structure of the medusae. He raised the subfamily Hydractiniinae to family status and the subfamily Bougainvilliinae was divided into two, each having family status (Bougainvilliidae *s.str.* and Pandeidae). Bougainvilliidae *s.str.* was further divided into Bougainvilliinae *s.str.*, Thamnostominae and Lizziinae ; Pandeidae into Pandeinae, Amphineminae, Protiarinae and Calycopsinae. Such a scheme of classification is quite acceptable for the medusae and for the hydroids if the latter reproduced by medusae alone. Since quite a large number of bougainvilliids reproduce through fixed gonophores, this scheme is not acceptable to this group, especially when we consider hydroid as the adult phase of the animal. Thus for example the genera *Thamnostoma* and *Bimeria* are closely related so far as the trophosomal characters are concerned. The former reproduces through medusae which are referable to the medusa family Thamnostominae, while the latter reproduces through fixed gonophores. If one is to follow Russell's (1953) classification, *Bimeria* will have to be included in Thamnostominae, which is quite unfair as far as the characters of the gonosome are concerned. In the present paper the characters of the medusae are given only generic importance, a procedure in keeping with the trend followed by a majority of the hydroid systematists. Among the Bougainvilliidae reproducing through fixed gonophores the nature of the perisarc is taken as an important character in generic identification. It is, however, doubtful whether this can be taken as a reliable generic character, because the perisarc is known to show considerable variations depending on the ecological conditions (Rees, 1938).

The following key will serve for the generic identification of Bougainvilliidae occurring in the Indian region.

1. Polyps polymorphic, colonies creeping and encrusting.
   Subfamily HYDRACTINIINAE

   1. Tentacles scattered or nearly in several whorls. *Clavactinia* Thornely

   2. Tentacles in a single whorl.

      (i) Reproduction through medusae. *Podocoryne* Sars

      (ii) Reproduction through sporosacs. *Hydractinia* Van Beneden

II. Polyps not polymorphic, colonies with well developed hydrocaulus.
Subfamily BOUGAINVILLIINAE

1. Reproduction through medusae.

(i) Medusae liberated is a *Leuckartiara*. *Leuckartiara* Hartlaub

(ii) Medusae liberated is an *Amphinema*. *Amphinema* Haeckel

2. Reproduction through fixed gonophores.

(i) Colony branched, periderm extending close to the mouth of the hydranth and investing the basal half of the tentacles. *Bimeria* Wright

(ii) Colony abundantly branched, periderm reaching close to the mouth of the hydranth, but not extending to the base of the tentacles. *Garveia* Wright

(iii) Colony sparingly branched, periderm forming membraneous funnel. *Rhizorhagium* Sars

Subfamily HYDRACTINIINAE Stechow

Hydractinia Van Beneden

Hydractinia Van Beneden 1841.
Echinochorium Hassall 1841.
Syncoryne De Quadrefages 1843.
Cionistes Wright 1861.
Stylactis Allman 1872.

Hydrorhiza is reticulate, covered over by horny perisarc ; hydrocaulus absent ; polyps polymorphic, with gastrozooid for nutrition, gonozooid for reproduction and dactylozooid for defence ; gastrozooid with a single whorl of filiform tentacles ; gonozooid with or without tentacles ; dactylozooid in the form of spiral zooid or mere sharp conical spines arising from the hydrorhiza ; reproduction through fixed gonophores.

Podocoryne M. Sars, *Stylactis* Allman, *Cionistes* Wright and *Stylactella* Haeckel are all closely related to *Hydractinia* Van Beneden. *Podocoryne* differs from *Hydractinia* in having free swimming medusae, and *Stylactis* in having sporosacs arising directly from the hydrorhiza (Iwasa 1934). Motz-Kossowska (1905) and Kramp (1932) have expressed the view that *Stylactis* should be merged with *Hydractinia*. Broch (1909) pointed out that even *Podocoryne* should be united with *Hydractinia*. Broch's view cannot be accepted as *Podocoryne* reproduce through medusae. A study of *Hydractinia epidocleensis* Leloup has shown that the gastrozooid itself gets transformed into gonozooid and this process is associated with a reduction in height and number of the tentacles. The nature of the gonozooids therefore varies from a typical gastrozooid to a tentacleless blastostyle and it will be incorrect to assign any generic value to the degree of reduction of the gonozooid.

On this principle *Stylactis* Allman and *Clonistes* Wright should be treated as synonyms of *Hydractinia.*

Hydractinia epidocleensis Leloup

(Fig. 5)

Hydractinia epidocleensis Leloup 1931, p. 1, figs. 1-5.
Hydractinia epidocleensis Leloup 1932, p. 135, Pl. XVI, fig. 5, text figs. 4-11.

The present specimens agree in general with the descriptions of Leloup (1931, 1932). The gastrozooids in the present case are comparatively thin, with 8-20 tentacles arranged in a single whorl, the alternate tentacles slightly raised upwards, this arrangement getting exaggerated during contraction, producing a two-whorled appearance. The arrangement of the tentacles in two whorls as observed by Leloup is evidently the result of contraction. In the present study it was seen that various stages of gonozooid formation from a typical gastrozooid to a blastostyle occur in the same colony. The polyps with large number of tentacles have few gonophores in the form of lateral buds, the larger and mature gonophores are associated with reduced polyps with fewer tentacles. This shows that the gonozooid is only the reproductive phase of the gastrozooid and as such the character of the gonozooid are highly variable.

Length of gastrozooid	.. 2.10-2.60 mm.
Maximum breadth of gastrozooid	.. 0.30-0.33 mm.
Length of gonozooid	.. 0.88-1.80 mm.
Maximum breadth of gonozooid	.. 0.15-0.25 mm.

Locality.—This species was collected from Neendakara and Alleppey at depths varying from 5-8 fathoms and they were found epizoic on crabs like *Dorippe* and *Doclea* and gastropods like *Murex.* It has been previously recorded from *Doclea* sp. from Madras harbour (Leloup 1931, 1932).

Subfamily BOUGAINVILLIINAE Stechow

Leuckartiara Hartlaub

Atractylus, Wright 1859.
Perigonimus, Allman 1863 (in part).
Dinema, Van Beneden 1866.
Leuckartiara, Hartlaub 1914.

Hydrocaulus is sparingly branched ; perisarc often wrinkled, extending beyond the base of the hydranth as a thin membrane and terminating below the base of the tentacles ; hydranth fusiform, with a whorl of filiform tentacles at the base of conical hypostome ; gonosome non-pedunculate ; reproduction through *Leuckartiara*-medusa characterised by hollow tentacles with large stomach, an apical process and horseshoe-shaped gonad.

Fig. 5. *Hydractinia epidocleensis* (a) gastrozooid. (b) transition stage between gastrozooid and gonozooid. (c) gonozooid.
Fig. 6. *Leuckartiara octona* (a) developing gonophore.
Fig. 7. *Rhizorhagium palori* (a) developing gonophore.
Fig. 8. *Bimeria vestita* (a) gonophore.
Fig. 9. *Garveia franciscana* Tip of a colony showing primary and secondary polyps. (a) female gonozooid.
Fig. 10. *Garveia franciscana* Basal part of a colony showing double polyp arrangement.
Fig. 11. *Garveia franciscana* Part of a colony showing male gonophores.

This genus is often incorrectly referred to as *Perigonimus*. Rees (1938) restored the name *Leuckartiara*, after the medusa it produces. This genus is represented by *Leuckartiara octona* (Fleming) in the present collection.

Leuckartiara octona (Fleming)

(Fig. 6)

Geryonia octona Fleming 1823, p. 299.
Atractylus repens Wright 1858, p. 108, Pl. I, figs. 4-5.
Perigonimus repens Hincks 1868, p. 90, Pl. XVII, fig. I.
Perigonimus jonesii Nutting 1901a, p. 372, fig. 80.
Leuckartiara octona Bigelow 1909, p. 45, Pl. I, fig. 15.
Leuckartiara octona Ritchie 1910a, p. 204.
Leuckartiara octona Stechow 1919, p. 17.
Leuckartiara octona Leloup 1932, p. 9.
Leuckartiara octona Menon 1932, p. 9.
Leuckartiara octona Rees 1938, p. 12, text figs. 3-5.
Leuckartiara octona Russell 1953, p. 188, Pl. XI, figs. 5, 6, Pl. XII, fig. 3, Pl. XXI.
Leuckartiara octona Millard 1957, p. 182.
Leuckartiara octona Kramp, 1961, p. 105.

The hydrocaulus is long, sparingly branched, periderm thick, except at the proximal part of the polyp where it is extremely thin and irregularly wrinkled ; hydranth peduncles proximally narrow ; hydranth large with 12-14 tentacles ; gonophores present in large numbers, all immature, appearing as dark masses encased in gelatinous matrix.

Height of hydrocaulus	..	2.80-5.85 mm.
Width of proximal part of hydrocaulus	..	0.10-0.12 mm.
Width of distal part of hydrocaulus	..	0.22-0.28 mm.
Height of hydranth	..	0.56-0.94 mm.
Length of gonophore	..	upto 0.62 mm.
Width of gonophore	..	upto 0.45 mm.

Locality.—This species was collected from Neendakara, where it was found completely embedded in fine mud. In the Indian region it has been previously reported from Andamans and off Puri (Leloup 1932). The medusa of this species has been previously reported from Madras (Menon 1932) and Trivandrum (Nair 1951).

Rhizorhagium Sars

Wrightia L. Agassiz 1862.
Rhizorhagium M. Sars 1877.
Gravelyi Totton 1930.

Hydrocaulus is unbranched or sparingly branched, arising from creeping and reticulated stolon, hydranth clavate with a single whorl of filiform tentacles at the base of a conical hypostome ; perisarc distally expanding to form a pseudo-hydrotheca ; reproduction through fixed gonophores arising from hydrorhiza or hydrocaulus.

Rhizorhagium palori n.sp.

(Fig. 7)

This species was seen epizoic on the body and fins of *Palor* sp. a scorpaenoid fish caught twice at Trivandrum. Hydrorhiza consists of closely woven network, which together with mud forms a firm leathery investment over the body of the fish ; hydrocaulus simple, very rarely branching, with narrow proximal and broadened distal part, terminating in a hydranth ; perisarc invests the hydrocaulus, extends to two-thirds the height of the polyp forming a pseudohydrotheca, transversely and irregularly wrinkled ; hydranth large, clavate, tentacles 10, thick and fleshy, carrying a very large number of nematocysts giving a setose appearance ; gonophores egg-shaped, borne on short peduncle, arise directly and singly from the hydrocaulus.

Height of hydrocaulus	..	1.20-1.58 mm.
Breadth of hydrocaulus at the base	..	0.04-0.05 mm.
Breadth of distal end of hydrocaulus	..	0.21-0.25 mm.
Height of hydranth	..	0.42.0.46 mm.
Length of tentacle	..	0.20-0.23 mm.
Breadth of tentacle	..	0.02-0.03 mm.
Length of gonophore (immature)	..	upto 0.17 mm.
Breadth of gonophore (immature)	..	upto 0.14 mm.

Locality.—Two specimens of scorpaenoid fish (*Palor* sp.) were caught at Trivandrum in shore seine. At the time of capture, the fish were completely covered with mud. On washing the fish clean off the mud, innumerable small tubercles were noticed all over the body of the fish, which on closer examination turned out to be this hydroid. The hydroid growth was particularly good on the fins and near the gill opening.

Remarks.—Rees (1938) has recognised only 3 species of *Rhizorhagium* and the present species is easily distinguished from them by the proportionately large hydranth, setose tentacles and above all in its association with *Palor* sp. The association of several genera of Athecata with other animals are well known. There

are however only a few records of Athecata association with fishes, but none so far from *Palor* sp. Nor any *Rhizorhagium* association with any fish has so far been reported.

Bimeria Wright

Bimeria Wright 1857.

Hydrocaulus is branched ; perisarc extends over the hydranth forming a sheath over the basal part of the tentacles ; reproduction through fixed gonophores ; gonophore pedunculate and arising from the hydrocaulus.

In the present paper *Bimeria* Wright is treated as separate from *Garveia* Wright. There has been in the past some controversy over the independent status of *Garveia* Wright. According to Allman (1872), the chief distinguishing character is the nature of the periderm. The periderm extends close to the mouth and forms a glove over the lower half of the tentacles in *Bimeria*, which does not occur in *Garveia*. According to Fraser (1938) the wall of the gonophore remains unruptured during the entire period of development in *Bimeria*, whereas in *Garveia* the gonophore is enclosed in the perisarc only for a short time and this subsequently bursts, after which it is confined to the peduncle where it usually ends in cup-like expansion. Rees* holds the view that the affinity of *Bimeria* is to *Thamnostoma*, while that of *Garveia* is to *Bougainvillia*. The only species of *Bimeria* represented in the Indian region is *Bimeria vestita*.

Bimeria vestita Wright

(Fig. 8)

Bimeria vestita Wright 1857, p. 108, Pl. VIII, fig. 4.
Bimeria vestita Hincks 1868, p. 108, Pl. XV.
Bimeria vestita Allman 1872, p. 297, Pl. XII, fig. 1-3.
Perigonimus vestita Motzkossowska 1905, p. 74.
Non *Bimeria vestita* Annandale 1907, p. 141, Pl. II, fig. 5.
Bimeria vestita forma *nana* Leloup 1932, p. 142, fig. 14.

Hydrocaulus is branched ; hydranth borne on moderately long peduncles, with 3-4 proximal annulations and a single annulation at the distal end ; periderm thick, reaching upto the middle of the tentacle like a ' half glove ' ; tentacles 14-16, short and stout, with warty appearance due to the presence of nematocysts. Gonophores are short, stalked, spherical or egg-shaped, encased in thick gelatinous capsules, arising from peduncles of hydranth.

Height of hydrocaulus	..	upto 4.8 mm.
Breadth of hydrocaulus	..	0.10-0.13 mm.
Length of hydranth peduncle	..	0.32-0.42 mm.

* 1955—personal communication.

Breadth of hydranth peduncle	.. 0.08-0.10 mm.
Length of hydranth	.. 0.28-0.33 mm.
Breadth of hydranth	.. 0.18-0.23 mm.
Length of gonophore	.. 0.38-0.45 mm.
Breadth of gonophore	.. 0.24-0.28 mm.

Locality.—This species was collected from Pamban, Cape Comorin and Thankassery. It was found growing on rocks and shells of *Turbo* and *Balanus* usually with a heavy encrustation of algal filaments and suctorians.

Garveia Wright

Garveia Wright 1857.

Hydrocaulus is branched, with a conspicuous investment of periderm extending to the base of the hydranth, but never so far as the middle of the tentacles as in *Bimeria* and *Thamnostoma*; reproduction through fixed gonophores arising from the base of the hydranth. The only species of *Garveia* known in the Indian region is *Garveia franciscana*.

Garveia franciscana (Torrey)

(Figs. 9-11)

Bimeria franciscana Torrey 1902, p. 28, Pl. I, fig. 4.
Bimeria vestita Annandale 1907, p. 141, fig. 3.
Bimeria fluminalis Annandale 1915, p. 111, Pl. IX, fig. 3, text fig. 10.
Bimeria fluminalis Leloup 1932, p. 139, Pl. XVII, fig. 1, 1a, text figs. 12-13.
Bimeria franciscana Fraser 1937, p. 31, Pl. III, fig. 14.

The hydrocaulus is rooted by filiform stolons, attains a height of 15 cms., erect, stout, monopodially branching, branches alternate, arising at short intervals; perisarc thick, smooth, with 3-5 annulations at the base of the branches investing the basal part of the hydranth, becoming progressively thin and adherent to the polyp; polyp large, hypostome conical; tentacles arranged in a circlet of 10, and in young specimens apically bulged. At the distal end of the colony each polyp is borne on independent peduncle, but a little lower down in the same colony two dissimilar polyps may be seen to arise from a common peduncle, the smaller polyps are obviously of subsequent origin. Towards the basal region of the same colony these double polyps appear to be identical. Male gonozooids are few, arise from terminal branches, oval and enclosed in transparent membrane; female gonophores arise in dense clusters on bases of partially or completely atrophied hydranths.

Height of colony		upto 15 cms.
Breadth of hydrocaulus		0.28-0.35 mm.
Distance between consecutive branches	..	3-10 mm.
Length of primary hydranth peduncle	..	0.45-0.66 mm.
Length of secondary hydranth peduncle	..	0.20-0.36 mm.
Length of hydranth	..	0.40-0.48 mm.
Breadth of hydranth below the level of tentacles	..	0.25-0.32 mm.
Length of male gonophore	..	upto 0.24 mm.
Length of female gonophore	..	upto 0.26 mm.

Locality.—Colonies of this species were found in large numbers at Neendakara and Cochin below the bridges. This species has been previously recorded by Annandale (1907) from Port Canning and Chilka Lake (1915), and Leloup (1932) from Murmugoa bay, east of Kumbalam in Cochin State, Andamans and Ganges delta.

Remarks.—Colonies make their appearance during December, just after the end of the north-east monsoon. In January clean specimens of about 2-3 cms. in height with little or no branches are observed. By April the colonies attain their maximum length of 15 cms. and become much branched and overgrown with numerous epizoic hydroids and suctorians. During the south-west monsoon when the salinity is considerably lowered the colonies die leaving their stumps.

Family CORYNIDAE Allman

Hydrocaulus is solitary, colonial, hydranth sharply demarcated from the rest of the colony, tentacles scattered or arranged in several whorls, nematocysts on tentacles concentrated into terminal swellings to form capitate tentacles; reproduction through free swimming medusae or fixed gonophores.

Stechow (1924) included about 30 genera under this family based on the possession of capitate tentacles. Later workers restricted Corynidae to exclude Solanderiidae, Tricyclusidae, Candelabridae, Eleutheriidae, Hydrocorynidae and Cladocorynidae. Corynidae *s.str.* occurring in the Indian region may be identified as follows:

I. Tentacles scattered or in several distinct whorls.
   1. Hydrocaulus well developed, reproduction through fixed gonophores. *Coryne* Gaertner
   2. Hydrocaulus ill developed, reproduction through *Zanclea* medusae. *Zanclea* Gegenbaur

II. Tentacles in definite girdles around the base of the polyp, which can be resolved into two closely approximated whorls under ideal conditions. *Sphaerocoryne* Pictet

III. Tentacles in two widely separated whorls, an oral and an aboral. *Dicyclocoryne* Annandale

Coryne Gaertner

Coryne Gaertner 1774.
Fistularia O. F. Muller 1776.
Capsularia Cuvier 1798.
Stipula M. Sars 1827.
Hermia Johnston 1828.
Syncoryne Ehrenberg 1834.
Halobotrys Filippi 1866.
Eucoryne Broch 1909.

Hydrocaulus is moderately branched ; perisarc thick, smooth or annulated ; polyps fusiform with scattered capitate tentacles ; reproduction through fixed gonophores arising from the body of the hydranth.

This genus has not so far been reported from the Indian region.

Coryne muscoides (Linnaeus)

(Figs. 12 & 13)

Coryne vaginata Hincks 1861, p. 295.
Coryne vaginata Hincks 1868, p. 41, Pl. VIII, fig. 1.
Coryne vaginata Motz-Kossowska 1905, p. 26.
Coryne muscoides Stechow 1919, p. 4.
Coryne muscoides Stechow 1924a, p. 42.

Hydrocaulus is semi-erect, usually climbing, hydrothecal peduncles long ; perisarc closely annulated with the distal end dilated forming a thin pseudohydrotheca, which in well expanded colonies remains detached from the hydranth, except at their distal margin ; hydranth rose coloured, fusiform, with 15-20 scattered or whorled capitate tentacles. Gonophores fixed, spherical or ovoid, on short peduncles arising from the basal part of the hydranth.

Under laboratory conditions, the polyps carrying gonophores appeared to be more quiescent than those without. In young gonophores the germinal part appears as dull-red, spindle-shaped bodies surrounded by gelatinous matrix. As growth proceeds, the spindle-shaped structure increases in girth becoming finally spherical in shape. In the early stages of growth, the germinal part is nearly homogenous, this gradually becomes granular and finally develops into small spherical bodies which ultimately become ova. Ova emerge by the rupture of the gelatinous matrix, after which it remains attached to the gonophore for two or three hours by means of gelatinous strands and during this period they grow to more than double the original size. The development of the male gametes was not followed.

Height of colony	..	up to 5.6 mm.
Length of hydranth peduncle	..	2.20-3.80 mm.
Length of hydranth	..	1.10-1.68 mm.
Breadth of hydranth	..	0.38-0.48 mm.
Length of capitate tentacle	..	0.26-0.48 mm.
Diameter of capitula	..	0.08-0.10 mm.
Width of pseudohydrotheca	..	0.30-0.43 mm.

Locality.—This species was obtained from Thankassery attached to seaweeds. This species has not earlier been recorded from the Indian region.

Zanclea Gegenbaur

Zanclea Gegenbaur 1856.
Gemmaria McCrady 1858.
Halocharis L. Agassiz 1862.
Corynitis Allman 1872.

A hydrocaulus is absent or poorly developed ; hydranth usually arising directly from the hydrorhiza ; hydrocaulus short, surrounded by thick perisarc ; hydranth clavate with scattered or irregularly whorled capitate tentacles ; reproduction through free-swimming medusae, arising from the hydranth, medusae with 4 radial canals, interradial gonads, 2 to 4 marginal tentacles and exumbrellar armature of nematocysts.

Russell and Rees (1936) followed the peculiar development of *Zanclea implexa* (*Zanclea costata*). They conclusively proved that such characters like the extent of development of the hydrotheca, number of tentacles of hydranth and medusa, thickness of the jelly and the disposition of the nematophore have no generic value. So *Gemmaria* McCrady, *Halocharis* L. Agassiz fall in the synonymy of *Zanclea* Gegenbaur.

Zanclea indica n.sp.

(Figs. 14 & 15)

Colonies are dimorphic, both agree in having cylindrical elongate hydranth, distally rounded with a terminal mouth ; tentacles arranged in whorls, distal ones long, becoming progressively shorter towards the proximal part ; perisarc investing the hydranth-stalk like a short thimble with the distal margin adnate to the hydranth. In the larger forms there are 20-30 tentacles arranged in several whorls, gonophores are few and immature, while in the smaller forms there are 12 tentacles arranged in 3 whorls, most of these polyps possess mature gonophores with 4 distinct knobs representing 4 capitate tentacles.

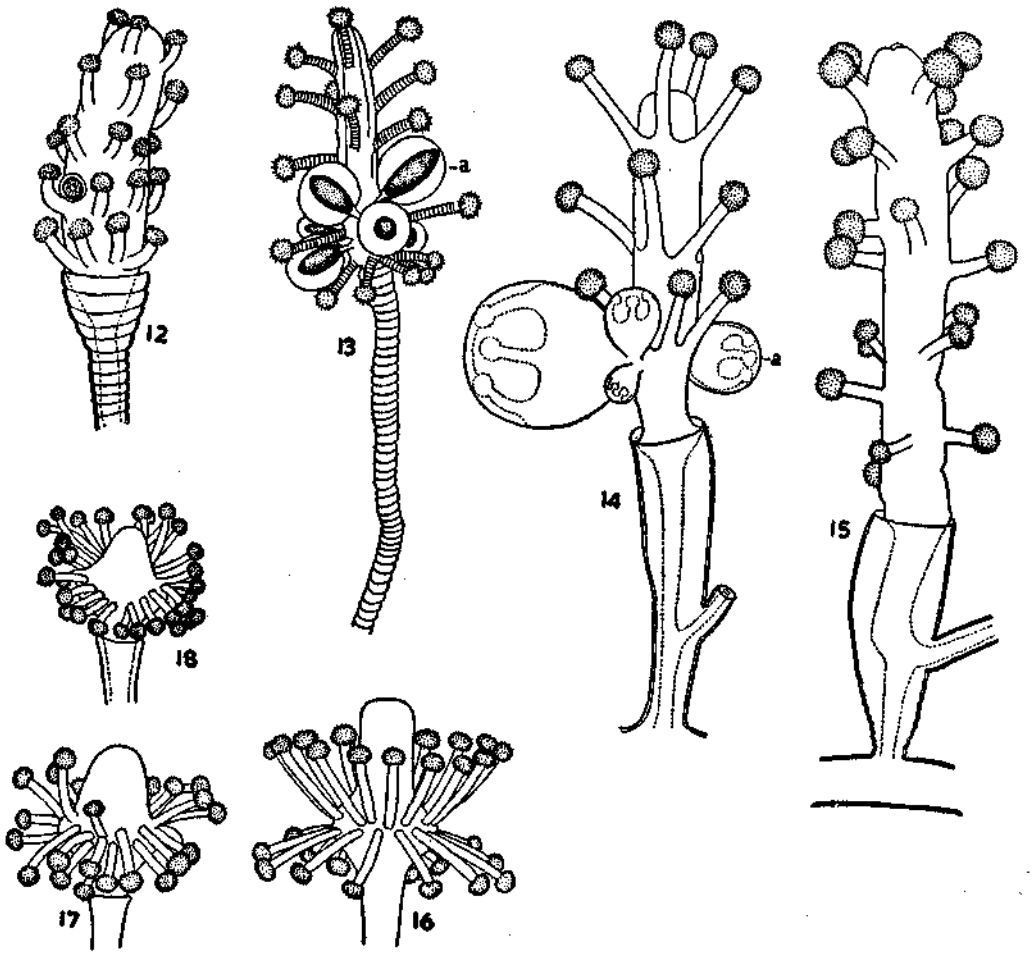

Fig. 12. *Coryne muscoides.*
Fig. 13. *Coryne muscoides* (a) developing gonophore.
Fig. 14. *Zanclea indica* Short form with developing medusa (a).
Fig. 15. *Zanclea indica* Tall form without medusa.
Fig. 16. *Sphaerocoryne bedoti* (Drawn from living specimen).
Figs. 17 & 18. *Sphaerocoryne bedoti* (Drawn from preserved specimens).

	large forms	*small forms*
Height of perisarcal cup	0.56-0.75	0.56-0.59 mm.
Breadth of perisarcal cup	0.22-0.25	0.20-0.22 mm.
Height of hydranth	1.20-1.80	0.80-0.95 mm.
Breadth of hydranth	0.20-0.25	0.20-0.25 mm.
Length of mature gonophore		0.40-0.52 mm.
Breadth of mature gonophore		0.36-0.46 mm.

Locality.—This species is represented by two collections from Thankassery, one set consisting of large immature forms collected on the 24th January 1955 and the other by smaller mature specimens collected on the 24th January 1953.

Remarks.—The two sets were at first thought to be two different species, especially because the small forms were all mature. In *Zanclea costata*, Russell and Rees (1936) have observed that the maturity of the gonosome was associated with a reduction in height and number of tentacles and in extreme cases the hydranth itself was represented by mere blastostyle. This observation will probably explain the present anomaly. The short forms are evidently in the reproductive phase and the reduction in height and number of tentacles is in conformity with the observations of Russell and Rees. The larger colonies with few immature gonosomes are approaching the reproductive phase.

Even though the medusa with the typical nematocysts was not observed, the mature gonophores showed four large tentacles. The nature of the hydrocaulus, arrangement of the capitate tentacles and the *Zanclea*—like medusa bud prompted the identification of the material as *Zanclea*. In the whorled arrangement of the tentacles and the presence of 4 tentacles in each whorl in mature colonies, the present species differs from all the known species of *Zanclea* and hence is described as new species.

Sphaerocoryne Pictet

Sphaerocoryne Pictet 1893.

The hydroid is solitary, borne on long peduncles arising directly from the hydrorhiza ; perisarc delicate, hydranth pearshaped, with a girdle of closely arranged capitate tentacles arising from the middle of its proximal half ; gonophore medusoid, arising immediately above the girdle of tentacles.

Sphaerocoryne bedoti Pictet

(Figs. 16-18)

Sphaerocoryne Bedoti Pictet 1893, p. 10, Pl. I, figs. 5 & 6.
Clavatella multitentaculata Warren 1908, p. 278, Pl. XIV, figs. 7-9.
Sphaerocoryne multitentaculata Stechow 1921, p. 248.
Sphaerocoryne multitentaculata Stechow 1924a, p. 44.
Syncoryne sp. Gravely 1927, p. 8, Pl. II, fig. 3.

Hydrocaulus is long, yellow in colour, embedded in silicious sponge, basally narrow, distally somewhat stouter ; periderm indistinguishable in fresh specimens, clearly visible in preserved material; hydranth large, pear-shaped, mouth terminal ; hypostome typically cylindrical, but varying to oval, conical or hemispherical depending on the degree of contraction during preservation and the amount of undigested food in the digestive cavity. There are 26-34 tentacles around the proximal half of the hydranth, set in two closely approximated alternating whorls, though in preserved material they often appear shifted out of position as if arranged in one or several whorls. Gonosome was not observed.

Locality.—Several colonies were collected from Thankassery.

TABLE 1

	Sphaerocoryne bedoti Pictet 1893	*Clavatella multitentaculata* Warren 1908	*Syncoryne* sp. Gravely 1927	Present specimens	
				Live specimens	Preserved specimens
Length of peduncle	5-6 mm. in text and 15 mm. in figure*	12.8 mm. ($\frac{1}{2}$")	10 mm.	14-20 mm.	14-20 mm.
Diameter of peduncle	0.15-0.20 mm.*	0.13 mm.	?	0.15-0.30 mm.	0.15-0.30 mm.
Length of hydranth	0.8-0.9 mm.	0.84 mm.	?	1.08-1.26 mm.	0.70-1.00 mm.
Diameter of hydranth	0.70 mm.	0.58 mm.	?	0.48-0.55 mm.	0.61-0.92 mm.
Habitat	Solitary, hydrorhiza and basal part of the peduncle immersed in silicious sponge.	Similar to *S. bedoti*.	?	Exactly similar to *S. bedoti*.	
Hydranth	Spherical	Formed of an anterior conical half and a basal hemispherical half.	Fusiform or oval.	In the living condition it has a barrel shaped anterior and a spherical posterior part. The shape of the preserved material varies considerably and agrees with one or other of the shapes mentioned for the other records.	
Number and arrangement of tentacles.	40 capitate tentacles in 3-4 closely arranged verticles in the median zone of the hydranth.	28-35 capitate tentacles arranged in one row, though 'too numerous to form a single verticil'.	3 closely approximated whorls along the middle of the hydranth.	26-34 capitate tentacles in 2 distinct, but closely approximated whorls along the middle of the basal half of the hydranth. In the preserved material the two whorled arrangement is obliterated and they appear to be disposed in one or more whorls.	
Gonosome.	Medusoid in the tentacular zone.	Medusoid.	Absent.	Absent.	

* Measurements computed from figure.

Remarks :—Sphaerocoryne is at present represented by three species (*viz. S. bedoti* Pictet, *S. multitentaculata* Warren and '*Syncoryne* sp' Gravely). The descriptions of all the three species are based on preserved material. They all agree in the solitary nature of the polyp, simple peduncle without annulations and the presence of a large number of capitate tentacles closely arranged around the middle of the proximal half of the hydranth. They also agree in the colour pattern and the association with silicious sponge. The difference is in the shape of the hypostome and the arrangement of the tentacles. The shape of the hypostome as already pointed out, is highly variable and this may explain how the hypostome came to be described as spherical in *S. bedoti*, distal half conical and proximal half spherical in *S. multitentaculata* and fusiform or oval in *Syncoryne* sp. All these conditions are noticeable in the preserved material of the present collection. Though Warren says that there is only one whorl of tentacles, he is of opinion 'they are too numerous to form a single verticil'. Moreover the magnified figure of longitudinal section given by him clearly shows that the section passes through the axis of one of the tentacles and along the side of another. From this it is evident that in his specimens there are 2 whorls of alternating tentacles. Pictet mentions 3 or 4 closely arranged whorls around the middle of the hydranth. A similar condition is noticed in some of the preserved specimens of the present collection. Thus it will be seen that the distinguishing characters of the three species are only the result of varying degrees of contraction due to preservation.

Pictet created *Sphaerocoryne* to include *S. bedoti.* Warren seems to have been unaware of this genus and hence referred his species to *Clavatella* and probably this wrong identification led him to describe that the tentacles are in a single whorl. However, the arrangement of the tentacle is evident from his figure. Moreover the medusoids which he observed cannot be assigned to *Clavatella.* Stechow (1921, 1924a) even without examining the specimens pointed out that Warren's species should belong to *Sphaerocoryne.* Gravely correctly noticed the characteristic arrangement of the tentacles, but was evidently misled by the nature of origin of the medusoid and referred his specimens to *Syncoryne* and suggested that Warren's specimens should also be transferred to that genus. However, in referring his material to *Syncoryne,* Gravely has ignored the whorled arrangement of the tentacles. Gravely was apparently unaware of the genus *Sphaerocoryne* for there is no reference to Pictet's paper in the list of references.

Family CLADOCORYNIDAE Allman (Emend)

Hydrocaulus is unbranched or sparingly branched ; hydranth clavate ; tentacles in oral and aboral whorls ; oral tentacles arranged in a single whorl, with terminal capitulae, aboral tentacles arranged in one or more whorls, with capitulae in longitudinal rows ; reproduction through medusoids in all the known genera.

Allman (1872) who created this family for accommodating the genus *Cladocoryne* Rotch defined the family as follows :—'Trophosome. Hydranth with both simple and ramified capitate tentacles. Gonosome unknown'. The present collection includes two new genera, *Lobocoryne* n.gen. and *Cladocorynopsis* n.gen. both showing affinity to *Cladocoryne* Rotch. The definition of the family has been modified as given above to accommodate the two new genera. The three genera of Cladocorynidae, all of which are represented in the Indian region, may be recognised as follows:

I. Capitulae of aboral tentacles sessile.
Aboral tentacles in three whorls. *Lobocoryne* n.gen.

II. Capitulae of aboral tentacles stalked.

1. Aboral tentacles in a single whorl. *Cladocorynopsis* n.gen.
2. Aboral tentacles in several whorls. *Cladocoryne* Rotch

Lobocoryne n.gen.

Hydrocaulus is long, seldom branching ; hydranth with an oral whorl of sessile capitate tentacles and three whorls of large fleshy aboral tentacles with the capitulae arranged in longitudinal rows ; gonosome unknown.

Lobocoryne travancorensis n.sp.

(Figs. 19-21)

Hydrocaulus arises at short intervals from a creeping and often reticulated stolon ; perisarc thin, devoid of annulations, occasionally with indistinct folds,

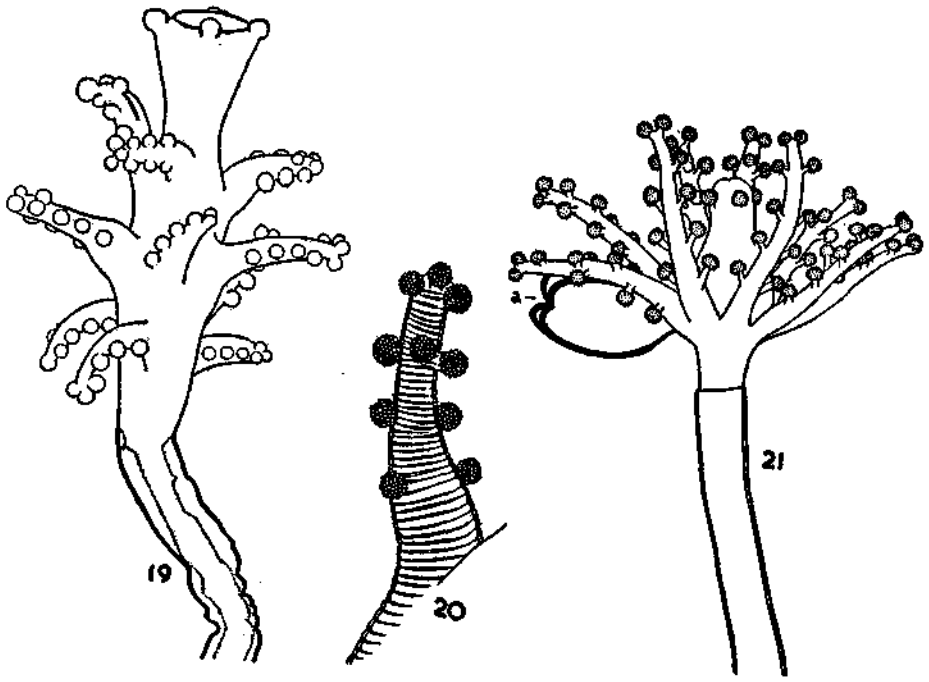

Fig. 19. *Lobocoryne travancorensis* (polyp only).
Fig. 20. *Lobocoryne travancorensis* (one tentacle—enlarged).
Fig. 21. *Cladocorynopsis littoralis* (polyp only).

hydranth comparatively large, barrel-shaped, whitish in colour, with almost transparent tentacles, with terminal mouth ; oral tentacles represented by four capitulae giving the hypostome a quadrate appearance ; aboral tentacles 12, septate as in *Asyncoryne ryniensis* Warren, very fleshy, somewhat dorso-ventrally flattened, with lateral rows of 4-5 capitulae and two dorso-median capitulae towards the distal

end, the latter alternating with the former ; capitulae spherical, sessile and studded with nematocysts ; gonosome not obtained.

Height of hydrocaulus	up to 11.30 mm.
Breadth of hydrocaulus	0.13-0.15 mm.
Height of hydranth	0.95-1.24 mm.
Breadth of hydranth at the level of proximal whorl of tentacles	0.32-0.42 mm.
Length of aboral tentacle	0.63-0.90 mm.
Breadth of aboral tentacle	0.18-0.22 mm.

Locality.—A good collection of this species was obtained from Thankassery.

Cladocorynopsis n.gen.

Hydrocaulus is long, invested in a thin perisarc, sparingly branched ; hydranth with an oral whorl of short pedunculate capitate tentacles and a single whorl of stout aboral tentacles with stalked capitulae arranged in longitudinal rows ; reproduction through medusoids arising between the aboral whorl of tentacles.

Cladocorynopsis n.gen. agrees with *Cladocoryne* Rotch in all characters except the arrangement of the aboral tentacles in a single whorl, a character which has always been considered to have sufficient generic status.

Cladocorynopsis littoralis n.sp.

(Fig. 21)

The hydrorhiza consists of creeping stolon, often intertwining around bases of seaweeds and tubes of eunicid worms ; hydrocaulus long, sparingly branched ; perisarc transparent, indistinguishable in live specimens, but clearly visible in preserved material, not extending beyond the base of the hydranth ; hydranth pink coloured, pear-shaped, with rounded apex and terminal quadrate mouth ; oral tentacles represented by four, short, stalked capitulae on the distal end of the hypostome ; aboral tentacles 10 to 12, thick, fleshy, but not to the same extent as in *Lobocoryne travancorensis* n.sp., with capitulae borne on moderately long peduncles in 4 longitudinal rows, the dorsal and ventral rows of capitulae being opposite and alternating with the laterals. Gonophores develop into medusoids ; medusoids as large as hydranth, with four, short, tentacles and four exumbrellar longitudinal ridges opposite the radial canals.

Height of hydrocaulus	up to 4.0 mm.
Breadth of hydrocaulus	0.12-0.15 mm.
Height of hydranth	0.53-0.62 mm.
Breadth of hydranth at the level of oral whorl of tentacles	0.12-0.15 mm.
Breadth of hydranth at the level of aboral whorl of tentacles	0.22-0.25 mm.

Length of aboral tentacle	0.62-0.78 mm.
Length of gonozooid	0.32-0.45 mm.

Locality.—This species is abundant at Thankassery and occasionally found at Kovilam.

Remarks.—Allman's original description of *Cladocoryne pelagica* (1876, p. 255, Pl. XII, fig. 7) applies to the present species to a great extent, but he did not mention anything about the arrangement of the tentacles. However, this species as described by subsequent authors refer to a polyp with tentacles arranged in several whorls. *Cladocoryne haddoni* Kirkpatrick has been recorded from Pamban in the Indian region by Jaderholm (1903), but since he did not give description or illustration of his material, it is not possible to compare his material with the present material.

Family HALOCORDYLIDAE Stechow

Hydrocaulus is branched, hydranth with oral capitate and aboral filiform tentacles ; reproduction through medusoids.

The type genus of this family is *Halocordyle* Allman. Cavolini (1785) first described a *Halocordyle* under the name *Sertularia pennaria*. The genus *Pennaria* was instituted by Oken (1815). This genus did not include any of the present day *Halocordyle*, but instead included species of *Hydrallmania* Hincks, *Plumularia* Lamarck, *Schizotricha* Allman, *Aglaophenia* Lamouroux and a few other insufficiently described species. Ayres (1852) described a true *Halocordyle* under the generic name *Globiceps*, and Leidy (1855) described the same under *Eucoryne*. These two generic names were preoccupied and so the generic name *Pennaria* came to be applied to *Halocordyle*. Allman (1872) created a separate family Pennariidae, for accommodating *Pennaria* with scattered and *Halocordyle* with regular whorls of capitate tentacles. Pictet (1893) reunited the two genera, since the generic distinction, namely the arrangement of the capitate tentacle is a highly variable character and so he adopted the earlier name *Pennaria* for the combined genus. Since the generic name *Pennaria* was originally used in a totally different sense, Stechow reinstated the name *Halocordyle*, this being the first valid name for the group. Subsequent authors have disagreed with Stechow, because of their preference to a more familiar name. Since Stechow's views are in conformity with the rules of Zoological nomenclature, the name *Halocordyle* is adopted and the family name Halocordylidae has been followed in the present paper.

Stechow recognised 10 genera under this family. Of these Westblad allotted the family Acaulidae for *Acaulis* Stimpson. Kramp (1949) transferred *Asyncoryne* Warren to Asyncorynidae, *Heterostephanus* Allman (*Heteractis* Allman) to Corymorphidae (Corymorphinae in the present paper), *Rhizotricha* Stechow (*Trichorhiza brunnea*) to *Heteractis* ; *Blastothela* Verrill to Acaulidae, *Acharydria* to *Tubularia* ; *Perinema* Stechow (*Coryne cerberus* Gosse) doubtfully as young stage of *Cladonema* Dujardin or *Stauridia* Rotch. Rees (1938) considers *Vorticlava humilis* Alder and *V. proteus* Wright as young stages of *Corymorpha* M. Sars. Thus the family Halocordylidae now contains the single genus *Halocordyle* Allman.

Halocordyle Allman

Sertularia Cavolini 1785 (in part).
Non *Pennaria* Oken 1815.
Globiceps Ayres 1852.
Pennaria Allman 1872.
Halocoryle Allman 1872.
Pennaria Pictet 1893.
Halocordyle Stechow 1919.

Hydrocaulus is rooted by a filiform hydrorhiza, pinnately branched ; hydrocladia bearing hydranths only on the upper side ; perisarc thick ; hydranth clavate, with filiform and capitate tentacles ; filiform tentacles placed in a single aboral whorl and capitate tentacles either in several whorls or scattered around the distal half of the hydranth ; reproduction through medusoid gonophores belonging to the medusa family Codonidae, characterised by four rudimentary tentacles placed opposite the radial canals.

Halocordyle pennaria (Cavolini) var. *australis* (Bale)

(Figs. 22-24)

Pennaria australis Bale 1884, p. 45.
Pennaria rosea Bigelow 1909, p. 185.
Pennaria rosea Mayer 1910, p. 27.
Halocordyle disticha (Goldfuss) var. *australis* (Bale) Stechow 1925, p. 194.
Halocordyle disticha (Goldfuss) var. *australis* (Bale) Vervoort 1941, p. 192.
Pennaria disticha (Goldfuss) var. *australis* (Bale) Vervoort 1942, p. 105.

The hydrocaulus is erect, divided into internodes bearing hydrocladia, which in turn demarcated into internodes, each carrying hydranth on their upper side ; hydranth clavate, the shape varying from conical to cylindrical depending on its location in relation to the hydrocladia ; filiform tentacles 10, arranged in a single verticil around the base of the hydranth ; capitate tentacles 12, irregularly placed on the terminal polyp, but arranged in 2 or 3 whorls in others, gonophores arise from hydranth immediately above the whorl of tentacles, developing into medusoids characterised by deep bell, four granular radial canals and four short rudimentary tentacles.

Mature colonies occurred from January to April. These were reared for obtaining medusoids. Medusoids were very active immediately after liberation. They were deep, bell-shaped and the manubrium extended to more than half the height of the bell (Fig. 24). The manubrium grew rapidly and in about 2 hours after liberation reached as far downwards as the velum, in certain cases even projected out through the velar opening. By the time this stage was reached, the medusoids became more and more inactive and finally sank to the bottom. In about 4-6 hours after liberation, about 80% of the medusoids were seen to settle down in

this manner, after which the bell contracted vigorously, everted and remained shrivelled up around the manubrium (fig. 23).

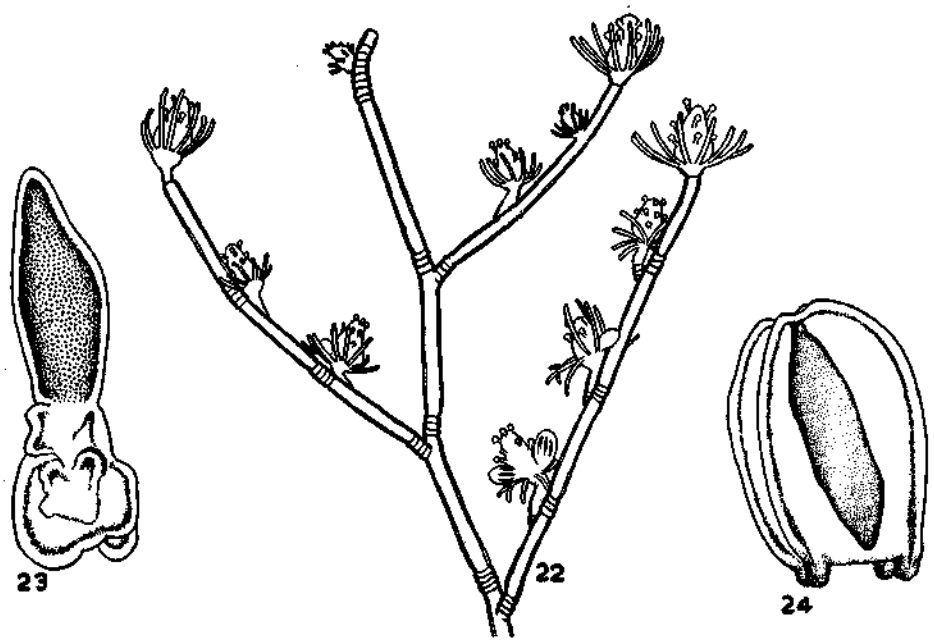

Fig. 22. *Halocordyle pennaria* var. *australis*. Tip of a colony showing the typical arrangement.
Fig. 23. Medusoid of *Halocordyle pennaria* var. *australis*, after the evertion of the bell.
Fig. 24. Medusoid of *Halocordyle pennaria* var. *australis*, an hour after liberation.

Height of colony	up to 15 cm.
Length of terminal polyp	1.25-1.76 mm.
Breadth of terminal polyp	0.45-0.51 mm.
Length of typical polyp	1.00-1.25 mm.
Breadth of typical polyp	0.40-0.47 mm.
Length of capitate tentacle	up to 0.30 mm.
Length of filiform tentacle	up to 1.40 mm.
Height of medusoid	0.98-1.45 mm.
Height of medusoid after liberation	0.35-0.45 mm.
Height of mature manubrium	0.98-1.18 mm.

Locality.—Abundant material of this species was collected from practically all stations. The growth was particularly good under the Pamban and Neendakara bridges.

Remarks.—It is now believed that many of the well established species of *Halocordyle* are only synonyms or varieties of *H.pennaria*. Pictet (1893) showed that *Pennaria symmetrica* Clarke differed from *H. pennaria* only in the shape of the hydranth and *P. tiarella* in its capacity to produce free swimming medusoids, the whorled arrangement of the capitate tentacles and the presence of annulations of the perisarc. However all these come within the range of intra-specific variations shown by *H. pennaria*. Ritchie (1910) considers *P. australis* as a variety of *H. pennaria*. Hargitt (1904) has pointed out that the only distinction between *H. gibbosa* and *H. pennaria* is in the whorled arrangement of the capitate tentacles of the former. This character is now recognised only as an intra-specific variation. It is therefore likely that a good number of the species are only synonyms and varieties of *H. pennaria*.

Family EUDENDRIIDAE Hincks

Hydrocaulus is branched; perisarc well developed and uniformly thick; hydranth large; hypostome trumpet-shaped with a girdle or a single whorl of filiform tentacles; reproduction through fixed gonophores, except in *Nemopsis* Agassiz.

The Eudendriidae represented in the Indian region may be identified as follows:

I. Tentacles numerous (80-100), arranged in 3 or 4 closely packed whorls — *Myrionema* Pictet

II. Tentacles few (less than 30), arranged in a single whorl. — *Eudendrium* Ehrenberg

Eudendrium Ehrenberg

Eudendrium Ehrenberg 1834.

Hydrocaulus is branched, invested by perisarc; hydranth large, with hemispherical base and trumpet-shaped hypostome: tentacles filiform, arranged in a single whorl at the base of the hypostome; reproduction through fixed gonophores, gonozooids on normal or partially atrophied hydranths.

More than 50 species of *Eudendrium* have been recorded so far. A detailed study of *Eudendrium capillare* in the the present collection has shown that some of the characters usually employed for the identification of species are variable and undependable. For instance the height and mode of growth varies greatly depending on the environment. The transverse constriction observed in the polyp immediately above the upper end of the perisarc is due to the contraction of the polyp, as it vanishes when the polyp expands. So also in the description of any one species by different authors, considerable difference in number and arrangement of the gonophores is noticed. The number of chambers in the male gonophore is considered a suitable character, but immature gonophores will invariably show a lesser number of chambers. What appears as a spread-out gonangia in the immature state, assume a clustered appearance in the mature state. It is therefore necessary to define the extent of variation in the different species. Recorded species of *Eudendrium* from the Indian region may be identified as follows*:

* Sufficient details about *E. pusillum* Thornely are not available and hence excluded from the key. Briggs (1922) and Stechow (1924a) are of opinion that it is different from *E. pusillum* von Lendenfeld and Stechow gave it the new name *E. indopacificum*.

I. Male gonophores arising from a normal or partially degenerate hydranth.

1. Male gonophore 2 chambered. *E. maldivense* Borradaile
2. Male gonophore 3 chambered. *E. album* Nutting

II. Male gonophores arising on atrophied hydranths.

1. Male gonophore 1 chambered. *E. armstrongi* (Armstrong)
2. Male gonophore 2 chambered. *E. capillare* Alder

Eudendrium capillare Alder

(Figs. 25 & 26)

Eudendrium capillare Alder 1856, p. 355.
Eudendrium capillare Hincks 1868, p. 84, Pl. XIV, fig. 2.
Eudendrium capillare Allman 1872, p. 335, Pl. XIV, figs. 1-3.
Eudendrium capillare Nutting 1901, p. 234.
Eudendrium capillare Stechow 1909, p. 29.
Eudendrium capillare Jaderholm 1909, p. 82, Pl. III, figs. 8-9.
Eudendrium capillare Stechow 1913, p. 61, figs. 15-17.
Eudendrium capillare Stechow 1919, p. 31.
Eudendrium capillare Stechow 1924a, p. 4.
Eudendrium capillare Stechow 1925, p. 202.
Eudendrium capillare Fraser 1937, p. 40, Pl. VII, fig. 28.
Eudendrium capillare Vervoort 1941, p. 193.
Eudendrium capillare Vervoort 1946, p. 236.
Eudendrium capillare Leloup 1947, p. 19.

Hydrocaulus is erect and arborescent or lax and straggling; periderm covering the entire colony and forming a short thin cup closely applied to the basal third of the hydranth, variously annulated on the hydranth peduncle ; young colonies from calm and protected waters with 3 to 4 annulations at distal and proximal ends of the peduncle, older colonies with annulations at intermediate regions also and specimens from break-water-line with the entire peduncle annulated. Hydranth typical, flesh coloured when alive, campanulate ; tentacles 12 to 17, large, alternate ones slightly inclined inwards. Immediately above the free margin of the basal perisarcal cup the hydranth often shows a shallow transverse groove. An examination of live specimens shows that the groove is only a temporary phase and occur only during contraction. Male gonophores are numerous, arising on short peduncles, originating from the hydrocaulus ; each peduncle carrying 6 to 8 club-shaped secondary peduncles, whose distal part usually carrying a terminal tubercle in the immature stage, but absent in the mature forms. Female gonophores arise from the peduncle of normal or partially degenerate hydranths, with a progressive degeneration corresponding with the growth.

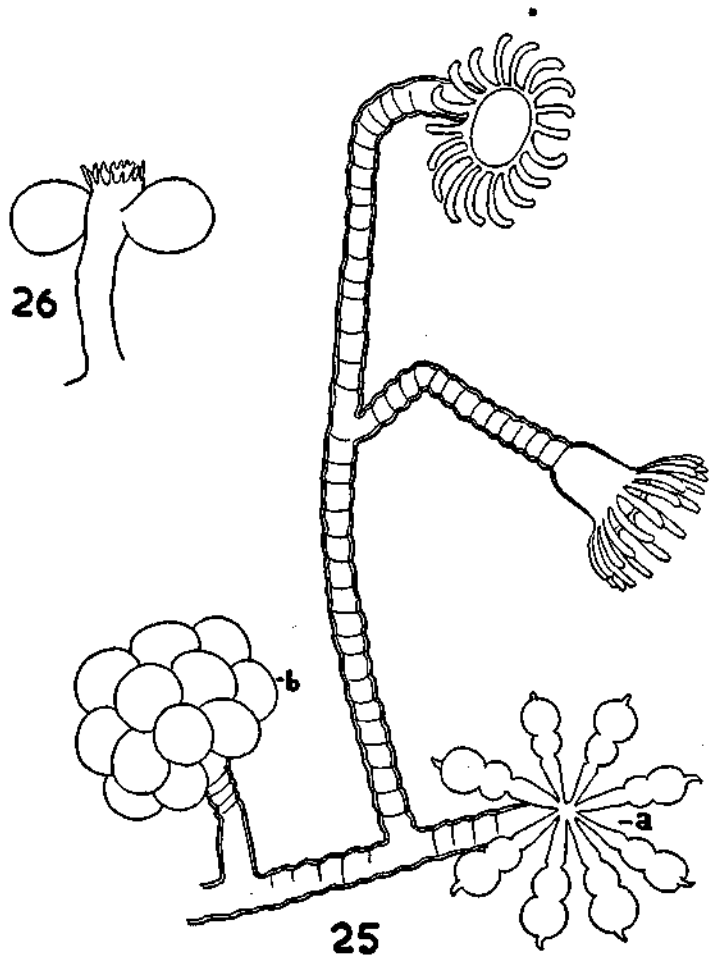

Fig. 25. *Eudendrium capillare*. Part of a colony. (a) immature male gonophore (b) mature male gonophore.

Fig. 26. *Eudendrium capillare*. Hydranth bearing female gonophores.

Height of colony	upto 35 mm.
Height of hydranth peduncle	1.0-2.30 mm.
Breadth of hydranth peduncle	0.10-0.18 mm.
Length of hydranth	0.36-0.70 mm.
Breadth of hydranth	0.17-0.24 mm.
Length of mature male gonophore	0.15-0.24 mm.
Length of mature female gonophore	0.20-0.46 mm.

Locality.—This hydroid was collected from all stations of the present collection.

Remarks.—The present material differs from *E. capillare* described by previous authors in having fewer branches and the hydranth having only 15-17 tentacles. The first difference is evidently only a local variation, but the fewer number of tentacles is an important difference. Excepting Stechow (1909) who observed 12 tentacles in the material collected from the east coast of Japan, all other authors give the number varying from 24-36. Besides there are a large number of records without any reference to this detail. Hence though the difference is noteworthy, since all other characters show close agreement, the present collection is provisionally identified as *Eudendrium capillare*.

Family TUBULARIIDAE Johnston

Hydrocaulus is unbranched, periderm well or ill developed ; hydranth pear-shaped, with oral and aboral whorls of filiform tentacles ; reproduction through free-swimming medusae, medusoids or sporosacs ; gonophores borne on blastostyles arising between the crown of aboral tentacles.

Allman (1872) divided Tubulariidae Johnston into Tubulariidae and Corymorphiidae, the latter distinguished by the absence of a periderm. However, it is now known that Corymorphiidae also has a periderm, though usually it is not thick as in Tubulariidae. Kuhn (1914) therefore treated them as sub-families of Tubulariidae. Even though some of the later authors like Kramp (1949) again treat these as independent subfamilies ; in view of the general similarity, Kuhn's classification seems to be more acceptable. The two genera of Tubulariidae occuring along the Indian coast may be distinguished by the following key.

I. Hydroid slender, provided with thick periderm, newly liberated medusae with 4 tentacles and 8 exumbrellar tracts of nematocysts. *Ectopleura* L. Agassiz

II. Hydroid stout, fleshy and provided with thin periderm, medusae liberated with one tentacle, exumbrellar nematocyst tracts absent. *Corymorpha* M. Sars

Ectopleura L. Agassiz

Ectopleura L. Agassiz

Hydroid is unbranched, rooted by filiform stolon ; hydranth with short oral and long aboral whorls of filiform tentacles ; reproduction through free swimming medusae having 4 pairs of meridional nematocysts, gonads arising from around stomach and without ocelli.

The only species of *Ectopleura* recorded from the Indian region is *E.pacifica* Thornely.

Ectopleura pacifica Thornely

(Figs. 27-29)

Ectopleura pacifica Thornely 1900, p. 452, Pl. XLIV, fig. 1, 1a.

Tubularia gracilis Thornely 1904 (von Lendenfeld), p. 111.

Tubularia gracilis Borradaile 1905, p. 838.

Tubularia sp. Gravely 1927, p. 11.

Hydrocaulus is slender, unbranched, rooted by filiform stolon ; perisarc without annulations, terminating slightly below hydranth, hydranth pear-shaped, aboral

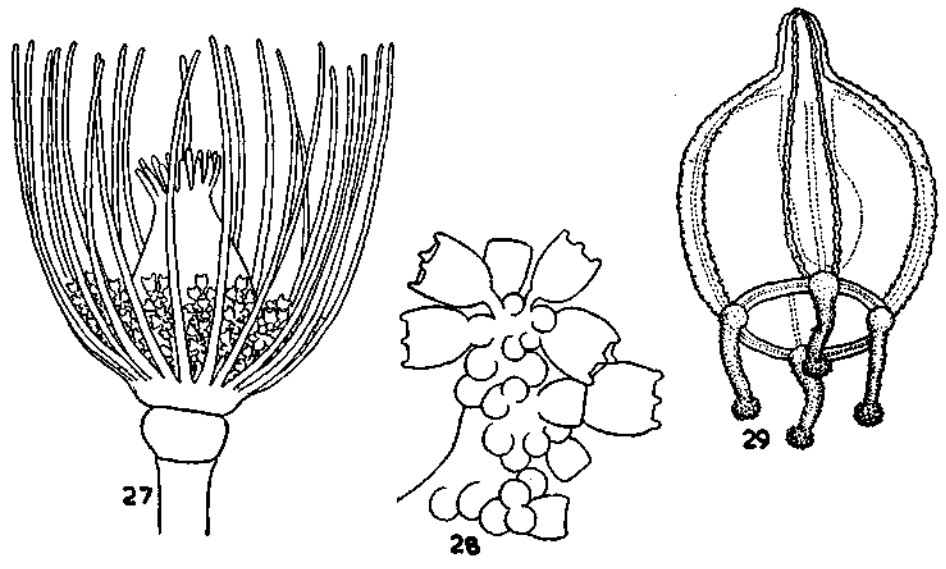

Fig. 27. *Ectopleura pacifica* Distal part of polyp.
Fig. 28. A blastostyle with medusa of *Ectopleura pacifica*
Fig. 29. Medusa of *Ectopleura pacifica*

tentacles 24, curved upwards and extending beyond the tip of the hydranth by half its length ; oral tentacles 18, short, ectoderm of hydranth and tentacles with a superficial reticulate appearance. Gonophores arising on blastostyles, each blastostyle carrying a large number of gonophores in different stages of maturity. Young gonophores are simple ovoid bodies, but as development proceeds, the distal end becomes truncated and four small projections arise along the periphery. The gonophores when liberated develop into free swimming medusae with roughly hemispherical bell, with the apical pole slightly raised upwards, umbrella margin thin, tentacles four, short, studded with nematocysts, otocysts absent, velum moderately wide, manubrium reaching the velar opening and brick red in colour, exumbrellar nematocysts in 8 meridional rows.

Height of hydrocaulus	upto 45 mm.
Breadth of hydrocaulus	0.33-0.42 mm.
Height of hydranth	0.18-0.23 mm.
Width of hydranth at the level of the origin of the distal whorl of tentacles	0.50-0.55 mm.
Width of hydranth at the level of the origin of the proximal whorl of tentacles	1.10-1.50 mm.
Length of aboral tentacle	3.20-3.45 mm.
Diameter of medusa	upto 0.45 mm.
Height of medusa	upto 0.50 mm.

Locality.—This species was collected from Neendakara, Thankassery and Madras harbour.* It has been previously recorded from Galle bay (Thornely 1904), Suvadiva atoll (Borradaile 1905) and from Pamban (Gravely 1927).

Remarks.—Gravely (1927) observed that the material identified by Thornely (1904) as *Tubularia gracilis* to be different from *T. gracilis* von Lendenfeld. Thornely herself was aware that her species was not quite identical with those of von Lendenfeld and remarked that examination of more material might prove its separate identity. Borradaile (1905) however, correctly recognised the identity of his material with *Ectopleura pacifica* Thornely, but considered it as *Tubularia* species, probably because of the absence of information as to whether the gonophore would lead an independent free swimming life or not. Observation of free-swimming medusa in the present study clearly shows that the species is really an *Ectopleura*. According to Russell (1953) *Ectopleura*-medusa does not have an apical process on the umbrella. But the medusa of the present collection was seen to have an apical projection. Such an apical projection has been described and figured by Bigelow (1909, p. 184, Pl. VI, fig. 6 and Pl. XXXVIII, fig. 12 & 13).

* Through courtesy of Dr. J. P Joshua, Professor of Zoology, Madras Christian College, Tambaram.