4. Hydroids from Christmas Island, Indian Ocean, collected by C. W. Andrews, D.Sc., F.R.S., F.Z.S., in 1908. By JAMES RITCHIE, M.A., B.Sc., Natural History Department, The Royal Scottish Museum*.

[Received April 28, 1910.]

(Text-figures 80 & 81).

The present paper gives account of a small collection of Hydroids which formed part of the Marine Invertebrate collections obtained by Dr. Andrews during the autumn of 1908. The smallness of the collection, however, is hardly to be taken as an indication of the poverty of the Hydroid fauna of the Island, for Dr. Andrews found that, at virtually all points, shore-collecting was dangerous or impossible. The present specimens, therefore, were obtained in a limited area: in Flying Fish Cove, either on the shore, or on a reef laid bare at low tide.

The collection is of interest as being a first sample of the Hydroid fauna of this isolated island; and in spite of its limitation, for it contains representatives of only thirteen species, it adds four of these to the known fauna of the Indian Ocean. The most remarkable of these additions are hydranths which exactly correspond with those of *Rhizogeton nudum*, described by Broch, in 1909, from Spitsbergen.

I have to thank Mr. R. Kirkpatrick, of the British Museum, for giving me the opportunity of examining the collection.

List of Species.

Gymnoblastea.

Family CLAVIDÆ.

Rhizogeton nudum Broch (?)

Family EUDENDRIDÆ.

Eudendrium parvum Warren (?)

Family PENNARIDÆ.

Pennaria disticha Goldfuss, var. *australis* Bale.

Family TUBULARIDÆ.

Tubularia crocea Agassiz.

Calypptoblastea.

Family CAMPANULARIDÆ.

Campanularia corrugata Thornely.

Clytia noliformis M'Cradly (?)

Clytia serrulata Bale.

* Communicated by R. KIRKPATRICK, F.Z.S.

Family SERTULARIDÆ.

Sertularella polyzonias Linn.*Thuiaria tubuliformis* Marktanner.

Family PLUMULARIDÆ.

Plumularia buskii Bale.*Plumularia setacea* Linn. (?)*Plumularia* sp. (*megalocephala* Allman, aff.).*Halicornaria hians* Busk, var. *laxa*, nov.

NOTES ON THE SPECIMENS.

GYMNOBLASTEÆ.

Family CLAVIDÆ.

RHIZOGETON NUDUM Broch (?)

1909. *Rhizogeton nudum* Broch, Hydroiden, in Fauna Arctica, Jena, vol. v. p. 137, fig. 1.

On the surface of a fragment of millepore there occurred a delicate stolon from which solitary hydranths sprang at intervals. The stolon is branched, forming a loose, irregular network upon the substratum, and it is protected by a very thin layer of perisarc. No perisarc occurs on the hydranths, even at the base. The hydranths are elongated, subcylindrical or spindle-shaped according to the state of contraction. They are armed with long filiform tentacles varying in number from seventeen to twenty-four or twenty-five, and decreasing gradually in size, from the longest which, in extension, surround the hypostome, to short, stumpy individuals at the base. The tentacles are scattered over all but the lower fourth of the hydranth; but except for four oral tentacles which lie almost in one whorl, no definite arrangement could be traced.

The soft parts are well preserved, and in the hydranth a thin ectoderm with flattened cells could be distinguished, lined by endoderm with elongated cells, which project for a short distance into the digestive cavity, and within which, in some hydranths, lie clusters of minute, deep-brown, almost opaque spherules, probably refuse products of digestion. The internal portions of the tentacles are filled by a septate skeletal endoderm. The growing point of the stolon, in the one instance observed, was formed of a thick pad of ectodermal cells, which gradually dwindled into the insignificant layer which lines normal portions of the stolon.

The gonosome was not observed.

Dimensions :—

Stolon, diameter.....	0.060 mm.
Hydranth, length	0.77 0.92 to 2 mm.
„ greatest diameter	0.17 0.21 mm.

Text-fig. 80.

Rhizogeton nudum (?), $\times 65$.

corp., dark corpuscles in endoderm of hydranth; *ect.*, ectoderm; *end.*, endoderm; *g.p.*, growing point of stolon; *p.*, perisarc; *st.*, stolon.

Locality. Flying-Fish Cove.

Owing to the absence of the gonosome, identification with *R. nudum* must remain a matter of doubt. The trophosomes, however, agree in shape, in character, and in the number and position of the tentacles; and Broch's figures represent hydranths which agree in size with those from Christmas Island, although he states that his hydranths may attain a length of 4 mm. The original specimens of *R. nudum* were obtained by the 'Helgoland' Expedition, in Bismark Sound, east of West-Spitsbergen, at a depth of 35 metres.

Family EUDENDRIÆ.

EUDENDRIUM PARVUM Warren (?)

1908. *Eudendrium parvum* Warren, Ann. Natal Government Mus. vol. i. pt. 3, p. 272, text-fig. 1, pl. xlv. figs. 1-4.

A single fragment of creeping stolon, from which spring two

simple stems, and one, showing traces of a branch, occurred on the surface of a fragment of millepore. The gonosome is absent, and the characters of the hydranths have all but disappeared, but the perisarc of the trophosome shows the structures described by Warren. The stolon measures 102μ , and the hydrocauli from 81μ to 111μ , in diameter, but the unbranched hydrocauli are very short, less than 2 mm. in height.

Locality. Flying-Fish Cove.

Family PENNARIIDÆ.

PENNARIA DISTICHA Goldfuss (= *P. cavolinii* Ehrenb.), var. AUSTRALIS Bale.

*1820. *Pennaria disticha* Goldfuss, Handb. der Zool., Nurnberg, p. 89.

1884. *Pennaria australis* Bale, Cat. Australian Hydroid Zooph., Sydney, p. 45.

Several well-preserved colonies of this variety, distinguished from typical *P. disticha* by the restriction of the annulation of the peduncles to six, or fewer, rings at the base, and by the small size of the colonies, were obtained. No gonosome is present, and the specimens are overgrown by seaweed and diatoms.

Locality. Flying-Fish Cove.

Family TUBULARIDÆ.

TUBULARIA CROCEA Agassiz.

1862. *Parypha crocea* Agassiz Contr. Nat. Hist. U.S., vol. iv. p. 249.

A considerable number of specimens of a small *Tubularia*, with stems up to 25 mm. high, show the following significant characters. The stems are white, becoming faintly tinged with yellow at the base. They are mostly unbranched, or have a few straggling offshoots at the base, and they are marked here and there by groups of faint annulations. The hydranth is translucent, set above a marked dilatation, the lower part of which is protected by thin, wrinkled perisarc, while on the upper portion the ectoderm is markedly thickened, appearing as if it hung downwards from the base of the hydranth in a short flap. In this respect, and in the separation of the hydranth cavity from that of the dilation, the structures are similar to those of *T. bethæ* Warren, but the ectoderm of the present specimens is also much thickened at the neck beneath the dilation, and the endoderm lining the dilation does not exhibit the development of elongated cells which Warren describes†.

In these specimens the oral tentacles number about 15 to 17, and the proximal tentacles about 18 to 20, set in single whorls.

* For synonymy see Bedot, Rev. Suisse de Zool., vol. ix. 1901, p. 459.

† Warren, Ann. Natal Government Mus., vol. i. 1908, p. 282.

The blastostyles are short, generally erect, although some tend to droop through the row of tentacles, and they are closely set with male gonophores, characterised by their elliptical shape, and by the replacement of tentacular rudiments by a single terminal wart. Unfortunately, female gonophores have not been observed. The characters, however, point to identity with *T. crocea*, the male gonophores of which, according to Allman, are "destitute of [tentaculiform] processes," although Torrey's observations show that the presence or absence of tentacular processes is variable*.

Dimensions :—

Stem, diameter	0.31 mm.
Hydranth, height (from base of dilation)...	about 3 mm.
" diameter at level of proximal	
tentacles	about 2 mm.

Locality. Reef, Flying-Fish Cove.

T. crocea has been found on the Atlantic (Agassiz) and Pacific (Torrey) coasts of North America, and in Plymouth Harbour on a ship from Peru (Browne). Specimens were obtained growing amongst barnacles on the screw-casing of the German Antarctic Expedition ship 'Gauss,' while it was in the South Atlantic, and Vanhöffen is of opinion that the specimens settled on the ship during its passage through the south of the Indian Ocean†, in which, until the present record, the species had not been observed.

CALYPTOBLASTEÆ.

Family CAMPANULARIDÆ.

CAMPANULARIA CORRUGATA Thornely.

1904. *Campanularia corrugata* Thornely, in Herdman, Ceylon Pearl Fisheries, Part ii. p. 114, pl. i., fig. 2, Suppl. Rep. viii. Hydroida.

A couple of hydrothecæ were observed on *Plumularia buskii* Bale.

Locality. Flying-Fish Cove.

CLYTIA NOLIFORMIS M'Cradly (?).

1876. *Campanularia noliformis* M'Cradly, Proc. Elliott Soc. vol. i. p. 194.

A few hydrothecæ, referred to this species, were growing upon a fragment of sponge, and on *Pennaria disticha*, var. *australis*. The hydranths bear twenty tentacles. Without the presence of the gonangia the identification of this species is uncertain, owing to the resemblance of the trophosome to that of *Clytia johnstoni*,

* Torrey, Univ. California Pub., Zool., vol. i. p. 44.

† Vanhöffen, Deutsche Südpolar-Exp. 1901-1903, vol. xi. Zool. iii. Berlin 1909: die Hydroiden, p. 279.

but I have been guided by the very small dimensions of these specimens, which are even less than those of specimens recorded by Pictet from Amboyna*, and by Vanhöffen from the South Atlantic†, and approach most closely in size the original specimens of *Campanularia attenuata* Calkins, regarded by Vanhöffen (l.c.) as identical with *Clytia noliformis*.

Dimensions :—

Total length	1.5-2.5 mm.
Stem, diameter	0.054-0.066 mm.
Hydrotheca, depth.....	0.32-0.45 mm.
„ diameter at mouth	0.21-0.28 mm.

Locality. Flying-Fish Cove.

This species has not hitherto been recorded from the Indian Ocean.

CLYTIA SERRULATA Bale.

1888. *Campanularia ? serrulata* Bale, Proc. Linn. Soc. N. S. Wales (2), vol. iii. p. 757, pl. xii. fig. 4.

A single poor colony, growing along with *Plumularia setacea* Linn., the structures and dimensions of which agree with those given by authors.

Locality. Flying-Fish Cove.

This species has not hitherto been recorded from the Indian Ocean, although Vanhöffen has recently described specimens from Observatory Bay, Kerguelen‡.

FAMILY SERTULARIDÆ.

SERTULARELLA POLYZONIAS Linn.

1758. *Sertularia polyzonias* Linnæus, Syst. Nat., ed. x. p. 813.

A solitary colony was found on the stem of *Pennaria disticha*, var. *australis*. Although its structures appear to be indistinguishable from those of *S. polyzonias*, this specimen is exceedingly minute, only 3 mm. high, reminding one of the small New Zealand variety figured by Hilgendorf§; and the dimensions of the hydrothecæ are also very much smaller than those of typical specimens. The hydranth has about twelve tentacles.

Dimensions :—

Internode, length	0.28-0.35 mm
„ diameter	0.08 mm.
Hydrotheca, length	0.28-0.31 mm
„ length free	0.16-0.18 mm.
„ diameter at mouth	0.13 mm.

Locality. Flying-Fish Cove.

* Pictet, Rev. Suisse de Zool., vol. i. 1893, p. 31.

† Vanhöffen, op. cit. p. 299.

‡ Vanhöffen, op. cit. p. 302.

§ Hilgendorf, Trans. New Zeal. Inst. vol. xxx. 1898, pl. xx. fig. 2 a.

THUIARIA TUBULIFORMIS Marktanner.

1890. *Dynamena tubuliformis* Marktanner-Turneretscher, Ann. k.k. Hofmus. Wien, vol. v. p. 238, pl. iv. fig. 10.

Only a few colonies of this species, the largest 15 mm. high, were found. The structures are typical, and agree more closely with Marktanner's and with Nutting's* figures than with those of Natal specimens by Warren†, in which the hydrothecæ are shown to be less crowded, and are more seldom arranged in groups of several pairs. Our specimens show all the peculiarities of arrangement of hydrothecæ on the stem internodes which Marktanner cites. Most commonly, as in Nutting's specimens, each stem-internode bears "a branch and two hydrothecæ on one side and a single hydrotheca on the other," but occasionally, as Clarke‡ also has found, a hydrotheca-pair is added to this typical internode, and occasionally a hydrotheca-pair is subtracted and isolated on a separate internode, leaving one hydrotheca with its associated branch-process alone on an internode.

Dimensions:—

Length of colony	up to 15 mm.
Typical stem internode, length	1·06 mm.
Stem internode, diameter	0·18-0·31 mm.
Branch, length	about 5 mm.
Hydrotheca, length of adnate portion.....	0·42 mm.
" " free " 	0·11-0·15 mm.
" diameter	0·14 mm.

Locality. Reef, Flying-Fish Cove.

This species has now been found in the Eastern Pacific Ocean (Perico Island, Gulf of Panama—Clarke, 1907); in the Western Atlantic Ocean (Bahia; Florida; Bahama Banks—Nutting, 1904); in the Eastern Atlantic Ocean (St. Thomas Island—Billard, 1907); in the Red Sea (Jidda—Marktanner, 1890; Suez Bay—Thornely, 1908); from the West Indian Ocean (Natal—Warren, 1908); and now from the East Indian Ocean. Pictet has recorded from Amboyna, in the East Indies, specimens which he has named *Sertularia vegæ* (Thompson), as a synonym of which he ranks *Dynamena tubuliformis* Marktanner§. With Jäderholm||, I am of opinion that these specimens are not to be identified with *T. vegæ*. They clearly belong to *T. tubuliformis*.

Family PLUMULARIDÆ.

PLUMULARIA BUSKII Bale.

1884. *Plumularia buskii* Bale, Cat. Australian Hydroid Zooph., Sydney, p. 124, pl. x. fig. 3, pl. xix. figs. 34, 35.

Several colonies occurred growing on a sponge. They are much

* Nutting, "American Hydroids," Spec. Bull. Smiths. Inst., Part 2, 1904, pl. xi. figs. 1, 2, 3.

† Warren, op. cit. p. 315, text-fig. 12.

‡ Clarke, Mem. Mus. Comp. Zool. Harvard, vol. xxxv. 1907, p. 14.

§ Pictet, Rev. Suisse de Zool. vol. i. 1893, p. 44.

|| Jäderholm, Kungl. Svenska Vet.-Ak. Handl. vol. xlv. 1909, p. 91.

smaller than the two or three inch high specimens described by Bale, and even than Miss Thornely's immature Ceylon examples; for the largest is under 15 mm. in height. On account of the absence of intermediate athecate internodes from the hydrocaulus, and of the presence of a minute median nematophore, with small and delicate pedunculate sarcotheca, in the angle behind the hydrotheca, the species can readily be distinguished from the very similar *P. cornucopiæ* Hincks, and *P. alternata* Nutting. Hartlaub* has described a specimen from Laysan, in which the minute sarcotheca immediately behind the hydrotheca is assuredly absent, and which, notwithstanding, he assigns to *P. buskii*; but I regard the specific identity of the two forms as doubtful.

The following observations supplement Bale's description. The lower portion of the stem consists of a varying number of nodes separated by transverse joints, the lower nodes being altogether destitute of appendages, while those nearest the cladate portion of the stem, from which they are separated by an oblique node, bear a series of several sarcothecæ. The hydroclades spring alternately from one side or the other of a hydrotheca. In rare cases, opposite hydroclades arise from the proximal cladate internode, as in Miss Thornely's specimens. The hydroclades rest on a very insignificant process of the internode, which coincides with the base of the lateral nematophore. A strong constriction separates this stem-process from the hydroclade, although these specimens do not show the excessive tendency to deciduousness of pinnae which Bale noted.

• At the origin of the hydroclades there are generally two very short internodes (although rarely only one is present) without appendages, and with transverse nodes; and these are succeeded by a longer internode which bears, on its anterior surface, a single pedunculate sarcotheca on a swelling near its proximal end, and is limited by a proximal transverse node, and by a distal oblique node which separates it from the first thecate internode. In these specimens the hydroclade is very distinctly divided, by transverse and oblique joints, into intermediate internodes furnished with a single nematophore, and hydrothecate internodes; and although Bale describes "a hydrotheca on each, except the first [internode] of each pinna," his figure (pl. x. fig. 3) indicates the presence of an obscure horizontal constriction immediately above the hydrotheca. Only very exceptionally does the fusion of an intermediate with the preceding hydrothecate internode occur in these hydroclades, a phenomenon recorded by Billard in the lower portion of the hydrocaulus of the closely related *P. cornucopiæ* †.

While emphasizing the fixedness of the median sarcothecæ in his original description, Bale later regarded only the sarcotheca beneath the hydrotheca as fixed ‡. I am inclined to agree with the earlier statement, as the large area of their attachment, and

* Hartlaub, Zool. Jahrb. Syst., vol. xiv. 1901, p. 374, pl. xxi. figs. 22, 32, 36.

† Billard, Exp. Sc. 'Travailleur' et 'Talisman,' vol. vii. 1907, p. 207.

‡ Bale, Trans. Roy. Soc. Victoria, vol. xxii. 1886, p. 94.

the invariable position they assume, seem to show that there is no movability in any of the median sarcothecæ.

The colonies are mature, male gonangia arising from the stem at the proximo-lateral portion of a hydrotheca, on the side other than that from which a hydroclade springs. They are club-shaped in lateral aspect, resembling the gonangia of *P. geminata* Allman, and are furnished with a stalk consisting of two short internodes, each of which has a thick adcauline wall, from which, in the second, a diminutive chitinous ledge projects inwards. Although a nematophore usually occurs on each side of the gonangium, occasionally only one side is furnished with an individual.

Dimensions :—

Stem internode, length	0.35–0.43 mm.
diameter	0.07–0.11 mm.
• " Hydroclade, length	up to 2 mm.
thecate internodes, length *.....	0.25–0.34 mm.
intermediate " " 	0.18–0.21 mm.
Hydrotheca, depth	0.21–0.22 mm.
diameter at mouth	0.17–0.18 mm.
Gonangium (male), length.....	0.36–0.42 mm.
" " greatest diameter in lateral	
aspect	0.17–0.18 mm.

Locality. Growing on a sponge from the Reef, Flying-Fish Cove.

The only previous Indian Ocean record is that of Miss Thornely, from Gulf of Manaar.

PLUMULARIA SETACEA Linn. (?).

1758. *Sertularia setacea* Linnæus, Syst. Nat. p. 813.

Many small colonies apparently belonging to this widely-distributed species, and averaging 15 mm. in height, were found growing on a sponge. As it seems impossible to separate this species from *P. strictocarpa* Pictet by characters of the trophosome alone, and as the gonosome is not present on any of these specimens, I refer them doubtfully, by courtesy, to the older, and cosmopolitan species, until the discovery of the gonothecæ shall fix their identity. For guidance I append dimensions of parts.

Stem internode, length.....	0.31–0.49 mm.
diameter.....	0.051–0.159 mm.
Hydroclade, length	2–3 mm.
Hydrothecate internode, length	0.32–0.36 mm.
Intermediate " " 	0.17–0.25 mm.
Hydrotheca, depth	0.090 mm.
diameter at mouth	0.096–0.105 mm.

Locality. Reef and piles of the pier, Flying-Fish Cove.

* Measured from extreme points.

PLUMULARIA sp. (*megalcephala* Allman, aff.).

Growing on the base of a stem of *Halicornaria hians*, var. *laxa*, were two simple stems of a *Plumularia* which remains unidentified. Most of the hydroclades have disappeared, but sufficient remains to show that the trophosome is akin in structure and relative proportions to that of *P. megalcephala* Allman, found on the shores of the western Atlantic and eastern Pacific Oceans. From this they appear to differ only in their simple habit and small size, and in lacking that sarcotheca which occurs on the stem internodes, immediately proximal to the hydroclade-bearing process.

Dimensions :—

Stem, length	9 mm.
Stem internode, length	0.35–0.49 mm.
" " diameter	0.039–0.084 mm.
Hydrothecate internode, length	0.31 mm.
" " diameter	0.019–0.027 mm.
Basal athecate internode, length	0.14–0.19 mm.
Hydrotheca, depth	0.045 mm.
" diameter at mouth	0.048–0.051 mm.

Locality. Flying Fish Cove, 46 fathoms.

HALICORNARIA HIANS Busk, var. *LAXA*, nov.

This is the species most abundantly represented in the collection. The largest colony is 12 cm. in height, and the minute characters of the hydrothecæ agree closely with Bale's * diagnosis, except that the mesial sarcotheca, in overtopping the hydrotheca-wall for some distance, approaches the condition of that described by Stechow †. The ultimate portion lies, however, at a slight angle to the course of the main portion of the sarcotheca.

There are differences in habit, however, which distinguish this variety. The colonies are delicate and fine in appearance; and the stem is thin and shows no traces of nodal constrictions. The hydroclades, which are of the unusual length of 22 mm. (twice as long as those recorded by Stechow), are alternate, and are wide apart, a space of 2 mm. separating successive individuals on the same side of the stem. They are divided into long internodes, on the upper portion of which the hydrothecæ are set. In this respect, and on account of the greater depth (as compared with Bale's and Stechow's figures), and more erect posture of the hydrothecæ (the axes of which are inclined to that of the hydroclade at an angle of about 40°, instead of 55°), and of the greater elevation of the intrathecal septum above the floor of the hydrotheca, these specimens resemble var. *profunda*, from the Andamans ‡.

* Bale, Cat. Australian Hydroid Zooph., 1884, p. 179.

† Stechow, Abh. K. Bayer. Akad. Wissens., Suppl.-vol. i. 3, 1900, p. 101, pl. vi. fig. 16.

‡ Ann. Mag. Nat. Hist. (8) vol. iii. 1909, p. 528.