ON TWO NEW CERIANTHARIAN LARVAE FROM THE MADRAS PLANKTON.

By

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(Plates III-V.)

INTRODUCTION.

The present paper deals with two new species of Ceriantharian larvae, belonging to the genera *Arachnactis* and *Anactinia*, collected for the Madras Plankton during the years 1942 to 1945.

Arachnactis albida, the first larval Ceriantharian to be described, was discovered by Sars in 1846 from the Faroe Island, off the Coast of Norway. Since then many contributions on the developmental stages and anatomical features of this North Atlantic form have appeared of which those by van Beneden (1891 and 1897), Vanhoffen (1895), Carlgren (1906 and 1912) and Bourne (1920) are noteworthy in this field. Subsequently three more species have been discovered from tropical waters. *Arachnactis sibogae* was collected by the " Siboga" Expedition from the Malayan Archipelago and the account of it by McMurrich (1910) is incomplete in several respects. The " Valdivia " Expedition collected *Arachnactis valdiviae* (Carlgren, 1924) from the North West Coast of Sumatra. Recently Panikkar (1947) described *Arachnactis indica* from the Madras Coast together with a detailed account of its developmental stages and morphological features.

The genus *Anactinia* was established by Annandale in the year 1909 for the reception of an interesting pelagic anemone without tentacles collected from Puri on the Orissa Coast of the Bay of Bengal. He described its anatomy and considered it as an adult Ceriantharian. Menon (1914), suspecting them to be larval forms, reared the specimens obtained by him from the Madras Plankton and succeeded in metamorphosing them into the adults and thereby established the larval nature of *Anactinia pelagica.* Carlgren (1924), from a detailed study of the specimens of *A. pelagica* collected by the German Deep Sea Expedition on "Valdivia" and of the material in the Uppsala Museum, made additions to Annandale's account of the structural features. In the same paper, Carlgren, doubtfully, refers *Ovactis superficialis* and *Ovactis indiana*, the two non-acontiated forms of Bamford (1912), to the genus *Anactinia*, on account of the presence of mucus cell patches in the tentacular prominences, particularly in the latter species. But he also suggests the possibility that they may be young ones of *A. pelagica* itself. A clarification of this is possible only if Bamford's material is re-examined in the light of our present knowledge of the morphological features of larval Ceriantharia.

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It is known that the Ceriantharian larvae occur in the Madras Plankton mostly during the colder months of the year (Nair, 1944). The two larvae described in this paper are rare and they occurred in the townet collections made on the following days :—

Arachnactis panikkari, sp. nov.—

3rd Nov., 1944	1 Specimen.
4th Jan., 1945	4 Specimens.
19th Jan., 1945	1 Specimen.

Anactinia carlgreni, sp. nov.—

23rd Nov., 1942	3 Specimens.
16th Apr., 1943	1 Specimen.
16th Feb., 1945	1 Specimen.
19th Feb., 1945	2 Specimens.
21st Feb., 1945	1 Specimen.
16th Apr., 1945	1 Specimen.

Some specimens were allowed to metamorphose into the adults in the Laboratory Aquaria and the remaining ones were utilised for this study. The larvae were narcotised with Menthol and fixed in 10 per cent. Formalin. Serial sections of a few specimens were made at seven microns thickness stained in Delafield's and Heidenhain's Iron Haematoxylin counterstained with Acid Fuchsin.

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Family ARACHNANTHIDAE Carlgren, 1924.

Genus **Arachnactis** Sars, 1846.

Arachnactis panikkari, sp. nov.

(Plates III, IV.)

Diagnostic characters.—*Arachnactis* with nine marginal and six labial tentacles without directive tentacle and without an aboral pore on the column in the final pelagic stage. The directive tentacle and the aboral pore develop only after the transformation of the larva into the adult. Actinopharynx one-eighth the length of the column with a hyposulcus of about the same length provided with well developed ciliated tracts. Himisulci extremely short or practically absent. The first pair of metamesenteries is the longest and extends to the aboral end of the column, each ending in a slender, thread-like acontium. All the other metamesenteries shorter than the second pair of protomesenteries.

Orthocraspedon of the second pair of protomesenteries, and the first and the third pairs of metamesenteries of Type II. Orthocraspedon of the third pair of protomesenteries, and the second and the fourth pairs of metamesenteries of Type III. Cnidoglandular craspedonemes present. Metamorphoses into burrowing tube-dwelling adult.

EXTERNAL CHARACTERS.

Arachnactis panikkari is translucent and slightly opaque with the tips of the marginal tentacles brightly pigmented. The extremities of the marginal tentacles are pasture-green in colour with a deep brown pigmented region below this patch. The endodermal portions of the green and brown pigmented regions of the tips of the tentacles are milky white in colour. The labial tentacles and the gullet are light violet. The green tinge of the column in reflected light is more pronounced in the aboral region. The yellowish brown colour of the mesenterial filaments can be made out only in transmitted light. The preserved specimens are white and opaque with the column and the tips of the tentacles coloured light brown. In all the six specimens collected, nine marginal tentacles are present of which five belong to the right side and four to the left side (Pl. III, fig. 1). The fifth marginal tentacle of the left side had not developed, though the corresponding one of the other side had grown to about the same length as the other marginal tentacles. In the expanded condition the marginal tentacles are about one and three-fourths the length of the column and are 12 mm. long with a diameter of 0·4 mm. The directive marginal tentacle is absent with no indication whatsoever of its growth in the larval stage. From observations made in the Laboratory on larvae which have metamorphosed into the adults, it seems that the directive tentacle in this species makes its appearance only after the larvae have begun to metamorphose by burrowing into the substratum of sand. Apart from the interesting nature of this fact, it is an important distinguishing feature of *A. panikkari*. In all the recorded species of *Arachnactis*, the directive tentacle develops after the fourth couple of marginal tentacles has appeared, except in *A. valdiviae* where it appears after the formation of the third couple of marginal tentacles. The marginal tentacles originate as direct continuation of the column without a marked constriction at their bases. The larvae have not been observed to shed their tentacles either in the living or in the preserved condition. All the specimens possess six labial tentacles, three on each side of the oral opening and belong to the second, the third and the fourth pairs of actinocoels. The labial tentacles of the directive and the two adjoining actinocoels are absent in the larva. The very small labial tentacles, 1 mm. long and 0·2 mm. in diameter in the fully expanded condition, arise as direct continuations of the oral disc. The cylindrical column is 7·5 mm. long and 1·2 mm. in diameter and does not show any differentiation.

STRUCTURE OF THE LARVA.

The Tentacles.—In transverse sections the marginal and labial tentacles are rounded, and there is no appreciable difference in the structural features of the two sets of tentacles. The greater part of the thickness of the tentacle is occupied by the well developed ectoderm composed of columnar supporting cells with numerous interstitial cells (Pl. III, fig. 2). The few cnidae are irregularly arranged. In this respect the present species differs from *A. valdiviae*, where bands of cnidae have been observed by Carlgren (*op. cit.*) on the abaxial side. The dimensions of the thick-walled nematocysts and the thin-walled spirocysts are 18·8 × 3·3 μ and 9·9 × 2·2 μ respectively. The spirocysts are more numerous than the nematocysts which are common on the tips of the tentacles. The definite aggregations of cnidae at the tips of the tentacles described by Panikkar (*op. cit.*) in *A. indica* are not present in this species. Large numbers of mucus cells are scattered amidst the ectodermal cells with no trace of the regular grouping of cells on the adaxial side of the tentacle recorded in *A. valdiviae*. The long supporting cells of the inner side of the labial tentacles are so compactly arranged that this region appears to be broader and more deeply stained than the other side of the tentacle.

The musculature of the tentacle is very well developed, the mesodermal folds and the muscle branches being more pronounced than in the anterior region of the column. The homogeneous mesogloeal layer is devoid of nuclei. The thin endodermal layer is about a third to half the thickness of the epidermal layer. In *A. indica* the endodermal layer is thicker than the ectodermal layer especially at the basal region of the tentacles. Spirocysts of the same dimensions as found in the ectoderm have been noticed in relatively small numbers in the endoderm of the tips of the tentacles.

The Column.—There is a gradual tapering of the column towards the aboral end. This extremity is rounded and no aboral pore has been noticed in any of the larvae collected, though the ectodermal musculature of the column wall was fully developed in the larvae studied. In *A. albida*, Bourne (*op. cit.*) has shown that the aboral pore appears rather late when the larva reaches the 23 tentacled stage. His suggestion that the appearance of the aboral pore coincides with the full development of the longitudinal musculature does not apply to *A. indica* and *A. panikkari*. The formation of the aboral pore in *A. panikkari*, like that of the directive tentacle, is not a larval feature, for, judging from their metamorphosis soon after a suitable substratum is provided, these larvae seem to represent the final pelagic stage. Metamorphosed adults have, however, an aboral pore indicating that in *A. panikkari* it appears only after the transformation into the adult. The same condition may be expected in *A. indica* also as the 12-tentacled stage without the aboral pore is the final pelagic stage.

Like the tentacles, the column in transverse sections presents a circular appearance, with the wall of uniform thickness at the two extremities, while in the middle region the wall is thicker by two-thirds. There is no histological difference between the regions of the columnar wall except that presented by the ectodermal longitudinal musculature. The musculature is very feebly developed in the anterior end of the column below the tentacles, with the folds and the muscle branches very few in number (Pl. III, fig. 3). These are well developed in the middle region corresponding with the position of the hyposulcus where they form the most prominent part of the body wall (Pl. XIV, fig. 4). The mesogloeal folds here are very high, numerous and compactly arranged containing a large number of muscle branches. The muscle layer at the posterior extremity of the column is better developed than that of the anterior extremity, but not to such an extent as in the region of the hyposulcus (Pl. XIV, fig. 5). The columnar ectodermal cells of the body wall are compactly arranged with numerous interstitial cells (Pl. III, fig. 6). Mucus cells are very common and a gradual increase in their number is discernible towards the aboral extremity. Differently sized nematocysts are very common and the largest measure 21 × 4·4 μ. Curved nematocysts are not rare. Nematocysts are more abundant at the aboral end. Spirocysts and gland cells are almost completely absent from the ectoderm of the body wall. The mesogloeal layer, as in the tentacles, is homogeneous without any nuclei. The endodermal layer is thin and contains curved spirocysts, similar to those on the tentacles. Straight spirocysts, which are slightly longer than the curved ones, are very rarely seen in the endoderm. Nematocysts are extremely rare in the endoderm of the body wall.

The Stomodaeum.—The mouth in *A. panikkari* is an elongate slit-like opening, the two sides of which are closely apposed together. The mouth leads into the stomodaeum, extending to about one-eighth the length of the column. The siphonoglyph is clearly differentiated from the rest of the actinopharynx and its lining cells are thin and long with elongated nuclei and provided with very long cilia (Pl. IV, fig. 3). Gland cells and mucus cells are also present amidst the supporting cells of the siphonoglyph. The ectoderm of the remaining portion of the actinopharynx, between two consecutive mesenteries, forms a high ridge with deep furrows on either side opposite the mesenterial attachments. The number of the ridges corresponds to the number of actinocoels excluding those belonging to the siphonoglyph. These ridges are formed exclusively of ectodermal cells without any mesogloeal support and thus resemble the condition found in the two adult Ceriantharians, *Arachnanthus oligopodus* and *Arachnanthus sarsi.* Large gland cells with numerous globular secretory granules are the most conspicuous elements in the ectodermal ridges. Cnidae, especially the nematocysts, occur in large numbers in these ridges. The nematocysts, both curved and straight, are of different sizes and the largest measure 20 × 3·3 μ. Spirocysts are rare in the ectodermal ridges. Mucus cells also occur in fairly large numbers. Cilia are uniformly distributed on the ridges and the furrows, but are short when compared with the ciliation of the siphonoglyph.

The aboral continuation of the siphonoglyph, namely the hyposulcus, is very broad and powerfully ciliated with a structure similar to that of the siphonoglyph (Pl. IV, fig. 4). Distinct ciliated tracts are present throughout the entire length of the hyposulcus, and these fade away at its termination (Pl. IV, fig. 1). Only in *A. albida* and in *A. indica*, the ciliated tracts are well developed in the hyposulcus and this tract is continued on to the hemisulci in the latter species. In *A. valdiviae* the ciliated tracts are absent in the hyposulcus. Spirocysts, large nematocysts and gland cells are common at the free curved end of the hyposulcus in the vicinity of the ciliated tracts.

Hemisulci are extremely short and can be regarded as practically absent in *A. panikkari*. Only in *A. valdiviae* the condition of the hemisulci approaches that of the present form. These are present in *A. sibogae* and in *A. indica*, while in *A. albida* they are completely absent.

The Mesenteries.—In the two specimens sectioned serially fifteen mesenteries are present in the anterior region including the directive mesenteries (Pl. XV, fig. 3). Of these, eight belong to the right side and seven to the left side. One specimen was slightly advanced in age and possessed two more mesenteries, the ninth of the right side appearing as a rudiment and the eighth of the left side as an incomplete septum extending half way between the body wall and the actinopharynx. Of these fifteen mesenteries, the last of either side is very short and does not extend below the posterior border of the actinopharynx. All the remaining mesenteries in both the specimens show filament differentiation except the directive mesenteries and the seventh mesentery of the right side of the younger larva. The directive mesenteries are not continued beyond the rudiment of the hemisulci. The second pair of protomesenteries is about the same length as the directive mesenteries. The third pair of protomesenteries is shorter than the other two pairs of protomesenteries. Of the metamesenteries, the first pair is the longest and extends as far as the aboral extremity and each ends in a slender thread-like acontium. All the other metamesenteries are shorter than the longest of the protomesenteries. In both the specimens the third metamesentery of the right side is slightly longer than its fellow of the other side. The fourth metamesentery of the right side is short and shows filament differentiation only in the older larva while that of the left side as already mentioned disappears before the termination of the actinopharynx.

As observed in *A. indica*, the lamellar portion of the mesenteries contains many large vacuolated cells. Very few thick-walled nematocysts are present in this region.

The Mesenterial Filaments.—The directive mesenteries are without any filaments and the outer free border of the hyposulcus shows the well developed ciliated tracts of the directive mesenteries very clearly (Pl. IV, fig. 1). The filament of the second pair of protomesenteries consists of a very long orthocraspedon having a straight course and without any folds or craspedonemes. In sections the orthocraspedon shows a broad flattened median region with well developed ciliated tracts. (Pl. IV, fig. 2). The rounded sides of the median streak contains spirocysts measuring 7·8 × 2·2 μ. Granular gland cells are also present on the median streak. In structure the spirocyst glandular tract of this protomesentery closely resembles that of *Cerianthus lloydii* and so can be classed under Type II of Carlgren. The plectocraspedon of the second pair of protomesenteries, though short, is well developed and has the typical appearance in sections (Pl. IV, fig. 3). Numerous gland cells and thick-walled nematocysts measuring 20 × 3·3 μ occur in this region. The cnidoglandular tract is wavy in its course and a couple of craspedonemes is formed. The plectocraspedon is followed by a short telocraspedon, which is slightly longer than the plectocraspedon of the same mesentery. In the third pair of protomesenteries the ciliated tract region is short and, in sections, presents a different appearance from that found in the second pair of protomesenteries (Pl. IV, fig. 4). The median streak is rounded and contains spirocysts and gland cells. The ciliated tracts are well developed. The orthocraspedon of this protomesentery resembles in structure the ciliated tract region of *Botrucnidifer norvegicus* and so belongs to Type III of Carlgren. The plectocraspedon is long and well developed with the folds of the filaments forming a number of small craspedonemes. This is the best developed region of the mesenterial filament of the third pair of protomesenteries. A telocraspedon is present in the third pair of protomesenteries, but is shorter than the orthocraspedon of the same mesentery.

The ciliated tract region of the first pair of metamesenteries is fairly long and forms the longest orthocraspedon of the mesenteries in *A. panikkari*. The structure of this region is the same as that of the second pair of protomesenteries and belongs to Type II and thus differs from the condition found in *A. albida*. It is interesting to mention here that in *A. valdiviae*, the ciliated tract region of the first pair of metamesenteries is like the corresponding region in the third pair of protomesenteries of *A. panikkari*. The cnidoglandular region is completely absent in the first pair of metamesenteries. The telocraspedon forms the longest region of the mesenterial filament and is well developed in this pair of metamesenteries. It consists of supporting cells with a few spirocysts and gland cells. Large thick-walled nematocysts are very common in the endodermal portion of the telocraspedon of this mesentery (Pl. IV, fig. 5). The cnidae, found in large numbers anteriorly, are practically absent in the posterior region of the craspedion.

There are two acontia in *A. panikkari*, each arising from the terminal region of the telocraspedon of the first pair of metamesenteries. They are slender, long and thread-like and could be seen actively moving inside the body cavity of the larva in the living condition. Panikkar (*op. cit.*) has suggested that in *A. indica*, the acontium and the directive tentacle probably develop at about the same time. This is in complete contrast with the condition found in the present species where the acontium and the directive tentacle are developed during the larval and adult stages respectively. In sections the acontium is composed of a compact mass of supporting cells in which are found gland cells, mucus cells and very rarely nematocysts (Pl. IV ; fig. 6). In some adult Ceriantharia studied by Carlgren, he has noted distinct zonations in the acontium representing the ascending and the descending limbs of the craspedion region separated on either side by groups of endodermal cells. In *A. indica* a similar condition has been described at the basal region of the acontium only, while at the tip the endoderm disappears and the two limbs completely fuse. In *A. panikkari* the endodermal portion of the acontium could not be detected in the two specimens sectioned and suggests that this portion has undergone complete reduction resulting in the fusion of the two limbs of the filament.

The remaining metamesenteries are shorter than the second pair of protomesenteries ; yet, the various regions of the filament are well developed. The second couple of metamesenteries agrees with the third pair of protomesenteries in the proportion of the various regions. Further, the structure of the orthocraspedon is similar to that of the third pair of protomesenteries. The plectocraspedon forms the longest region of the filament and is drawn out into small craspedonemes as in the third pair of protomesenteries. The telocraspedon is of about the same length as that of the third pair of protomesenteries. In the third couple of metamesenteries, the orthocraspedon is the longest region. The cnidoglandular region is completely absent in this metamesentery. The craspedion region is short and is about half the length of the orthocraspedon. This metamesentery is like the second protomesentery and the first metamesentery in the structure of the ciliated tract region and resembles more closely the latter in the absence of the cnidoglandular region. Though the fourth metamesentery of the right side of the older larva is extremely short, the different regions are well developed with the ciliated tract region similar to that of the third protomesentery and the second metamesentery. The cnidoglandular region is slightly longer than the orthocraspedon followed by a telocraspedon of about the same length as the latter.

Reviewing the structural features and the proportions of the different regions of the filaments of the mesenteries, we find that the second pair of protomesenteries, the first and the third pairs of metamesenteries are similar, but for the short plectocraspedon present in the protomesenteries. The very long orthocraspedon of these mesenteries belongs to Type II of Carlgren. The third pair of protomesenteries, the second and the fourth pairs of metamesenteries are alike, in that they possess only a very short orthocraspedon of Type III and a well developed long plectocraspedon, the folds of which form small craspedonemes. A craspedion region is present in all the mesenteries.

DISCUSSION.

Carlgren, in his monograph on Ceriantharian larvae, includes only the species *albida*, *sibogae* and *valdiviae* under the genus *Arachnactis*, removing forms like *Arachnactis bournei*, *Arachnactis lobiancoi* and *Arachnactis brachiolata* of different authors to separate genera. *A. indica* is the only species added to the genus in subsequent years. A comparison of the characters of *A. panikkari* with those of the different species of *Arachnactis* clearly shows that this species possesses distinct features. The most important difference is that presented by the directive marginal tentacle. In *A. albida*, *A. sibogae* and *A. indica* the directive tentacle develops after the formation of four pairs of marginal tentacles. In *A. valdiviae* the directive tentacle originates after the formation of three pairs of marginal tentacles and probably simultaneously with the formation of the fourth pair of marginal tentacles. In *A. panikkari*, in the final pelagic condition with nine marginal tentacles, there is absolutely no indication of the growth of the directive tentacle. So the directive tentacle in *A. panikkari* seems to develop only after the transformation of the larva into the adult. In the absence of adaxial mucus cell bands and abaxial bands of cnidae the present form differs from *A. valdiviae* and in the absence of definite groups of cnidae at the tips of the tentacles from *A. indica*. The length of the actinopharynx is relatively short in *A. panikkari* being only one-eighth the length of the column. There is no information on this point in regard to *A. sibogae*, but in the other species the gullet is long. It is slightly longer than a quarter of the length of the column in *A. albida* while it is about a third in length in *A. indica* and *A. valdiviae.* The hyposulcus in the present species resembles that of *A. albida* being broad and of about the same length as the gullet. In the other species it is short and is about one-third the length of the gullet. In *A. panikkari* there is a well developed ciliated tract on the hyposulcus and no trace of it could be found in the extremely short hemisulci. *A. valdiviae* and probably also *A. sibogae* are without ciliated tracts in the hyposulcus. This region is present on the hyposulcus of *A. albida* and *A. indica*, but in the latter species on the hemisulci also. In the extremely short condition of the hemisulci, the present species resembles *A. valdiviae* where also they are very short and practically absent. The ciliated tract region of the first pair of metamesenteries in *A. panikkari* belongs to Type II of Carlgren. In *A. valdiviae* the orthocraspedon comes under Type III with some resemblance to Type II and in *A. albida* and *A. indica* it comes under Type I.

These differences taken in conjunction with the structural variations presented by this species, clearly show that we are dealing with a form which is different from the other known species of *Arachnactis* and the name *Arachnactis panikkari* is proposed for it.

Family ARACHNANTHIDAE Carlgren, 1924.

Genus **Anactinia** Annandale, 1909.

Anactinia carlgreni sp. nov.

(Plate V.)

Diagnostic characters.—*Anactinia* without marginal and labial tentacles, with concentration of cnidae at the anterior extremity. Actinopharynx about one-fourth the length of the animal. Hyposulcus without ciliated tracts measuring a quarter of the length of the stomodaeum. Hemisulci about twice as long as the hyposulcus. Siphonoglyph with all the protomesenteries attached to it. The first pair of metamesenteries the longest, extending to the aboral end and each terminating in an acontium. Orthocraspedon of the second pair of protomesenteries, and the first, the third, etc., pairs of metamesenteries of Type II. Orthocraspedon of the third pair of protomesenteries, and the second, the fourth, etc., pairs of metamesenteries of Type III. Mesenterets and cnidoglandular craspedonemes present. Metamorphoses into tube-dwelling adult with marginal and labial tentacles.

EXTERNAL CHARACTERS.

Anactinia carlgreni is translucent and pale white when alive with a tinge of green colour detectable only on very close examination. The preserved specimens are opaque and white. Like *A. pelagica* the present form is also without tentacles, not even traces of them even as slight protuberances in the fully expanded larvae. The larvae are spherical to oval when taken from the Plankton. When they are placed in fresh sea water of the Aquarium they assume an elongated oval shape (Pl. XVI, fig. 1). In the fully expanded condition, the larvae are 5 mm. long with a diameter of 2·5 mm. The mouth is in the form of a slit-like opening. A distinct aboral pore is present. When viewed under the binocular microscope, the gullet, the mesenteries and the acontia are fairly visible through the body wall of the living larvae. Such an examination further reveals the aggregation of the large nematocysts in the tentacular region at the oral end and also round the aboral pore.

STRUCTURE OF THE LARVA.

The Column.— The cylindrical column of *A. carlgreni* has, throughout its entire length, a more or less uniformly thick body wall. Further, no appreciable variation in the structure of the different regions of the column has been observed except in the disposition of the cnidae and the mucus cells. Large nematocysts measuring 43·2 ×7·2 μ form very prominent groups around the oral opening and these groups are the only indications of the position of the tentacles which appear during metamorphosis. The tentacles are formed during metamorphosis as outpushings of these nematocyst group regions and as they grow the nematocysts get scattered over the surface of the tentacle. Nematocysts of this type are present at the posterior end around the aboral pore. These nematocysts are rare in the other regions of the column. The spirocysts of the body wall, which are all of the same size, are found in enormous numbers at the extreme anterior region of the larva, particularly in the tentacular regions and around the oral opening. Such a regional aggregation of cnidae in the body wall has not been observed in *A. pelagica.* The large mucus cells of the body wall are numerous at the two extremities. At the anterior extremity they form groups at the middle of the body wall of each mesenterial compartment below the nematocyst groups (Pl. V, fig. 2). Similar mucus cell groups are also present in *A. pelagica.* Carlgren (*op. cit.*) suggests that these are morphologically similar to those found on the inner side of the marginal tentacles of some Ceriantharian larvae like *Calpanthula* and *Hensenanthula.* In *A. carlgreni*, the tentacles are formed in the nematocyst group regions situated above the mucus cell group regions and as such if the mucus cell groups persist in the adult they can be only on the outer side of the bases of the tentacles.

The ectodermal layer occupies about half the thickness of the body wall and the columnar cells composing it are closely arranged with numerous interstitial cells between them (Pl. V, fig. 3). In addition to the sparsely distributed large nematocysts, large numbers of small ones occur amidst the cells of the ectoderm. These measure 21·6×4·32 μ, and are more or less uniformly distributed over the entire surface of the body wall. Spirocysts measuring 14·4×2·16 μ, similar to those found aggregated in the anterior region, are also present, but are not so numerous as the nematocysts. Mucus cells are common in the body wall and occasionally gland cells are also present in the body wall. The ectodermal longitudinal musculature is fairly well developed except at the extremities. The mesogloeal folds on which are placed the muscle fibres are short. The homogeneous mesogloeal layer is devoid of nuclei. The prominent endodermal layer, which is about two-thirds the width of the ectodermal layer, consists of cells vacuolated at their bases with the protoplasmic part at the apical end where the nuclei are situated. Nematocysts, such as those found in *A. pelagica*, have not been observed in the endodermal layer of the body wall.

The Stomodaeum.—The slit-like oral opening leads to the stomodaeum which extends to about one-fourth the length of the animal. The siphonoglyph is not well differentiated from the other regions of the actinopharynx and all the protomesenteries are attached to it (Pl. V, fig. 4). The ectodermal cells of the siphonoglyph are thin and long with oval nuclei and carry cilia which are of about the same length as that of the ridged portion of the stomodaeum. Mucus cells and occasionally gland cells are present amidst the supporting cells of the siphonoglyph. The ectoderm of the remaining portion of the stomodaeum forms faint ridges and there is no mesogloeal extension into them. Numerous gland cells with secretory granules are present in the ectodermal ridges. Mucus cells are also present in fair numbers. Nematocysts are very common and measure 17·28×3·6 μ. Spirocysts are extremely rare. The ridges and the furrows are uniformly ciliated.

The siphonoglyph is continued as the hyposulcus which is about a fourth of the length of the stomodaeum. The hemisulci are long and prominent and are about twice the length of the hyposulcus. The structure of these two organs is the same as that of the siphonoglyph. Ciliated tracts are completely absent in the hyposulcus of *A. carlgreni*, unlike the condition in *A. pelagica* where it is provided with distinct ciliated tracts.

The Mesenteries.—In the two specimens of *A. carlgreni* used for studying the mesenteries, 18 mesenteries are present including the directives. Of these nine belong to the right side and nine to the left (Pl. V, fig. 4). The tenth mensentery of the right side has only begun to develop and could be seen in some of the anterior sections as bud-like projections from the body wall. The last mesentery of the left side is the shortest and extends only up to the posterior border of the gullet. The directive mesenteries and the ninth mesentery of the left side do not have filaments while the remaining mesenteries carry well differentiated filaments. The ninth mesentery of the right side and its filament are short. The directive mesenteries are continued even after the termination of the hemisulci, but no filaments are present in the free portion of these mesenteries. The second pair of protomesenteries are comparatively long and of about the same length as the third pair of metamesenteries. The third pair of protomesenteries is only slightly longer than the third pair of metamesenteries. The first pair of metamesenteries is the longest and extends almost to the aboral extremity. Each mesentery of this pair is provided with a long slender acontium. The third pair of metamesenteries is the next longest of the metamesenteries with the second and the fourth pairs of metamesenteries succeeding it in their respective lengths. Therefore, the mesenterial formula for *A. carlgreni* is MBmb. Mesenterets (Grenzstreifen) are prominently developed in the plectocraspedon of the mesenteries (Pl. V, fig. 5).

The Mesenterial Filaments.—The long directive mesenteries are without filaments and ciliated tracts are absent in the hyposulcus. The filaments of the second pair of protomesenteries are well formed with a fairly long orthocraspedon which has a straight course. The orthocraspedon has a somewhat wide median region containing spirocysts in small numbers measuring 8·64×1·44 μ. Gland and mucus cells are present in the median streak. The ciliated tracts are prominently developed. In structure the orthocraspedon of the second pair of protomesenteries and the first, the third, etc., pairs of metamesenteries resemble one another and comes under Type II of Carlgren (Pl. V, fig. 8). The plectocraspedon of the second pair of protomesenteries is of about the same length as the ciliated tract region and has the usual structure with numerous gland cells and nematocysts measuring 11·52 ×2·88 μ (Pl. V, fig. 5). This region of the filament is wavy in its course and a few craspedonemes are formed. The telocraspedon is fairly long and is not very conspicuous, the spirocysts occurring only very sparsely (Pl. V, fig. 6). The cilated tract region of the third pair of protomesenteries is very short and in structure it is different from that of the preceding protomesentery. The median streak is rounded and the ciliated tracts are small and poorly developed (Pl. V, fig. 7). In structure this region agrees with Type III of Carlgren. The plectocraspedon is very long and forms the prominent region of the filament of this mesentery. A number of craspedonemes are formed in this region. The telocraspedon is longer than that of the second pair of protomesenteries.

In anatomical features and in the comparative lengths of the different regions of the mesenterial filaments two types could be recognised among the metamesenteries as in the other members of Ceriantharia. The first, the third, etc., pairs of metamesenteries are similar in having a ciliated tract region resembling in structure that of the second pair of protomesenteries. In these metamesenteries the cnidoglandular region is completely absent. The craspedion region is very long and arises as a direct continuation of the ciliated tract region. The other metamesenteries, namely, the second, the fourth, etc., pairs are similar in structural features and resemble the third pair of protomesenteries. The orthocraspedon is short and agrees in structure with that of the third pair of protomesenteries. The plectocraspedon is well developed with prominent and, sometimes with, branching craspedonemes. The telocraspedon is fairly long. A gradual decrease in the lengths of the metamesenteries is noted when they reach the multiplication chamber.

There is only a single pair of acontia arising from the terminal portion of the telocraspedon of the first pair of metamesenteries. In *A. pelagica*, the first, the third and sometimes the fifth pairs of metamesenteries carry acontia and in this respect this species differs from the former. The acontium is composed of a compact mass of supporting cells amidst which are found gland cells and a few mucus cells (Pl. V, fig. 9). A fair number of large sized nematocysts, the largest found in the species, measuring 65×16·25 μ are found in the acontium particularly at the extremity. Small nematocysts measuring 19·5 × 4·9 μ are also present in the acontium. The ascending and the descending parts of the filament with the endodermal part lying between them is seen in the acontium and this differentiation vanishes at the tip of the acontium as has been found also in *Arachnactis indica*.

REMARKS.

Apart from the differences in the external features, the two species of *Anactinia* differ considerably in morphological features, the most important of them being the presence of acontia on the first pair of metamesenteries only and the absence of the ciliated tracts on the hyposulcus of *A. carlgreni*.

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NOTE.—References marked with an asterisk have not been referred to in the original.