ON THE SEA-ANEMONE *ACTINOPORUS ELEGANS* DUCHASSAING[1)]

DIVA DINIZ CORRÊA

Departamento de Zoologia do Instituto de Biociências da Universidade de São Paulo, Brasil, Caixa Postal, 20. 520.

With 2 Text-figures

Abstract

In the preceding paper, CORRÊA (1964) described 23 species of sea-anemones, of which 16 from the Island of Curaçao and 10 from Brazil, mainly from the coast of São Paulo State. Five of them are common to both localities: *Actinia bermudensis* (MCMURRICH, 1889), *Anemonia sargassensis* HARGITT, 1908, *Phyllactis conchilega* (DUCHASSAING & MICHELOTTI, 1860), *Calliactis tricolor* (LESUEUR, 1817) and *Aiptasia pallida* (VERRILL, 1864) (see also PAX, 1924). The species here described, *Actinoporus elegans* DUCHASSAING, 1850, is added to these five.

Actinoporus elegans DUCHASSAING, 1850

Actinoporus elegans DUCHASSAING 1850, p. 10 (CARLGREN 1949, p. 71)
Actinoporus elegans DUCHASSAING & MICHELOTTI 1860, p. 46 (CARLGREN 1949, p. 71)
Aureliania elegans ANDRES 1884, p. 281
Actinoporus elegans DUERDEN 1898, p. 451
Actinoporus elegans DUERDEN 1898a, p. 102
Actinoporus elegans DUERDEN 1900, p. 175

External Morphology

The *base* is almost circular, both in attached and unattached specimens. The collectors informed me that the base was not adherent in the natural habitat. However, when specimens were put into an aquarium without sand, they adhered rather firmly to the glass wall and bottom. As the animals are bulky, the attachment to the wall was not firm enough to keep them erect. They fell off easily due to their heavy weight. They were then transferred into an aquarium with sand, but none of them was able to bury in the sand. This had to be repeated several times before the animals became to use the new substratum and remained buried in it. Once buried they extend the column down through the sand to attach to the glass bottom. The fact that they are not attached with the base in their natural habitat makes it easy to collect them, using a shovel to loose the animal from the sand. I believe that they

1) This work was partially supported by the Royal Government of the Netherlands and by the Fundação de Amparo à Pesquisa do Estado de São Paulo, Brazil.

would attach in their natural habitat if they could find any proper substratum.

The basal wall is thin, whitish, and semi-transparent. Sand grains sometimes adhere to the wall. The insertions of mesenteries are shown best when the base is attached and expanded. The margin is slightly grooved according to the mesenteric insertions.

The diameter in a large, attached specimen, reaches up to 4 cm, being slightly smaller in the unattached animal.

The *column* can be rather elongate in the unattached animal (about 10 cm) but much longer when it is buried in sand. It is nearly cylindrical in its whole extension.

The lower and middle portions of the column are apparently smooth. The upper portion for 2 centimeters, immediately below the oral disc, shows very distinct mesenteric insertions, delimiting about 54 narrow ridges in a large specimen. The ridges correspond to the exocoels and endocoels, and each bears one row of vesicles, different in shape and size. The central part of the vesicles is covered by a transparent wall, which gives a lacy appearance to this region. The vesicle region is much more transparent than the smooth one, which is opaquely wrinkled and grooved. In the expanded and buried animals the vesicular portion of the column forms a parapet. The column adheres slightly to the glass wall of the aquarium, and sand grains stick to the smooth part of the column. A few vesicles could be seen in this part of the column. The column is uniformly opaque white, as well as the vesicles, except for the transparent whitish area of the latter. Some of the vesicular ridges, in groups of 2 or 3, are pig-

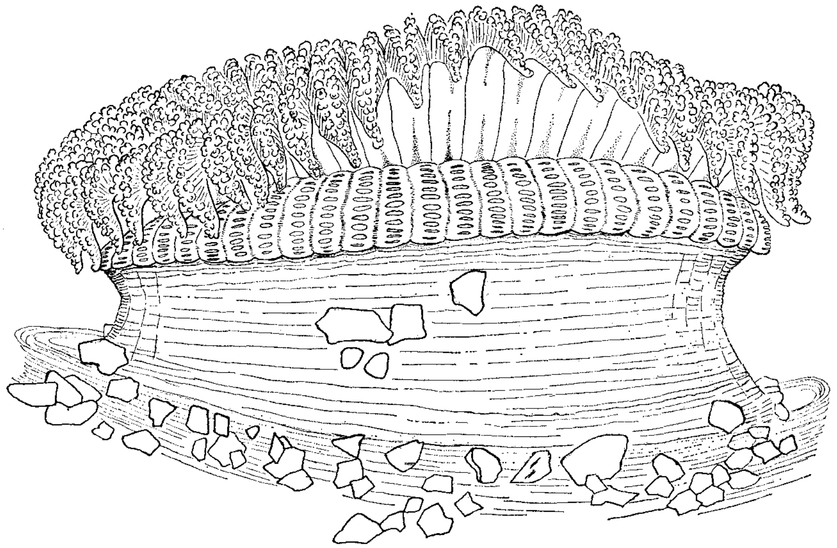

Fig. 1. *Actinoporus elegans* DUCHASSAING, 1850. Side view of the upper part of a half burrowed living specimen, showing the rows of knob-like discal tentacles and the column with rows of transparent vesicles and sparsely encrusted with sand grains.

mented light brown, forming vertical stripes, which do not reach the smooth part of the column. After preservation the column becomes deeply wrinkled, brownish and rough. A deep fosse is present. Height: up to 25 cm in a distended specimen. Largest diameter: about 5 cm.

The *oral disc* is circular when the animal is expanded and overhangs the fosse and the upper part of the vesicular region of the column. In its center lies the large mouth containing the upper part of the strong siphonoglyph, which bears a thick, triangular lip, the conchula. Around the mouth there is a naked, circular, smooth, transparent, whitish peristome. Externally to it there are 46 to 56 radial areas corresponding to the exocoels and endocoels, separated from each other by deep grooves. Along each tongue-shaped area there are 2 or more rows of knob-like tentacles, irregularly distributed, which cover most of the disc. The outer tentacles are larger than the inner ones. The number of radial rows of tentacles is about 96. The tentacles are diversely pigmented in brown, pink, yellow, blue and opaque white. The tip of each tentacle appears dark by transparency. The colors are distributed with some regularity. Around the peristome there is a ring of dark brown tentacles together with a few scattered ones of different color. On the border of the disc there are about 7 radial areas containing almost only dark brown tentacles. They are followed by the brown vertical stripes of the vesicular portion of the column. The spaces among these

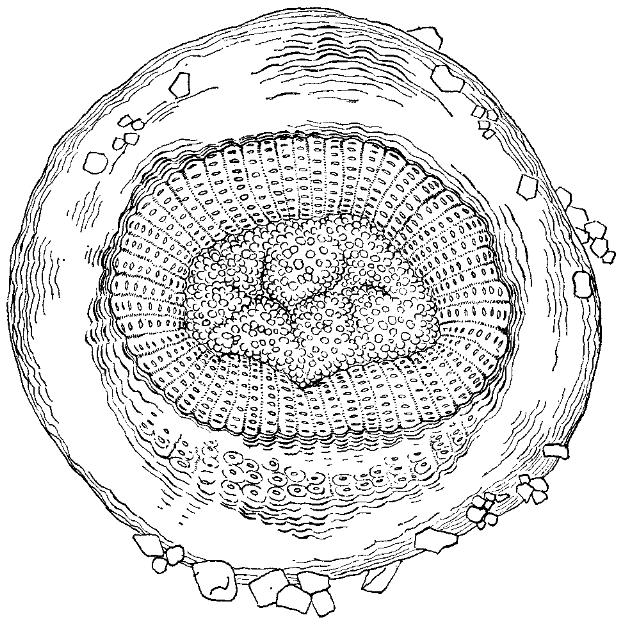

Fig. 2. *Actinoporus elegans* DUCHASSAING, 1850. Partially contracted specimen seen from above, showing the oral disc with knob-like tentacles, surrounded by the rows of transparent vesicles on the upper part of the column. The column shows also a few vesicles and sand grains attached to it.

dark discal areas are filled with the diversely pigmented tentacles. In nature there occur two color varieties, the one pigmented as described and the other of intensely milky white, with a light tinge of pink, mostly on the oral disc and the upper part of the column. One specimen kept for about 2 years in the aquarium lost most of its pigments and became whitish.

The oral disc can be completely retracted and then covered by the vesicular portion of the column. The study of the oral disc, the most important part of the external morphology for this genus, is rather difficult as the animals are extremely sensitive to touch and respond by immediate contraction of the strong sphincter. The return to expanded condition is slow.

When too much pressure is applied against the animals they will squirt the water from the oral disc. As HAND & BUSHNELL (1967, p. 2) remarked for *Flosmaris grandis* HAND & BUSHNELL, 1967, I do not believe, either, that this is a natural reaction, nor that this would occur frequently in the absence of abnormal pressure. When roughly handled the anemones will squirt but I have never observed it as a natural reaction. At changing the water I verified that the animals lose water slowly through the mouth.

The diameter of the oral disc is about 5 cm when fully expanded.

The preservation of the animals was achieved with 10% formalin, after relaxation in a solution of magnesium chloride (20 grs $MgCl_2$+250 cc sea-water+250 cc fresh-water). The column responds well to this anesthetic and stretches, this being helpful for the macroscopic study of thick transverse sections of it. The oral disc, however, contracts strongly, making its study difficult in preserved animals. So far, I have not been able to obtain any relaxed specimens with a reasonably expanded disc.

Internal Anatomy

There is only one deep and strong siphonoglyph, but two pairs of directive mesenteries. One is attached to the siphonoglyphic border of the actinopharynx and the other to the opposite side. The highly transparent actinopharynx is large, elongated and irregular in outline. There are 24 pairs of mesenteries, all perfect, of which 2 pairs are the directives and the remaining 22 pairs are regularly distributed on each side of the actinopharynx. The retractor muscles are enormously developed, filling the whole of the gastric cavity. The sphincter muscle is strong and belongs to the circumscribed pinnate type.

Cnidom: spirocysts, basitrichs and microbasic p-mastigophors.

Tentacles	
spirocysts	28.0–34.0μ–3.4μ
basitrichs	18.0–22.0μ–3.4μ
Column	
spirocysts	24.0–28.0μ–3.4μ

basitrichs	18.0–22.0μ–3.4μ
Actinopharynx	
basitrichs	18.0–22.0μ–3.4μ
microbasic p-mastigophors	28.0–30.0μ–6.8μ
Filaments	
basitrichs	15.0–22.0μ–2.7μ
microbasic p-mastigophors	23.0–34.0μ–6.8μ

Occurrence

The first two specimens were collected on Siriuba Beach, Island of São Sebastião, Northern coast of São Paulo, Brazil (45° 3' S, 21° W). This beach belongs to a series of small and protected sandy beaches, bounded by small rocky promontories, facing the São Sebastião channel.

The species occurs also on Araçá Beach, a sheltered beach situated on the continental side of the São Sebastião channel, about 8 km southward from the former beach. Araçá Beach contains several kinds of environments: mud flats, mangrove swamps, rocky coast and sandy stripes, where the specimens occur. It is much more muddy and the sand grains are smaller there than on Siriuba Beach.

The area inhabited by the animals is at the low water level, and then they are most easily collected during the low water of spring tides, when they can be observed with their white or colorful oral disc expanded, though any movement near them will cause their sphincters to contract to draw the whole body down into the sand. Normally the animals live with the column buried in the sand, but the oral disc lies on the surface of the substratum. They live well in an aerated aquarium, regularly fed with bits of shrimp flesh and the water changed periodically.

The species is not a common one. The first collector, Prof. Paulo SAWAYA, found only two specimens of the white variety on Siriuba Beach. Later on I received six more specimens of both varieties from Araçá Beach, collected by Dr. Jorge Alberto PETERSEN and Dr. Antonio Sérgio FERREIRA DITADI. I wish to thank them for the animals submitted to me.

The species has already been known from Guadeloupe and Jamaica, but it is new for Brazil. In addition to these Mr. J. C. DEN HARTOG has collected two specimens in Curaçao, N. A. DUERDEN (1898, p. 451; 1900, p. 179) mentions his single specimen and unsuccessful searches repeated for further specimens at the same locality, Wood Island, Port Antonio, Jamaica.

Nutrition

Hitherto observations of the feeding in *A. elegans* were limited to those of DUERDEN (1900, p. 179–180), who saw the extrusion of a skeleton of a crab, with all flesh digested.

The occurrence of the species on the coast of São Paulo, made a more detailed study possible. Experiments on food intake were made in the laboratory.

STEPHENSON (1935, p. 179) mentions that the tentacles of *Aureliania heterocera* (W. THOMPSON, 1853) are almost completely useless, in spite of the existence of spirocysts crowded on them, and that those knob-like tentacles cannot be accepted as certain food-catching devices. On one occasion when a specimen was fed, it retracted the oral disc and allowed the food to lie on the top of the closed column. After some time the "throat" was everted and the food was taken in by it, without assistance of any tentacles.

PAX and MÜLLER (1962, p. 184) suppose that the food of *A. heterocera* is probably organic detritus. The particles would fall onto the peristome and then be drawn to the mouth by centripetal movements of ciliary currents; however, this process was not actually observed.

In my experiments with *A. elegans*, the animals were kept in an aquarium without their native substratum, but buried in coarse artificial gravels, leaving the oral disc and the upper part of the column exposed. The oral disc was completely expanded at the time when the experiments were begun.

Bits of shrimp flesh, about 1 cm in the largest diameter and a half cm in smaller diameter and height, were put with a forceps directly on the peristome. The anemone did not show any immediate reaction, but slowly it everted the large actinopharynx, which formed big lobes that covered about half the expanded disc area. Several lobes slowly surrounded and engulfed the food, and then swallowed it down. After this the anemone assumed the digestive position. Apparently the tentacles did not participate in the process, but the oral disc itself sometimes retracted a little around the food.

In this process it can be shown that the actinopharyngeal lobes have performed the function of normal long tentacles which are absent in the species.

In the second experiment I put the bits of shrimp flesh of similar size on the knob-like tentacles. In this case the food was slowly drawn to the peristome without any apparent help of the disc itself, which remained expanded. Owing to the small size of the crowded tentacles it was not possible to verify whether the tentacles had participated in this process. I believe that ciliary currents are responsible for the transportation of the food to the peristome. When the food reaches onto the peristome the eversion of actinopharynx takes place as described above.

Further, the third process was observed. Sometimes the bits of shrimp flesh, put on the peristome or on the tentacles, are rapidly engulfed by a very quick retraction of the oral disc. This is a very rapid reaction of swallowing the food in contrast with the two slow reactions described above.

To verify whether the food size played a role in different reactions observed, I offered the anemones bits of flesh half or twice as large as the former bits. No change of behaviour was observed. Any of the three processes was seemingly adopted at random.

As far as observations go, it seems that the problem is not related to the food size but to some special physiological condition at the time of the food intake.

Taxonomic Discussion

The species described here belongs to the Family Aurelianidae ANDRES 1883, p. 494 (CARLGREN 1949, p. 70). The family includes two genera, *Aureliania* GOSSE 1860, p. 282, with a smooth column and few tentacles arising from each exocoel and endocoel and *Actinoporus* DUCHASSAING 1850, p. 10, with vesicles on the upper part of the column and numerous tentacles for each exocoel and endocoel.

DUERDEN (1898a, p. 102) asserts that *A. elegans* bears no close relationship to the British *Aureliania*, as supposed by ANDRES (1884, p. 281). The two latest descriptions of *Aureliania heterocera* (W. THOMPSON, 1853), by STEPHENSON (1935, p. 173) and PAX and MÜLLER (1962, p. 182), do not show any need to erect a new family for *Actinoporus*.

Genus *Actinoporus*

DUCHASSAING 1850, p. 10 (CARLGREN 1949, p. 71)

Aurelianidae of considerable length. Pedal disc rather small. Column with longitudinal rows of vesicles on its upper part below the sphincter. Fosse deep. Sphincter strong, pinnate, circumscribed. Tentacles short vesicular knobs, sometimes lobed, arranged in radial rows. Two principal rows of tentacles communicate with each exocoel and endocoel. Longitudinal muscles of tentacles and radial muscles of oral disc absent or very weak, ectodermal. Oral disc not extensive but notched into little lappets at the margin, which correspond in number to the exocoels and endocoels. A single, deep siphonoglyph, but 2 pairs of directives. Mesenteries all perfect and all or most of them fertile. Retractors strongly restricted to circumscribed. Parietobasilar muscles well developed. Cnidom: spirocysts, basitrichs, microbasic p-mastigophors.

DUERDEN (1900, p. 174) had only one specimen and questioned the presence of only one siphonoglyph but 2 pairs of directives. This character is confirmed in all six specimens I have studied, which belong to the type species of the genus.

Until now the genus *Actinoporus* contains only two species: *A. elegans* DUCHASSAING, 1850 and *A. elongatus* CARLGREEN, 1900.

A. elongatus was described from one specimen in the Museum of Berlin, collected at Querimba Island, off Mozambique, and a second specimen in the Royal Museum of Stockholm, from an unknown locality.

The old description of *A. elongatus* by CARLGREN (1900, p. 283–287) does not allow enough comparison between the two species.

The body size agrees in both species, except for the basal disc which is much smaller in *A. elongatus*. This might be due to age or to the bad preservation of the specimens. The colors of *A. elongatus* are not known.

The 24 pairs of mesenteries are perfect in *A. elegans*, but the 26 or 25 pairs in *A. elongatus* are not all perfect, some of them being incomplete.

CARLGREN measured the nematocysts from the tentacles, column and actinopharynx, but did not give them any names. He distinguished nematocysts with thin walls (spirocysts?), nematocysts with thick walls (basitrichs?), and one special type of nematocysts (microbasic p-mastigophors?).

I compared the sizes of the nematocysts between *A. elegans* and *A. elongatus*, and if I am right about CARLGREN's classification of nematocyst types, the sizes are not too different between both species.

CARLGREN received a fragment of DUERDEN's specimen of *A. elegans* from Jamaica and compared its nematocyst sizes with those of his specimens of *A. elongatus*. The sizes also proved to be not too different.

The only good character to separate the two species from each other seems to be the absence of rows of vesicles on the upper part of the column in *A. elongatus*. As far as CARLGREN could see (p. 284) they do not exist, or in any case they are not so conspicuous as in *A. elegans*.

LITERATURE CITED

ANDRES, Angelo 1884. Le Attinie. Fauna und Flora des Golfes von Neapel. **9**: X+459.

CARLGREN, Oskar 1900. Zur Kenntnis der stichodactylinen Actiniarien. Ofvers. Kongl. Vet. Akad. Forhand., **2**: 277–287.

——— 1949. A survey of the Ptichodactiaria, Corallimorpharia and Actiniaria. Kungl. Sv. Vet. Hand., **1**: 1–121.

CORRÊA, Diva Diniz 1964. Corallimorpharia e Actiniaria do Atlântico Oeste Tropical. Serv. Doc. R.U.S.P., 1–139.

DUERDEN, J. E. 1898. The Actiniaria around Jamaica. Journ. Inst. Jam., **2** (5): 449–465.

——— 1898a. The geographical distribution of the Actiniaria of Jamaica. Nat. Sci., **12**: 100–105.

——— 1900. Jamaican Actiniaria, Pt. II—Stichodactyline and Zoantheae. Trans. Roy. Dubl. Soc., **7** (6): 133–220.

HAND, Cadet and Ralph BUSHNELL 1967. A new species of burrowing acontiate anemone from California (Isophelliidae: *Flosmaris*). Proc. Unit. St. Nat. Mus. Smith. Inst. Wash. D.C., **120** (3554): 1–8.

PAX, Ferdinand 1924. Actiniarien, Zoantharien und Ceriantharien von Curaçao. Bijdr. Dierk Fauna Curaçao **23e** (7): 93–122.

PAX, Ferdinand and Ingeborg MÜLLER 1962. Die Anthozoenfauna der Adria. Fauna et Flora Adriatica. **3**: 1–343.

STEPHENSON, Thomas A. 1935. The British sea anemones, II: (Ray Society, 121), IX+426.