

## THE AMPHIPOD GENUS ACIDOSTOMA

by

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The genus *Acidostoma* was established by Lilljeborg (1865, p. 24) to receive *Anonyx obesus* Sp. Bate (1862, p. 74). Afterwards two further species have been added, viz. *A. laticorne* G. O. Sars (1879, p. 440) and *A. nodiferum* Stephensen (1923, p. 40). In the present paper it will be shown that *A. laticorne* as generally understood comprises two superficially similar but clearly distinct species with a widely different geographical range.

On the whole the species of *Acidostoma* appear to be nowhere numerous and practically nothing is known about their ecology. The present writer has had access to a comparatively large number of specimens collected by the Danish Fisheries Research vessels in the North Sea. From these it was possible to draw some further information both on taxonomy and ecology.

### DEFINITION OF THE GENUS

In most respects the *Acidostoma* species are typical representatives of the family Lysianassidae, but the mouth-parts are peculiar and show a series of interesting adaptations. The generic name was chosen by Lilljeborg in order to call attention to the fact that they form a long and protruding cone.

The generic definition given by Lilljeborg (1865) runs as follows:

“Forma corporis et antennarum cum genere Anonycis congruit, oris partes appendiculares tamen plane diversae. Labii rami laterales angusti. Mandibulae processu accessorio, maxillae 1: mi paris palpo, et palpus maxillipedum ungue carentes, et hae partes oris conjunctim acumen productum praebent. Pedes trunci 1: mi paris robusti, manu prehensili. Pedes 2: di paris graciles, ungue carentes.”

This definition was amplified by Della Valle (1893, p. 782), G. O. Sars (1895, pp. 37-38), and Stebbing (1906, p. 14). It was demonstrated that the maxillula is provided with a vestigial palp and that there exists a very small fourth segment on the palp of the maxilliped.

With respect to the molar there are some apparent contradictions. The authors quoted above agree that no molar is present, but Shoemaker (1930, p. 3) in his description of the female of *A. laticorne* states that the mandible bears a “prominent conical process which appears to be the molar”. Della

Valle (1893, p. 783) and later Chevreux & Fage (1925, p. 30) in their descriptions of what was presumed to be the same species stress the absence of a molar, while G. O. Sars (1879, p. 440, and 1885, p. 152) provided no information about the mouth-parts.

In fact, however, Shoemaker was the only one of the subsequent writers mentioned to deal with the true *A. laticorne* G. O. Sars, the other writers had before them specimens of the species which will be described below as *A. neglectum* n.sp. I have had the opportunity to examine the mandible (fig. 10) of a specimen of *A. laticorne* from North East Greenland in the collections of the Zoological Museum in Copenhagen, which corroborates the observations made by Shoemaker. There can be no doubt that the narrow and acute conical process on the medial side of the mandible represents the molar. Also in *A. neglectum* a low ridge is found in the same place and will have to be interpreted as a vestigial molar (fig. 14). In *A. obesum* and *A. nodiferum* the molar has disappeared altogether. The reference to the mandible in the generic description consequently will have to be brought into conformity with the observations recorded here.

Further the generic diagnosis given by Stebbing (1906) refers to the presence of a small tooth at both ends of the cutting edge of the mandible. I have re-examined the mandibles of all four species and found such a tooth only at the anterior corner of the cutting edge.

Some comment must also be made on the peculiar shape of the maxilliped. The outer plate of the maxilliped of all four species is very large, and together these outer plates of the maxilliped envelop the posterior and lateral sides of the mouth cone (figs. 16, 17). It is interesting to note that in all species except *A. laticorne* this folding round the mouth-parts takes place along a pre-formed line beginning at an incision of the medial margin near the distal end (fig. 2). The probable function of this arrangement will be dealt with in another connection (p. 55).

The most adequate definition of the genus so far is the one given by Stebbing (1906, p. 14). With respect to most morphological features it can be accepted as it stands, although, as shown by the previous discussions, a few additions and changes must be made. The definition will now have to run as follows:

#### **Acidostoma** Lilljeborg

Body short, robust. Side-plates large, deep. Antennula, second and third segments short, in ♂ but not in ♀ nearly as stout as the first; first segment of flagellum small in ♀, in ♂ laminar, densely fringed; accessory flagellum in ♂ and ♀ nearly as long as primary. Antenna rather slender. Labrum

long, narrow and acute. Labium with narrow lobes. Mandible with minute tooth at anterior corner of cutting edge, narrow, simple, molar small or absent, palp slender. Maxillula, inner plate small, narrow, outer plate narrow, tipped with small unguiform teeth, palp rudimentary. Maxilla, both plates stiliform. Maxilliped, inner plate tapering, truncate, outer plate large without marginal teeth, with or without preformed folding line enveloping posterior and lateral sides of mouth parts, palp rather short, fourth segment small. First gnathopod rather robust, carpus subequal in length to metacarpus which tapers distally and lacks palm. Second gnathopod, metacarpus narrowly oblong, densely hirsute, dactylus wanting. Last three pereopods robust, basis and merus much expanded. Second uropod with broad peduncle, third uropod very small. Telson short, more or less cleft or emarginate.

Type species: *A. obesum* (Sp. Bate, 1862)

Key to the species of *Acidostoma*

1. Telson longer than broad, deeply cleft . . . . . 2
- Telson broader than long, emarginate . . . . . 3
2. First segment of urosome with dorsal margin straight *A. obesum* (Sp. Bate)
- First segment of urosome dorsally saddle-shaped with a conspicuous hump near posterior margin . . . . . *A. nodiferum* (Stephensen)
3. Outer plate of maxilliped with interior margin without incision, mandible with small pointed molar, dorsum of first urosome segment saddle-shaped . . . . . *A. laticorne* G. O. Sars
- Outer plate of maxilliped, inner margin with deep incision near apex, mandible with molar vestigial, dorsum of first urosome segment straight *A. neglectum* n. sp.

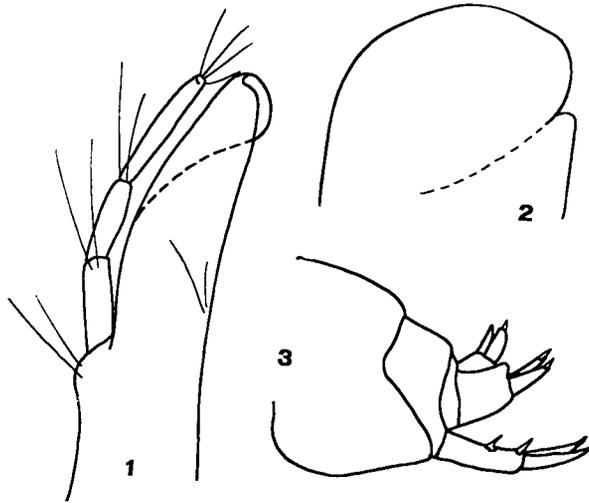
***Acidostoma obesum*** (Sp. Bate 1862) (fig. 1-3)

Descriptions also in Sars (1895, p. 38, with figs.), Stebbing (1906, p. 14), and Chevreux & Fage (1925, p. 32, with figs.).

A species widely distributed from N. Norway (Foldenfjord, Stephensen, 1926, p. 7) along the European west coast including the British Isles. In the transition area between the North Sea and the Baltic it occurs as far south as the deeper parts of the Öresund (Dahl, 1946, p. 4). Also reported from W. Africa (Sierra Leone, depth 15 m, Reid, 1951, p. 195), and from S. Africa (Duminy Point off Saldanha Bay, 165 m, Barnard, 1925, p. 322).

A record from the cold area of the Norwegian Sea (Norwegian North-Atlantic Expedition St. 31, Sars, 1886, p. 43) actually refers to *A. laticorne* (Sars, 1895, p. 39).

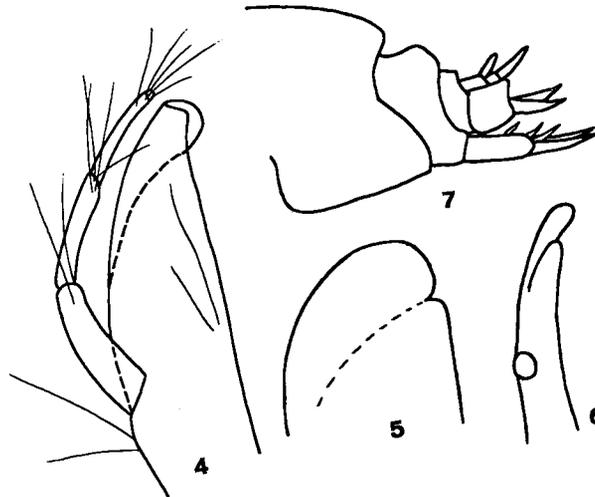
The Danish material from the North Sea contains 5 specimens from 5 localities E and W of the Dogger Bank in depths between 40 and 80 m.



Figs. 1-3. *Acidostoma obesum* (Bate). 1, maxilliped; 2, distal part of outer plate of maxilliped, flattened; 3, urosome.

***Acidostoma nodiferum*** Stephensen (1923) (figs. 4-7)

*A. nodiferum* has been recorded only comparatively few times, and all records are from the North Sea and the Transition Area. Its known range now comprises an area from SW of the Faroes, 823 m (type-locality, Stephensen, 1923, p. 40) and the Shetlands to the deeper part of the Öresund



Figs. 4-7. *Acidostoma nodiferum* Stephensen. 4, maxilliped; 5, distal part of outer plate of maxilliped, flattened; 6, mandible; 7, urosome.

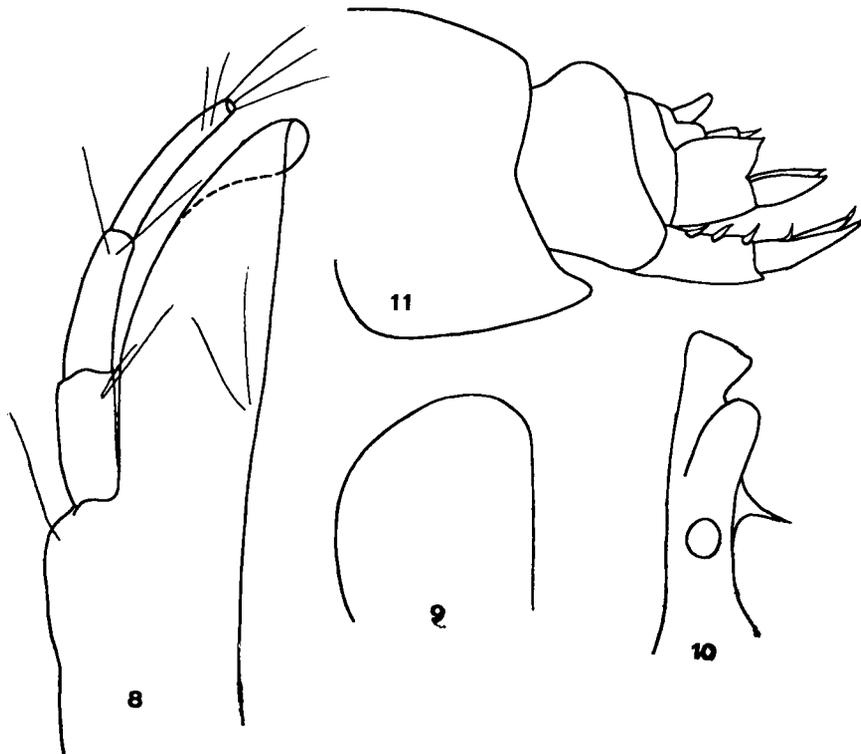
(Dahl, 1946, p. 4). Two new localities from the central North Sea can be added, viz.: Danish Biological Station Sta. 5772, 55° 53' N 6° 11' E, 47 m, sandy clay, 23 April 1938. — 1 specimen; and Danish Biological Station Sta. 7605, 56° 07' N 3° 02' E, 69 m, muddy sand, 3 May 1951. — 1 specimen.

***Acidostoma laticorne*** G. O. Sars (1879) (figs. 8-11)

For further descriptions and figures cf. Shoemaker (1930, pp. 1 ff). Descriptions and figures in Della Valle (1893, pp. 782 ff.) and in Chevreux & Fage (1925, pp. 30 ff.) refer to the next species.

It is obvious that the present species has been confused with the following to which it bears a considerable likeness. An examination of the mouth parts, however, immediately reveals the difference.

It seems, in fact, that the true *A. laticorne* is exclusively limited to Arctic waters, and at present it is probable that only the following 7 records refer to this species, viz.:



Figs. 8-11. *Acidostoma laticorne* G. O. Sars. 8, maxilliped; 9, distal part of outer plate of maxilliped, flattened; 10, mandible; 11, urosome.

E. Greenland. — Franz Joseph Fjord area, Dusénfjord, 25 miles inside the mouth, 185-75 m, brown clay,  $-1.2^{\circ}$  C, salinity 33.32‰ (Schellenberg, 1935); same area, Vega Sound, NW of Scott Keltic Islands, 250-190 m, brown-red clay (Schellenberg, 1935); Scoresby Sound area, Cape Leslie, 260 m, clay and gravel, bottom grab, 22 July 1933, 1 ♀ (Stephensen, 1944, p. 15, determination checked by present writer).

Kara Sea, 119-53 m (Gurjanova, 1951, p. 159).

Cold area of Norwegian Sea. —  $68^{\circ} 06' N 9^{\circ} 44' E$ , 1159 m, clay  $-1^{\circ}.3$  C, 9 August 1877, 1 ♂ type (G. O. Sars, 1879, p. 440; G. O. Sars, 1885, p. 152);  $63^{\circ} 10' N 5^{\circ} 0' E$ , 763 m,  $-1.0^{\circ}$  C, sabulous clay, 29 June 1876, 1 specimen (G. O. Sars, 1895, p. 39; G. O. Sars, 1886, p. 43, erroneously referred to *A. obesum*).

E. North America, East coast of Nova Scotia,  $44^{\circ} 07' 30'' N 57^{\circ} 16' 45'' W$ , 215 m, gravel, 1 ♀ (Shoemaker, 1930, p. 1).

Doubtful records probably referring to *A. neglectum*: Kattegat or Skagerrack, 20-200 m (Stephensen, 1928, p. 55), "Shetland" (Chevreux & Fage, 1925, p. 32, quoted also by subsequent writers). I have been unable to trace the origin of this last record.

#### ***Acidostoma neglectum* n. sp. (figs. 12-18)**

Description of female holotype. — In general appearance resembling *A. laticorne* G. O. Sars. Head with lateral lobes broadly rounded, eyes with traces of brownish pigment which rapidly disappears in alcohol. Dorsum of first urosome segment straight. Posterior part of third epimeral plate somewhat produced, corner rounded. Telson distinctly broader than long, emarginate. Mandible with molar obsolete, represented only by a low ridge. Outer plate of maxilliped with deep incision in inner margin near apex. Further descriptions and numerous figures of the species will be found in Della Valle (1893, p. 782, 6, 28) and Chevreux & Fage (1925, p. 30, figs. 7, 8). The type is preserved in the Zoological Museum, Lund.

The following material was examined:

North Sea, Dogger Bank, Danish Biological Station Sta. 7034,  $55^{\circ} 46.5' N 4^{\circ} 20' E$ , 38 m, 4 May 1950, fine sand with shells. — 1 overigerous ♀ (holotype).

Seven localities in same part of the Dogger Bank area of the North Sea, 19-38 m, sand with shells, collections of Danish Biological Station. — altogether 10 specimens.

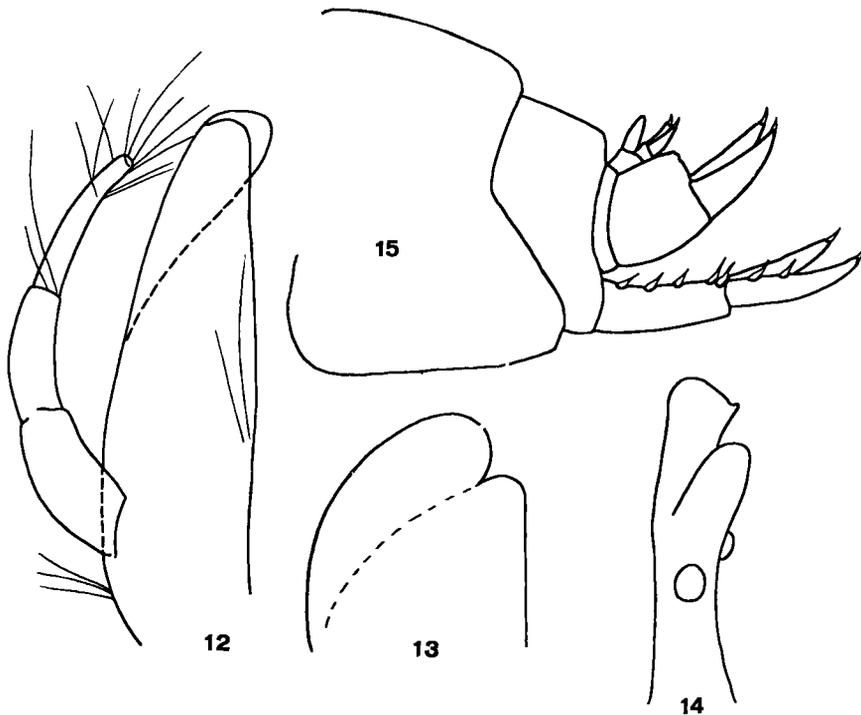
North Sea, SW of Dogger Bank, Danish Biological Station Sta. 4330,  $56^{\circ} 12' N 0^{\circ} 43' W$ , 74 m, 18 May 1932, clay and sand. — 1 specimen.

The species was furthermore reported from:

Perros Guisec and Roscoff, Brittany, W. France, muddy sand at low water mark, "very rare" (Chevreux & Fage, 1925, p. 32, as *A. laticorne*).

Bay of Naples, Italy, on the sea anemone *Cereactis aurantiaca* Andr. (Della Valle, 1893, p. 782, as *A. laticorne*).

Doubtful records probably referring to this species are the following: Kattegat or Skagerrack, 20-200 m. — 4 specimens (Stephensen, 1928, p. 55, as *A. laticorne*), "Shetland" (Chevreux & Fage, 1925, p. 32, as *A. laticorne*).



Figs. 12-15. *Acidostoma neglectum* n. sp. 12, maxilliped; 13, distal part of outer plate of maxilliped, flattened; 14, mandible; 15, urosome.

The superficial resemblance between *A. laticorne* and *A. neglectum* is very great, and it is not surprising that there has been a good deal of confusion. It is a curious fact that few amphipods have been so well and so often described as *A. laticorne* s. lat. There exist no less than four descriptions with numerous excellent drawings by G. O. Sars (1879), Shoemaker (1930), Della Valle (1893), and Chevreux & Fage (1925). The first two of these descriptions refer to the true *A. laticorne*, the other two refer to

*A. neglectum*. None of the writers concerned had access to specimens of both species.

My own doubts about the status of "*A. laticorne*" were awakened by the apparently incongruous geographical distribution with two well-separated groups of localities, one in deep or Arctic waters with low, most often negative, temperatures, and the other in shallow water along the western and southern coasts of Europe. An examination of the mouth-parts quickly revealed considerable differences between the two species. Some of these are quite clearly revealed by the previous descriptions.

It is obvious that within the genus *A. laticorne* G. O. Sars represents the most primitive type, retaining a distinct molar and lacking a preformed folding line in the outer plate of the maxilliped. All the other three species are highly specialized with respect to these two features.

#### THE STRUCTURE AND FUNCTION OF THE MOUTH-PARTS

*Acidostoma* is one of the few amphipod genera with mouth-parts apparently adapted for sucking.

As already pointed out it was the unusual shape of the mouth-parts which made Lilljeborg remove *A. obesum* from *Anonyx* and place it in a separate genus. He had, however, no comments to make as to their function. Della Valle (1893, p. 287) expressed the opinion that they are adapted for a parasitic life. His own specimens of *A. neglectum* were obtained from the column of the sea-anemone *Cereactis aurantiaca*. This is the only actual record of any species of *Acidostoma* being associated with another species. Sars (1895, p. 38), however, called attention to the similarity between the mouth-parts of the genera *Trischizostoma* and *Acidostoma*. *T. raschi* Esmark & Boeck is sometimes found attached to fishes, and Sars was of the opinion that *Acidostoma* though not closely related to *Trischizostoma* is adapted to a somewhat similar "semi-parasitic" mode of life. This suggestion has been frequently referred to by later writers but no fresh information has been produced.

In the course of the present investigation the mouth-parts were examined somewhat more closely. Their mutual position in a preserved specimen of *A. neglectum* is indicated in the diagrammatical drawings of figs. 16 and 17. As will be seen the whole apparatus forms a conical projection drawn out to form a fairly acute point. The distal end is formed by the terminal parts of the maxillulae. Obviously this mouth cone is well suited for penetrating the body wall of other organisms. As seen from fig. 17 the serrate margins of the outer plates of the maxillulae are in such a position that they can be supposed to facilitate an operation of this kind by means of a saw-like action.

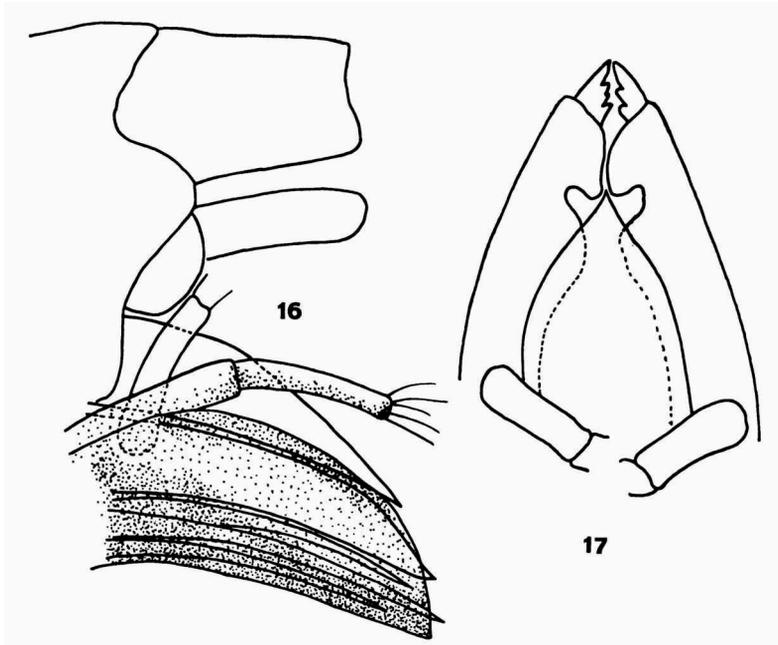


Fig. 16, 17. *Acidostoma neglectum* n. sp. 16, mouth cone seen in profile (note the sharp points of, from above, labrum, mandible, labium, maxillula, maxilla; the enveloping maxilliped is stippled); 17, mouth cone seen from above (only the labrum, the mandibles and the tips of the maxillulae are visible).

The dorsal part of the mouth cone is formed by the long and pointed labrum, and the ventral and lateral parts are enveloped by the large outer plate of the maxilliped, which, in three out of four species, has a preformed folding line near the apex (fig. 2). In this manner the lateral parts of the mouth cone become effectively sealed off from the surrounding water.

It is obvious that if the point of the cone is pushed into the tissues of another animal, food will have to be taken into the atrium oris mainly through the medial incisions in the mandibles flanking the tip of the labrum (fig. 17), possibly to some extent also between the distal ends of the mandibles. The atrium oris forms a comparatively narrow channel, surrounded by the labrum, the mandibles, and the labium, and sealed off laterally by the maxillipeds. It is in open communication with the oesophagus and the stomodaeal stomach.

As seen from the diagrammatical drawing fig. 18 the valve at the anterior opening at the stomach blocks the entrance with the exception of two narrow slits at either side. As seen from the arrangement of the muscles of the oesophagus and anterior part of the stomach the whole mechanism

will apparently be able to act as a fairly effective suction pump. When the muscles marked x are relaxed this will probably mean that the entrance to the stomach is completely blocked, while a contraction of these and other muscles attached to the stomach wall will apparently result in a sucking action upon the contents of the oesophagus. Unfortunately I have had no chance of checking these assumptions on living material.

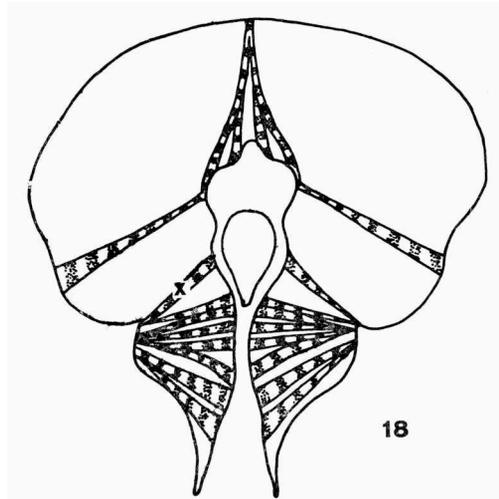


Fig. 18. *Acidostoma neglectum* n. sp. Diagrammatical sketch representing a transverse section through the oesophagus and the anterior part of the stomach, showing the arrangement of the muscles. The figure was composed from several sections.

Judging from purely morphological considerations it appears probable that the mouth cone and the stomodaeal mechanisms together form a fairly efficient apparatus for the extraction of fluid or at least of soft substances from the bodies of other animals. As mentioned above the only actual observation indicating the possibility of such a mode of feeding is the occurrence of some specimens of *A. neglectum* on the column of a sea-anemone.

In order to study the structure and contents of the alimentary canal one specimen of *A. laticorne* was sectioned serially. It had been preserved in formaline, and the fixation was far from perfect. The oesophagus, stomach, and midgut contained no formed food-remains, but the proctodaeum was filled with a tangle of tubular objects, many of which contained a spiral thread-like structure. Obviously these objects are nematocysts, most probably of Anthozoan origin.

In conjunction with the observations published by Della Valle this seems to indicate that *A. neglectum* is an ectoparasite of Anthozoans. The mouth-parts of *A. obesum* and *A. nodiferum* are so similar that their feeding

methods cannot be very different, while those of *A. laticorne* are less specialized in structure and possibly also in function. No new data are available concerning the food of anyone of the three species.

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