

Notes on the Genus *Monstrilla*, Dana.

By

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With Plate XXXVII.

IN 1848 Dana<sup>1</sup> described under the name of *Monstrilla viridis* an anomalous Copepod, taken in the Sulu seas during the Wilkes' Exploring Expedition. In 1857 another specimen of this remarkable genus was found by Sir John Lubbock<sup>2</sup> at Weymouth, and was described by him as *M. anglica*. Two years later Semper,<sup>3</sup> writing to Kölliker from Zamboanga, gave an account of a Cyclops-like parasitic Crustacean (Cyclops-ähnlichen Schmarotzerkrebse) which is clearly of the genus *Monstrilla*; and in 1863 Claparède<sup>4</sup> gave a detailed account of several specimens from St. Vaast la Hougue, to which he gave the specific name of *Monstrilla Danaë*. At about the same time Claus<sup>5</sup> described as *Monstrilla helgolandica* two females of this genus taken by him in Heligoland. No further captures of *Monstrilla* were recorded from this time up to

<sup>1</sup> J. D. Dana, 'Proc. Amer. Acad. Art. Sci.,' vol. ii, p. 53. See also the 'Crustacea of the U. S. Exploring Expedition,' part ii, p. 1313.

<sup>2</sup> J. Lubbock, 'Ann. Mag. Nat. Hist.,' 2nd ser., vol. xx, p. 409, pl. x, figs. 7 and 8.

<sup>3</sup> C. Semper, 'Zeit. Wiss. Zool.,' xi, p. 105.

<sup>4</sup> Ed. Claparède, 'Beobacht. über Anat. u. Entwicklungsgesch. Wirbellos. Thiere,' Leipzig, 1863, p. 95, Taf. xvi, figs. 1—6.

<sup>5</sup> C. Claus, 'Die freilebenden Copepoden,' Leipzig, 1863, p. 164, Taf. xii, fig. 15, and Taf. xiii, fig. 9.

1887, when I. C. Thompson<sup>1</sup> obtained a single female off Teneriffe, and soon afterwards another specimen of this genus was taken by the Liverpool Marine Biological Society near Puffin Island. Since then several specimens have been found. The genus is apparently fairly abundant at Jersey, and I have received, through the kindness of Dr. A. M. Norman, a considerable number of individuals, belonging, as will be shown below, to three different species, collected near the Channel Islands by Mr. J. Sinel. Eight specimens have been taken at Plymouth this year by Dr. Norman and myself, and Mr. T. Scott<sup>2</sup> has taken two near Inchkeith in the Firth of Forth. It has been found also in Lamlash Bay, Arran, and Loch Linnhe. Unfortunately, Thompson, in describing his Madeira specimen, failed to recognise its identity with *Monstrilla*, and not only described it as a new genus and species under the name of *Cymbasoma rigidum*, but has created the new family of *Cymbasomatidæ* for its reception. To the specimen from Puffin Island Thompson has given the name of *Cymbasoma Herdmani*,<sup>3</sup> and Scott's specimens from the Firth of Forth and Sinel's from Jersey have been referred to *Cymbasoma rigidum*.

*Monstrilla* is a genus of such an abnormal character that I was led to make a careful study of my first specimen, and as Dr. Norman has been kind enough to forward me a number of specimens in his possession, together with the two specimens taken by Scott in the Firth of Forth, which this observer has kindly permitted me to use, I have been able to make out several features imperfectly described or overlooked by previous authors, and to throw some light on the systematic position of the genus.

Although all the specimens of *Monstrilla* hitherto recorded

<sup>1</sup> I. C. Thompson, "Copepoda of Madeira and the Canary Islands" 'Journ. Linn. Soc.,' vol. xx, p. 154, pl. xiii, figs. 1—4.

<sup>2</sup> Thomas Scott, 'Seventh Annual Report of the Fishery Board for Scotland,' p. 316.

<sup>3</sup> I. C. Thompson, "Second Report on the Copepoda of Liverpool Bay," 'Proc. Liv. Biol. Soc.,' ii, p. 70, pl. i, figs. 10—12.

have been found swimming freely at or near the surface of the sea, the genus shows, in many respects, the characters of a parasitic Copepod.

The cephalothorax comprises five apparent segments; the first thoracic segment is fused with the head, and the two are enormously elongated, giving the animal a very characteristic appearance (fig. 1). The abdomen comprises two, three, or four segments in addition to the furca, the number of abdominal segments affording excellent specific characters. The first four segments of the thorax bear typical swimming feet; the protopodite is very large and provided with powerful muscles; the endopodite and exopodite have each three joints. The exopodite bears a short external spine on the first and on the third joints, and is furnished with seven stout plumose setæ. The endopodite is furnished with the same number of similar setæ. In one species, *Monstrilla helgolandica*, there is a spine on the internal and lower angle of the protopodite. The fifth thoracic segment bears, in the female, a pair of smaller modified appendages. Each member of the pair consists of a protopodite, from which arises a single-jointed exopodite bearing three strong setæ; internally there is a finger-shaped process, longer in some species than in others, which is the representative of the endopodite. This rudimentary endopodite has been overlooked by previous observers (fig. 10). In the male the fifth thoracic appendages are generally absent, but I have detected a minute rudiment corresponding to them in one of my specimens.

Both males and females have a single pair of antennæ, which in the former sex are modified for grasping; the second antennæ, unless certain structures to which reference will be made below may be considered as rudiments of these appendages, are entirely absent.

The first antennæ of the female consist each of four joints, of which the last is nearly as long as the other three. Claus also describes four joints in *Monstrilla helgolandica*, but I am otherwise unable to reconcile his account with my specimens, for he describes the two last joints as being much

elongated, and regards each as being composed of two fused joints, making the total number six.<sup>1</sup> His figure (op. cit., Taf. xii, fig. 15) is hardly in accordance with his description. The characters of the antennæ, and the arrangement of their spines and setæ will best be understood by reference to fig. 2.

The antennæ of the male, in *M. anglica*, have each five joints, of which the two last are subequal in length, and are hinged so that the last joint may be folded back on the fourth. The terminal part of the last joint is obscurely marked off as a sixth joint and is furnished, besides others, with two dichotomously branched setæ, which are probably smelling hairs (fig. 6). A comparison of the antennæ of the male and female lead to the conclusion that the three proximal joints correspond in the two sexes, but that the fourth joint in the female is formed of three fused joints of which two are completely and one incompletely separated in the male. Thus, as Claus pointed out, the number of joints in the antennæ is six, and in this, as in their general characters, they resemble those of the *Corycæidæ*.

Not only are the second antennæ absent in all the adult specimens examined by me, but also all the gnathites, as has been noticed by all previous observers with the exception of Semper, who refers to two pairs of small processes lying above the mouth, which he thinks may be the rudiments of the gnathites (op. cit., p. 106). In one of the immature specimens, taken by Dr. Norman, I found two such pairs of minute processes, and have not the least doubt that they are the representatives of the gnathites, probably of the mandibles and maxillæ. They are shown in fig. 11. I was unable to find any trace of them in the adults, and conclude that they must be lost during subsequent ecdysis.

<sup>1</sup> Since writing the above I have observed that the antennæ in Scott's specimens from the Firth of Forth have the characters assigned to *M. helgolandica* by Claus. I have no doubt, therefore, that Scott's specimens, which differ in this as in other points from the others in my possession, belong to the species discovered by Claus in Heligoland.

The eyes have been variously described by different authors; Dana and Claparède describe two simple eyes above, and a single median eye on the lower side. Semper describes a single non-faceted eye, consisting apparently of a single hemispherical lens, surrounded by pigment. Claus describes a single upper eye with two large lenses, and Thompson has given a similar account of the eyes of his *Cymbasoma rigidum*. Claparède states that the males of *M. Danæ* are entirely devoid of eyes.

My own observations confirm those of Dana and Claparède. In the males of *M. anglica* and the females of *M. rigida* one sees on the upper surface of the anterior part of the head an apparently single median eye, consisting of two lenses embedded in cup-shaped masses of dark brown pigment. The lenses are placed back to back so as to look laterally and somewhat anteriorly. On the ventral surface of the head is a third median lens embedded in pigment which is continuous with that of the upper lenses. The specimens of which I have been able to cut sections were not well enough preserved for me to be able to give account of the minute structure of these eyes, but from what I can make out they must be described as three monomeric eyes placed back to back. The eyes appear to differ in some other species. I have, for instance, an apparently eyeless male, similar to that figured by Claparède, which in all other features resembles *M. anglica*, and in *M. longispinosa* the median lower eye appears to be absent.

Situated at a short distance behind the antennæ, on the ventral surface of the head, are a pair of pits, which may be seen in fig. 1, and one of them is represented highly magnified in fig. 4. The exact nature of these pits is not yet clear to me. At first I was inclined to consider them as the rudiments of the second antennæ, but a further study leads me to believe that they are the openings of glands. In some specimens the aperture at the base of the basin-shaped depression of the cuticle appears to be surrounded with glandular cells, and in fig. 5 two masses of cells embedded in pigment

may be seen in the position of these openings. For the reasons already stated I am unable to throw much light on these structures by the study of sections, but, as far as my sections show anything, they support the view that they are the openings of a pair of glands. If this is the case, there is a pair of glands opening in the same position as the "green-glands" of the Decapods and some Amphipods; for it must be conceded that, although the second antennæ are absent in *Monstrilla*, these openings occupy the place in which they would be found were they present. Claus describes a pair of "shell-glands" in the nauplius of *Cyclops* opening on the bases of the second antennæ ('Freilebenden Copepoden,' p. 60, Taf. i, fig. 3). A reference to Claus's memoir will show the relation of the known antennary glands of Copepoda to the openings in *Monstrilla*, and a short discussion on their morphological significance is given in the same place.<sup>1</sup>

The mouth opens on a small cone on the ventral surface of the head. In *Monstrilla viridis* and *M. helgolandica* it is situated nearly in the middle of the first body-segment, but in other species it is placed more anteriorly, not far behind the antennæ. It leads into a pharynx with tolerably thick walls, which is connected by a string of tissue, thicker in some species than in others, with the hypodermis.

The only other feature in the external anatomy which calls for special mention is the appendage of the first abdominal or genital segment.

In the females of the majority of the species of *Monstrilla* this has the form of a pair of stout setæ, the bases of which enclose the genital aperture. The setæ are somewhat swollen and flexuous towards their extremities and end in fine points

<sup>1</sup> The "green-glands" of the Malacostraca are not the homologues of the "shell-glands" of Phyllopods, which open at the base of the fifth pair of appendages (second maxillæ); whereas the green-glands belong to the second pair of antennæ. The glands described by Claus in the nauplius of some Copepods are therefore the homologues of the green-glands of the Decapods; and the glands of *Monstrilla*, if I am right in believing them to be such, would have the same homology. Vide Claus, 'Untersuchungen des Crustaceen Systems,' Wien, 1876, p. 28.

which are often spirally twisted together (fig. 8). When the setæ are double they do not generally extend far beyond the furcal setæ. In *M. longispinosa* the genital opening is situated at the base of a ventral projection, from which proceeds a stout median seta; this seta is single for the first part of its course and then bifurcates to form two long setæ similar to those in other species. In this case the genital seta is more than one and a half times the length of the animal. In the males the genital aperture is situated on a conical ventral projection, and this is provided with a pair of foliaceous lappets, as shown in fig. 9. These organs, which at first sight appear to be peculiar to the genus, can, I think, be nothing more than an enormous development of the genital armature found in many Copepoda, especially in the genera *Euchæta*, *Cyclops*, *Canthocamptus*, and many *Calanidæ* (see Claus, op. cit. p. 65).

According to Claparède the genital appendages of the female serve for the attachment of the ova during the earlier stages of development, and he figures a female bearing a mass of ova in this position. I have had some difficulty in determining whether these are really ova on the spermatophores of the male, since I have not been able to procure specimens with masses of "ova" attached. From the study of a female of *M. rigida* which bears a few of these bodies, and from observations communicated to me by Mr. Sinel, I have little doubt that Claparède describes them correctly. At the time of their attachment they are surrounded by a mass of gelatinous matter which serves to attach them to the genital setæ.

Of the internal anatomy of *Monstrilla* there is little to be said.

Excepting for the mouth and pharynx, which have already been described, the alimentary tract is altogether aborted. The cellular cord which passes from the pharynx appears to be attached to the sheath of the nervous cord at the place where the œsophagus, if present, would pass between the connectives of the former.

Claus has called attention to the remarkable fact that in the female, when the ovary is not distended, the body wall is

separated from the chitinous shield of the cephalothorax, and forms a relatively thin cord traversing the latter.

Claparède pointed out that the males differ from the females in this respect: they have, in fact, powerful longitudinal muscles in the cephalothorax, which are not figured by Claparède; their arrangement is shown in fig. 5. In the female the ripe ovary distends the body and causes it to fill the cephalothoracic shield completely. It is in the form of a single median sac, and extends when full nearly as far forward as the eyes. The ova are relatively large and filled with yolk-spherules. Semper's specimen, which he describes as having very small ova, with the ovary extending very little into the cephalothorax, was probably unripe. The oviducts are difficult to distinguish, as they are completely hidden in the anterior part of the thorax by the muscles. Their terminal portion is easily distinguishable in a side view, but not from above or below for the same reason. As far as I have been able to make out, the two oviducts are united shortly before their termination, and open by a common pore on the ventral surface of the first abdominal segment between the origins of the genital setæ. The testis does not appear to offer any peculiar feature, as compared with that of other Copepods.

The nervous system has been described by Semper and Claparède. I was able to follow its general character in sections. It consists of a large cerebral ganglion, with which, judging from the position of the œsophageal cord, several post-oral ganglia are fused. Nerves are given off from the cerebral ganglion to the antennæ, and to the antennary muscles. The optic nerves can be distinguished in sections as short stems rising from the upper and anterior part of the ganglion. Posteriorly the ganglion is continued into the ventral cords, which appear single in a surface view, but are shown to be double in section. This double cord traverses the elongated anterior segment, and just before the origin of the first pair of swimming feet enlarges into a ganglion, from which stout nerves are given off to the swimming feet and to the longitudinal muscles of the body. From this point the ventral nerve-



cord is continued posteriorly as a flattened band, the double nature of which is shown by its dumb-bell shape in section. There is no trace of ganglionic enlargements. The cord may be traced as far back as the fifth thoracic segment, where it thins out and disappears.

Such is the general organisation of this remarkable genus. The determination of the species included in the genus is a matter of considerable difficulty, as the earlier descriptions are deficient, and it is in some cases difficult to make an accurate determination from the representations of the animal. Dana's *Monstrilla viridis* appears to be identical with the specimen described by Semper, both being characterised by the mouth being situate in the middle of the thorax.

*Monstrilla anglica*, Lubbock, and *M. helgolandica*, Claus, resemble one another in having six setæ on each member of the furca, and differ in the number of abdominal segments, and apparently in the characters of the antennæ, which are very long in Lubbock's figure. I regard *M. anglica* as identical with Thompson's *Cymbasoma Herdmani*, and with the specimens, all males, which I have received from Sinel, from Jersey. *M. helgolandica*, I am inclined to think, is identical with Scott's specimens, relying on the characters of the antennæ and the position of the mouth, but the latter have four abdominal segments, whereas Claus only describes three. This may be explained by the fact that Claus' specimens are young, as appears to be the case from his figures and description.

Claparède's figure of the female of *M. Danaë* shows three setæ on each furcal member and three abdominal segments. I regard it as identical with a specimen found by myself at Plymouth on October 24th, and with two specimens sent by Sinel from Jersey. All these are females, and are characterised by the elongate cephalothorax and the relative narrowness of the body. Claparède's male clearly belongs to another species; he figures four setæ on each furcal member, but, judging from the specimens in my possession, there must be six, and he has omitted to count them carefully. Nor does he

give a satisfactory representation of the number of abdominal segments in his figure, which otherwise resembles some of Sinel's specimens from Jersey, which I have identified as *M. anglica*.

The young specimens found in Plymouth in August by Dr. Norman have three setæ on each furcal member and two abdominal segments; they are identical with a single adult female in the collection sent to Dr. Norman by Sinel, which is further characterised by the shape of the first abdominal segment, which is elongate, twice as long as the last thoracic segment, and swollen, and by the fifth pair of legs, which are elongate, and have relatively long endopodites. These are clearly identical with Thompson's *Cymbasoma rigidum*, and must be placed under a separate species as *M. rigida*. Finally there is the single specimen taken by myself at Plymouth on Sept. 11th, which differs from all other species in the immense length and single origin of the genital appendage, and from *M. rigida* in the proportions of the fifth pair of legs and of the first segment of the abdomen. This specimen I propose to describe as a new species under the name of *M. longispinosa*.

To sum up, the genus and species of *Monstrilla* may be defined as follows:

Genus *Monstrilla*, Dana.

Cephalothorax composed of five apparent segments; the first segment consisting of the fused cephalon and first thoracic segment, enormously elongated, covered with a delicate transparent chitinous shield, often separate from the body wall. Abdominal segments 2—4, besides the furca. Four pairs of powerful thoracic swimming feet, a fifth pair, rudimentary, present in the female. The second antennæ and all the gnathites absent in the adult. The females provided with a genital appendage on the ventral side of the first abdominal segment, in the form of two setæ or a single seta which bifurcates at some distance from its origin, and which may greatly exceed the length of the whole body. Male with an

obtuse process in the same situation furnished with a pair of short foliaceous lappets. Two simple eyes and a third simple eye below. Mouth situated on a conical process on the ventral surface of the cephalon, leading into a short pharynx; the remainder of the digestive tract aborted.

A. Three setæ on each furcal member.

1. *Monstrilla rigida*, I. C. Thompson. *Cymbasoma rigida*, I. C. Thompson ('Proc. Linn. Soc.').

Two abdominal segments, the first twice as long as the preceding thoracic segment, swollen, bearing two genital setæ, which do not extend far beyond the furcal setæ. Hab. Madeira, Plymouth, Channel Islands.

2. *Monstrilla longispinosa*, nov. sp.

Two abdominal segments, the first of equal length to the preceding thoracic segment, and provided with a genital seta, single at its origin, bifurcating behind the furca, and more than half as long again as the whole animal. Fifth thoracic appendages of the female short, with the endopodite shorter than the exopodite. Hab. Plymouth.

3. *Monstrilla Danaë*, Claparède ('Beobacht. über Anat. u. Entwick.,' &c., p. 95).

Three abdominal segments, the first bearing two genital setæ. Body elongate, narrowed. Hab. Cherbourg, Plymouth, Channel Islands.

B. Six setæ on each furcal member.

4. *Monstrilla viridis*, Dana (Dana, 'Proc. Amer. Acad.,' ii, p. 52).

Four abdominal segments; buccal cone in the centre of the cephalothorax. Hab. Sulu seas, Zamboanga.

5. *Monstrilla helgolandica*, Claus ('Freileb. Copep.,' p. 165). *Cymbasoma rigidum*, Scott ('Seventh Ann. Report, Fishery Board for Scotland,' p. 316).

Four abdominal segments. Antennæ four-jointed, the two last joints elongate, subequal. The protopodite of the swimming feet bears a spine on its interior lower angle. Hab. Heligoland, Firth of Forth.

6. *Monstrilla anglica*, Lubbock ('Ann. Mag. N. H.,' 2nd ser., xx, p. 409). *Monstrilla Danæ*, ♂ Claparède, 'Beobacht. üb. Anat. u. Entwickl.,' p. 95. *Cymbasoma Herdmani*, I. C. Thompson ('Proc. Liv. Biol. Soc.,' ii, p. 70).

Four abdominal segments. Antennæ of the male five-jointed, the two last joints subequal, hinged on each other to form a grasping organ. Hab. Weymouth, Cherbourg, Channel Islands, Liverpool Bay.

Dana placed the *Monstrillacea* under his sub-order *Cormostomata*, of which it forms the first tribe, the sub-order including the *Caligacea*, *Lernæacea*, and the *Nymphacea*, Claparède very justly remarks that *Monstrilla* has no resemblance to any other members of the *Cormostomata*, and proceeds to point out a resemblance between this genus and the *Pontellidæ*, apparently because of the similarity of the eyes; *Monstrilla*, however, differs entirely from the *Pontellidæ* in the character of its antennæ. Claus (op. cit., p. 48) points out the resemblance of the eyes of the *Corycæidæ* to those of the *Pontellidæ*, without attributing any relationship on this account. In the same way the eyes of *Monstrilla* are similar to those of the *Corycæidæ*, and this, taken together with the character of the antennæ, the reduction of the mouth parts, and the habit of the animals, seems to justify the position of *Monstrilla* among the *Corycæidæ*, where it was placed by Claus. There are no grounds for Thompson's family of *Cymbasomatidæ*, nor for placing *Monstrilla* among the *Artotrogidæ*, as he has done in his first notice of the genus.

The aberrant character of the genus, however, might warrant us in regarding the *Monstrillidæ* as a separate sub-family of the *Corycæidæ*.

It will be noticed that nearly all previous authors have regarded *Monstrilla* as a parasitic form, for no other reason than the absence of mouth parts and alimentary tract. Excepting this character, there is no evidence for attributing parasitic habits to the genus. Every specimen that has yet been caught has been found in a free pelagic condition. The living animal is extremely lively, and swims with an energy unusual

among Copepoda. The well-developed swimming feet, with their powerful musculature, and the equally powerful musculature of the body, and, as Claparède has pointed out, the total absence of hooks or limbs modified for grasping (excepting the antennæ of the male, which have a merely sexual significance), speak against a parasitic habit. In the present state of our knowledge its mode of life must remain something of a mystery. Having no alimentary tract, and no organs for seizing or masticating food, it cannot feed itself. Possibly this creature may present an analogy with the Ephemeridæ, and the adult may be preceded by a predaceous larva supplied with mouth parts and an alimentary tract, which, after a succession of rapid ecdyses, develops into the mature sexual form, whose only function is that of reproduction. The fact that the female carries the ova would seem opposed to this view, but it might be suggested that the abortion of the muscles of the anterior part of the cephalothorax and the existence of numerous oil-globules in this region might afford, on the one hand, an economy in nutrition, and on the other hand a store of nutritive material sufficient to prolong her life for the period necessary for hatching the ova. It must be allowed, however, that the undoubtedly young specimens taken by Dr. Norman afford no support to this suggestion, except that in some of them rudiments of gnathites, which are entirely absent in the adults, are present.

In concluding, I must express my great obligations to Dr. Norman for kindly lending me the specimens in his possession, and for procuring for me, from different sources, the other specimens which have enabled me to give an account of the species of this genus.

## DESCRIPTION OF PLATE XXXVII,

Illustrating Mr. G. C. Bourne's paper "On the Genus  
Monstrilla."

*Lettering in the Following Figures.*

*a.* First antenna. *ab*<sup>1</sup>.—*ab*<sup>4</sup>. First to fourth abdominal segments. *a. g.* Openings of the antennary glands. *e.* Eye. *en.* Endopodite. *ex.* Exopodite. *g. a.* Genital appendage. *gn*<sup>1</sup>. Cerebral ganglion. *gn*<sup>2</sup>. Thoracic ganglion. *m.* Mouth. *md.* Mandible. *mx.* Maxilla. *ov.* Ovary. *s. f*<sup>1</sup>.—*s. f*<sup>4</sup>. First to fourth swimming feet. *v. d.* Vas deferens.

FIG. 1.—*Monstrilla longispinosa*, nov. sp., lateral view of an adult female. The genital appendage is cut off short. It is actually one and a half times the length of the entire animal.

FIG. 2.—Ibid. ♀. The first antenna, highly magnified.

FIG. 3.—Ibid. The two abdominal segments and furca from below, showing the bifurcate genital appendage.

FIG. 4.—Ibid. The opening of one of the antennary glands, highly magnified.

FIG. 5.—*Monstrilla anglica*, Lubbock, ♂. Ventral view of the con-joint head and first thoracic segment, showing the median ventral eye, *e.*; the mouth, *m.*; the nerve-cord and ganglia, and the arrangement of the muscles.

FIG. 6.—Ibid. The first antenna.

FIG. 7.—Ibid.—The four abdominal segments and furca from above, showing the six furcal setæ.

FIG. 8.—*Monstrilla rigida*, I. C. Thompson, ♀. Terminal part of genital appendage.

FIG. 9.—*Monstrilla anglica*, Lubbock, ♂. Genital appendage.

FIG. 10.—*Monstrilla longispinosa*, n. sp., ♀. Fifth pair of swimming feet.

FIG. 11.—*Monstrilla rigida*, I. C. Thompson, ♀, juv. Mouth and rudimentary gnathites. Highly magnified.

FIG. 12.—Ibid., I. C. Thompson, ♀, adult. Ventral view of the hinder part of the thorax and the abdomen.

FIG. 13.—*Monstrilla Danæ*, Claparède, ♀. Dorsal view of cephalo-thorax, showing the ripe ovary.

FIG. 14.—*Monstrilla helgolandica*, Claus, ♀. First antenna.

FIG. 15.—Ibid. One of the swimming feet.

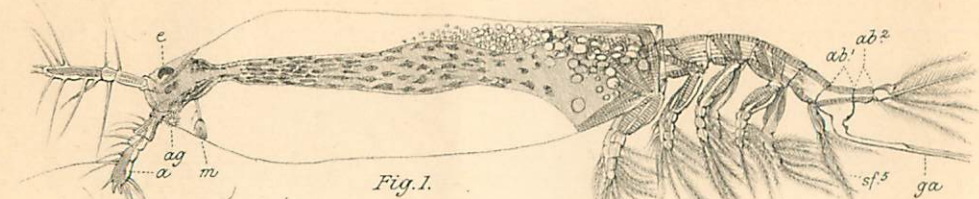


Fig. 1.

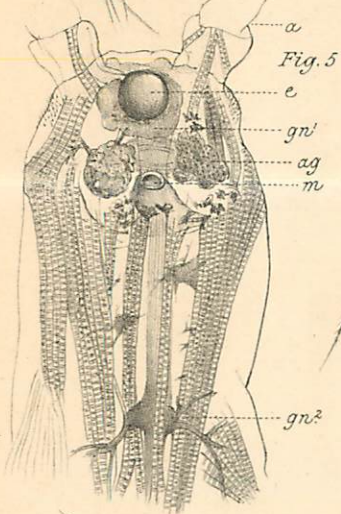


Fig. 5.

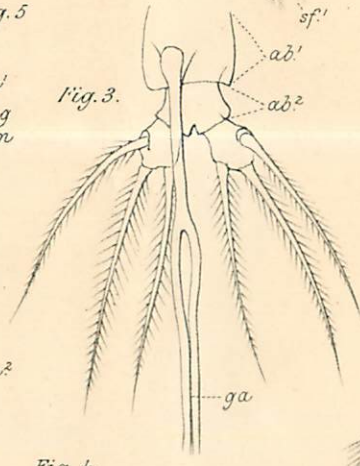


Fig. 3.

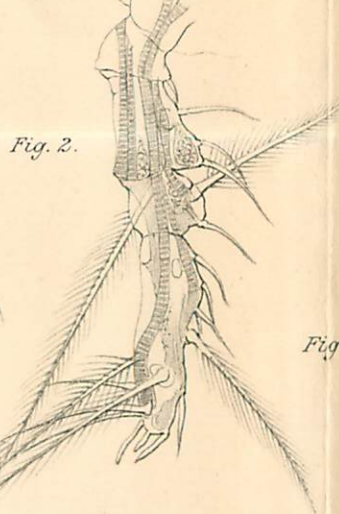


Fig. 2.

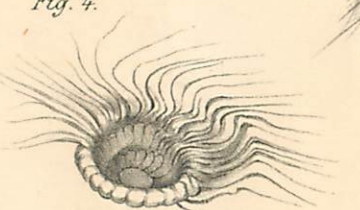


Fig. 4.

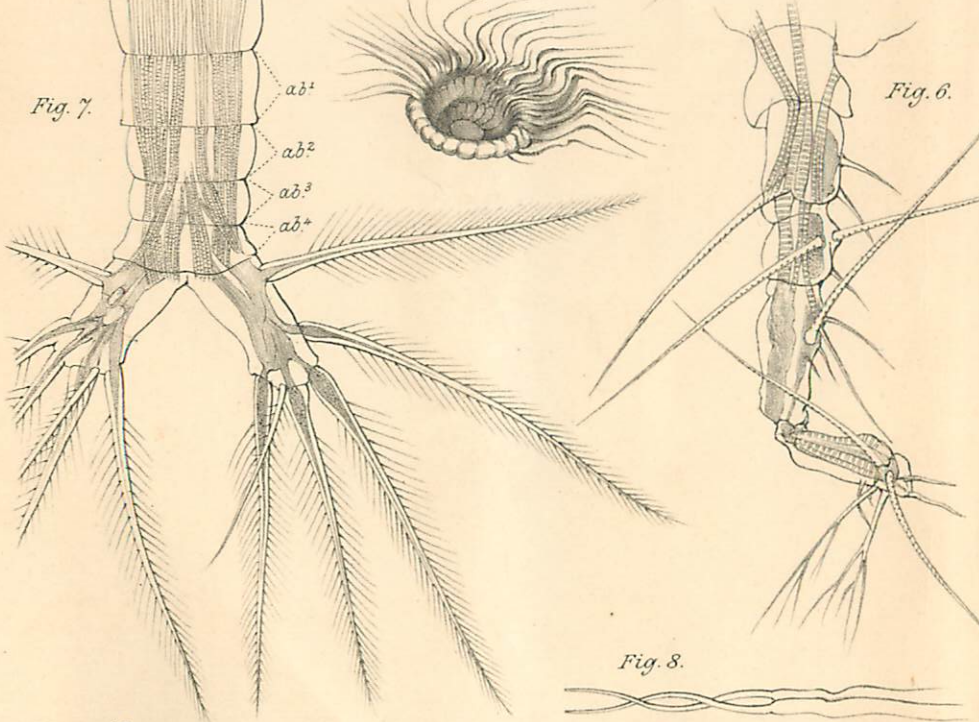


Fig. 7.

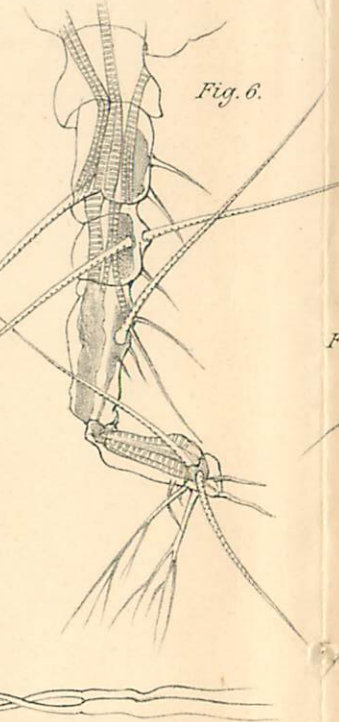


Fig. 6.

Fig. 8.

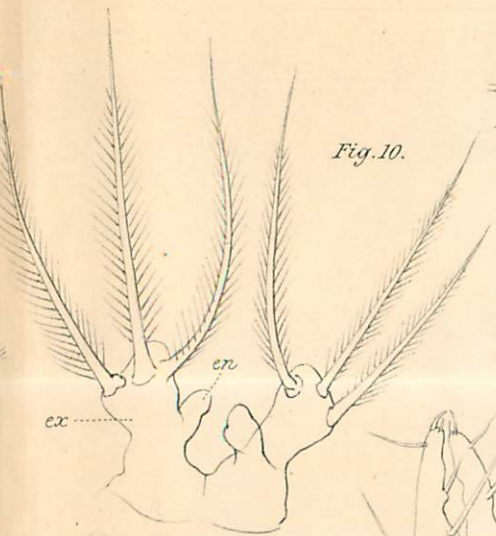


Fig. 10.

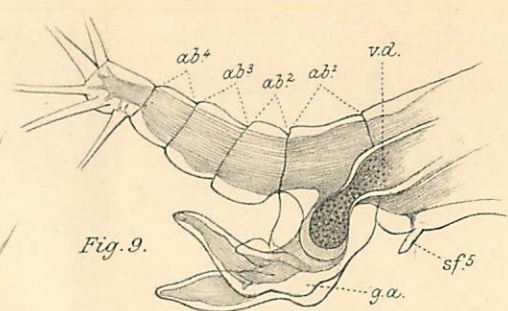


Fig. 9.

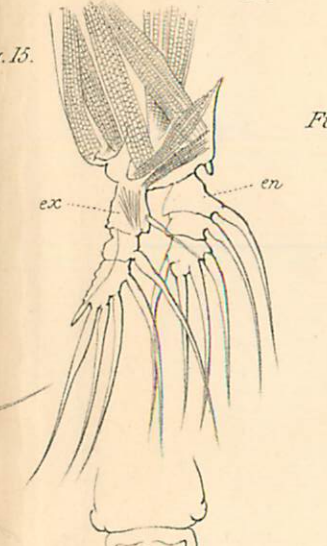


Fig. 15.

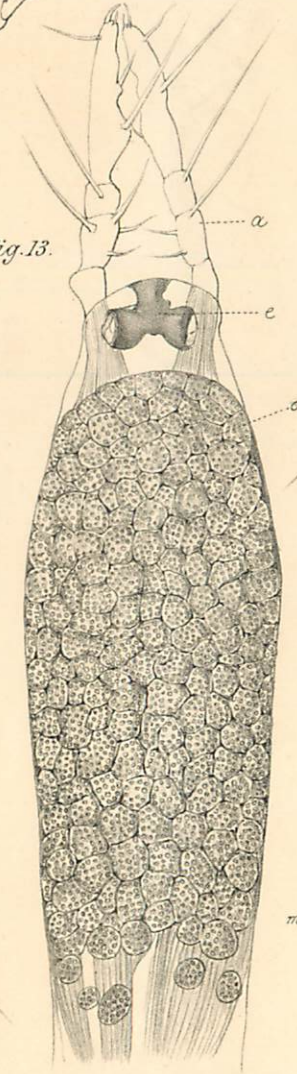


Fig. 13.

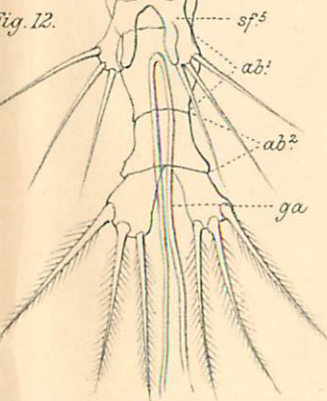


Fig. 12.

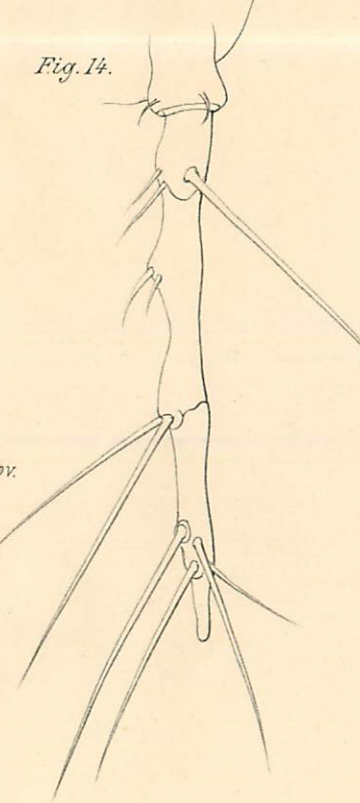


Fig. 14.

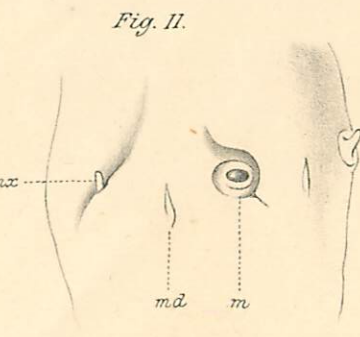


Fig. 11.

