

CLAVELLA SCIATHERICA, N. SP., A PARASITIC
COPEPOD OF *GADUS MORRHUA*.

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(With 8 Text-figures.)

Habitat and Record.

THE animal under consideration belonging to the family Lernaeopodidae was taken on a codling (*Gadus morrhua*), 13 ins. in length, caught at Plymouth several years ago, and preserved in formalin since that date. Although about twenty-six valid species of *Clavella* have been either recorded or described in detail, the subject of the present paper differs from them all in combining several of the more prominent characters of other species, notably the extreme length of the backwardly-arched cephalothorax taken together with the reduction of the "arms" (second maxillae) and their expansion into a disc so that the "bulla" or button appears to be almost directly affixed to the body. For this species I accordingly propose the name *Clavella sciatherica*.

One female specimen was taken from the first left gill slit, a second from the second right gill slit, a third (the longest) from the floor of the pharynx, while from the crescentic cushion upon which are borne the vomerine teeth two immature females without ovisacs, with two males adhering to each as indicated in Fig. 5, were obtained¹.

The Females.

Body. The outline of the animal is best seen from Figs. 1 and 2. The length of the specimens differs considerably, but the proportions are constant. The dimensions of the medium-sized specimen are: *Cephalothorax* 5 mm., *Trunk* 2 mm., *Ovisacs* nearly 4 mm.

The general colour and appearance is that usually exhibited in this family. The trunk is a clear white while the ovisacs are yellow.

The *Cephalothorax* is greatly elongated, being more than twice as long as the trunk. It is deflected backwards in a characteristically arched manner, but not so as to touch the dorsal surface of the trunk. It is unprovided with a dorsal carapace and forms a "neck" which is dilated at the base where it joins the trunk from which it is distinctly separated.

¹ Since recording the above, Michael G. L. Perkins, who followed my work, has presented me with upwards of a dozen specimens of *Clavella*, all of them of this new species though considerably larger in size, taken from various codling caught at Lowestoft in August 1918. The animals were located either on the roof of the buccal cavity, or on the floor of the pharynx, at the bases of the gill-arches, never on the gill-filaments.

The *Trunk* is almost spherical, resembling the seed of a pea. In front view, however, it is noticeably longer than it is broad. It is flattened dorsi-ventrally, but bears neither abdominal appendages nor anal laminae. The abdomen is represented by a pronounced genital process, ventral to the anus, bearing a median vulva which connects directly with the spermathecal sac.

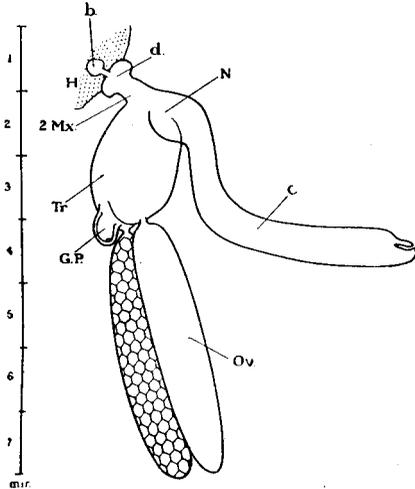


Fig. 1. *Clavella sciatherica*, ♀, in lateral aspect. C. cephalothorax; N. swelling at the base of the cephalothorax forming a neck; Tr. trunk; 2Mx. 2nd maxillae; d. disc; b. bulla; H. host; G.P. genital process; Ov. ovisacs.

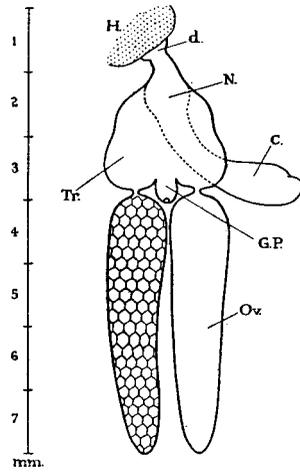


Fig. 2. *Clavella sciatherica*, ♀, in ventral aspect. C. cephalothorax; N. neck; d. disc; H. host; Tr. trunk; G.P. genital process; Ov. ovisacs.

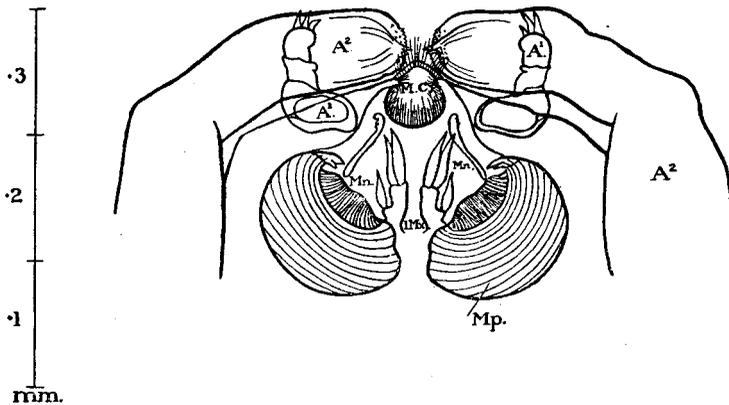


Fig. 3. *Clavella sciatherica*, ♀. The anterior end of an immature female showing some of the appendages *in situ*. M.C. mouth cone; A¹. antennule; A². antenna; 1Mx. 1st maxilla; Mp. maxillipede; Mn. mandible.

The **Appendages**, all paired (in both sexes) are: the first Antennae (Antennules), the Second Antennae, Mandibles, First Maxillae, Second Maxillae, and one pair of Maxillipedes (Fig. 3).

The 1st *Antennae*, or *antennules*, are small and three-jointed. They are so short that they do not project beyond the antennae. The basal joint is the largest and has a slight turn upon itself. The terminal joint is slightly the larger of the other two, and is tipped with two large spines, with a smaller spine on the inner border.

The 2nd *Antennae* are uniramous, without an exopodite or palp such as is present in *Lernaeopoda*. They are turned inwards towards each other across the frontal margin of the head. They often meet and overlap in the middle line, but do not appear to be deflected in such a way as to do so in this species. They are bluntly rounded at the apex which is covered by a large number of denticulations and are tipped with two or sometimes three very small spines.

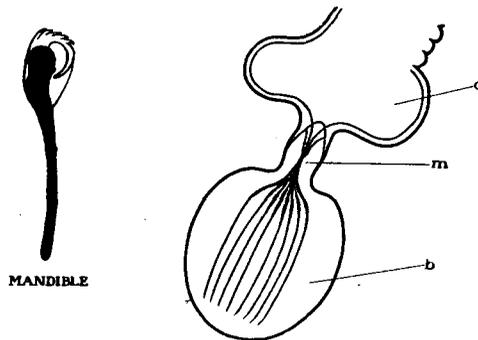


Fig. 4. *Clavella sciatherica*, ♀. The mandible, and the distal end of the 2nd maxillae. *d.* disc; *b.* bulla; *m.* manubrium.

The *Mandibles* appear to be very rudimentary, crotchet-like, bearing five or six teeth on their *outer* margin. In Fig. 4 the part blackened in is strongly chitinised; and the remainder may possibly become so in the course of time, as this is drawn from the immature female. The mandibles are entirely dissimilar from the usual type found in this family.

The 1st *Maxillae* are small, and bipartite with an exopodite or palp such as is present in *Lernaeopoda*.

The 2nd *Maxillae* are entirely fused, very short, not in the same straight line with the cephalothorax, and expanded at the apex into a flat (not cupuliform) *disc* which touches, but does not penetrate, the tissues of the host. From the disc arises a horn-coloured almost spherical *bulla* completely imbedded among the host's cells. The sphere, which exhibits characteristic markings, is joined to the disc by a short *manubrium*, which, like the bulla, but not the disc, is formed of chitin (Fig. 4). During development the 1st maxillae have migrated considerably posteriorly, so that they come to lie at the base of the neck a long distance behind the maxillipedes.

The *Maxillipedes* are clawed appendages whose bases diverge from one another. Each consists of a basal joint which is so stout as to be reniform, well supplied with powerful muscles which move the terminal clawed joint,

which is small, bearing a yet smaller accessory claw, and flex it down against the basal joint. These appendages appear to have undergone considerable outward rotation from the position normally found in this family. Being but feebly clawed, they seem to have lost their functions both of attachment and of feeding.

The **Mouth parts** (Fig. 3). The *mouth*, which is tubular, is situated at the summit of a cone, short in the female, but more than usually long in the male (Fig. 7). It forms a suctorial proboscis, and is composed of an upper and a lower lip, fringed with numerous ordinary setae. The lips are joined in the same manner in both sexes, and present no differences from the condition that obtains in *Lernaeopoda*.

The **immature females**, each individual bearing two pigmy males (Fig. 5), are of special interest, though such a condition has been previously

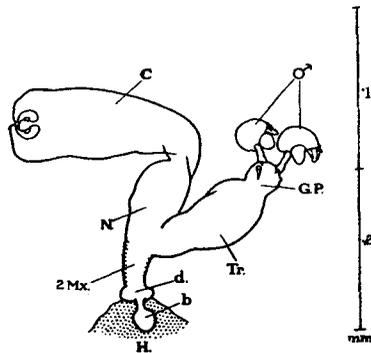


Fig. 5. *Clavella sciatherica*. An immature female carrying two pigmy males (σ). *C.* cephalothorax; *N.* neck; *2 Mx.* second maxilla; *b.* bulla; *d.* disc; *Tr.* trunk; *G.P.* genital process (abdomen); *H.* host.

recorded, and superficially figured in *C. uncinata*, and is said to be not uncommon in that species. The *cephalothorax* is, at this early stage, strikingly elongated, but the slightly expanded head (mentioned as a characteristic of other species) may be due to compression on mounting it as a slide for microscopical examination. The *trunk* is more vase-like than in the adult, and the coelomic cavities that will eventually become the ovaries are already recognizable within it. At the posterior end a spherical abdomen is present which has not dwindled down to a mere genital process. The abdomen is separated from the trunk by a deep constriction. At the posterior pole of the abdomen is situated the anus, the posterior end of the alimentary canal being difficult of recognition as it is void of faecal matter. Lateral in position, some little distance from the anus on either side, are the projecting tumid lips of the apertures from which the eggstrings or ovisacs will presently emerge. They possess a crenated margin, which may possibly be an artefact due to shrinkage in the Farrant's medium.

Clavella sciatherica n. sp.

The details of the reproductive system appear to be markedly different from those which obtain in *Lernaeopoda*. Instead of two separate *vulvae*, or apertures to the spermothecal ducts, there is but one prominent median opening surrounded by a funnel-like collar, which appears to represent the two vulvae fused. This leads into an enormously dilated *spermotheca*, the imperfect division of which down its median line seems to indicate its dual origin from two separate cavities. On either side of this division a *spermatophore* has been lodged presumably by the attached males. Into the upper portion of the spermotheca enter the oviducts, while posterior to their entrance they quit this chamber, and, approaching close to the abdomen wall, terminate on either side of the anus at the point where the ovisacs will subsequently be suspended. The proximal (Fig. 6 *Od.*) and distal (*Od*¹.)

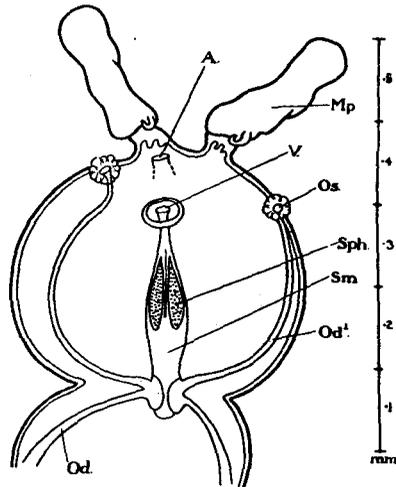


Fig. 6. *Clavella sciatherica*, ♀. The posterior end of the immature female showing part of the reproductive system. *Mp.* the maxillipedes of the males; *V.* vulva; *Od.* proximal portion of the oviduct; *Od*¹. distal portion of the oviduct; *A.* anus; *Os.* apertures from which the ovisacs will emerge; *Sm.* spermotheca; *Sph.* spermatophore.

elements of the oviduct are arranged at such an angle that it is conceivable that the ova of one side pass across the spermotheca for fertilisation and out on the opposite side.

The *males* are each attached, by their maxillipedes, to the posterior region of the abdomen in the vicinity of the vulva, on either side of the anus. By means of an inwardly curved hook, which is minute and falciform, they pinch up the body wall of the abdomen into a little papilla. The vulva could be almost completely surrounded by the maxillipedes, which, when placed in apposition, have the conformation of an imperfectly closed tube suitable for the conveyance of a spermatophore.

The *ovisacs* are long and slender, but do not taper; twice the length of the trunk, and containing eight rows of closely packed ova, 22 to 24 in a row.

The Male (Fig. 7).

Body. The cephalothorax and trunk are fused and folded together ventrally into an unsegmented ovoid without distinction of parts, so that the profile of the dorsum resembles that of *Cypris*, or has the general contour of a skull. The males of the genus *Clavella* are singularly uniform in appearance so that specific differences between them are not marked. The dorsum protrudes more posteriorly than in *C. uncinata*. There is neither dorsal carapace, nor abdominal appendages, so that the males of *Clavella* resemble those of *Brachiella* rather than those of *Lernaeopoda*, and even more particularly in

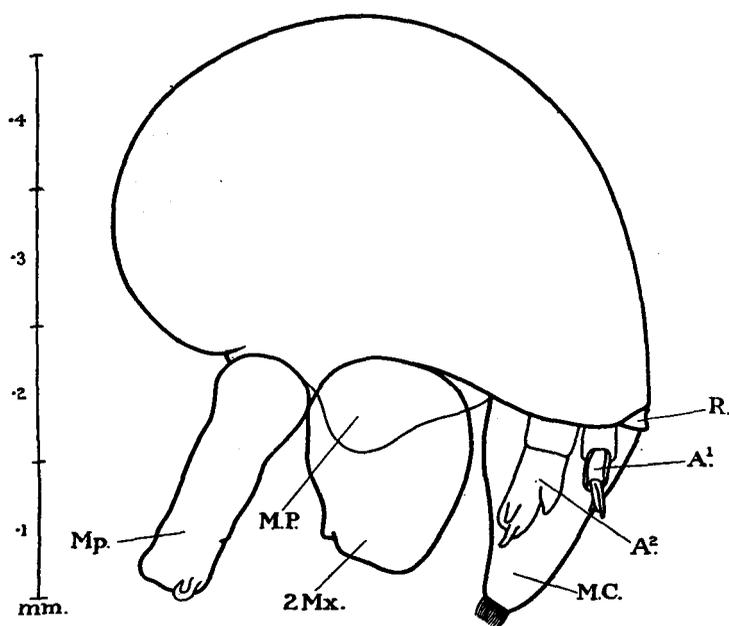


Fig. 7. *Clavella sciatherica*, ♂, in lateral aspect. *R.* rostrum; *A*¹. antennule; *A*². antenna; *M.C.* mouth cone; *2Mx.* 2nd maxilla; *M.P.* mediative process; *Mp.* maxillipede.

their appendages. Like *Brachiella* also they are of much smaller size in proportion to the female than in *Lernaeopoda*, being only just visible to the unaided eye. The dorsum is boldly arched, and the height is greater than the length. Between the maxillipedes and 2nd maxillae in the median line a short rounded mediative process like a carina is present, which is homologous with the paired structures similarly situated in *Lernaeopoda*. This process is not located so anteriorly as other authors figure it in other species, e.g. *C. uncinata*; it is, on the contrary, in this species, in a position more in harmony with its above-mentioned homology. All the appendages *in situ* point diagonally and forwards. The *mouth cone* is unusually long and the *rostrum* minute. Greatest length of the body .35 mm.

The **Appendages**, all paired, are (Fig. 8):

The *1st Antennae*, or *Antennules*, are two-jointed, the joints being of equal length. The terminal joint is tipped with three long, tapering, flexible, sensitive rami.

The *2nd Antennae* are uniramosae, and three-jointed. There is a smooth prominence where an exopodite is absent. The antenna is rounded at the apex, and tipped with two spines, with a shorter spine on the outer border.

The *Mandibles* appear to be absent, and considering their great degeneration in the female this is not unlikely, though they have been figured in other species. The point cannot be put to the proof without sacrificing the specimens.

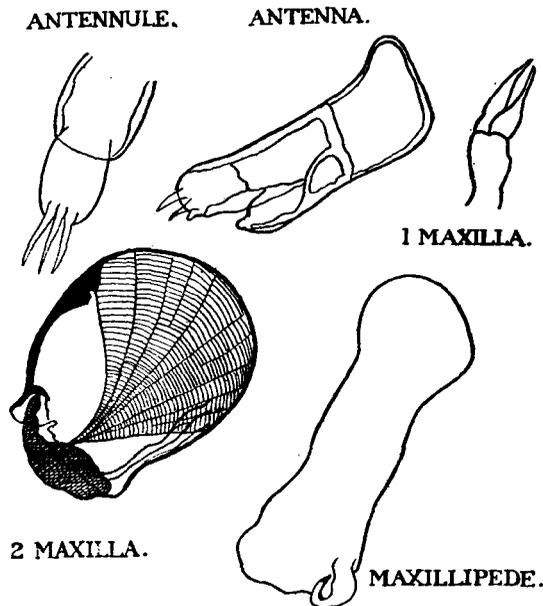


Fig. 8. *Clavella sciatherica*, ♂. Some of the appendages. The antennule, antenna, 1st maxilla, 2nd maxilla, and maxillipede.

The *1st Maxillae* are bipartite, and do not possess a palp. Each ramus terminates in a delicate point which projects outwards and forwards immediately below the rostrum (omitted for the sake of clearness from Fig. 7).

The *2nd Maxillae* are close to the mouth tube and almost circular in general outline. They bear a strong resemblance to those of *Lernaeopoda*, and are similarly furnished with a powerful incurved claw at the base which flexes into a protecting sheath.

The *Maxillipedes* are close behind the 2nd maxillae which they do not resemble, as they do in *Lernaeopoda*, but are somewhat like a femur in outline, having a rounded proximal end, and a slightly notched or cleft distal end, which is furnished with a small abruptly curved inturned hook. The maxillipedes are the organs of attachment to the female.

Generic characters.

Female. *Cephalothorax* distinctly separated from the trunk, long, vermiform, slender, arched posteriorly to the body axis, and unprovided with a dorsal carapace. No abdominal appendages, or anal laminae; the abdomen reduced to an unpaired genital process ventral to the anus. *1st antennae*, three jointed. *2nd antennae*, uniramous, turned inwards towards each other across the frontal margin of the head, and often meeting and even overlapping in the middle line. *1st maxillae*, bipartite with a palp. *2nd maxillae*, entirely fused, very short (sometimes absent in some spp.). *Maxillipedes*, stout with terminal claw, usually with an accessory claw on the inner margin.

Male. *Cephalothorax* and trunk fused and folded together ventrally into an unsegmented Cyprian ovoid, without distinction of parts. No dorsal carapace or abdominal appendages. *1st antennae* two jointed. *2nd antennae*, uniramous and three jointed. *1st maxillae*, bipartite, without palp. *2nd maxillae* and *maxillipedes* close to mouth tube, and strongly clawed. Between the maxillipedes in the median line, a short rounded mediative process homologous with the paired structures similarly situated in the males of *Lernaeopoda*. All the appendages point diagonally and forwards.

Specific characters.

Female. *Cephalothorax* much longer than the trunk but not deflected backwards so as to touch it. The base of the neck differentiated into a globular swelling, where it is distinctly separated from the trunk. *Trunk* definitely longer than wide. *2nd maxillae* short, completely fused, ending in a disc not quite on the body to which is attached a horn-coloured spherical bulla. The *mandibles* are entirely dissimilar from those figured of other species. *Ovisacs* long, nearly twice as long as the trunk. Genital process present.

There is no species hitherto described which combines all these characters, *C. uncinata* (O. F. Müller), which is also found on Gadoid fishes perhaps approximating most nearly, but that not very closely. The American species *C. irina* Wilson, likewise parasitic on Gadoids, approaches the present species in those points in which it differs most from *C. uncinata*.

The following table gives a comparison between these three species:

	<i>C. sciatherica</i>	<i>C. uncinata</i>	<i>C. irina</i>
Cephalothorax	Much longer than trunk	The same length or but little longer than the trunk	Longer than the trunk
Head	Not enlarged	Not enlarged	Not enlarged
Base of neck	Differentiated	Not differentiated	Not differentiated
Trunk	Nearly spherical, but a little longer than wide	Wider than long	Much longer than wide
2nd maxillae	Short, with a flat disc as well as a spherical bulla	Short, bulla spherical	Moderately short, bulla small and clavate

Clavella sciatherica n. sp.

	<i>C. sciatherica</i>	<i>C. uncinata</i>	<i>C. irina</i>
2nd maxillae	Not in line with the cephalothorax	In line with the cephalothorax	Not in line with the cephalothorax
Genital process	Large	Present, minute	Trilobate
Ovisacs	Long and slender, but do not taper. Twice the length of the trunk Ova: about 8 rows of 22-24 in a row	Tapering, from one to two and a half times as long as the trunk Ova: 10 or 12 rows of 15 to 35 in a row	As long as the trunk, tapering Ova: 6 rows of 40 in a row

Male. Dorsum boldly arched, but bulging somewhat posteriorly. Rostrum minute. Mouth cone unusually long. Mediative process present forming a carina between the 2nd maxillae and maxillipedes, in a more posterior position than in other species.

The males are not in a sufficiently good state of preservation for any details of their reproductive system or internal economy to be made out.

My best thanks are due to Miss E. C. Humphreys for her kind assistance with the figures.