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Naturvidenskabelig række nr. 4.

Urocopia singularis G. O. Sars,

a peculiar semiparasitic Copepod

from great deeps of the North Atlantic Ocean.

By

G. O. Sars.

With one Plate.

Communication from Bergens Museums Biological Station (nr. 49) and from Zoological Department.

Introduction.

The Copepod which forms the object of the present paper was found by Dr. Lysholm in a gathering of bathypelagic animals taken during the cruise of „Armauer Hansen“ in 1913, and was kindly submitted to me for examination and description. The outward appearance of the Copepod is very peculiar, and indeed at first I was in doubt about its real systematic position, though I conjectured that it might belong to the semiparasitic forms comprised within the great division Cyclopoida. This has also been fully confirmed by a closer examination and by the dissection of one of the two specimens obtained, proving it to be a true poecilostomous Cyclopoid, which, according to the structure of the oral parts, ought to be classed within the family Lichomolgidæ, as defined by the present author in his work on the Norwegian Cyclopoida. It cannot however be referred to any of the hitherto known genera included within this family, but evidently forms the type of a new genus, the chief characters of which will be given at the close of this paper. The generic name here proposed alludes to one of the most conspicuous characters, viz., the peculiar oarblade-like structure of the caudal rami or furcal joints.

Description of the Female.

The length of the body, measured from the frontal margin to the end of the caudal rami, does not fully attain 2 mm. (1.90 mm.), and this Copepod accordingly is of rather small size as compared with most other forms of the present family.

The general form of the body (see figs. 1 & 2) is rather slender, with the two chief divisions sharply marked of from each other. The anterior division is oblong oval in outline, or somewhat club-shaped, its greatest width occurring far in front and not

surpassing half the length. The cephalic segment is comparatively large, exceeding in length the 4 succeeding segments combined, and exhibits dorsally, somewhat behind the middle, a well-marked transversal suture, indicating the boundary between the cephalon and the 1st trunkal segment. The front is slightly narrowed and transversally truncated at the end, exhibiting below no trace of any rostral prominence. The 3 succeeding segments gradually diminish both in length and width, being sharply marked off from each other, and having the lateral parts simply rounded, without any projecting epimeral plates. The last trunk-segment is extremely small and, as usual, very movably articulated to the preceding segment, whereas it is more firmly connected with the adjoining genital segment. The tail is very slender and narrow, equalling in length about $^3/_4$ of the anterior division. It is composed of 4 well-defined segments, the 1st of which, the genital segment, as usual, is much the largest. Seen dorsally or ventrally this segment exhibits a somewhat fusiform shape, being produced on each side, a little in front of the middle, to an obtusely triangular expansion, to which probably the ovisacs, when present, are attached. Below the segment has close to the base a small protuberance (see fig. 2), and at the end of the above-mentioned lateral expansions a slight fissure, flanked behind by 2 small spinules, may be traced. The 2 succeeding segments are about of equal size, whereas the last, or anal segment is considerably larger and gradually somewhat widens distally. At the end this segment is transversally truncated, with a slight incision in the middle indicating the place where the anal opening occurs, and just in front of this incision the anal opercle is seen arching over the said opening.

The caudal rami (see figs. 1, 2 & 5) are highly remarkable and very unlike those in the other known Lichomolgidæ. They are of considerable size, exceeding half the length of the remainder part of the tail, and greatly divergent, forming 2 lamellar, oarblade-like pieces movably attached by a narrow base to the end of the anal segment. In about the middle the outer edge of each ramus forms a slight protuberance, which however does not exhibit any trace of a seta. The inner distal corner of each ramus is produced in a remarkable manner to form a tongue-like triangular lappet, outside which occurs a well-marked rectangular ledge carrying the caudal setæ. These are very small and only

3 in number, the outermost one quite simple, the other 2 jointed at the base, but more os less broken in the 2 specimens examined. As in most other Cyclopoida, moreover a very delicate sensory bristle occurs on each ramus dorsally, arising from a knob-like prominence at some distance in front of the apical lappet. A dense fascicle of fibres, apparently of nervous nature, enters each of the rami, spreading distally and adjoining partly the dorsal sensory bristle, partly the caudal setæ, some of them also continuing within the apical lappet. By these fibres the caudal rami acquire a rather opaque appearance, which perhaps in the living animal may be still more pronounced by pigmentary deposits.

Of eye no trace could be detected in either of the 2 specimens.

The anterior antennæ (fig. 3) are attached on each side of the truncated front and accordingly somewhat remote the one from the other. They are comparatively short and stout, not nearly attaining half the length of the cephalic segment, and are clothed with scattered simple bristles. The number of joints is apparently 6; but 2 of them, the 2nd and 3rd, are very imperfectly separated. The 3 outer joints, on the other hand, are very sharply defined and gradually diminish in size, all 3 combined occupying about $^1/_3$ of the length of the antenna.

The posterior antennæ (fig. 4), which are attached at a short distance behind the anterior ones, are about of same length as the latter, but somewhat narrower. They are of comparatively simple structure and almost naked, being composed of 5 joints, the first 2 of which are much the largest and nearly equal in size, forming together a sharp geniculate bend. The terminal part of the antenna, comprising the 3 outer joints, scarcely attains the length of the preceding joint and is much narrower. Its 1st joint is quite short and connected with the 2nd by an oblique suture; it carries at the end anteriorly a small curved seta accompanied by a still smaller hair-like bristle. The last joint is conically tapered, forming a comparatively short and nearly straight claw somewhat resembling that found in the siphonostomous Cyclopoida.

The oral area, as in most other poecilostomous Cyclopoida, is located at rather a long distance behind the insertions of the antennæ, occupying about the centre of the cephalon. Its composition agrees perfectly with that in other forms of this group and, according to the interpretation given by the present author in the

last Part but one of his work on the Norwegian Cyclopoida, it exhibits, beside the anterior lip or labrum, only 3 pairs of distinctly defined mouth — appendages, viz., the maxillæ with their palps, the anterior maxillipeds and the posterior maxillipeds, the mandibles being wholly absent. The said parts are densely crowded, forming together an obtuse protuberance, most easily observable in the lateral aspect of the animal (see fig. 2). Fig. 5 represents these parts in their natural position, as seen ventrally.

The anterior lip or labrum (fig. 5 l, fig. 6) is flap-shaped and deeply cleft in the middle, being divided into two thin rounded lobes covering over the masticatory parts of the maxillæ. The edges of these lobes are perfectly smooth, without any traces of hairs or cilia. At the somewhat constricted base of the labrum, the oral aperture, or more properly the arched chitinous stripes encircling it, may be plainly traced. Of a posterior lip no tracc can be detected.

The maxillæ (fig. 5 m, fig. 7), forming the foremost pair of true oral limbs, consist each of the chief part or stem and of a thin lamellar appendage, tbe palp, attached outside the base of the former. The stem itself (generally described in other poecilostomous Cyclopoids as the mandibles) forms a strongly chitinised piece placed transversally on each side of the labrum and produced inside to a slender masticatory part covered over by the lateral lobes of the labrum. This part terminates in a somewhat lamellar falcate process curving forwards and exserted to a thin setiform extremity adjoining from behind the oral aperture. Its inward turned (outer) edge exhibits a thin very finely denticulated crest, which however does not extend to the tip (see fig. 7 a). The part which here is termed the palp *(p)*, but which of most recent authors has been considered an independent oral limb (maxilla), clearly shows its immediate connection with the just described foremost oral limbs, of which it in reality forms only an appendage, evidently answering to the lobe or lamellæ almost invariably attached outside the maxillæ in other Copepoda. In the present Copepod it has the form of a thin pellucid lappet without any obvious musculature and extending obliquely backwards. It is evenly rounded at the tip, and carries along the inner edge 4 small simple setæ.

The anterior maxillipeds (fig. 5. mp^1, fig. 8), constituting the middle pair of the true oral limbs, exhibit each a rather

voluminous and strongly muscular basal part placed transversally to the axis of the body and slightly narrowed distally. To the end of this part is movably attached a much narrower and more highly chitinised terminal joint, which, like the masticatory part of the maxillæ, points inwards and forwards towards the mouth. It carries about in the middle a strong lateral spine coarsely spinulose at the edges, and terminates in another similar spine, which in addition to the usual spinulation has at the base outside a strong denticle.

The posterior maxillipeds (figs. 5 mp^2, fig. 9), limiting the oral area behind, are more pronouncedly pediform than the anterior ones, and consist each of 3 well-defined joints, the 1st of which is the largest. The 2nd (propodal) joint is oval in shape, and forms with the 1st a sharp elbow-like bend. It has inside, about in the middle, a small bristle, but is otherwise quite unarmed. The terminal (dactylar) joint is small and conically pointed, forming a short simple claw curving inwards. In all the known Lichomolgidæ these limbs are very differently developed in the two sexes. Whereas in the female they are rather small and apparently but little mobile, they are transformed in the male to very powerful prehensile organs, by the aid of which the female is got hold of during the copulation. No doubt a similar difference will be found to exist also in the present form.

The 4 pairs of natatory legs (see figs. 10—18) are all well developed, with the basal part very broad and flattened, carrying inside, at the end of the 1st segment, the usual densely ciliated seta. The rami are subequal in size and distinctly 3-articulate in all the pairs, the terminal joint being the largest and about equal in length to the other two combined. The spines clothing the outer ramus and partly also the inner, are remarkable by their large size and pronouncedly dagger-like shape, being bordered by a thin hyaline rim finely serrated at the edges. The outer ramus has in the 3 first pairs 6 such spines, 4 of them belonging to the terminal joint, whereas in the 4th pair (fig. 13) the proximal spine of this joint is absent. In all the pairs the apical spine is much the largest and moreover differs in having only the outer edge sharpened and serrate, whereas the inner edge is thickened and densely clothed with cilia like those on the natatory setæ. The inner ramus has in the 1st pair (fig. 10) only a single spine attached outside the terminal joint near the end. In the 2 suc-

ceeding pairs (fig. 11 & 12) there are 3 spines on this joint, two of them apical. The inner ramus of the 4th pair (fig. 13) is comparatively narrower than that of the other pairs, and has only 2 slender spines, both apical. As to the natatory setæ, their number is somewhat different in the several legs. In all the pairs the 1st joint of the outer ramus is devoid of any seta inside. The terminal joint of this ramus has inside in the 1st pair (fig. 10) 4, in the succeeding pairs 5 setæ. The middle joint of the inner ramus has inside in the 1st and 4th pairs (figs. 10 & 13) only a single seta, whereas 2 setæ are present on this joint in the 2 middle pairs (figs. 10 & 11). The terminal joint of the same ramus has in the 1st pair (fig. 10) 5 setæ, 2 apical and 3 lateral. In the 2nd pair (fig. 11) there are, as in the 1st pair, 3 setæ inside this joint; but the 2 apical setæ are here, as in the succeeding pairs, replaced by 2 spines. In the 3rd pair (fig. 12) this joint has only 2 setæ, and in the 4th pair no setæ are present at all, both edges of the narrow terminal joint being perfectly smooth.

The last or 5th pair of legs are only present as a very slight rudiment, being replaced on each side by 2 small setæ issuing immediately from the corresponding segment (see fig. 14).

Of inner organs the greatly developed ovarial tubes are easily observable, filling up the greater part of the anterior division of the body and sending off several lobular diverticles both laterally and ventrally. From the luxuriant development of these organs it may be inferred that the ovisacs, when present, must be of very large size, as is the case with several forms of Lichomolgidæ, for instance in the species of the typical genus Lichomolgus Thorell.

Occurrence. — As above mentioned, 2 female specimens of the present form were secured, both adult and of about equal size. According to the statement given by Mr. Nordgaard, the gathering in which they occurred was taken July 1913 at Station 14, located in lat. 59° 35′ N, long. 20° 40′ E, the towing net having been dragged by a line of 1000 m, and thus had probably worked through a water-layer of a depth of about 6—700 m. The temperature of this layer has been stated to be 7—7.5° C, and the degree of saltness 35.16 pro mille.

General remarks. — It will be seen from the above given description, that the present Copepod in several respects

differs conspicuously from the other known Lichomolgidæ. The very peculiar structure of the caudal rami is even among Copopoda quite an unique character, and moreover the absolute want of any rostral prominence, the anomalous structure of the 2 pairs of antennæ and partly also that of the legs afford characters distinguishing this form rather prominently. On the other hand are the oral parts quite normally developed, and are in reality far less different in structure from those in the typical genus Lichomolgus than is the case with those in some of the other genera included in the said family. As the structure of the oral parts is generally recognised to be in the first place conclusive by the systematic determination, no hesitation can arise in classing the present form within the family Lichomolgidæ. The above mentioned differences are however great enough to warrant its validity as the type of a new well-defined genus, the chief characters of which may be given as follows: —

Gen. Urocopia, G. O. Sars.

Body comparatively slender, with the two chief divisions sharply marked off from each other, the anterior club-shaped, the posterior very narrow. Cephalic segment with a well-marked transversal suture dorsally, front truncated, without any trace of a rostrum. Tail with the normal number of segments. Caudal rami of quite an unusual appearance, being very large, oarblade-shaped and greatly divergent. Anterior antennæ comparatively short and stout, with the number of joints reduced. Posterior antennæ simple in structure and almost naked, terminating in a short claw-like spine. Oral parts quite normally built. Natatory legs with the rami equal-sized, their spines very large, dagger-like, with serrated edges; inner ramus of 4th pair distinctly 3-articulate with the terminal joint narrow and smooth on both edges. Last pair of legs quite rudimentary.

As to habits, the present Copepod seems to differ essentially from the other known Lichomolgidæ. None of these lead a pelagic existence, but are found near the shores either parasitic on various bottom-animals, for instance Tunicata, Worms, Echinoderms, or freely among algæ and other marine growths. The occurrence of the present form, on the other hand, in a gathering taken in the open sea at a considerable distance from the bottom, clearly stamps it as a true pelagic animal. In this respect it agrees with the members of 3 other families of poecilostomous Cyclo-

poidæ, viz., the Oncæidæ, Sapphirinidæ and Corycæidæ. Of course the animals which at times may be infested by the present Copepod must also be pelagic in habits; but of what kind they are, it is impossible at present to decide. At my request, Mr. Nordgaard informs me, that in the same gathering in which the present Copepod was found occurred, in addition to Calanoida and other pelagic Crustacea, some small Medusæ and Ctenophora, as also plentiful of Chætognathi and Pteropoda.

G. O. Sars del.

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Explanation of the Plate.

Fig. 1. Adult female, dorsal view.
— 2. Same, viewed from left side.
— 3. Anterior antenna.
— 4. Posterior antenna.
— 5. Oral area, viewed ventrally, and exhibiting the several parts composin it in their natural position. *l* labrum; *m* maxilla with its palp *(p)*; mp^1 anterior maxilliped; mp^2 posterior maxilliped.
— 6. Labrum isolated.
— 7. Maxilla with its palp *(p)*.
— 7a. Same; extremity of the masticatory part, more highly magnified.
— 8. Anterior maxilliped.
— 9. Posterior maxilliped.
— 10. Leg of 1st pair.
— 11. Leg of 2nd pair.
— 12. Inner ramus of a leg of 3rd pair.
— 13. Leg of 4th pair.
— 14. Lateral part of last trunk-segment, with the rudiment of the corresponding last pair of legs.
— 15. Left caudal ramus, viewed dorsally.

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