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Parasitic Copepods in the Collection of the Riksmuseum at Stockholm.

By

CHARLES BRANCH WILSON,
Ph. D., Westfield, Massachusetts, U. S. A.

With 2 Plates

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Introduction.

Seven species belonging to this collection, of which five were new to science, and which were collected by Dr. SIXTEN BOCK in Japan, have already been described in this Archiv (vol. 14, no. 10, pp. 1—17; pls. 1—4).

The present paper includes the remainder of the collection, all of which are in an excellent state of preservation. Two of the species here included are new to science, one presents us for the first time with the male sex of a species long known, another gives us a developmental stage which throws much light upon a problem hitherto unexplained, and the remaining specimens furnish in almost every instance new hosts, new localities, or both. Taken altogether this museum collection furnishes a very creditable and important contribution to our knowledge of the parasitic copepods.

Cyclopoida.

Fam. Artotrogidae.

Artotrogus australis n. sp.

Host and record of specimens. A single female with egg cases was captured during the Swedish Southpolar Expedition of 1901—1903, at a depth of 160 m. on the Shag-rock Bank west of South Georgia Island in the southern Atlantic.

This is a very unique specimen and is readily distinguished from all other siphonostomous *Cyclopoida*, as SARS has remarked of the genus type, by the pronounced clypeiform shape of the body and by the absence of the fourth swimming legs. The present specimen becomes of course the type of the new species.

Specific characters of the female. Body decidedly clypeiform, a little longer than wide, its dorsal surface very convex, its ventral surface concave. Carapace one-third wider than long, its anterior margin evenly rounded, its posterior margin concave, leaving the posterior corners sharp, conical, and curved backward. Each of the first two free thoracic segments is covered with a dorsal plate, whose lateral margins are produced into flaps or lappets. These curve backward more and more strongly until the terminal portions of the last pair become almost parallel with the body axis. The third free segment is practically concealed in dorsal view and has no plate. The genital segment is quadrate and is produced backward on either side into a narrow lamella flanking the base of the abdomen.

The egg cases are spherical, each about 1 mm. in diameter and containing twenty eggs. They are carried side by side on the ventral surface of the thorax, a little in front of the genital segment and are wholly concealed in dorsal view. The oviducts open on the ventral surface of the genital segment and the egg cases turn forward instead of backward, lying ventral to the bases of the swimming legs.

The abdomen is three-jointed, the two basal joints about the same length and very short, the terminal joint three or

four times as long and much wider. Anal laminae large, subquadrate, each armed with four long setae, the outer and inner ones approximately equal, the two middle ones half as long again.

First antennae nine-jointed, the third and terminal joints considerably longer than the others, while the basal joints are somewhat thickened. All the joints are heavily armed with setae along their front margins; the terminal joint is club-shaped and carries a large aesthetask on its front margin. The second antennae are three-jointed, the terminal joint much longer than the penultimate one and somewhat curved. It bears at its tip three setae, the central one twice the length of the others, and on its outer margin, nearer the base, another large seta. The space between this last seta and the tip of the joint is fringed with minute hairs. Maxillae with the outer lobe only slightly shorter than the inner, both lobes slender, and each tipped with two setae. On the outer lobe the inner seta is a little shorter than the outer and much shorter than the lobe itself. Both lobes at the tip and the inner one at the base are fringed with fine hairs. The siphon is very slender and extends considerably back of the bases of the maxillipeds. The claws on the second maxillae are strongly curved while those on the maxillipeds are nearly straight. There are three pairs of swimming legs, each biramose and three-jointed; there is no fourth or fifth pair. Since there was but the single specimen it was not deemed advisable to remove the swimming legs in order to secure their details of structure.

Color (preserved material) light cream-yellow, tinged with brown on the dorsal surface, the eggs orange.

Total length 4,15 mm. Width of carapace 3,85 mm. Diameter of egg cases 1 mm.

Remarks. The type of the genus, *Artotrogus orbicularis*, is only half the size of the present species, and is further distinguished by differences in the structural details of the two pairs of antennae, the first maxillae and the siphon. This type species has been taken on the coast of Norway, around the British Isles, in the Kara Sea, and along the shores of Ceylon. It was parasitic on nudibranchiate mollusks and was

also captured swimming freely among algae. The nudibranchs taken in the same haul were *Doris nivalis* THIELE var. *antarctica* VAYSSIÈRE, in considerable number, and besides 1 sp. of *Tritoniella belli* ELIOT. The present specimen may have been swimming freely since no mention is made of a host, or the parasite and its host may have been separated while being brought to the surface. The specific name recognizes that this is the first species in the family to be found in the southern hemisphere.

Fam. **Lichomolgidae.**

Pseudomolgus sp.

A single female, not fully developed, was obtained on the same station as the preceding species from the branchial chamber of the nudibranch, *Doris nivalis* THIELE var. *antarctica* VAYSSIÈRE. It is apparently a new species, but since it is not fully developed it would be unwise to attempt to establish it as a type specimen.

Fam. **Ergasilidae.**

Ergasilus nanus P. J. VAN BENEDEN.

Five females with egg strings were obtained from the gills of *Clarias anguillaris* at Cairo, Egypt by C. LOVÉN. This species was originally taken by BENEDEN from the gills of the mullet, *Mugil chelo*, on the coasts of Belgium. It was subsequently obtained by VALLE, RICHIARDI and BRIAN from various species of mullets in the Mediterranean. The present host is a new one.

Taeniacanthus coelus WILSON.

A second lot of this new species was obtained from the pharynx of a sunfish at Misaki, Japan, May 5th, 1914. This species was described in Band 14, no. 10 of this Arkiv, p. 6, and the specimens which served as types were obtained from an unknown host. The present specimens will serve to locate the host more definitely.

Caligoida.

Fam. Caligidae.

Caligus coryphaenae Steenstrup & Lütken.

One female and two males were taken from the anal fin of *Squalus acanthias* at Delagoa Bay, East Africa. This species is easily recognized by the fact that the carapace is definitely less than half the entire length, while the abdomen is four-jointed. The original specimens were found by Capt. Hygom on a species of *Coryphaena* caught in the open Atlantic opposite the Canary Islands. Adults have also been taken from the gill cavity of *Coryphaena hippurus* at several places in the Mediterranean, and young males were captured in a townet at the Dogger Bank in the North Sea. The present locality and host are entirely new and widely separated from the others, and hence they show that the species is widely distributed.

Caligus phipsoni Bassett-Smith.

Two females of this species were found upon the outer surface of *Plectropoma cyanostigma* at Sydney, Australia. The original types were found on the inner surface of the gills of *Cybium guttatum* at Bombay, India, and the species has never been observed by any other investigator. In the present instance, therefore, both the host and the locality are new.

Caligus cheilodactyli Krøyer.

Three specimens of the chalimus stage of some Caligus species were taken from the scales and fins of *Chilodactylus variegatus* at Junin, Chile in 1894. None of them are developed enough to reveal their identity with certainty, but as Krøyer's type adults of both sexes were obtained from the same fish host at Valparaiso, Chile it is very probable that these chalimi are the young of that species.

Achtheinus pinguis Wilson.

Six females were taken from a dogfish shark at Tafel Bay, Cape-of-Good-Hope in 1873 by G. de Vylder. The original

types of this species were obtained from the fin of a sawfish at the Cape-of-Good-Hope. The present specimens correspond in structure to the type and add a new host.

Dinematura latifolia STEENSTRUP & LÜTKEN.

Twenty mature females, twelve immature females, and thirty-three males belonging to this species were taken from an unknown host at Durban (Port Natal), South Africa by WAHLBERG. A second lot containing a single female was obtained from an unknown host at Messina, Italy by THÉEL & APPELLÖF in 1888. A third lot of six females was obtained at the same time and place as the preceding, but from a different host, also unknown. In all these instances the host was probably a local species of shark.

Some of the mature females are 18 mm. in length, with egg strings 45 mm. long, and thus surpass in size any previously reported. The color of the preserved material is a cartilage gray, considerably lighter than that of the specimens in the collection of the U. S. National Museum and not as yellow. This color is only lightly tinged with brown on the dorsal surface of the female and along the lateral margins of the genital segment in the male.

The immature females are of special interest since they show the manner in which the adult body form is gradually attained, and for this reason they are worthy of a detailed description.

Specific characters of the immature female. Carapace much larger than the genital segment, its width one and a half times the length on the median line, its lateral margins strongly convex. Posterior lobes of medium length and curved inward, but not reaching beyond the dorsal plates on the second segment. Posterior sinus three-fifths of the carapace width, its base nearly a straight line. The dorsal plates of the second thoracic segment extend diagonally outward and backward to the tips of the carapace lobes. The dorsal plates of the fourth segment have a combined width equal to that of the posterior sinus of the carapace, and project far beyond the lateral margins of the genital segment. The posterior sinus separating

these plates is about half the width of the genital segment. Each plate is cut diagonally and its postero-lateral margin is concave. The genital segment is one-half longer than wide, and is prolonged into a small, well-rounded lobe at each posterior corner. The sixth segment is half the width of the genital segment, and is entirely visible in dorsal view behind the latter. The sixth legs appear as rudimentary processes, one on either side of this segment, and on its dorsal surface are the beginnings of two dorsal plates and the posterior process. The abdomen and anal laminae are like those of the adult.

In subsequent growth the posterior lobes of the carapace grow backward until they meet and overlap the dorsal plates of the third segment. The dorsal plates of the second and fourth segments increase in length and width, while those of the genital segment grow backward until their sides reach beyond the sixth segment and most of the abdomen. In the center, however, is a deep triangular sinus, which reaches forward to the genital segment. In this sinus may be seen the dorsal plates and posterior process of the sixth segment, which cover the whole of the abdomen and most of the anal laminae.

The appendages are like those of the adult with the following differences. The basal joint of each first maxilla carries on its outer margin two small processes tipped with spines, like those found in the adult female of *Dinematura producta*. These apparently disappear in the adult of the present species. The second maxillae lack the accessory claw at the base of the terminal claw, and have only the tuft of cilia. The rami of the second and third legs are two-jointed, while the margins of both rami of the fourth legs are armed with tiny spines.

Remarks. This development stage looks very much like the adult male, and as it is the same size, many of the early investigators were lured into describing it as the male. It differs from the male, however, in that the sixth segment shows a pair of rudimentary legs, and on the dorsal surface are the beginnings of a pair of dorsal plates and a median unpaired posterior process.

Dinematura producta (MÜLLER).

Two females and two males were found in connection with the preceding species upon the unknown host at Durban (Port Natal), South Africa by WAHLBERG. The females are somewhat mutilated but the males are in excellent condition, and since this sex has remained hitherto unknown in this species a description of it is here given.

Specific characters of male. General body form elongate and narrow, considerably more than twice as long as wide. Carapace evenly rounded, a little wider than long; frontal plates wide and prominent; frontal margin incised at the center; posterior lobes narrow and bluntly pointed; posterior sinus about half the width of the carapace. Second, third, and fourth segments about the same length; dorsal plates on the second segment not reaching the lobes of the carapace, their lateral margins diagonally truncated. Dorsal plates of the third segment small and circular in outline, fused at the midline, with a combined width about equal to that of the genital segment. Dorsal plates of the fourth segment also fused on the midline, with a nearly straight posterior margin, their combined width a trifle more than that of the genital segment. The latter is nearly twice as long as wide, its lateral margins only moderately convex, its posterior corners diagonal or even concave.

The abdomen is two-jointed, the terminal joint the same as the basal in width, but half as long again. Each anal lamina is longer than the terminal joint, and is tipped with five stout plumose setae.

Of the appendages the second antennae are stout and terminate in a stout claw, shorter and not as much curved as in the female. The second maxillae have the two joints about the same length; the terminal claw is half the length of the joints, is moderately curved and fringed with tiny setae. There is a tuft of long setae just outside the base of the claw, and behind this on the outer margin of the terminal joint is a stout accessory claw. The maxillipeds are large and stout and more like those of the *latifolia*-female than those of the female of the present species.

The swimming legs are like those of the *producta*-female, except the fourth pair, which are not as broadly laminate, and are indistinctly three-jointed and armed with plumose setae.

Total length 10 mm. Carapace 4,35 mm. long, 4,60 mm. wide. Genital segment 3 mm. long, 1,60 mm. wide.

Color (preserved material) yellowish-brown.

Remarks. The developmental stage described for the preceding species and the male of the present species help us to locate the specimen which P. J. VAN BENEDEN published as the male of »*Dinematoura elongata*» in Bulletin de l'Académie royale de Belgique, series 3, vol. 23, 1892, p. 231. Most authorities have made his species a synonym of the present one, in which case his male would become the male of the present species. That his specimen, however, was not a male but an immature female is evident from the fact that there were no dorsal plates on any of the segments, that only two segments were shown between the carapace and genital segment, and that the rami of the second and third legs were only two-jointed instead of three. These facts would indicate that his specimen was a very young female before the thoracic segments had been fully differentiated or the dorsal plates had been formed. Unfortunately he said nothing at all about the actual size of his specimen.

Pandarus cranchii LEACH.

There are seven vials containing specimens of this species. The first contains ten females taken by WAHLBERG from an unknown host in the open Atlantic. Three of these are nearly white in color and do not show any traces of the dark pigment which covers nearly the entire dorsal surface of the other specimens. They are slightly smaller than the others but not enough so to account for so much difference in color.

The second lot includes forty females taken from a shark in the northern Atlantic by EKSTRÖMER. These include immature specimens in various stages of development and many finely colored adults.

The third lot is made up of twenty females and a single male and was taken by WAHLBERG from an unknown host at Port Natal (Durban), South Africa. The fourth lot contains eight females also taken by WAHLBERG from an unknown host at Port Natal.

The fifth lot includes but a single female labelled »*Pandarus dentatus* DU HELLER», taken from an unknown host at Tahiti, Society Islands. The species which HELLER and MILNE EDWARDS designated *Pandarus dentatus* was the same as the present species.

The sixth lot includes five females and two males taken from a shark captured off Cape San Roque in Brazil.

The seventh lot contains but a single female which was taken from an unknown host in the open Pacific during the Eugenie Expedition.

It is probable that the »unknown host» of these various lots was some one of the local species of sharks, since this is a shark parasite and all the specimens whose origin is known were taken from sharks.

Pandarus brevicaudis DANA.

Three males of this species were taken in company with the sixth lot of the preceding species off Cape San Roque, Brazil. The original species types were obtained by DANA from a shark in the Pacific Ocean north-east of New Zealand. Another male was taken from a species of *Carcharias* between Papua and Japan during the Challenger Expedition. The present specimens, therefore, are the first to be obtained in the Atlantic, and leads to the belief that the parasite is as widespread as the sharks themselves.

Nesippus borealis (STEENSTRUP & LÜTKEN).

A single male was captured at Hackluyt's Headland, Spitzbergen, swimming about freely at a depth of 16 to 18 fathoms.

Another male was captured in a surface net by Capt. HÖGBERG off the British Channel in 1890. STEENSTRUP &

LÜTKEN obtained their original type specimen in a surface net and the single specimen in the U. S. National Museum was captured in the same manner. Evidently the males swim about quite freely at the surface while hunting for a host or while seeking the females. The latter are no doubt fastened to their fish hosts and will be found some day possibly in the throat of one of the large sea sharks.

Specilligus curticaudis DANA.

A single male was captured in a surface net off the coast of Brazil just north of Rio Janeiro by Capt. HÖGBERG in 1890.

Another lot of eight males were taken from a shark captured off Cape San Roque, Brazil. DANA's original specimens were obtained from a shark captured in the Pacific Ocean northeast of New Zealand and were all males. No females have ever been secured and this, added to the fact that DANA's type specimens have long since been lost, makes it impossible to locate his genus with certainty. His description and figures correspond well with the males of the genus *Nesippus* established by HELLER 13 years later. But it would be manifestly unfair to substitute DANA's name for that given by HELLER until it was certain that the two genera are identical. In HELLER's genus several species are recognized and both sexes have been identified, while DANA's genus rests upon the male sex alone, and of a single species. It is better to allow DANA's name to stand until such time as it can be definitely proved whether it is a valid genus or not.

Dysgamus longifurcatus n. sp.

Host and record of specimens. A single male was captured from an unknown host near the Cape Verde Islands by Capt. HÖGBERG in 1890. Another single male was taken between the Madeira Islands and the Canaries by A. KLINCKOWSTRÖM in 1903. Whether the latter was captured in a surface net or taken from an unknown host is not stated. Since the males of this genus are free swimmers either alternative becomes possible.

Specific characters of male. Carapace two-thirds of the entire length, elliptical in outline and rather squarely truncated posteriorly. Frontal plates indistinctly separated from the carapace, with a slit-like incision at the center of the anterior margin. Eyes far forward and in contact on the median line; median transverse groove much nearer the anterior than the posterior margin of the carapace and arched forward instead of backward. This leaves the area of the first thoracic segment one-half longer than that of the head; it is also nearly one-half longer than the fused second and third thoracic segments. These two latter segments are 62 percent of the width of the carapace, while the corresponding segments in *ariommus* are considerably more than this and in *atlanticus* considerably less. The fourth segment is two-fifths as wide as the carapace, the same proportion as is found in *ariommus* but much larger than that in *atlanticus*. The genital segment is one-fifth wider than long, its lateral margins only moderately convex and armed at the center with a pair of rudimentary fifth legs. The abdomen is half the width of the fourth segment and is two-jointed, with the joints about the same length. Anal laminae large and foliaceous, each armed with four stout plumose setae.

First antennae two-jointed, both joints heavily armed with setae; second pair stout, with a large and strongly curved terminal claw. First maxillae slender, acuminate and slightly curved near their tips; furca at least twice as long as wide, its lateral margins concave, its rami about half the entire length, parallel to each other and bluntly pointed. Swimming legs similar to those of the other two species.

Color (preserved material) a light yellowish brown.

Total length 5,15 mm. Carapace 3,50 mm. long, 2,75 mm. wide. Length of genital segment 0,70 mm., of abdomen 0,55 mm.

Remarks. This species differs much from the two previously established in the body proportions, in the position of the eyes, in the relative size of the first thoracic segment, in the presence of rudimentary legs on the genital segment, and in the details of the appendages, especially the furca and the first maxillae. All the specimens in the three species have thus far been males captured while swimming freely at the

surface. Probably, as BASSETT-SMITH has stated, the females are shark parasites which have hitherto escaped detection, or rather description. For this same author declared that there are in the collection of the British Museum females with egg strings still attached.

Echthrogaleus coleoptratus (GUÉRIN).

A single female was taken in company with twenty females of *Pandarus cranchii* from an unknown host at Port Natal (Durban), South Africa. There is no record of the position of either kind of parasite upon the body of the host, but the probability is that the *Pandarus* parasites came from the fins and outside surface and the *Echthrogaleus* from the gills.

Fam. **Dichelesthiidae.**

Anthosoma crassum (ABILDGAARD).

One lot, consisting of a male and a female, was taken from an unknown host at Port Natal (Durban), South Africa by WAHLBERG. A second female was secured at the same place from another unknown host.

This parasite is very widely distributed and has been observed by a long list of investigators. The sunfish, *Mola,* is the only host outside of a great variety of sharks that has been thus far reported.

Fam. **Lernaeidae.**

Peniculus fissipes WILSON.

Three females of this species were obtained from the scales and fins of *Chilodactylus variegatus* at Junin, Chile, just north of Iquique.

The types of this species were found upon an unknown host from the straits of Magellan. The present specimens were taken much farther north but still on the coast of Chile, and the name of the host was fortunately recorded.

Phrixocephalus triangulus WILSON.

A single female, belonging probably to this species, was obtained from an unknown host at Ushuaia, Tierra del Fuego. This specimen is minus its head and neck and hence cannot be determined with positive certainty. It was taken during the Swedish Expedition under O. NORDENSKJÖLD, 1894—1896.

Lernaeopodoida.

Fam. **Lernaeopodidae.**

Clavella uncinata (MÜLLER).

Two females with egg strings were taken from the gills of *Doydixodon fasciatum* on the west coast of South America.

Fam. **Chondracanthidae.**

Chondracanthus sp.

A single female with egg strings was obtained from the gills of *Gadus capensis* at Table Bay, South Africa by E. HOLUB in 1894. This is apparently the same species as one obtained by the present author in considerable numbers from the gills of the whiting, *Merluccius bilinearis,* on the New England coast. It is a new species and has already been described and figured in manuscript and will soon be published.

Explanation of the plates.

Plate 1.

Fig. 1. Dorsal view of *Artotrogus australis*.
» 2. Ventral view.
» 3. Antenna.
» 4. Second antenna.
» 5. First maxilla.
» 6. Dorsal view of development stage of female of *Dinematura latifolia*.
» 7. Mouth tube and first maxillae.
» 8. Second maxilla.
» 9. Third swimming leg.
» 10. Fourth swimming leg.

Plate 2.

Fig. 11. Dorsal view of male of *Dinematura producta*.
» 12. Second antenna.
» 13. Mouth tube and first maxillae.
» 14. Second maxilla.
» 15 to 18. First, second, third, and fourth swimming legs.
» 19. Second swimming leg of immature female of *Dinematura latifolia*.
» 20. Dorsal view of male of *Dysgamus longifurcatus*.
» 21. First antenna.
» 22. Second antenna.
» 23. Mouth tube and first maxillae.
» 24. Furca.
» 25 to 27. First, second, and third swimming legs.

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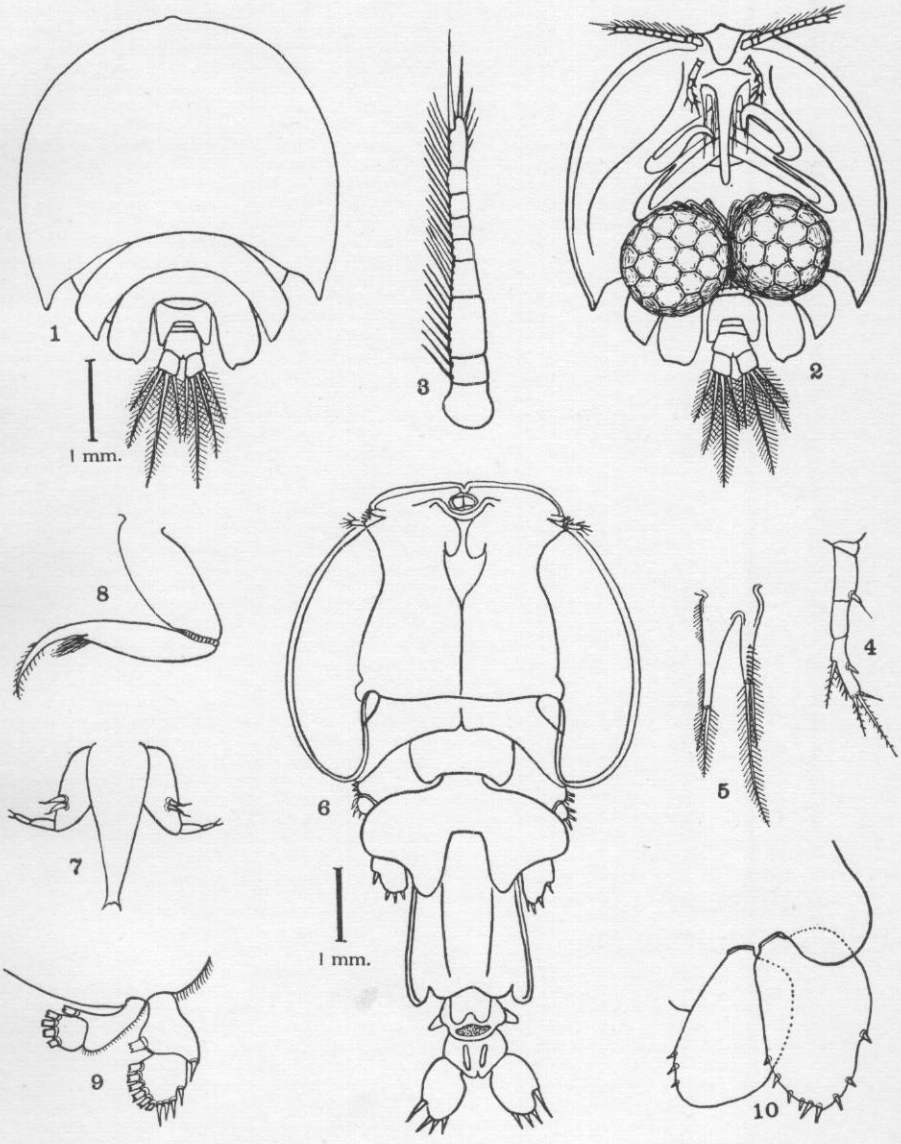

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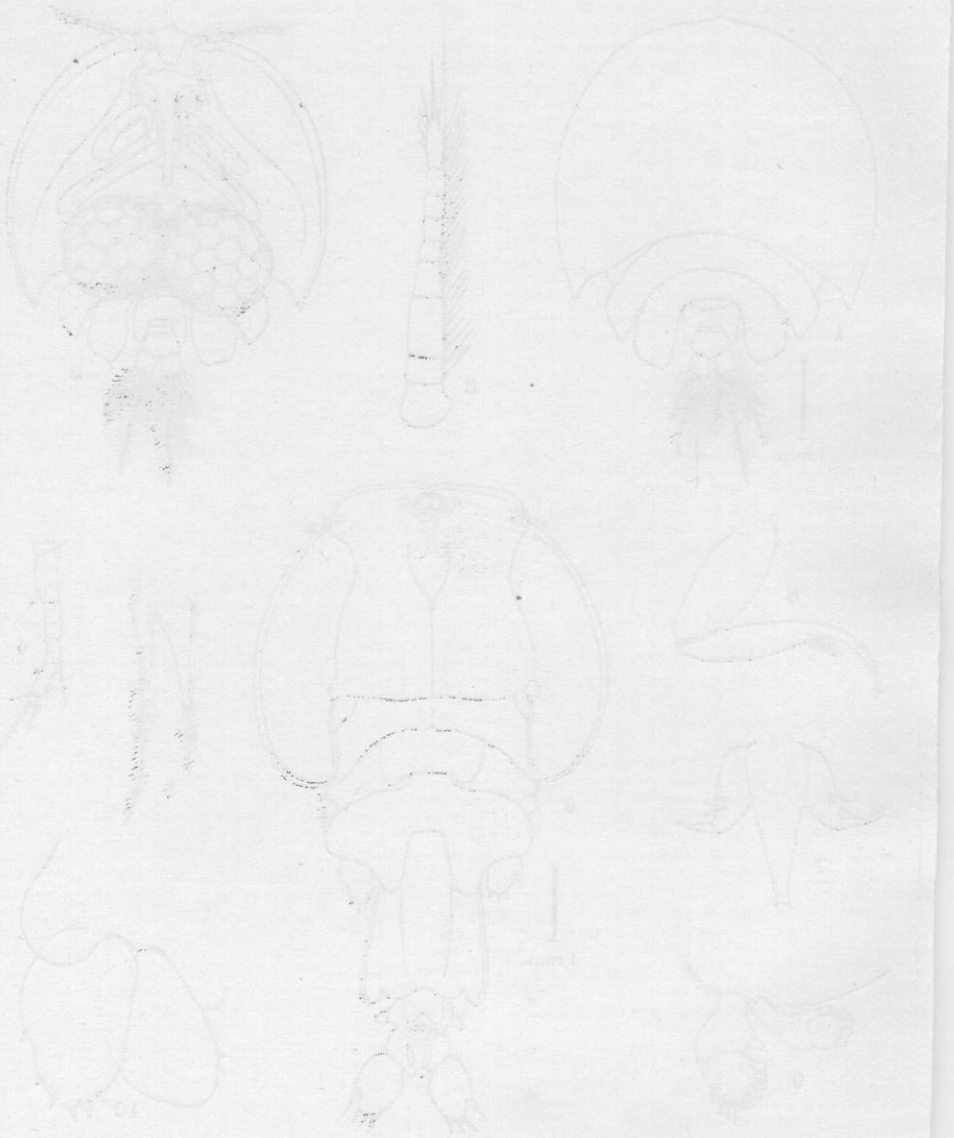

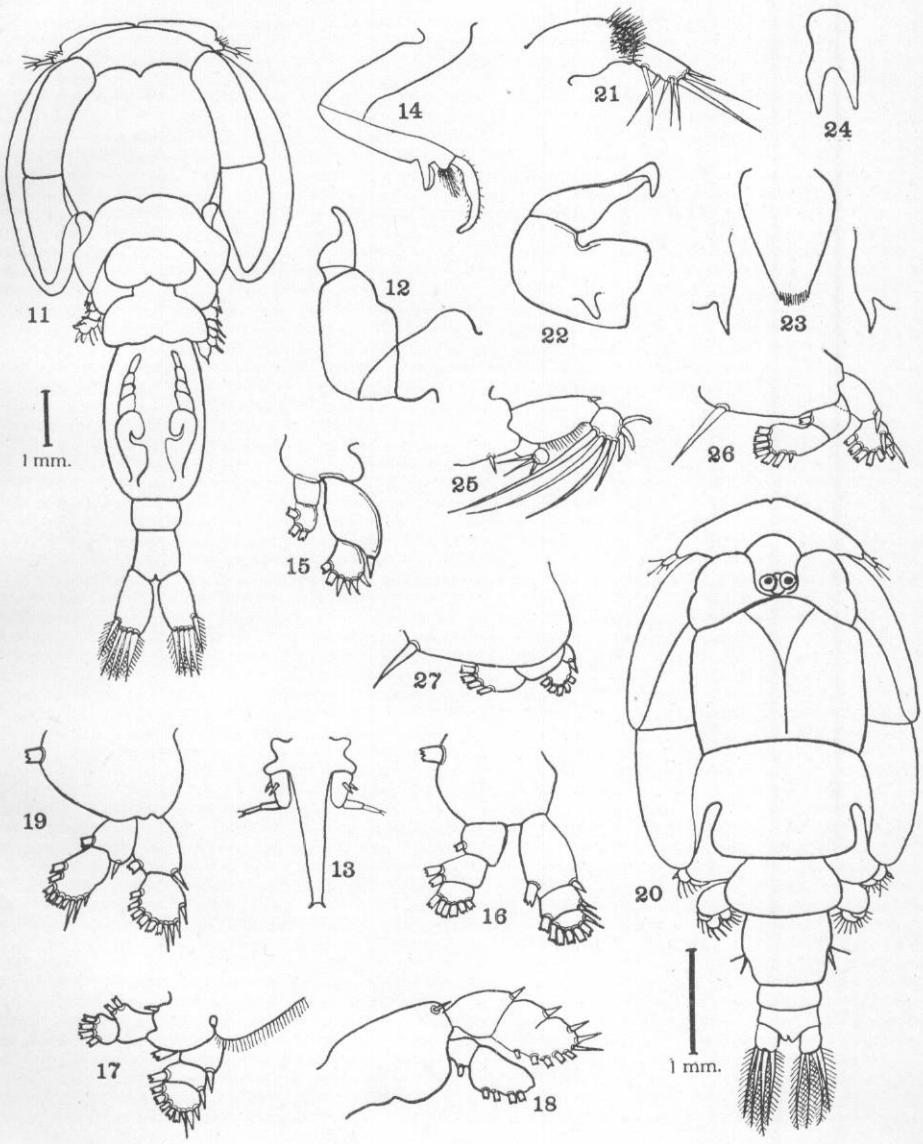

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