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Article I.—PARASITIC COPEPODS FROM THE CONGO BASIN¹

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PLATES I TO III

The Congo Expedition of The American Museum of Natural History, 1909–1915, brought back a small number of parasitic copepods, Messrs. Lang and Chapin collectors. These were turned over to me for identification and prove to be of considerable interest.

Our previous knowledge of African species was chiefly confined to two papers by Dr. W. A. Cunnington, who had charge of the Third Expedition sent to Lake Tanganyika by The Zoological Society of London. These papers were published in the Proceedings of the Society, the first in 1913, pp. 262–283, Pls. XLI–XLV; the second in 1914, pp. 819–829, Pl. I. The former described seven new species of *Argulus* from the Lake and an eighth, *Argulus africanus* Thiele, found also in Lakes Victoria Nyanza and Albert Nyanza, and in the Nile River. The latter contained three new species of *Lernæa* (*Lernæocera*), all from Lake Tanganyika.

One of these latter species is included in the present material and thereby proves that it is not confined to the Lake, but is found also in the Congo River Basin. Cunnington gave a photograph of the species and described its general appearance, but the appendages are here described and figured for the first time. On the other hand, the two

¹Scientific Results of The American Museum of Natural History Congo Expedition. General Invertebrate Zoology, No. 3.

Argulus species are decidedly different from any of those found in the Lake, and the *Brachiella* from a salt-water fish at the mouth of the Congo River also proves to be new. Accordingly, all four of the species merit a detailed description and figures of the more important appendages.

Argulus reticulatus,¹ new species

Plate I

Host and Record of Specimens.—Three females and three males were taken from the gills of *Hydrocyon goliath* Boulenger, at Malela near the mouth of the Congo River, July 5, 1915.

Specific Characters of Female

Carapace elliptical, distinctly longer than wide, reaching nearly to the center of the abdomen and entirely concealing the legs in dorsal view; posterior sinus two-fifths the length of the carapace and quite narrow, with parallel sides; posterior lobes broadly rounded; cephalic area scarcely projecting.

Abdomen transversely elliptical, a fourth wider than long, evenly rounded; anal sinus one-third the length of the abdomen, anal laminae basal.

First antennae with a short spine at the posterior corner of the basal joint, stout anterior and lateral claws on the second joint, and a short curved spine on the posterior margin. The basal joint of the second antennae is considerably thickened, with a long slender spine on its posterior margin; the terminal joints are comparatively slender. The eyes are of medium size and well separated. The sucking disks are large, one-sixth the diameter of the carapace, and quite close together some distance behind the antero-lateral sinuses. The supporting rods in the margins of the suckers are separated quite a distance one from another. Each is composed of a short basal portion, somewhat enlarged at its base, and two terminal cylindrical portions, joined end to end or nearly so. Maxillipeds rather slender; basal plates narrow triangular, prolonged posteriorly into three flattened laminae, separated by wide triangular sinuses; roughened area small, ovate, produced into a long narrow point anteriorly. First two pairs of swimming legs with flagella; lobes on the fourth legs with a tiny "heel" and a short pointed "toe," quite like the shoes in vogue amongst Chinese ladies of the upper classes half a century ago.

Respiratory areas divided into two portions, the anterior one triangular with rounded corners, the posterior one a little wider and four times as long, curved parallel with the lateral margin of the carapace.

Color (preserved material) a yellowish gray, the dorsal surface of the carapace covered with a network of irregular black lines, except around the eyes and through the center of the cephalic and thoracic areas.

On the dorsal surface of the abdomen and at the anterior ends of the lateral areas of the carapace the pigment is gathered into isolated, rounded spots.

Total length, 8 mm. Carapace, 7.50 mm. long, 6 mm. wide. Abdomen, 1.50 mm. long, 1.75 mm. wide.

¹*Reticulatus*: net-like, alluding to the black pigment on the carapace of the female.

Specific Characters of Male

Carapace a little shorter than in the female, but still overlapping the base of the abdomen; cephalic area projecting more strongly and relatively wider; posterior sinus a little more than a quarter of the length of the carapace, narrow triangular.

Abdomen slightly wider than long with an evenly rounded outline; anal sinus a mere slit, one-fourth the length of the abdomen, anal laminae basal.

Eyes considerably larger than in the female. Swimming legs projecting beyond the margins of the carapace, the lobes on the fourth pair longer and more pointed. Of the accessory sexual apparatus the peg on the second joint of the fourth legs is of medium size, while the semen receptacle on the third legs is exceptionally large and projects strongly from the posterior margin.

Color, the same as in the female except that the black pigment is in widely scattered spots instead of a continuous network.

Total length, 6 mm. Carapace, 5 mm. long, 4 mm. wide. Abdomen, 1.25 mm. long, 1.30 mm. wide.

Remarks.—Mention has been made of eight African species already reported; from them and from all other species, the present one is distinguished by the intricate reticulation of the dorsal surface of the female, by the squarely truncated teeth on the basal plate of the maxillipeds, by the peculiar pattern of the respiratory areas of the carapace, by the structure of the supporting rods of the marginal membranes of the sucking disks, and by the peculiar lobes on the fourth legs of the female.

Argulus ambloplites,¹ new species

Plate II

Host and Record of Specimens.—A male and female were secured from the outside surface of the gills of *Ophiocephalus obscurus* Günther at Faradje on the Dungen River, very near the headwaters of that part of the Congo River Basin which is north of Lake Albert Nyanza and close to the watershed separating the Congo from the Nile Basin.

Specific Characters of Female

Carapace ovate, considerably longer than wide and reaching beyond the center of the abdomen, with the posterior lobes considerably narrowed and turned inward; cephalic area broadly triangular and projecting moderately; lateral areas spindle-shaped, narrowed both anteriorly and posteriorly; posterior sinus a little more than one-third the length of the carapace and somewhat enlarged at its base.

Abdomen ovate, widest at its base, with broadly rounded sides and posterior lobes; anal sinus less than one-eighth the length of the abdomen, as wide as deep, squarely truncated at its base, anal laminae basal.

First antennae of medium size, basal joint with a blunt posterior process re-

¹*Ambloplites*: ἀμβλῖς, blunt, and ὀπίτρος, armed, alluding to the spines on the antennae and maxillipeds and the accessory processes.

enforced by a much larger one behind the insertion of the antenna; second segment with stout anterior and lateral claws and a small posterior spine opposite the anterior claw; second antennæ with a long blunt process on the basal segment. Eyes rather small, separated by a distance a little less than one-fourth the width of the carapace, and situated just in front of the lateral sinuses; median eye very small and far behind the lateral eyes. Sucking disks about one-eighth the diameter of the carapace and opposite the lateral sinuses and widely separated. Maxillipeds of medium size, the basal plate broadly triangular, produced posteriorly into three flattened laminae, which are squarely truncated and pressed so tightly together that the sinuses between them are mere lines. On the ventral surface inside the base of each maxilliped is an accessory process, also flattened into a wide, squarely truncated lamina. The first two pairs of swimming legs with flagella; the basal lobes on the posterior pair small and rectangular.

Respiratory areas divided, the anterior portion a little more than half the diameter of the posterior, ovate, with its long axis inclined backwards and inwards; the posterior portion somewhat enlarged at either end.

Color (preserved material) a uniform gray-brown.

Total length, 5 mm. Carapace, 4.50 mm. long, 3.75 mm. wide. Abdomen, 1.12 mm. long, 1 mm. wide.

Specific Characters of Male

Carapace elliptical, not narrowed posteriorly and not reaching the base of the abdomen, but distinctly longer than wide; cephalic area projecting more than in the female but relatively narrower; posterior sinus a little more than one-fourth the length of the carapace, with parallel sides.

Abdomen ovate, a little longer than wide, less than a quarter of the entire length, lobes broadly rounded; anal sinus one-fifth the length of the abdomen and narrower than in the female.

Lobes on the posterior swimming legs extended laterally into a broad and blunt cone; of the accessory sexual apparatus the peg on the fourth legs is exceptionally large, as is also the semen receptacle on the third legs, and there is a long rounded process extending backward from the center of the ventral surface of the second legs.

Color, a little lighter than that of the female.

Total length, 7 mm. Carapace, 5.30 mm. long, 4.50 mm. wide. Abdomen, 1.60 mm. long, 1.50 mm. wide.

Remarks.—This species is clearly distinguished from all the African forms by the conspicuous overlapping of the abdomen by the carapace lobes in the female, by the wide and shallow anal sinus of both sexes, and by the blunt armature, especially of the maxillipeds.

These two argulids, coming as they do from widely distant localities, one at the very headwaters of the Congo River and the other close to its mouth, suggest that the whole basin may yield specimens upon further examination. They are closely related to Thiele's *A. africanus* and to the present author's *A. americanus*, but may be recognized by the characters above given.

Lernæa haplocephala (Cunnington)

Plate III, Figures 20 to 22

Host and Record of Specimens.—Eight females were obtained from the outside skin and flesh of *Polypterus ornatipinnis* Boulenger at Faradje on the Dungen River, one of the headwaters of the Congo. One was obtained January 1912, four in February 1912, one in January 1913, and two in February 1913. They were all found on the sides of the body near the tail; they had penetrated the skin between the scales, and their cephalothorax with its processes was enclosed in a tough cyst just beneath the skin. In obtaining the four, Feb. 25, 1912, the skin, the scales, and a thin layer of flesh were removed entire with the parasites *in situ*; these specimens are excellently preserved.

Specific Characters of Female

General form thick and stout; cephalothorax with four large fleshy processes or horns, two ventral and two dorsal, very similar to those of *L. cruciata*. Each horn is conical, thick, and often flattened laterally at the base and tapered to a bluntly rounded point. The ventral horns are swollen a little more than the dorsal, especially on their ventral margins and toward their tips. The four horns are arranged like the letter X and each is a little more than one-fifth of the entire length. The neck behind the cephalothorax increases gradually in diameter back to the pregenital prominence. Just behind the horns and external to the second pair of legs there is a swelling on either side of the neck which projects ventrolaterally, the two coming together across the midline on the ventral surface, but not extending on the dorsal surface. These accessory processes correspond to those found in *L. variabilis* behind the primary horns.

The pregenital prominence is exceptionally large, not bilobed, and spherical in shape. It projects more than half its diameter, giving the body a decided boot or foot shape. The toe of the boot is the abdomen, which is somewhat inclined to the body axis and whose diameter is nearly equal to that of the body in front of the pregenital prominence. It is a half longer than wide, the same diameter throughout, bluntly rounded, and shows no signs of anal laminae.

The first pair of swimming legs is on the ventral surface of the cephalothorax between the bases of the ventral horns; the second pair is on the ridge connecting the two accessory prominences just behind the horns. The relative distances of the four pairs of legs from the anterior margin of the cephalothorax, calling the entire length of the body 100, are 11.15:35:70.

In the specimen from which the drawing of the entire animal was made there was a torsion of 180, the fourth legs being apparently on the side of the body opposite the first pair.

No egg-strings were found upon any of the present specimens, but Cunningham stated that the egg-sacs were moderately long, about one-fifth the length of the body, and tapering. Each contains four or five rows of eggs, with twenty-five or thirty in a row.

Head fairly large and ovate, being narrowed anteriorly between the bases of the antennæ; the anterior margin of the narrowed portion is somewhat reëntrant at the center. The first antennæ are three-jointed and well armed with setæ, the second pair are two-jointed, the joints of the same length, the terminal one armed at the tip with curved claws and several short setæ. The maxillipeds are stout, the terminal joint small, spherical, and tipped with four stout curved claws.

Color (preserved material), a uniform yellowish white.

Total length, 10 mm. Transverse length of dorsal and ventral arms and the head, 3.80 mm. Greatest diameter of the body, 1 mm.

Remarks.—This is one of the three species established by Dr. Cunningham in 1914; his type specimen was taken from the soft region at the junction of the pelvic fins of a large *Polypterus congicus* Boulenger. Other specimens were obtained from different species of *Polypterus* in the White Nile, and, so far as recorded, they were found in the soft flesh at the junction of paired fins. But the present specimens, instead of choosing such a locality, burrowed in between the hard scales on the side of the body. Coming from the Dunggu River, they extend the habitat of the species to the Congo Basin, and make it reasonably certain that this parasite is as widely distributed in Africa as is the genus of fish (*Polypterus*) upon which it is found. The present host is the fourth species of the genus from which this parasite has been obtained.

Cunnington gave some excellent photographs of the species and a good general description, but he did not locate the swimming legs, except the second pair, nor did he describe any of the appendages. These omissions are here supplied and, fortunately, they only emphasize the validity of the species.

Cunnington stated: "The appendages appear to show comparatively minor differences within the limits of this genus, and have not been appealed to for the purpose of establishing new species. Thus I have not deemed it necessary to study in detail the head appendages of my new forms since they are by no means easy to investigate, and my material, with one exception, was very scanty" (p. 283).

While this may be true in a measure, and while it may be advisable to base an artificial key upon characters easily observed, it should never be forgotten that the final decision of the validity of a species must always rest upon the structure of the appendages. Consequently, a description and figures of the appendages are more or less indispensable for the establishment of the species. Even in dealing with such bizarre forms as these lernæids, where species may be distinguished fairly well without resort to the appendages, the presentation of their details will avoid all question.

The distinguishing characters of this species are the well-developed and undivided pregenital prominence, the four horns of equal length arranged like the letter X, and the small spherical terminal joint of the maxillipeds, with its four curved claws.

Brachiella macrura,¹ new species

Plate III, Figures 23 to 28

Host and Record of Specimens.—Three females with egg-strings were obtained from the gills of an African snapper, *Neomænis fulgens* Cuvier and Valenciennes, at Banana on the mouth of the Congo River, July–August 1915.

Specific Characters of Female

Cephalothorax about the same length as the trunk, cylindrical and the same diameter throughout, and inclined backward at right angles to the trunk. Head neither enlarged nor separated in any way from the thorax, covered with an indistinct carapace. Maxillipeds nearly even with the anterior margin of the head and forming apparently a heavy under jaw; second maxillæ at the angle between the cephalothorax and the trunk. Trunk narrowed anteriorly into a very short neck, more or less wrinkled posteriorly, flattened dorsoventrally.

Four posterior processes of about the same length, two dorsal and two ventral; a genital process between the two latter and a little ventral to them, about half their length and the same diameter throughout, which is equal to that of the posterior processes.

Egg-strings arising between the ventral and dorsal processes and considerably more than twice their length, tapering gradually to a blunt point. Each string has a diameter at its base one-fourth greater than that of the processes, and contains five rows of eggs, forty to forty-five in a row, making the aggregate of each string a little over two hundred eggs.

First antennæ swollen at the base and three-jointed; second antennæ biramose and turned down squarely across the frontal margin of the head, the endopod (dorsal ramus) large and bluntly rounded, one-jointed and armed at the very tip with tiny spines, the exopod smaller, two-jointed, and tipped with a tuft of finger-like setæ. Mouth-tube short and wide, extending forward between the tips of the second antennæ. First maxillæ tripartite, the third division lateral and much smaller than the two terminal ones; palp one-jointed, bipartite, the rami very short and stout, each tipped with a single spine. Second maxillæ about one-third the length of the cephalothorax, slender, fused at the base and then separate as far as the bulla. Maxillipeds large and stout, the basal joint armed on its ventral surface near the inner margin with two large knobs, covered with small spines; the terminal claw has an accessory spine at its base.

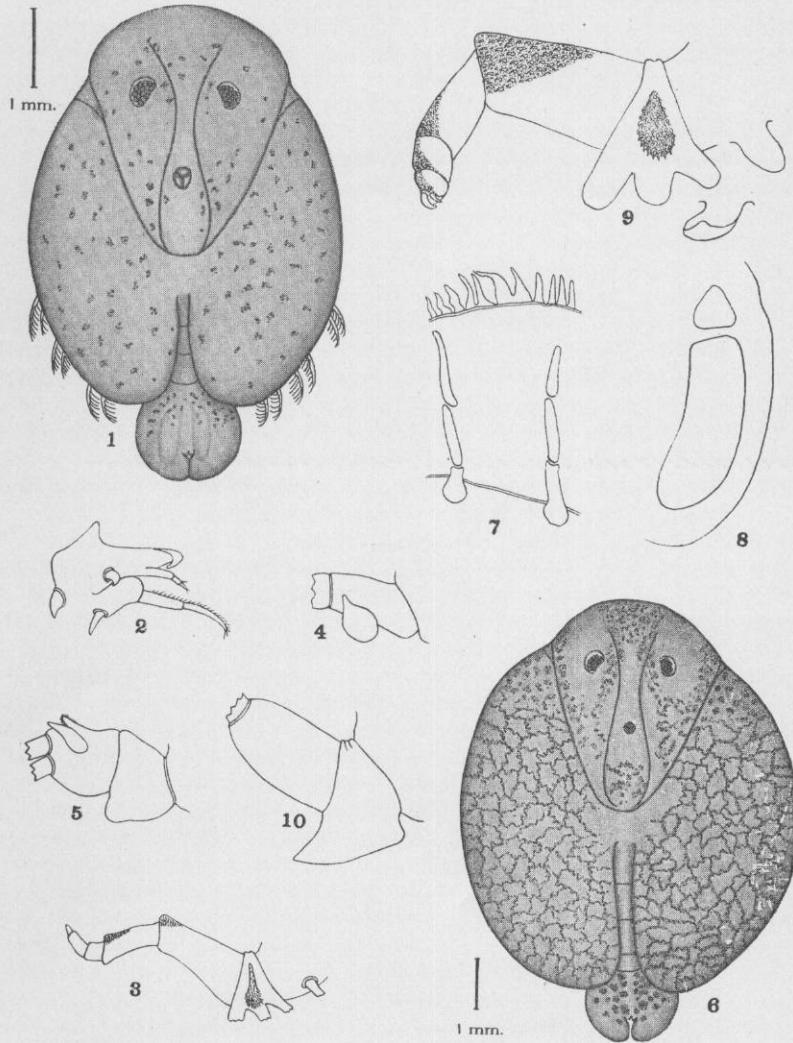
¹*Macrura*: μακρός, long, and οὐρά, tail, alluding to the genital process.

Color (preserved material), a brownish yellow.

Cephalothorax, 4 mm. long, 0.85 mm. in diameter. Trunk, 4 mm. long, 2 mm. wide, 1.75 mm. thick. Posterior processes, 4 mm. long. Egg-strings, 9 mm. long.

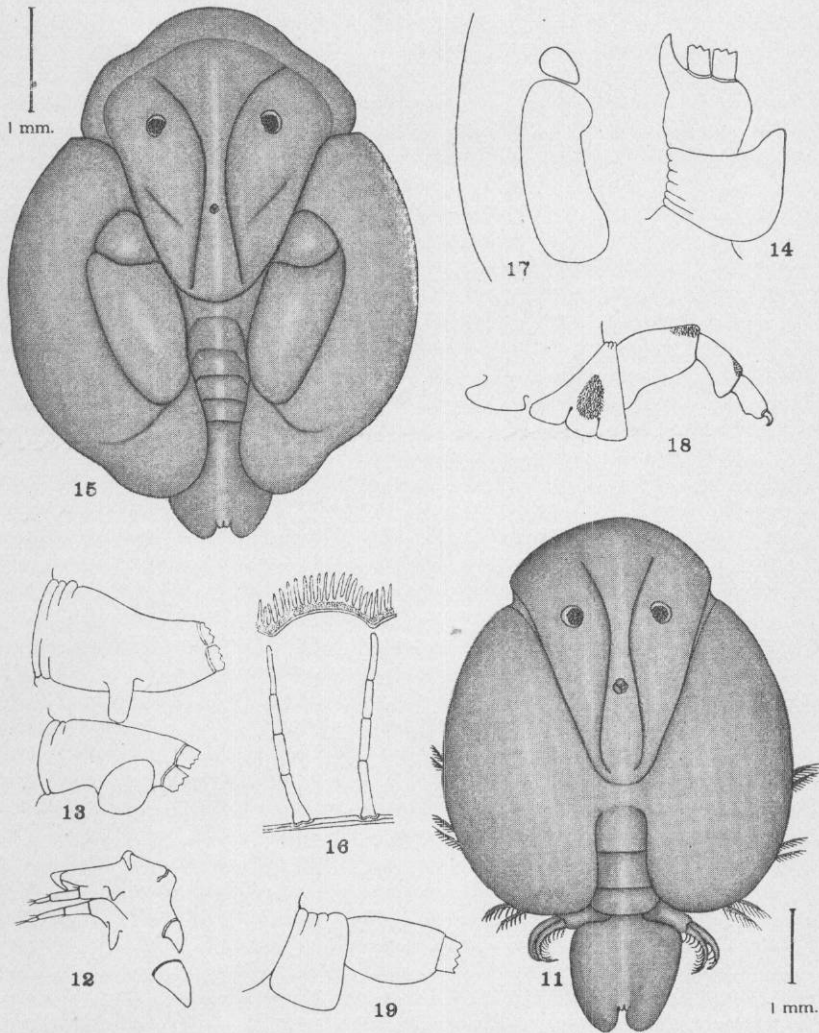
Remarks.—This species is most closely related to Beneden's *chevreuxii*, which is the only other one possessing a long genital process. But in *chevreuxii* the head is much enlarged and distinctly separated from the thorax, the trunk is as wide as long and nearly twice as wide as thick, and the egg-strings are only a trifle longer than the posterior processes.

The name *macrura* is especially appropriate for this species because not only is the genital process (tail) longer than in any other species except *chevreuxii*, but the posterior processes and egg-strings are also exceptionally long. The combination of the three makes it a question as to whether in this case "the dog wags the tail or the tail wags the dog."



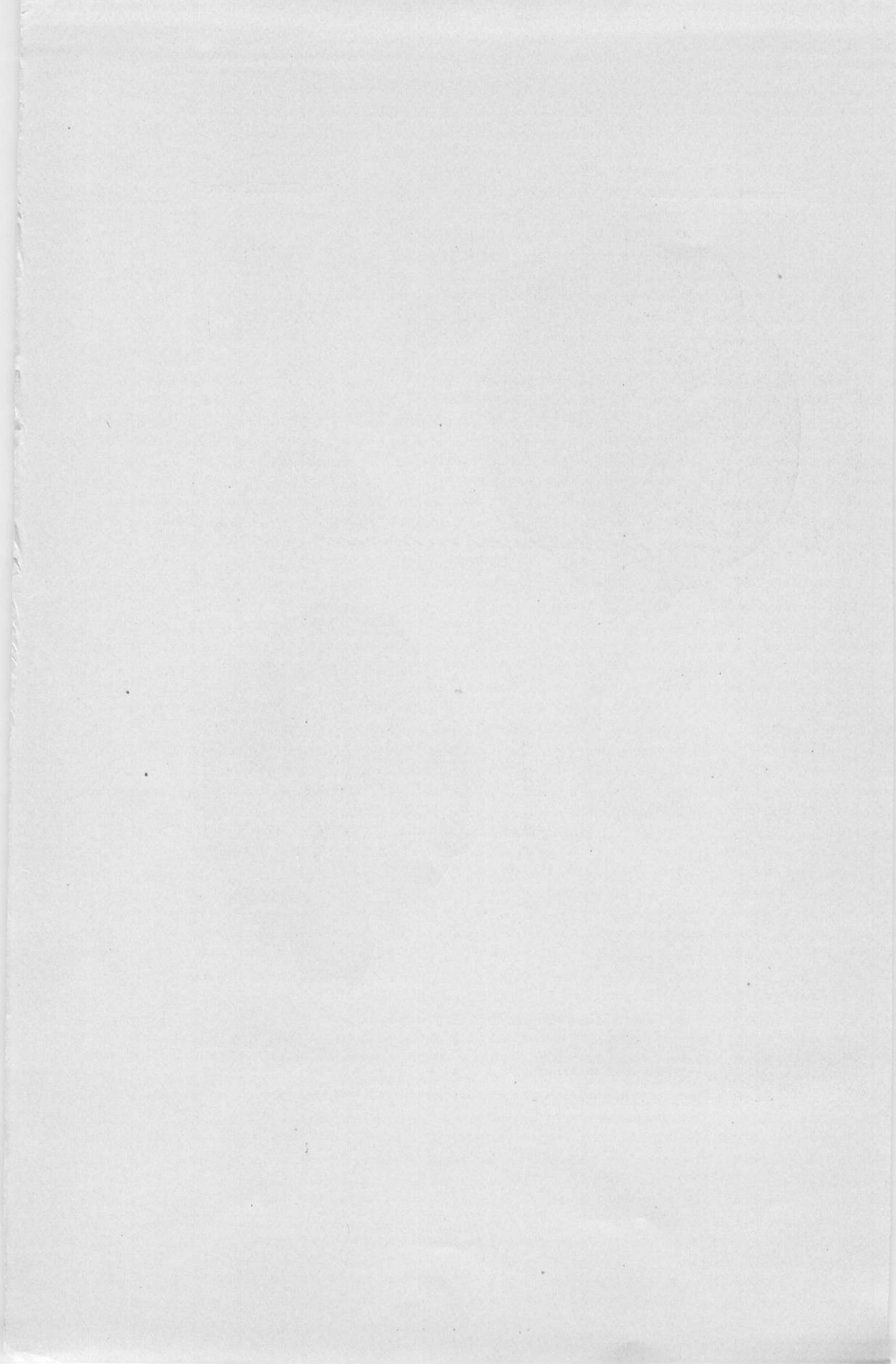
The Male and Female of *Argulus reticulatus*

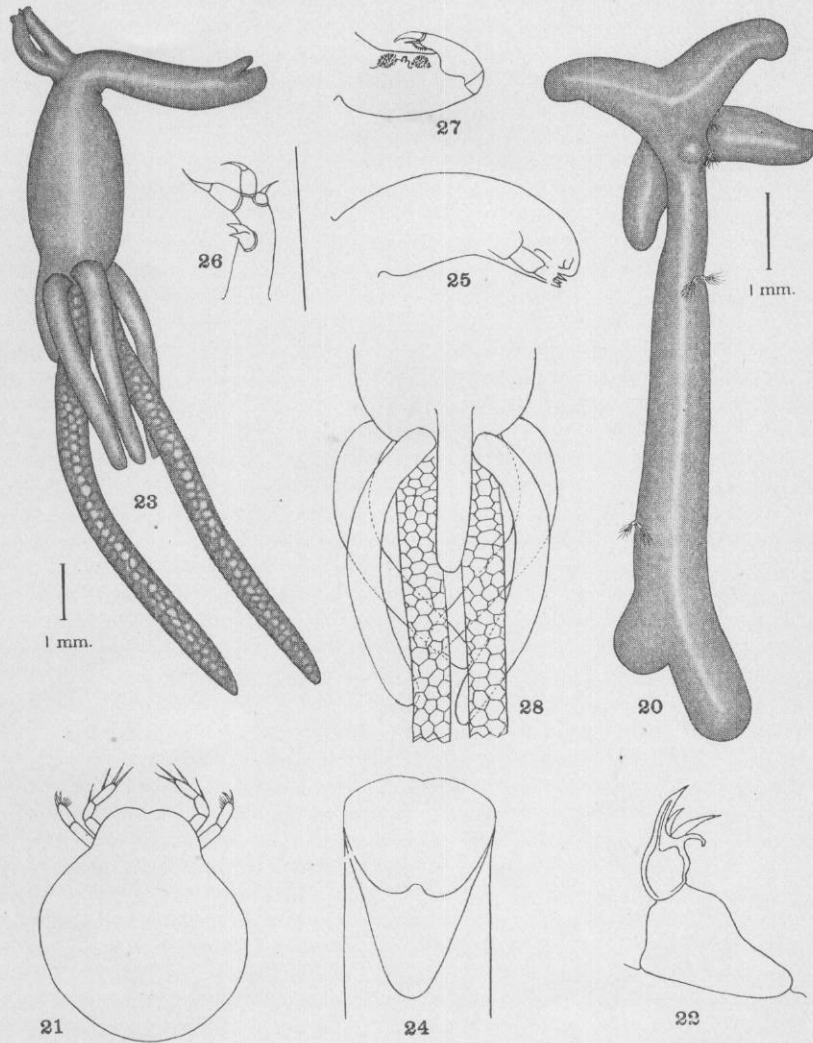
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|------------|---------------------------------|----------|----------------------------------------------------|
| Fig. 1. | Dorsal view of male. | Fig. 7. | Rods supporting the membrane of the sucking disks. |
| Fig. 2. | First and second antennæ. | Fig. 8. | Respiratory areas of the carapace. |
| Fig. 3. | Maxilliped. | Fig. 9. | Maxilliped. |
| Figs. 4-5. | Third and fourth swimming legs. | Fig. 10. | Fourth swimming leg. |
| Fig. 6. | Dorsal view of female. | | |



The Male and Female of *Argulus ambloplites*

- Fig. 11. Dorsal view of male.
- Fig. 12. First and second antennæ.
- Fig. 13. Second and third swimming legs.
- Fig. 14. Fourth leg.
- Fig. 15. Dorsal view of female.
- Fig. 16. Rods supporting the membrane of the sucking disks.
- Fig. 17. Respiratory areas of carapace.
- Fig. 18. Maxilliped.
- Fig. 19. Fourth swimming leg.





The Females of *Lerneæ haplocephala* and *Brachiella macrura*

- Fig. 20. Side view of female of *L. haplocephala*.
 Fig. 21. Dorsal view of head showing first and second antenna.
 Fig. 22. Maxilla.
 Fig. 23. Side view of female of *B. macrura*.
 Fig. 24. Dorsal view of head showing carapace.
 Fig. 25. Second antenna.
 Fig. 26. Maxilla.
 Fig. 27. Maxilliped.
 Fig. 28. Ventral view, showing genital and posterior processes.

