

EXPLANATION OF PLATE II.

Fig. 1, 2. The external appearance, natural size, of some of the nodules.

Fig. 3. A thin slice treated with hydrochloric acid and seen between crossed Nicol's prisms; shewing the dark crosses and radiating structure of the aggregates.

Fig. 4. A thin slice shewing some of the enclosed Foraminifera as seen by ordinary light; from a microphotograph (Smith and Beck's $1\frac{1}{2}$ " obj.) taken in the Biological Laboratory of the Indian Museum, Calcutta.

XV.—*Natural History Notes from H. M.'s Indian Marine Survey Steamer 'Investigator', Commander ALFRED CARPENTER, R. N., Commanding. No. 6. On Six new Amphipods from the Bay of Bengal.—By G. M. GILES, M. B., F. R. C. S., Surgeon-Naturalist to the Marine Survey.*

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(With Plates III—VIII.)

CONTENTS.

§ 1. A description of two new Species (i. *Phronima bucephala* and ii. *Phronimella hippecephala*) of the Amphipod Family *Phronimidæ*, with some Remarks on the Genera of the Family.

§ 2. *Rhabdosoma investigatoris*.

§ 3. *Amphipronoë longicornuta*.

§ 4. *Lestrignonus bengalensis*.

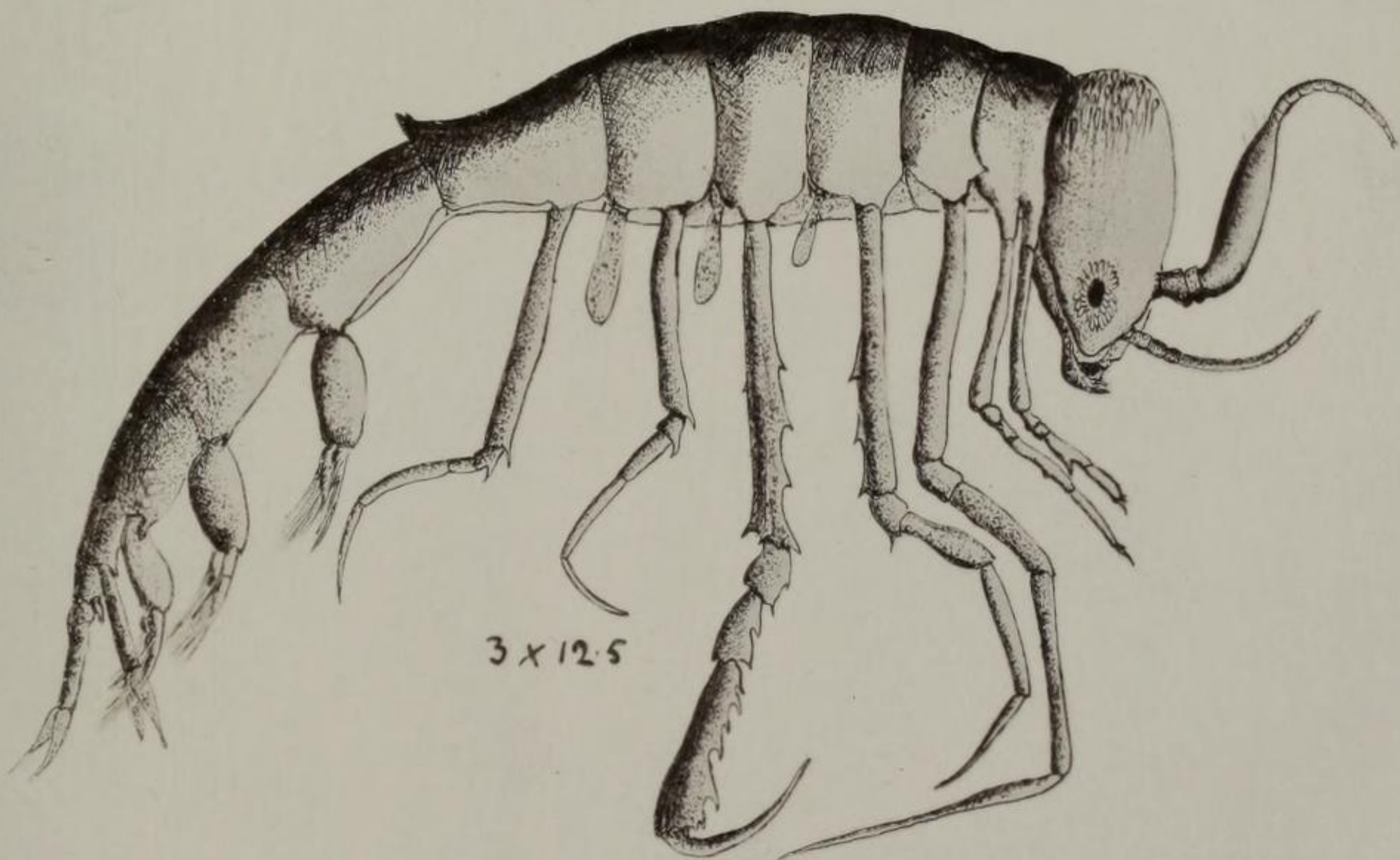
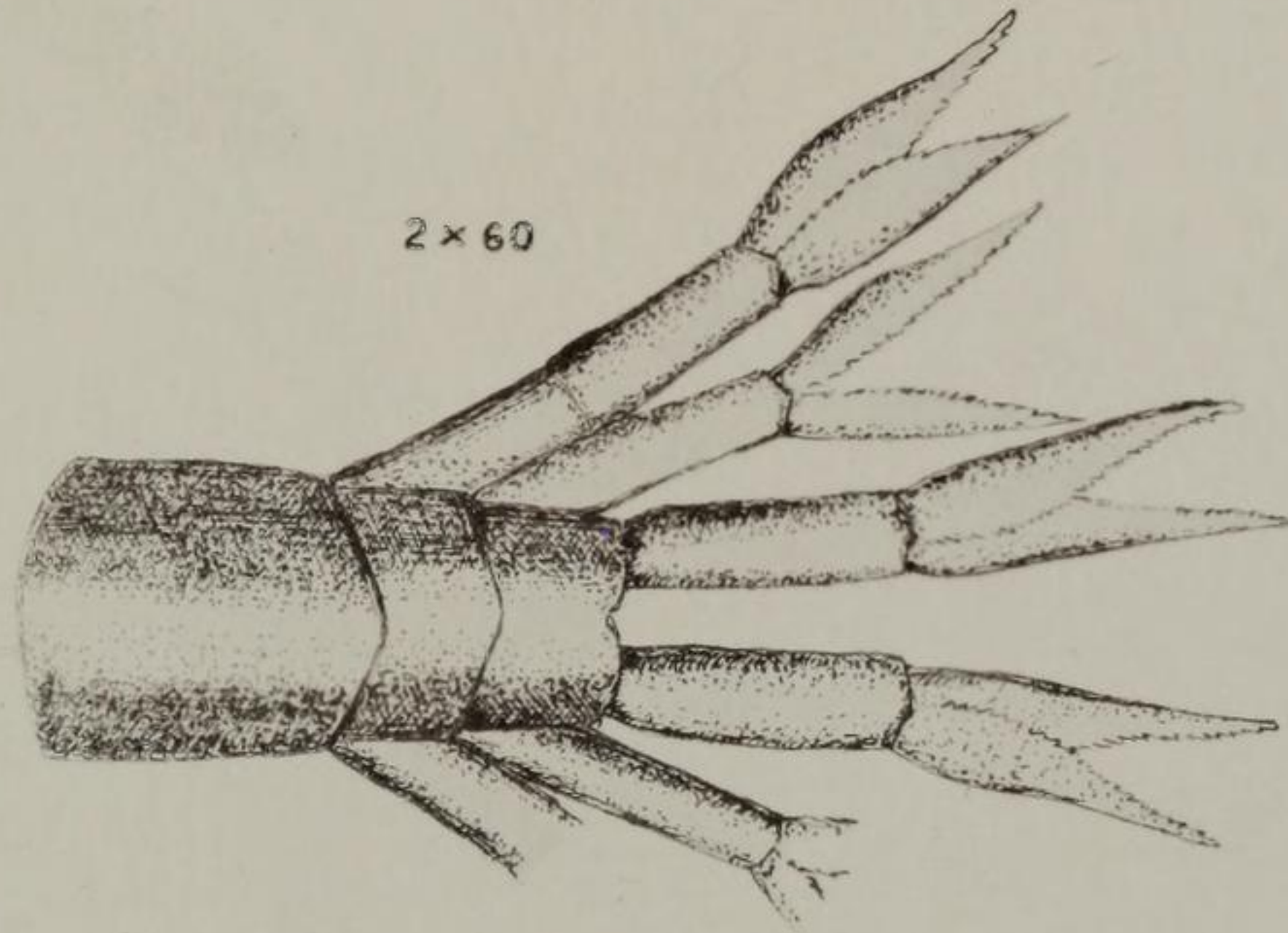
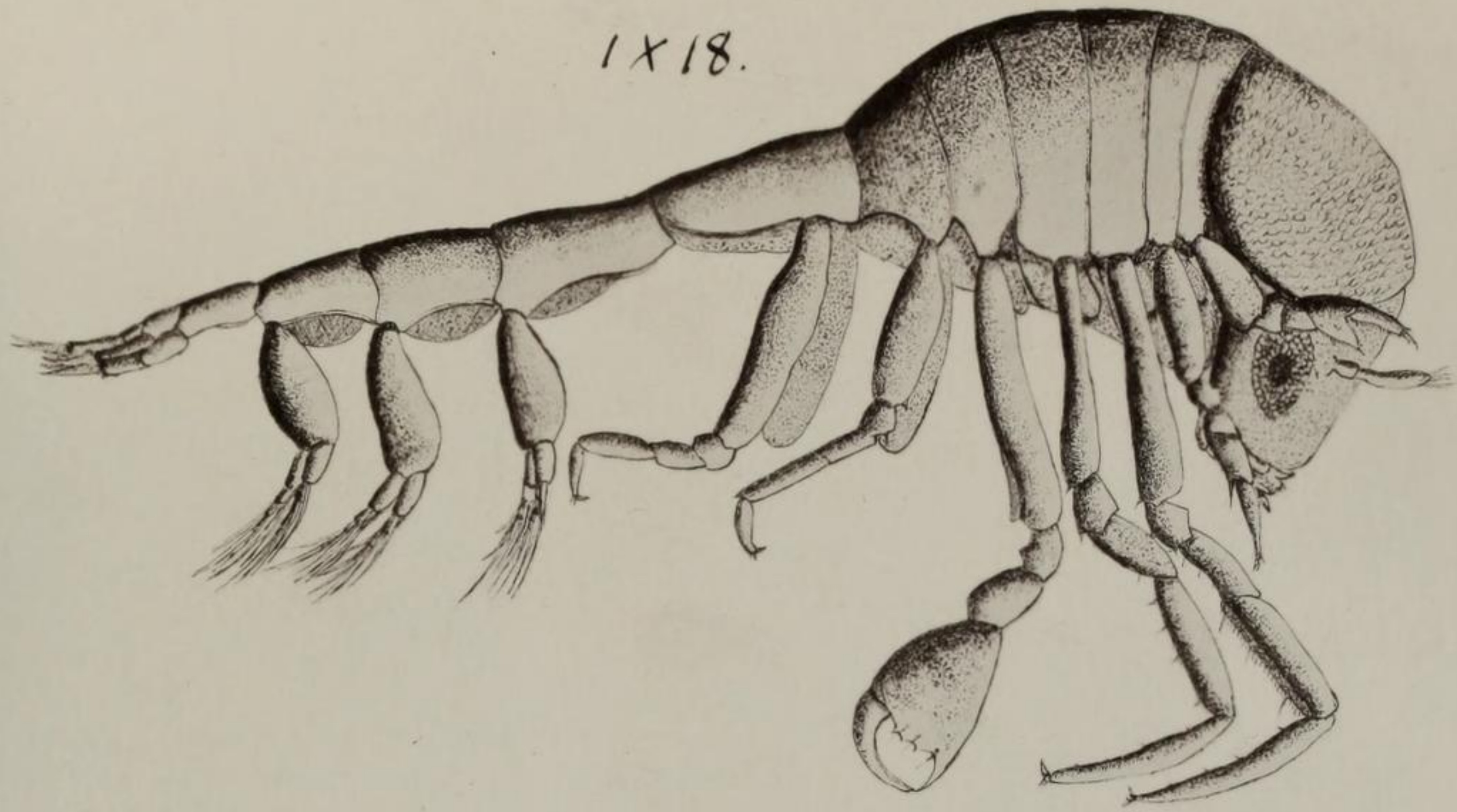
§ 5. *Eurystheus hirsutus*.

§ 1. *A Description of two new Species of the Amphipod Family Phronimidæ with some Remarks on the Genera of the Family.*

The genus *Phronima* of the division *Hyperina* and family *Phronimidæ* is a very limited and peculiar one. The species that belong to it are remarkable for their bizarre form, and for the circumstance that the head is considerably prolonged downwards, like that of a quadruped, in a direction at right angles to the long axis of the body.

The number of joints in the legs appears to be less than the normal seven. This is due, on the one hand, to the coxal plates being fused with the pleuron of each segment, and, on the other, to the circumstance that the dactylopodite is in most instances very small or reduced to a mere rudiment. Spence Bate* gives as a generic character that the 6th thoracic appendage (third pereopod) has the dactylopodite fused with the propodite. This is, however, I am inclined to believe, an error, arising probably from the want of fresh specimens. Such also appears

* Catalogue of Amphipodous Crustacea in the British Museum, p. 316.



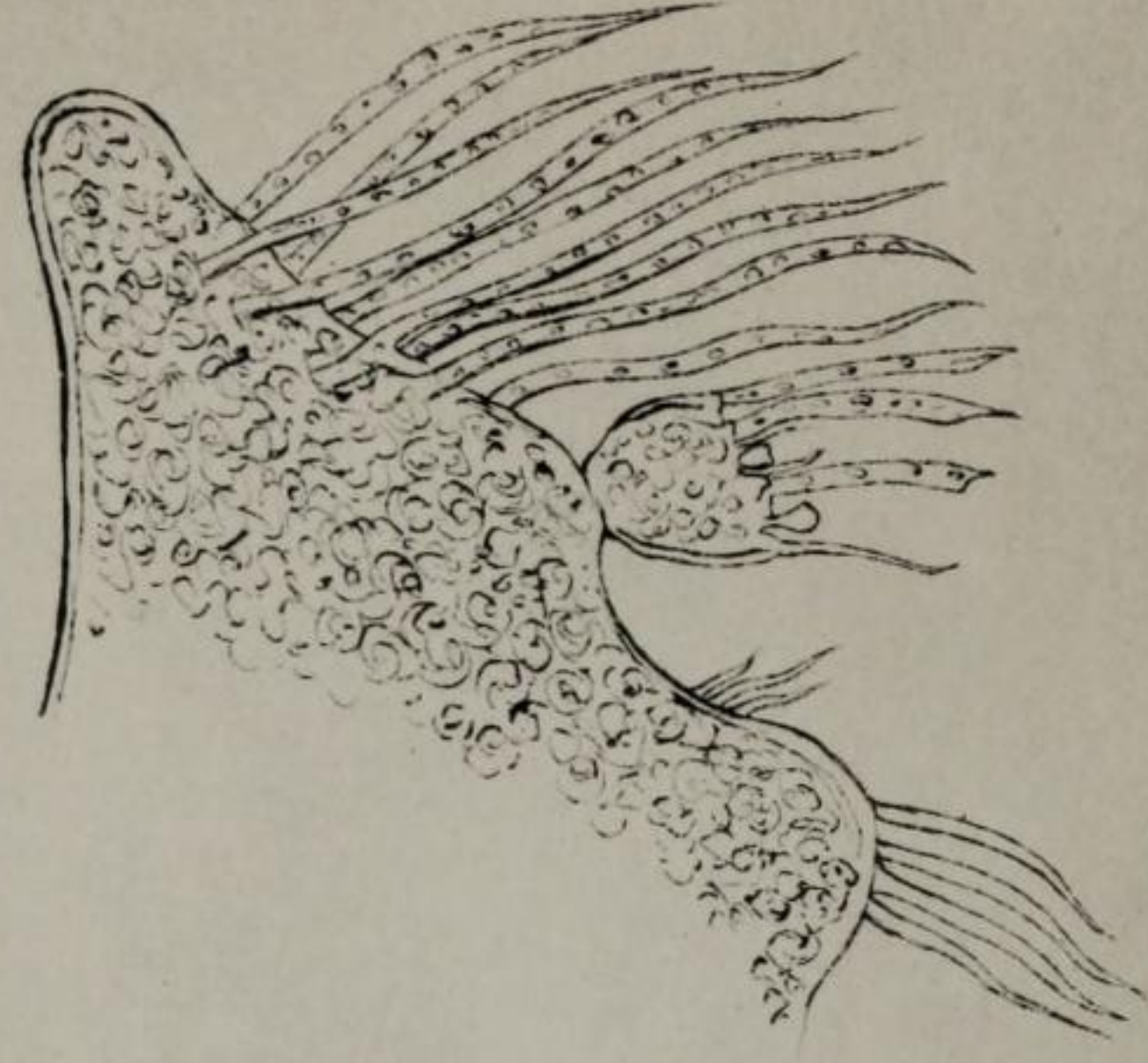
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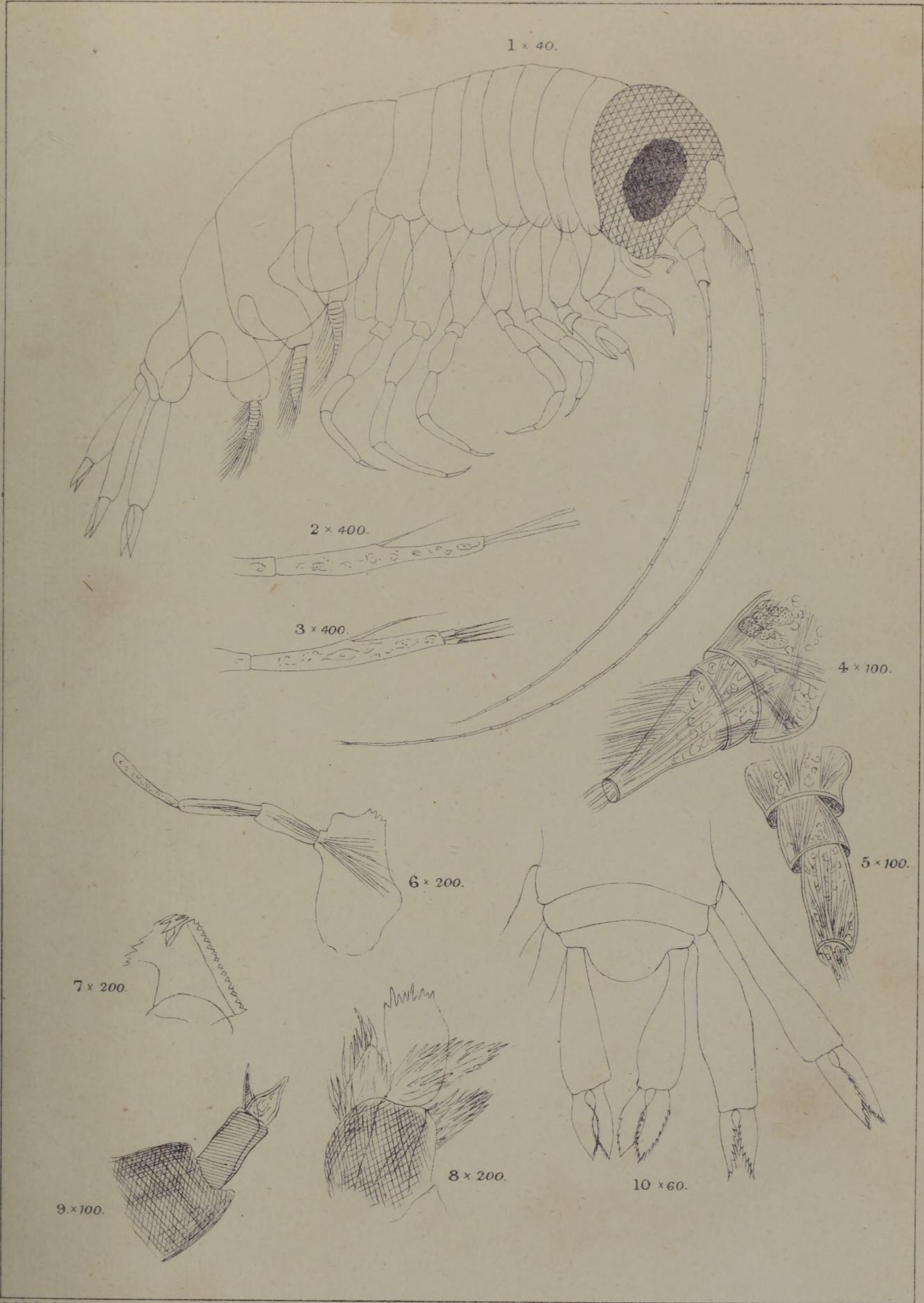
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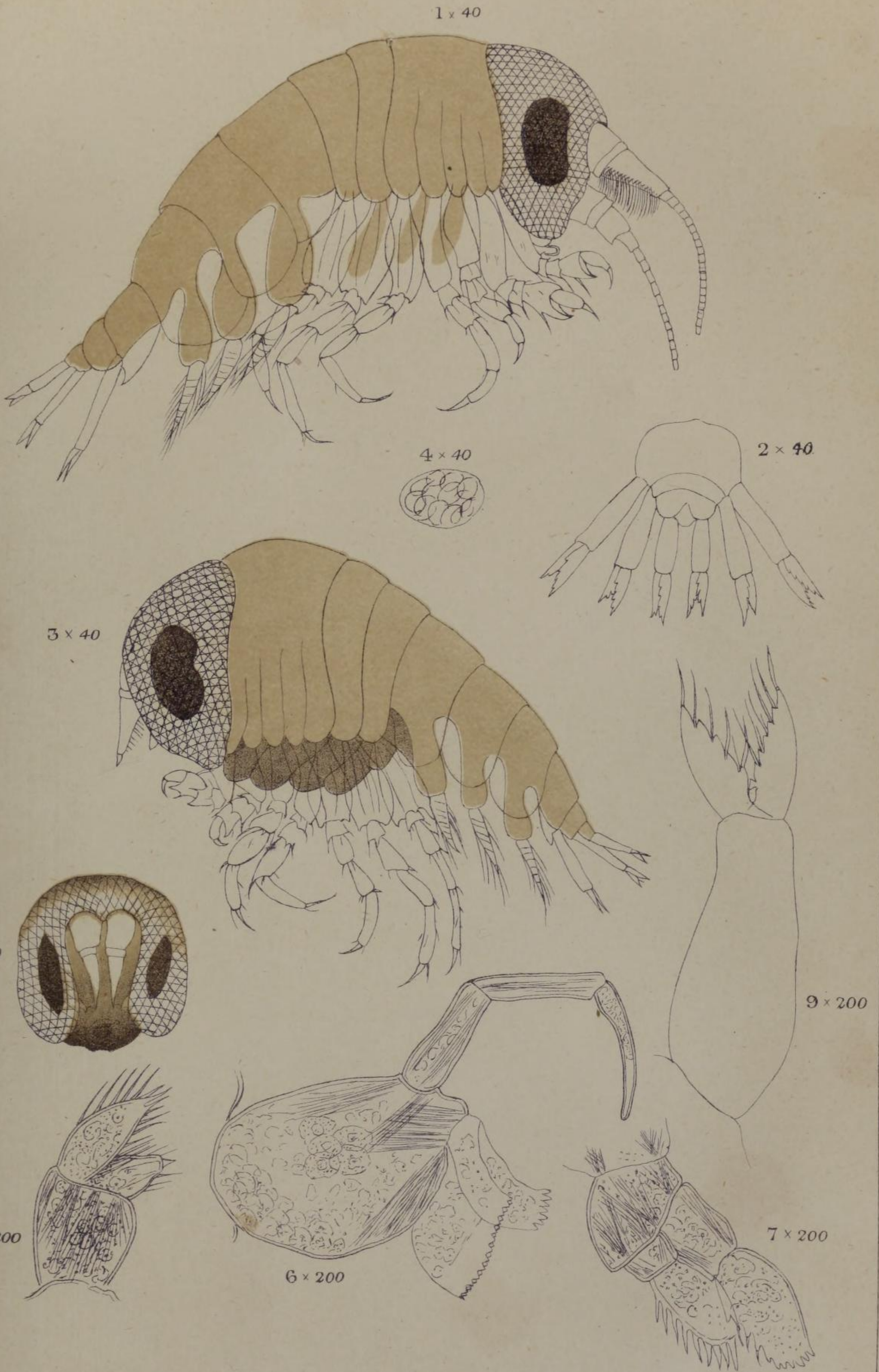


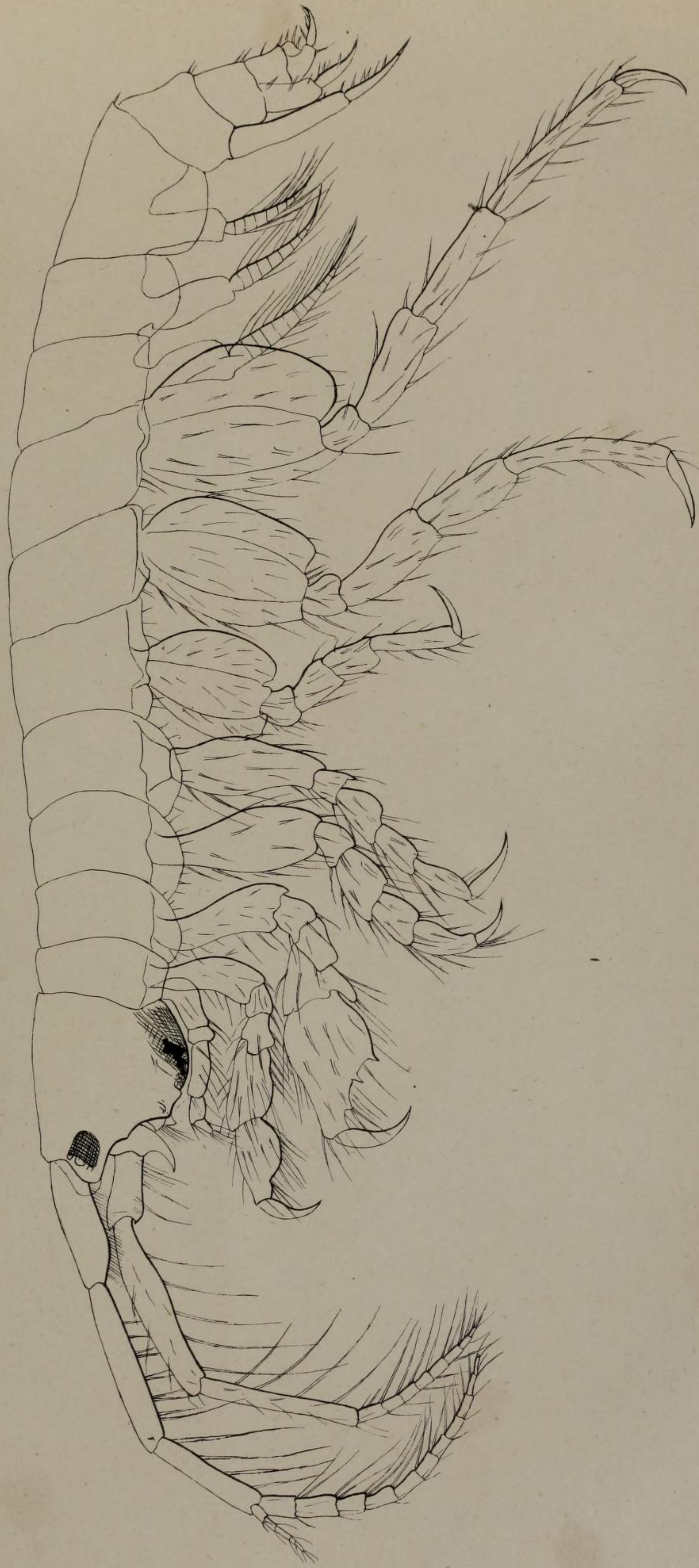


G.M.G. del.

Parker & Coward, lith.

West Newman & Co imp.





to be the case not only in the sixth but in the two preceding appendages of one of the species described below. A careful examination, however, of various intermediate examples, furnished by the different appendages of the two species that have come under my notice, has satisfied me that the dactylopodite is neither absent nor fused with the propodite, but is, in such instances, represented by a minute spine-like body articulated to the distal extremity of the propodite, and usually flanked by a pair of tiny hairs, which appear again in a more developed form in the similarly placed "dactyloptera" which Spence Bate (*loc. cit.*) describes on the dactylo-propodital articulation of *P. sedentaria*.

Both my species were taken in the drift (surface) net,—the one that has been named *P. bucephala*, off the Mutlah light in a depth of 15 fathoms, the other, *Phronimella hippocephala*, in somewhat shallower water off the mouth of the Dhamrá river on the Orissa Coast. Both are perfectly colourless and transparent, so that most of the internal organs, muscles, &c., can be seen with the greatest facility through the integument. The circumstance of my only having obtained a single specimen of each in the surface-net appears to point to their not being normally surface organisms. While under observation, living in the tube of the net, although perfectly capable of swimming with considerable activity, they yet showed a tendency to sink to the bottom and rest there. For these reasons, it is probable, that their true habitat is the bottom in the localities and depths already mentioned.

In his recent monograph on the *Phronimidæ*,* Claus divides the family into two sub-families—the *Phrosininae* and the *Phroniminae*. With the first we have nothing to do, as neither of the species to be described can be referred to this subfamily. Of the *Phroniminae*, he enumerates four genera, of which *Phronima* Latr. is thus defined:—

"Body produced, with much narrowed and elongated last thoracic segment, with 3 pairs of styloid uropods. Head short, but elevated, with much produced vertico-oral axis. In the female the anterior antennæ two-jointed, and posterior antennæ represented by a globularly arched basal joint provided with a short bristle. The mandibular palps are wanting even in the male. Maxillipedes strongly compressed with lanceolate laminæ and a conical "tongue" (Zunge). Both pairs of gnathopoda slender, with weak, apposed subchelæ. The 5th pair of thoracic appendages provided with slender apposed shear-like forceps. Three pairs of gill-sacs on 4th, 5th, and 6th thoracic segments."

Now, the family, so far as it is known, is of such variable character that each new addition to its numbers appears to require a genus to

* Arbeit. aus d. zool. Inst. d. Univ. Wien u. d. zool. Stat. in Triest, 1879, II, 1.

itself; and to the genus, as thus limited, neither of my forms can be said perfectly to agree.

To the less limited genus of Spence Bate, however, one of them corresponds in every point, but it differs from the genus as defined by Claus in the following points:—1st., in my one female specimen, I can make out no trace whatever of inferior antennæ; 2nd., the subchela of the “5th” (6th) thoracic appendage cannot be said to be slender, the fixed ramus being very stout and almost quadrate; 3rd., there are two extra small gill-sacs on the 2nd and 3rd thoracic segments, a character extremely abnormal, but of the reality of which I carefully satisfied myself. To avoid, however, the necessity of manufacturing a new genus, I describe it as a member of the genus *Phronima*, as defined by Spence Bate, under the name of *P. bucephala*.

With the second of the species to be described the case is different, as it will not fit into any genus, whether the *Phronima* of Spence Bate, or the genera distinguished by Claus, namely, *Phronima*, *Phronimella*, *Phronimopsis*, and *Paraphronima*. Of these the species comes nearest to the definition of *Phronimella*, which is thus given by Claus:—

“Body much produced, entirely transparent, with but two pairs of style-shaped uropods, head short, with high-arched upper surface, vertico-oral axis much produced. The two front segments united without suture. Mandibular palps wanting even in the male. Tongue (Zunge) of the maxillipedes reduced to a wart-like excrescence. Both pairs of gnathopods slender with weak apposed subchelæ. The third pair of thoracic appendages somewhat smaller, the fourth much produced. The fifth pair of legs with a much produced apposed pair of subchelæ. Three pairs of gill-sacs on the 4th, 5th, and 6th thoracic segments.”

With this definition, the specimen agrees in the very important detail of possessing but two pairs of style-shaped uropods, and in nearly every other item save in this that, in our species, the “3rd” (4th) thoracic appendages have the unfortunate peculiarity of being the longest and almost the largest of the whole series, instead of being smaller. A minor difference is that the two first thoracic segments, although united, shew signs of a short, but perfectly distinct, suture between their pleura.

On this account, one is reduced to the alternatives of either widening the range of *Phronimella* by cutting out the character referring to the third thoracic appendage, or of making a new genus. The making of new genera is an expedient which should, I take it, be avoided whenever possible, so that I prefer to adopt the former alternative and to describe the species as *Phronimella hippocephala*.

I will now proceed to the description of the two species.

(i.) PHRONIMA BUCEPHALA, n. sp., Pl. III, Figs. 1 & 2.

Head large, and broad at the top, which is almost completely occupied by the regularly arranged series of components of the apical eyes. These latter, though essentially paired organs, very nearly blend in the middle line, so that only a small space in that situation is unoccupied by their visual cones. The dorsal aspect of the head forms a large, transversely oval shield, which is separated from the anterior and lateral surfaces by a distinct horizontal fold. The portion of the head below this forms a truncated cone, tapering from the shield like vertex to the mouth, which is placed on the truncate (ventral) aspect; the whole presenting a curious resemblance to the head of a buffalo, which is further heightened by the circumstance that the maxillipedes, lying along the posterior aspect of the truncated cone, present an outline much like the large fleshy fold behind the lower jaw of that animal. The lateral eyes are placed on the lateral aspect of the head, immediately below the fold that separates the lower truncate portion from the oval apical shield. Their component cones, like those of the apical eyes, are regularly arranged, but are somewhat widely separated, so that there is no true faceting, although a close approach to the true compound faceted eye is attained.

The *antennules* are short and two-jointed; the first joint about a quarter the length of the second, which is of clavate form, and terminated by a tuft of fine, short hairs: the entire length of the organ being a full third less than that of the conical portion of the head.

The *antennæ* are obsolete.

The *gnathites* are somewhat small and are articulated to the inferior or ventral aspect of the truncated cone. Only enough was seen of them to establish their being quite of the usual type, without any salient peculiarities, and that the mandibles are unprovided with any appendage. An unfortunate lurch of the ship spilled the portion of the dissection containing them as they were being separated for the purpose of drawing.

The *thorax*, as seen from above, forms with the cephalic shield a pear-shaped body; its five anterior dorsally visible segments being very broad, the penultimate tapering rapidly, and the last being very long and narrow. The first two are short and hard to distinguish from each other.

All the *thoracic appendages*, with the exception of the anterior gnathopoda, are provided with branchial sacs, but the last two of these greatly exceed the rest in size. 1st gnathopod about one-sixth the length of the body. The dactylopodite very minute and claw-shaped, its

articulation with the propodite flanked by a pair of minute flattened hair-like bodies. The propodite is simple, slightly falciform, its posterior border fringed with fine, short, stiff setæ. It forms, in conjunction with the prolonged postero-inferior angle of the carpopodite, a somewhat incomplete subchelæ. The meropodite and ischiopodite are short and triangular, and the basipodite is stout and cylindrical, forming more than a third of the length of the appendage. The 3rd thoracic appendage, or 2nd gnathopod, is of generally similar form to the preceding, but is longer and slighter, equalling a fourth of the whole body length. The subchela, too, is even less perfect, the prolonged postero-inferior angle of the carpopodite amounting to little more than a stout spine. The 4th and 5th thoracic appendages, subequal and closely resembling each other, just equal the combined head and thorax in length, the anterior being slightly the longer and stouter. In both, the dactylopodite is minute and claw-like, propodite and carpopodite subequal and cylindrical, but stouter, and a third shorter than the two preceding joints, the ischiopodite short and triangular, and the basipodite long, cylindrical, swelling somewhat at its distal extremity, and forming quite a third of the length of the whole limb. The 6th thoracic appendage is by far the strongest of the series; it is, however, considerably shorter than 3rd and 4th, being as long only as the thorax. The dactylopodite is represented by a mere rudimentary spine. The propodite forms a stout curved claw which, in apposition with the inferior border of the carpopodite, forms a powerful subchela. The carpopodite is triangular, its inferior border being nearly as long as the lateral. The antero-inferior angle is prolonged into a powerful spine, and the inferior border is armed with three dentations, between which are a corresponding number of small, isolated tufts of hairs. The meropodite and ischiopodite are short and quadrangular, and the basipodite, forming fully half the length of the limb, is stout, cylindrical, and strengthened along its posterior border by a narrow buttress. The 7th and 8th thoracic appendages are alike in plan, the former being, however, decidedly the smaller, especially as to the basipodite, which is much longer and stouter in the 8th appendage. In both, the dactylopodites are minute and claw-like, the propodites of an elongated pyriform outline. The carpo- and meropodites cylindrical, the ischiopodites short and triangular, and the basipodites spindle-shaped.

Abdomen narrow, tapering, depressed rather than compressed, the first three segments long, diminishing from before backwards, the first nearly equalling the long last thoracic segment in length, the third being but half its length. The last three together only equal the 2nd in length.

The first three *abdominal appendages* are of the usual amphipod type, the first and third being subequal, the middle one slightly the longest. The last three abdominal appendages are alike in plan, and the fourth is the longest. They consist of a long cylindrical basal joint provided with a pair of lanceolate rami with serrate margins. The penultimate pair are the shortest of the three and the last but little inferior to the fourth in size. The basal joint of the fourth has the appearance of being composed of two joints; such an arrangement is, however, from a morphological point of view, so improbable, that, although it is represented in the drawing, I have hesitated to describe it as such. Both sides, however, appeared alike.

The *telson* appears obsolete.

The unique specimen is certainly a female, but the unlucky accident to the dissection prevented my dissecting out the generative organs.

Its actual length was 5.75 mm.

(ii.) *PHRONIMELLA HIPPOCEPHALA*, n. sp., Pl. III, Fig. 3.

The second species differs from the first in many important points. Speaking generally, it is, both as to body and limbs, if I may use the expression, a much more lanky species.

The *head* somewhat resembles that of a horse in shape, but the resemblance is not nearly so striking as that of the first species to the head of a bull. It is not so broad at the top, and no fold surrounds it; so that the appearance of a cephalic shield is not produced: its dorsal aspect is covered with a large, widely separated pair of apical eyes. The lateral eyes are situated low down laterally, of medium size, and of the same structure as in the first species.

Both *antennules* and *antennæ* are present; the former, much the larger, consist of a three-jointed peduncle and a flagellum of eight or ten short segments, total length equal to a third of the body exclusive of the head. The first two joints of the peduncle are short, while the third, of dilated spindle-shaped form, makes up more than half the length of the organ. Near the distal extremity it is provided with a few short, flattened hairs. The flagellum is quite naked with the exception of one or two small hairs on the last joint.

The *antennæ* are little more than half the length of the *antennules* and consist of a peduncle formed of three short joints and a naked tapering flagellum as long as that of the antennule, the proximal articulations of which are ill-marked.

Being unwilling to destroy my only specimen, the *gnathites* and *maxillipedes* were not closely examined: they appeared to resemble very closely those of the first species.

The *thorax* is long, narrow, depressed rather than compressed, the first two dorsally visible segments scarcely separable. The third has the inferior angle of its pleuron produced into a sort of triangular spine, overlapping the second. The fourth and fifth, of nearly equal length, form the widest portion of the body; the sixth longer and narrower than these; and the last, the longest and narrowest of all, is provided behind with a spine on either side of the middle line and has this posterior border considerably everted, so as to admit of hyperextension of the abdomen on the thorax.

The 5th, 6th, and 7th *thoracic appendages* are provided with branchial sacs, the hindermost being the largest. In the gnathopoda, the coxal extension of the pleura is considerable, and extends well below the level of any of the rest. The gnathopoda are on the same general plan as those of the first species, but are much longer and more slender, and their subchelæ are far less developed, being represented, in the anterior of the two, by a process some distance from the inferior extremity of the carpopodite, and, in the posterior, by a small projection half way along its length (this is if anything somewhat exaggerated in the drawing). The 4th is considerably the longest of all the appendages. It is, however, very slender, both the 5th and 6th exceeding it in stoutness. It equals in length the thorax and first two segments of the abdomen, and to all appearance consists of but five joints, the dactylopodite being represented only as a minute hair-like body. The propodite is very long and tapering, forming nearly a third of the length of the limb. The carpopodite, meropodite, and basipodite are long and cylindrical, and the ischiopodite is short and quadrangular. The 5th closely resembles the preceding, but is shorter than it by the length of the basipodite, the carpopodite being less than half as long as that of the 3rd. The postero-inferior angle of its ischiopodite is prolonged into a spine, and the posterior border of its much stouter basipodite is armed, along the distal half of its posterior border, with three strong serrate spines. The 6th is considerably the stoutest of the series, and equals the thorax and first segment of the abdomen in length. The dactylopodite is represented only by a minute hair-like body, the propodite, long and falciform, the carpopodite, a long flattened body, the opposable inferior border of which is but of small extent, is armed along its anterior border with six powerful serrations, so that the extremity much more resembles the sabre of a *Squilla* than a subchela. The mero- and ischiopodites are short and triangular, each having the anterior border armed with two serrations. The basipodite, cylindrical above, is three-sided below, each border ending in a strong spinous process, in addition to which the anterior border is armed with three stout, and the postero

with two smaller, serrations. The 7th and 8th are alike in all respects, save size, the hinder being the larger. With the exception of the short triangular ischiopodites, all the joints are cylindrical. The longer of the two barely equals the abdomen in length. In both the dactylopodites are minute and hair-like.

The *abdomen* is slightly shorter than the thorax, the segments diminishing in length from before backwards. The anterior extremity of the first segment, where it joins the thorax, is much constricted, the broadest part of the region being across the second segment. The last three segments together barely equal the third in length.

The three anterior *abdominal appendages* are of the usual type, the middle one being the largest and the hindermost, the smallest. The fourth consists of a cylindrical basal joint nearly as long as the third abdominal segment. It is provided with two lanceolate entire-margined rami, the outer of which is slightly the larger. The fifth is represented only by a short bud-like rudiment. The last closely resembles the fourth, but is somewhat shorter, and its rami are equal.

The *telson* is rudimentary.

A single specimen measuring about 7 mm. in length.

§ 2. RHABDOSOMA INVESTIGATORIS, n. sp, Pl. IV.

This species presents a close resemblance to *R. whitei* and *R. armatum*, forms which have recently been demonstrated to be male and female of one species by Claus,* by whom, as also by J. H. Streets,† they are well described. The two must accordingly now stand as *R. armatum* (Milne-Edwards).

After comparing the present species with the above descriptions, I am inclined to think that it is a distinct form, more especially as the animal was obtained, although at some distance from the land, from the shallow muddy water about the Palmyrus shoals. Still, the resemblances are so numerous that the shortest way of describing the new species will be to enumerate the differences from the above quoted descriptions of *R. armatum*.

Two specimens, one male and the other female, were obtained; the latter being that shown in the figure. It is probably an adult, as the brood-pouch, although empty, is well-marked and of considerable size.

The differences, described from the female as the more complete specimen, are as follows.—1. The head is shorter, not equalling (rostrum included) one half the total length of the body. 2. The mandibular

* Arbeit. aus d. zool. Inst. d. Univ. Wien. u. d. zool. Stat. Triest, 1879, II. 2.

† Proc. Acad. Sc. Phil., 1878, pp. 287—290.

palp is longer, exceeding in length considerably the first joint of the inferior antennæ. 3. Spence Bate (*Cat. Amphipodous Crust. Brit. Mus.* 1862) describes *R. whitei* as "having the coxa of first pair of gnathopoda produced to an obtuse point": this is wanting in our species. 4. All three of the authorities agree in describing considerable differences between the 1st and 2nd gnathopoda in size, length, and formation: in the present species these are subequal and very closely resemble each other. 5. Spence Bate describes the pereopoda (last 5 thoracic appendages) as gradually increasing in length posteriorly, the fourth pair longest, the fifth obsolete. In our form, the third is longer than the fourth, and the fifth, although either obsolete or destroyed in the male, is represented by a club-shaped basipodite in the female. 6. The same writer also gives the last three abdominal appendages as differing considerably in length, the last being the longest, while in our form they are subequal, the first being a trifle the longest.

Length of male 2.5 c. m., of female 4.9 c. m.

The male differs further in the inferior antennæ being much shorter, and the mandibular appendage correspondingly diminished.

I append a table of measurements from Claus of *R. armatum*; and a comparison of the corresponding measurements of the present species in an adjacent column is, I think, alone sufficient to establish the specific distinctness of the two forms. The measurements are in millimeters.

	<i>R. armatum.</i>						<i>R. investigatoris.</i>	
	♂	♂	♂	♂	♀	♀	♂	♀
Length of rostrum (broken)	15	18	20	36	24	28	4½	10
" " head	6¼	8	8	9	10	11	4¼	8
" " thorax	6¾	9	9	9	9½	11	4	7
" " 3 anterior abd. segs.	7½	9½	9½	10	10	12	5	7
" " 4th abd. seg.	3	4	3¾	2½	3	3½	2⅞	3½
" " 5th & 6th abd. segs.	3½	4½	4¼	3½	4	5	2	3½
" " telson	6	9	8	10	18	23½	3¾	6
" " 1st caudal style	6	8	7½	8	10	11	3¼	5¾
" " 2nd " "	4½	4½	5½	3	—	4	—	5½
" " 3rd " "	6	8	7½	9	—	18	—	5½

In the male specimen of our species the rostrum is very much broken, in the female it is nearly complete. The specimens are preserved in the Indian Museum.

§ 3. AMPHIPRONOË LONGICORNUTA, n. sp., Pl. V.

Three specimens of the small amphipodous crustacean to be described below were taken in the drift-net in the clear but shallow water of the Mergui Archipelago.

It probably has its proper habitat at the surface, as it swims easily,

though with no great speed. Its most salient peculiarity is the immense length of the rigid 5-jointed antennæ, which are much longer than in any form hitherto described, and are carried folded up and directed obliquely downwards and forwards in front of it.

The total length of the body is 6.5 mm., and the animal is opaque, of a pale pinkish brown tint, and plentifully sprinkled with deep madder-brown pigment spots, which are most numerous on the pleura and coxæ of the thorax, and on the entire surface of the 2nd and 3rd abdominal segments.

It is stoutly built, not markedly compressed.

The *head* is large, its length, depth, and breadth each equalling rather less than $\frac{1}{5}$ th the body length; its entire upper and lateral surfaces occupied by the large regularly faceted eyes, and its anterior inferior aspect deeply hollowed for the reception of the antennules and of the first joint of the antennæ.

The *thorax* forms the broadest and deepest part of the body, but its segments are short, so that its entire length is but $\frac{2}{5}$ th longer than the head. The coxal plates are united to the pleura, without any very obvious suture, and the first and the last two segments have their terga ankylosed.

The *antennæ* and *antennules* are formed on almost exactly the same plan as those of *Rhabdosoma*. On looking at the latter genus, one is inclined to be led to the conclusion that the curious antennæ have been evolved to enable the animal to reach out beyond the enormously prolonged rostrum and cephalon generally, which latter formation together with its generally slender form certainly suits the attainment of a high rate of speed. The present species, however, demonstrates the danger of such hasty deduction, as we have here the antennæ of even greater proportional length than in *Rhabdosoma*, while the head and body generally are short and stout and the entire plan of its structure is adapted for strength rather than speed.

The *antennules*, when at rest, are almost completely hidden within the depression of the antero-inferior face of the cephalon, the tip of the flagellum only being visible; they consist of a three-jointed peduncle of peculiar form (Fig. 2.) and a three-jointed flagellum (Figs. 2. & 3.). The basal joint is articulated to the recessed surface of the cephalon, close to the middle line, at a point about even with the middle of the eye. The first two joints are short and compressed and quadrate, directed obliquely downwards and forwards; the third joint is much larger, and is much compressed, so that, seen from below, it appears merely slightly clavate, viewed laterally, it is seen to be broad and of falciform outline, curving round, so that its distal

border comes to be directed upwards and forwards. Its convex border is thickly clothed with a multitude of very fine, soft, flexible hairs, regularly arranged in distinct, but closely placed, transverse rows. The body of the joint is filled up by a large ganglionic mass, which appears to send off branches to the bases of the hairs. The flagellum (Fig. 3.) is extremely small in proportion to the peduncle, and consists of three joints, subequal in length, compressed, and diminishing progressively in breadth, so that the last joint is cylindrical; the first joint is provided with a circlet of soft clavate or spindle-shaped flattened hairs not so long as, but considerably broader than, those of the distal joint of the peduncles. The second has a similar pair of hairs springing from a depression on its distal aspect, while the last joint, which presents two slight constrictions in its length, is free from hairs, with the exception of three stiff tapering auditory bristles at its extremity. The entire organ is less than a millimeter in length and is so articulated as to be capable of flexion and extension only, no lateral play being practicable.

The *antennæ* take their origin a little behind, but much external to, the antennules, so that their first joint is placed close to the wall of the recess, and, in their habitual posture, they are completely hidden from the outside. The first joint reaches quite to the front of the recess, so that, to the casual observer, the second appears to be the first joint of the appendage, and to take its origin considerably in front of the antennules. The 2nd, 3rd, and 4th joints are carried folded sharply upon one another and the 2nd and 3rd of them are each half as long as the animal exclusive of the last two abdominal segments; the fourth is slightly shorter and the fifth very short: the proportional length of the 5 joints being as 25 : 67 : 67 : 60 : 3; and the whole length of the organ being a little over 9 m.m., or about $1\frac{1}{2}$ times the length of the body. Each joint is thickly clothed with extremely fine short hairs, too small to be visible except under very high amplification. The musculature of their appendages is peculiar. In the first joint, a pair of powerful muscles, flexor and extensor, are located in its proximal two-thirds, and act by means of two distinct tendons on the second joint. In the remaining articulations, the muscles are confined to a small part of the distal extremities, which are dilated for their reception, the muscles in each case being in pairs so that no lateral motion is obtainable.

The *mouth-organs* appeared to be very rudimentary, but were not closely examined.

The 2nd and 3rd *thoracic appendages* (gnathopoda) are short and stout and can scarcely be made out in the usual position of the animal, being carried folded closely against the ventral surface of the body. They closely resemble each other, differing only in the more anterior

being stouter with its basipodite shorter than in the hinder; they are provided with a curious complex subchela (Fig. 7.). The dactylopodite forms a stout sharp claw and is articulated to the propodite by a movable joint acted on by powerful muscles. The propodite consists of a stout cylindrical curved body so bent that its posterior border is apposed to the prolonged inferior border of the carpopodite. This posterior border is armed with a strong flat plate provided with a toothed cutting edge. The carpopodite is stout, compressed, and quadrangular, and has its infero-posterior angle prolonged into a sharp process. The posterior half of this border is formed by a thin plate with a toothed edge, opposable to the smaller plate on the propodite. In extreme flexion, these two plates overlap each other, the carpopodital plate passing inside that of the propodite; all the remaining articulations are compressed, but broad and strong, the meropodites are short and triangular, the ischiopodites short and quadrangular. The basipodite of the 2nd gnathopoda is as long as all the other articulations together, while that of the first is but $\frac{2}{3}$ as long; in both, the articulations are curved forwards and extremely stout. A cord-like glandular body runs through the middle of each of these appendages ending in the base of the propodite. It is difficult to be certain as to the point of exit of its duct, but this was doubtfully made out as opening near the angle between the two limbs of the subchela. The muscles of these appendages are large and distinct, each joint being provided with a flexor and extensor; in the two distal articulations, the flexor is by far the more powerful, but in the next the two are nearly of equal strength, while, of the muscles contained in the basipodite, the extensor is the more powerful, and its tendon, passing through the ischiopodite, is inserted into the base of the meropodite, being reinforced by only a small slip taking origin from the former joint, while only a small accessory slip of the extensor contained in the basipodite is inserted into the ischiopodite. The 4th and 5th thoracic appendages are cylindrical and of the usual ambulatory type; they are subequal, slightly exceeding the thorax in length, but the fifth is slightly the stouter of the two. The 6th and 7th are like the two preceding appendages, save that their basipodites are strengthened by strong buttress-like developments of their anterior and posterior borders; the 7th but little exceeds the 5th in length; but the 6th is the longest of all the thoracic appendages, equaling the thorax and the first abdominal segment in length. The 8th thoracic appendage is peculiar, its basipodite is formed on the same plan as those of the sixth and seventh, but is shorter, and if anything broader, so that its outline approaches the circular, and its remaining joints are so short that together they do not equal the breadth of the basipodite.

The first three *abdominal appendages* are subequal and are of quite the usual amphipod type, but are rather short. The three remaining (Fig. 8) abdominal appendages differ greatly in length; the 1st has the protopodite as long as the basipodite of the longest thoracic appendage; its two rami are foliaceous, the inner slightly exceeding the outer ramus. The 5th is but half the size of the 4th, and the irregularity of its rami is more marked, while the last appendage is but half the length of the penultimate and has its inner ramus nearly twice as long as the outer.

The animal agrees well with all the characteristics of the genus as given in Spence Bate, though the 8th thoracic appendage would perhaps be better described as stunted than as rudimentary.

§ 4. *LESTRIGONUS BENGALENSIS*, n. sp., Pls. VI. & VII.

In looking over the literature referring to the genera *Lestrigonus* and *Hyperia*, it becomes increasingly apparent that Spence Bate's suspicion as to the doubtful value of the latter genus was well founded. One after another species of *Lestrigonus* have been paired off as males with *Hyperia* females, so that the latter genus must, in all probability, be entirely abandoned, as its retention could only be justified by the discovery of a form whose males retain permanently the character of the genus.

The present species is one of the commonest surface organisms of the Bay of Bengal, and is especially so in the more truly pelagic portion of its area.

I was on this account able to obtain a large number of specimens,—including (a) females of *Hyperia* form, but with rudimentary inferior antennæ; (b) immature males of *Hyperia*-form; and (c) 9 mature males of *Lestrigonus* form,—amongst which all stages between the two latter conditions were observable.

I notice that the pelagic *Lestrigoni* are very generally credited with being parasitic on medusæ, &c. In the present species, this is not the case. I have occasionally seen them ensconced in the cavity of a *Salpa*, but believe this to have been an accidental circumstance, as by far the larger number were captured swimming freely.

The specimen figured (Pl. VI.) was taken in the drift-net about 100 miles from land in the Bay of Bengal, the depth of the water in the locality being 850 fathoms. Seven specimens were obtained on this occasion and some hundreds have since been taken.

As all specimens of the *Lestrigonus*-form are of nearly equal size, and all the appendages are fully developed, it is probable that they are, in spite of their small size, adult animals. The greater part of the

surface of the body and appendages is liberally besprinkled with patches of black pigment, so that, seen in the water, they appeared of a dark reddish grey tint. The pigmentation is deepest on the pleura of the thoracic segments, on the basipodites of their appendages, and on the abdomen. The lower part of the cephalon, too, including the gnathites, is so deeply pigmented, that it is extremely difficult to make out the arrangement of the parts, as they are almost opaque to transmitted and nearly impossible to be illuminated by direct light. The entire length of the animal is 2.5 m.m.

The only two of the members of the genus enumerated in Spence Bate and elsewhere which approach it in size are *L. ferus* and *L. fuscus*, though both of these are considerably larger than any of my specimens. Moreover, in the present species, the seventh thoracic appendage (fourth pereopod) is considerably larger than the preceding and succeeding appendages, whereas in *L. ferus* all three are described as subequal, and in *L. fuscus* the third pereopod is stated to be longer than the fourth.

It differs also from the description and figures of these species in several other particulars. I would, therefore, propose to name it *L. bengalensis*.

In swimming, it progresses by a series of jerks, lying on its side and moving in small circles.

The *head* is the broadest portion of the animal, the two immense eyes projecting considerably beyond the very narrow thorax when seen from above. The eyes are of large size and distinctly faceted, the anterior faceted membrane being easily separable, and they cover the entire upper and lateral aspects of the head, the anterior aspect of which is deeply excavated for the reception of the antennæ.

The *thorax* is composed of seven distinct, but very short, segments; the junction between the pleura and the coxal plates being hard to make out, as also are the junctions of the terga of the first 5 thoracic segments. The segments increase in length slightly from before backwards, but not to any very marked extent; the entire thorax forming less than a third of the entire length of the animal.

The first three *abdominal segments* are of very large size, especially the first two, either of which is as long as any three of the thoracic segments. The fourth abdominal segment is much shorter and narrowed in front, so as to be freely movable under the much excavated posterior border of the third. The fifth and sixth abdominal segments are very small, and the latter is united without suture to the short, accurately semicircular telson.

The *antennules* are as long as the entire body of the animal *plus* the protopodite of the sixth abdominal appendage. Their peduncles

consist of three joints, of which the first is large and globular and filled with a number of muscular bands, that are evidently capable of moving its articulation with the second in all directions. It contains also a small antennular gland. The second is extremely short, and the third, which is pear-shaped, is provided, along its inferior border, with a number of closely set exceedingly fine hairs. The flagellum consists of between 20 and 30 long, narrow articulations, longest in the middle of the organ, the first being exceptionally short. Each joint carries two or three exceedingly fine hairs, and the last, a pair of blunt, cylindrical hairs of uniform thickness throughout.

The *antennæ* are shorter than the antennules, equalling in length only the head, thorax, and first two abdominal segments; and, like these, their peduncles are three-jointed, the third joint being considerably longer than the two first. The flagellum is also closely similar, but differs in the first joint being long and conical, and in the armature of the terminal joint, which is provided with a pair of bifid (or, possibly, four) tapering hairs.

The dissection of the *gnathites* was attended with considerable difficulty no less on account of their extreme minuteness than because of their dense pigmentation, so that I am even now by no means satisfied as to the exact relative position of the parts in this stage of the animal. The mandibles (Fig. 6.) are stout and provided with a long three-jointed naked palp. Their masticatory plate (shown separately in Fig. 7) is peculiarly well developed, being provided with several rows of regularly arranged conical teeth. The maxillæ are liberally toothed and the maxillipedes have one of their lobes terminated by a biramous jointed appendage.

The second of the *thoracic appendages* is short and stout and provided with a somewhat incomplete subchela. The third, longer and somewhat slighter, has the subchela very well developed, the opposable prolongation of their carpopodites being distinctly hollowed out for the reception of the cylindrical propodite. The remaining thoracic appendages are of the usual type, increasing regularly in size to the seventh, which is largest; the sixth and eighth being subequal. The eighth has its posterior border provided with a strong buttress-like plate. Some of the posterior thoracic appendages are provided with gill-sacs, but I was unable to satisfy myself as to their exact number and position in this stage of the animal, although they are probably identical with those of the *Hyperia*-stage.

The first three *abdominal appendages* are subequal, and on the usual amphipod plan. The remaining three have long protopodites and small equal rami, the first two being subequal, while the last is a quarter shorter than the preceding two pairs.

The form (the *Hyperia*-stage) figured on Pl. VI. was obtained on the same occasion as the *Lestrigonus bengalensis*. The specimens were about equally divided between the sexes; and I have little doubt that the males (Fig. 1.) are merely a young stage of this species, as they agree in all essential particulars save the smaller development of the flagella of the antennæ. Even here the difference lies only in the smaller length of the individual joints and not in their number. Seen apart from the more fully developed forms, they would certainly be assigned to the genus *Hyperia*, especially some specimens, smaller than that figured, in which the antennæ are even shorter. If this supposition be correct, distinctions between *Hyperia* and *Lestrigonus* can hardly, as already advanced, be of generic value. Whether or not all male *Hyperia* ultimately develop a long flagellum is of course doubtful, but there can be little doubt that all *Lestrigonus* pass through an *Hyperia*-stage. Speaking generally, the *Hyperia*-stage is shorter and stouter and more like the female (Fig. 3.) described below. In this specimen, I could clearly make out three gill-sacs attached to the 4th, 5th, and 6th thoracic segments. I was more fortunate, too, in the dissection of the gnathites in the younger than in the adult specimen; and a glance at the incomplete figures of those of the adult form as compared with those of the more completely figured *Hyperia*-stage confirms the opinion as to the identity of the two forms. With the exception of the antennæ, the appendages are practically identical in both, save that in the younger form they are proportionally a trifle shorter than in the adult.

The female, in general form, closely resembles the young male; she is, however, shorter, but more stoutly built, the very short thoracic segments being of remarkable depth. The principal external difference between the sexes lies in the antennæ, which, in the female, are remarkably ill developed. In the *antennules*, there is a three-jointed peduncle, practically identical with that of the male, but the flagellum is reduced to a rudimentary first joint. The *antennæ* are reduced to a rudiment of the basal joint of the peduncle. All the females collected carried in a well-developed brood-pouch a number (about 18 or 20) of largish (6.25 m.) ova, none of which had gone beyond the stage of segmentation. The length of the specimen figured is 1.75 m.m.

§ 5. EURYSTHEUS HIRSUTUS, n. sp., Pl. VIII.

The species described below was taken on the same occasion as *Lestrigonus bengalensis*. It is nearly transparent and, saving a few scattered patches of reddish brown pigment, colourless. Only a single specimen was obtained.

The animal is 4 m.m. long.

The *head* is $\frac{3}{20}$ ths of the total length, irregularly quadrate and smooth; it is produced anteriorly into a small blunt rostrum, and the small eye, which is pigmented red brown and consists of numerous ocelli, is placed opposite to the root of the antennules.

The *thorax* and *abdomen* are of equal length and of nearly the same depth and breadth throughout. In the thorax, the segments increase regularly in length from before backwards, while the first two of the abdomen are subequal to the hinder thoracic segments and the third is much longer than any other segment, the last three decreasing rapidly in length.

The *antennules* are rather more than half as long as the body; the peduncle forms the larger half of their length and consists of three stout joints, the distal two of which are fringed on their lower surface by a number of very long flexible hairs, the proximal joint is beset with extremely fine short hairs only, the secondary appendage is small and consists of four short joints well provided with short stiff hairs, and the flagellum consists of about eleven short articulations liberally fringed below with short fine hairs.

The *antennæ* are somewhat shorter, slightly less than half the body length; their peduncle consists of five joints, of which the first two are extremely short, the second being armed with a strong downwardly produced spine, the third joint is longer and stouter than either of those of the antennules and the fourth and fifth subequal in length and considerably longer; as in the antennules, the two distal joints are liberally fringed below with long flexible hairs; the flagellum is short, barely equalling the last joint of the peduncle in length; it consists of seven short joints all well provided with hairs, the last joint carrying, in addition, a pair of peculiar stout bifid hairs.

The *gnathites* could not be examined, with the exception of the maxillipedes, which are remarkably long and pediform.

All the *thoracic appendages* are remarkably hirsute, being covered, in addition to the large stout hairs, shewn in the figure, with a perfect coat of fine hairs visible only under considerable amplification. The second and third are very weakly subchelate, the propodites being merely dilated and not produced into an opposible member. The first is much smaller and slenderer than the second, but both are on the same general plan, the dactylopodites being barely serrated and the propodites armed only with one or two stout spines. The fourth and fifth are subequal, the fourth slightly the longer and stouter; they slightly exceed the second in length and are of the usual ambulatory type. The sixth, seventh, and eighth thoracic appendages agree in having their basipodites very large and strengthened by large anterior and posterior buttress-

like plates; they differ, however, considerably in length, the fifth being the shortest of all the thoracic appendages, while the sixth and seventh much exceed the anterior ones, the seventh being more than half as long as the body, and the eighth even longer.

The first three *abdominal appendages* are rather long and slender, but are quite of the usual type. The last three are short and cylindrical, having both their protopodites and rami armed with a number of short very stout spines; they decrease regularly in length from before backwards, the fourth being as long as the fifth and sixth together, and the sixth, very short. The *telson* is a short compressed lamina armed with a number of short tooth like spines similar to those on the posterior abdominal appendages.

EXPLANATION OF THE PLATES.

PLATE III.

Fig. 1. *Phronima bucephala*, n. sp., male. $\times 18$. Fig. 2. Last three abdominal segments of the same with their appendages. $\times 60$. Fig. 3. *Phronimella hippocephala*, n. sp. $\times 12.5$.

PLATE IV.

Fig. 1. *Rhabdosoma investigatoris*, n. sp., female, as seen by dark ground illumination. $\times 3.8$. Fig. 2. Thorax with appendages of the same. $\times 14$. Fig. 3. End of an antennule. $\times 200$.

PLATE V.

Fig. 1. *Amphipronoë longicornutus*, n. sp., male. $\times 17$. Fig. 2. Antennule. $\times 39$. Fig. 3. Flagellum of antennule. $\times 180$. Fig. 4. An antenna. $\times 7$. Fig. 5. First joint of an antenna. $\times 40$. Fig. 6. Head seen from below (diagrammatic). Fig. 7. 2nd thoracic appendage. $\times 110$. Fig. 8. Last three abdominal segments. $\times 25$.

PLATE VI.

Fig. 1. *Lestrigonus bengalensis*, n. sp., male. $\times 40$. Fig. 2. Last joint of antennule. $\times 400$. Fig. 3. Last joint of an antenna. $\times 400$. Fig. 4. Peduncle of antennule. $\times 100$. Fig. 5. Peduncle of antenna. $\times 100$. Fig. 6. Mandible and its appendage. $\times 200$. Fig. 7. Masticatory plate of mandible. $\times 200$. Fig. 8. The maxillæ. $\times 200$. Fig. 9. Portion of maxillipede. $\times 100$. Fig. 10. Last three segments of abdomen with their appendages, seen from above. $\times 60$.

PLATE VII.

Fig. 1. *Lestrigonus bengalensis*, n. sp., immature male. $\times 40$. Fig. 2. Last three segments, seen from below. $\times 40$. Fig. 3. *Lestrigonus bengalensis*, female. $\times 40$. Fig. 4. An ovum from her brood-pouch. $\times 40$. Fig. 5. Head of female, front view. $\times 40$. Fig. 6. Mandible and its appendages. $\times 200$. Fig. 7. 1st maxilla. $\times 200$. Fig. 8. 2nd maxilla. $\times 200$. Fig. 9. Maxillipede. $\times 200$.

PLATE VIII.

Eurystheus hirsutus, n. sp. $\times 40$.