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AN ACCOUNT
OF THE
CRUSTACEA
OF
NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY
G. O. SARS

VOL. III
CUMACEA

PART I & II
CUMIDÆ, LAMPROPIDÆ (part)

WITH 16 AUTOGRAPHIC PLATES



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INTRODUCTION.

The *Cumacea* form a sharply-defined and very peculiar group of Crustacea, the systematic position of which has been much debated among zoologists, most of the earlier authors referring them to the lower Decapods, whereas in recent time they have generally been placed close to the Isopoda. The fact is that they differ materially from both of these groups, and should thus more properly be considered as constituting a distinct order, occupying its place between the great divisions *Podophthalmia* and *Edriophthalmia*. It is true, indeed, as first shown by Dr. Dohrn, that the embryonal development of the Cumacea agrees very nearly with that of the Isopoda; but in all other respects these Crustacea exhibit, in my opinion, a much closer relationship to the Podophthalmia than to the Isopoda. Among the former, it is chiefly the *Schizopoda* with which the Cumacea have many features in common, though the external appearance is certainly very different; and even those anatomical characters which have been specially adduced as proofs of the near relationship of the Cumacea with the cheliferous Isopoda, viz., the presence of a reflexed palp on the anterior maxillæ, and the peculiar development of the epipodite on the 1st pair of maxillipeds, may be found quite as distinct in some of the Schizopoda, e. g. *Gnathophausia*. In my opinion, therefore, the recent arrangement of the Cumacea as a sub-order of the *Edriophthalmia* can scarcely be supported. On the other hand, I consider that the differences from the Schizopoda are still great enough to forbid of the Cumacea being included in the great division Podophthalmia.

Our knowledge of these singular Crustacea does not date from very long ago. The first form recorded is probably that described by Lepechin in the year 1780, as *Oniscus scorpioides*, which has turned out to be a species of the genus *Diastylis*. Another Cumacean form was observed in the year 1804 by Colonel Montagu, and designated by the very same specific name; but this author erroneously believed that the solitary specimen found was a defective

Decapod (*Astacus*) that had lost its head. In the year 1828, H. Milne-Edwards observed apparently the same form, and established for its reception the genus *Cuma*; and it is from this genus that the name of the whole order is derived. Another genus, however, viz. that of *Diastylis*, is, in fact, of a still earlier date, having been established by the American zoologist Say, in the year 1818. It is rather strange that the founder of the typical genus *Cuma*, H. Milne-Edwards, subsequently altogether abandoned this genus, believing the form upon which it was founded to be only a larval form of some higher Crustacean; and this erroneous assumption was entertained by many other authors, according to whom the Cumacea should be wholly discarded from the zoological system, as only representing immature animals. Certainly both Kröyer and Goodsir, in the year 1841, clearly showed the Cumacea to be perfect animals, and added several new species; but there was still for many years doubt among zoologists as to the true nature of these Crustacea. Thus Dana, in his great work on Crustacea, did not include the Cumacea at all in his carcinological system, urging in support of this action a statement given in 1852 by the celebrated Prof. L. Agassiz, who claimed to have witnessed the escape of true Cumacea from the ova of Hippolyte and other Carids. Meanwhile the investigation of these problematical Crustacea was continued by several distinguished zoologists, Kröyer, Sp. Bate, and Prof. Lilljeborg, and all of them agreed in absolutely denying the larval nature of the Cumacea, giving most convincing reasons for their opinion. Notwithstanding this, even in the year 1858, the Cumacea were declared by a high authority, Prof. H. Milne-Edwards, to be immature animals, and were placed in the same rank as *Phyllosoma*, *Erichtus*, *Zoëa* and other larval forms.

As will appear from the above short historical account, the general acknowledgement of the Cumacea as perfect animals worthy of being ranked in the carcinological system, is of comparatively recent date. The number of species at first detected was a very limited one, and they were generally all referred to a single genus, *Cuma*. Subsequently, a few additional genera were established, but some of these have turned out to be spurious, being founded only on the male sex. Sp. Bate comprised all the genera at that time established, within a single family, that of the *Diastylidæ*, which he believed to be nearly allied to the *Stomatopoda*. In recent times, by the investigation of several zoologists, the number of both species and genera has considerably increased, and it accordingly appeared very desirable to group together the several genera in a suitable manner, by a subdivision of the original family. The first attempt to effect such a classification was made in the year 1879 by the present author, who, in his account of the Mediterranean Cumacea, arranged the 18 genera at that time known, in 8 distinct

families, viz., *Cumida*, *Vaunthompsoniida*, *Lampropida*, *Leuconida*, *Diastylida*, *Pseudocumida*, *Cumellida* and *Campylaspida*. This classification, the only one as yet proposed, is followed in the present account, except that one new family, *Platyaspida*, has been established, to include the anomalous genus *Platyaspis*, formerly referred to the *Lampropida*.

General characters of the Cumacea.

The external appearance of the Cumacea is quite particular and unlike that of any other Crustacea. The slenderness and extreme flexibility of the posterior division or tail is especially very characteristic, and has given rise to the first specific names given, viz., *scorpioides* (with a tail like a scorpion). The anterior division is much broader, in some cases exceedingly tumid, and sharply marked off from the slender tail, whereas in other cases it gradually tapers behind. In all the known forms, this division is covered anteriorly by a well-defined carapace, behind which, never more than 5 segments of the mesosome are exposed. By this character, the Cumacea undoubtedly approach nearer to the Podophthalmia than to the Edriophthalmia, among which, only the cheliferous Isopoda exhibit any sign of the formation of a carapace by the fusion of the cephalon with the 1st pedigerous segment. The structure of the carapace is very peculiar, especially as regards its anterior part. In the greater number of forms, it projects in front to a more or less distinct rostriform prominence, covering the bases of the antennæ. On a closer inspection, however, this rostrum-like prominence is found to be very different from the so-called rostrum in other Crustacea. In all cases, it is found to be composed of 2 juxtaposed lappets, which are generally closely applied to each other along the dorsal line, without, however, in any case coalescing, a narrow fissure being always present between them. This fissure at the base of the prominence, divides into 2 diverging rami, encompassing a bell-shaped dorsal area of the carapace, the frontal lobe. Of course the lappets forming the pseudorostral prominence, originate at the points where the lateral fissures terminate, and more properly represent the antero-lateral corners of the carapace, which are developed in a very peculiar manner, to encompass its frontal part. Below them, the anterior edges of the carapace often project in the form of a triangular lobe; and from the sinus between these lobes and the pseudorostral prominence, the antennæ are seen to project. The lateral parts of the carapace form a narrow duplicature below, turning abruptly inwards and limiting the oral area, which is rather narrow. They do not loosely cover the sides of the body, as in the greater number of the Podophthalmia, but are firmly connected with it along their edges, only leaving a small slit on each side of the

3rd pair of maxillipeds, for the entrance of the water into the branchial cavities. On the carapace, 4 regions may be more or less distinctly distinguished, 2 successive median, and 2 lateral. Of these regions the lateral ones occupy by far the greater part of the carapace, and represent the *branchial regions*. They extend throughout the whole length and depth of the carapace, and draw closer together dorsally, so as to leave only a narrow space in the middle, by which the 2 median regions are connected. Of these the anterior may be termed the *gastric region*, as beneath it the stomachal part of the intestine is located. Anteriorly, this region is very sharply defined by the above-mentioned diverging fissures encompassing the frontal lobe; posteriorly, it gradually contracts, passing without any distinct limit, at about the middle of the carapace, into the posterior region. This region occupies the posterior part of the dorsal face of the carapace, and gradually widens somewhat behind. It may be termed the *cardiac region*, because at any rate the anterior part of the heart, with the great artery-stems, lies beneath its posterior part.

The exposed part of the trunk, as stated above, is generally composed of 5 segments, the 1st of which, however, is sometimes (Cuma) almost wholly concealed, in which case, only 4 such segments appear behind the carapace. Of the segments, the 2nd and 3rd are the largest, and are, as a rule, firmly connected, whereas the 2 posterior segments are generally separated by thin-skinned interspaces, allowing them comparative freedom of movement. The epimeral plates are easily observable in most of the forms, and in the adult males generally appear more extant than in the females. In the last segment they sometimes project posteriorly to spine-like processes.

The tail is narrow cylindric in form, very flexible, and always composed of 6 sharply defined segments, of which the penultimate is the longest. The epimeral plates are wanting in the female, whereas in the adult male they are more or less distinct in those segments which carry pleopoda. The last segment is slightly dilated distally, and carries at the tip 2 diverging biramous appendages, the uropoda, and in some cases a median piece between them, the telson.

The integuments, in the greater number of the forms, are rather hard and brittle, being strongly incrustated, and they exhibit a closely reticulated, or squamous structure. In some cases they project in spine-like processes (especially on the carapace), or are thickly covered with strong hairs; but in other cases, they appear perfectly smooth.

The eyes, when present, are, as a rule, united in a single organ, which occupies the end of the bell-shaped frontal lobe, appearing generally as a small nodule, just above the base of the pseudorostral prominence. Only in the genus

Nannastacus are the eyes separated by a distinct interspace. The structure of the eyes is rather simple, and they contain only a very limited number of visual elements, corresponding to an equal number of more or less refracting corneal lenses of the integument. In the adult male, they are generally more fully developed than in the females.

The superior antennæ are rather small, each consisting of a 3-articulate peduncle, and 2 diminutive flagella, the inner of which is sometimes quite obsolete. The outer flagellum is tipped with one or 2 slender sensory filaments, and in the adult male, an additional bundle of such filaments is generally attached to the base of this flagellum.

The inferior antennæ are in the female, as a rule, very small and rudimentary, whereas in the adult male they are greatly developed, generally attaining the length of the whole body. In structure, they resemble those in the male *Phyllocarida* and *Amphipoda*, each consisting of an angularly bent peduncle, the outer part of which is densely clothed with sensory filaments, and, together with the slender, multiarticulate flagellum, extends straight backwards. They are generally borne closely applied to the sides of the body, and thus easily escape observation; but they admit of being moved from this position, and are probably subservient to copulation. This could be directly proved in the species of the genus *Lamprops*, where they are used as true prehensile organs, to obtain a hold of the female during copulation.

The oral aperture is bounded in front by a generally small and simple, rounded anterior lip (which is more strongly developed only in the genus *Campylaspis*), and behind by a lamellar, bilobed posterior lip.

The mandibles are strongly incrustated, and are in no case provided with palps. They are articulated to the inner side of the carapace just at the points where the diverging fissures encompassing the frontal lobe, terminate, and they are extended obliquely in front. The masticatory part is divided into 2 diverging rami, the anterior representing the cutting part, the posterior the molar expansion. The latter, in the greater number of forms, is rather thick, cylindrical, and exhibits at the end a finely fluted triturating surface. The former has generally a dense series of curved spines immediately behind the cutting edge.

The anterior maxillæ exhibit the 2 usual incurved lobes, the masticatory and basal, the former being much the stronger, and armed at the obliquely truncated tip with short spines. The palp is peculiarly modified, and turned straight backwards, terminating in one or 2 band-like bristles, which project into the branchial cavity. It is wanting in 2 of the known genera, viz., *Paralamprops* and *Platyaspis*.

The posterior maxillæ are rather small and simple in structure, somewhat resembling those in the Isopoda. As in the latter, they carry at the end outside, 2 small movable lamellæ, which partly overlap each other, and are clothed with incurved spines. These lamellæ, which have often been described as the palp, may more properly represent the modified masticatory lobe, as suggested by Dr. Boas. In the genus *Campylaspis*, however, these lamellæ are wholly wanting.

Behind these true oral parts there are 3 pairs of limbs, which, judging both from arrangement and function, appear to be subservient to mastication, and which accordingly ought to be termed maxillipeds. In this respect the Cumacea differ very materially from the Edriophthalmia, in which never more than one pair of maxillipeds are found. In the higher Crustacea (Decapoda), on the other hand, the number of maxillipeds is normally the same as in the Cumacea.

The 1st pair of these maxillipeds is rather short and stout, exhibiting inside the end of the basal joint a short conical lobe, clothed with peculiarly modified spines and bristles. To the base of these limbs the remarkable branchial apparatus is movably appended, so as to admit of being swung freely within the roomy branchial cavities. As shown elsewhere by the present author, this apparatus is composed of the modified epipodite and exopodite, the former occupying the greater part of the apparatus, and carrying inside it the true gill-elements in the form of densely crowded lamellæ, or more scattered digitiform sacs. The exopodal portions of the apparatus extend straight forwards, and together form a funnel-shaped tube, through which the water introduced into the branchial cavities is at certain intervals expelled by the oscillatory movements of the epipodal portions. They are to some extent connected with the latter at the base, and their extremities are closely applied to each other, admitting of being exerted from the tip of the pseudorostral projection. In some cases, they terminate in 2 incrustated lamellæ, which work as a valve by alternately opening and closing the anterior aperture leading to the branchial cavities. In other cases, they form together a long delicate tube, which admits of being protruded and again withdrawn, and which is opened and closed at the tip by its own elasticity. The explanation here given has been contested by some recent authors; but after renewed careful examination, I must still insist on its correctness. Anything analogous to this singular apparatus is only found in the Schizopoda (Lophogastridæ and Mysidæ) and in [the cheliferous Isopoda; but in these it is only the epipodite which is peculiarly modified for branchial purposes, and in no case does this part carry true gill-elements, as in the Cumacea,

The 2nd pair of maxillipeds is much more slender than the 1st pair, and also more simple in structure. At their base, 2 small rounded lamellæ are appended, which, in the ovigerous females, are fringed with long setæ forming together a broad fan, which projects within the incubatory cavity. It is somewhat doubtful whether these lamellæ should be regarded as the epipodites or as a pair of modified incubatory plates.

The 3rd pair of maxillipeds are considerably larger than any of the preceding pairs, and, as a rule, more or less completely cover all the other oral parts below. The basal joint is very large and curved, being sometimes produced at the end outside to a linguiform setiferous lobe. In all the known forms, these limbs are provided at the base with well developed natatory exopodites; and this is also the case with the next succeeding pair of limbs (the 1st pair of legs). In the greater number of forms, also the 2nd pair of legs, sometimes, too, the 3rd pair, carry similar appendages; and in the adult males the entire number of legs, with exception of the last pair, are, as a rule, provided with well-developed natatory exopodites, only the family *Cumidae* forming an exception in this respect. The presence of these appendages is another character by which the Cumacea differ very materially from the Edriophthalmia, and in which they evidently approach much nearer to the lower Podophthalmia (Schizopoda).

As regards structure, the legs (the number of which, accordingly, as in the higher Crustacea, is only 5 pairs) are rather simple, none of them being cheliform or even subcheliform. The 1st pair is generally the largest, and somewhat resembles in structure the 3rd pair of maxillipeds; but they are much more slender. They extend forwards below the carapace, with their outer, doubly geniculated part generally projecting far beyond its extremity. These legs seem to act chiefly as a sort of imperfectly developed preying organs, and for conveying food to the mouth. The 4 remaining pairs of legs are the true pereopoda, or more properly, fossorial legs. Of these the anterior pair differs slightly from the other 3, being somewhat intermediate in structure between them and the 1st pair. In all the legs, as also in the maxillipeds, the normal number of 7 joints may generally be found. Only in the 2nd pair does a fusion of 2 of the joints (the basal and ischial) sometimes take place, whereby this pair, in such cases, appears to be only 6-articulate. Of the joints, the coxal one is so firmly connected with the body, that, on dissection, it is generally separated from its connection with the other part of the leg. It is, however, always present, though often of very inconsiderable size. The basal joint, on the other hand, is by far the largest of all the joints, and in those legs which are provided with natatory exopodites, is considerably dilated

to receive the strong muscles moving these appendages. For this reason the legs in the adult males often appear very unlike those in the females.

The pleopoda are always wanting in the female, and sometimes in the male also; but more generally the adult male possesses them either on all the caudal segments except the last, or at least on some of the anterior segments. These limbs are rather small, with the rami very short, and never composed of more than 2 joints, and carrying at the tip long ciliated setæ. In some cases the rami are coalesced or quite rudimentary.

The uropoda generally have the basal part very slender and elongated, often much longer than the rami. The latter are narrow, styliiform, and the inner one often densely spinulose inside.

The telson is only fully developed in 3 of the 8 families, viz., the *Lampropidæ*, *Platyaspidæ* and *Diastylidæ*. In the *Pseudocumidæ* it is certainly present, but only as a rudiment.

The sexual dimorphism of the Cumacea is very pronounced, the adult males looking, as a rule, very different from the females, both as regards their outward appearance and the structure of the several appendages, whereas the young, not yet sexually developed males on the whole closely resemble the females. This circumstance has caused much confusion, and has given rise to the establishment of several spurious genera, even in quite recent times.

Of the inner organisation and development of the Cumacea, a detailed account will be given at the close of this work. I will here only remark that the structure of the various internal organs, which is said to resemble closely that in the Isopoda, agrees fully as well with that found in the lower Schizopoda (*Mysidæ*). The embryonal development also exhibits many points of agreement with that in the *Mysidæ* and *Lophogastridæ*, though the resemblance with that of the Isopoda is perhaps still more obvious. The embryos undergo their metamorphosis within a roomy marsupial pouch formed by 4 pairs of thin plates issuing from the bases of the 3rd pair of maxillipeds and the 3 anterior pairs of legs. On escaping from the marsupium, the young, like those of the Isopoda, still want the last pair of legs.

In occurrence, the Cumacea are exclusively marine, and, on the whole, true bottom-forms, though the more agile adult males of some species may be found at times swarming near the surface, especially at night. Some of the forms are littoral or sub-littoral in their occurrence; but by far the greater number of species are pronounced deep-water forms, descending to the greatest depths explored. Cumacea are found in every part of the ocean, and as far north as deep-water exploration has been instituted, these peculiar Crustacea have been met

with rather plentifully. Indeed, in the Arctic Ocean they seem to reach their maximum of development, the huge *Diastylis Goodsiri* being more than an inch in length. The occurrence of Cumacea in the Caspian Sea, as stated by the present author, is of considerable interest. The fauna of this large basin also exhibits in other respects a pronounced marine character, and undoubtedly has originally been derived from the Ocean, when long ago an open communication existed.

Of the 9 families into which the Cumacea are divided, all, except one, the *Vaunthompsoniidae*, are represented in the fauna of Norway, and will be treated of below.

Fam. 1. Cumidæ.

Characters.—Body in some cases rather short, in others very slender, with no sharp demarcation between the anterior and posterior divisions. Carapace comparatively large, with a distinct notch on each side below the pseudo-rostral projection; the latter more or less distinct, in some cases wanting. 1st pedigerous segment more or less concealed. Eye distinct or wanting. Superior antennæ with the flagella very short, the inner one, as a rule, rudimentary. Inferior antennæ in female very small, scale-like, biarticulate; in male well developed, with the flagellum filiform and composed of numerous, short articulations. Oral parts normal. Branchial apparatus well developed, with the gill-elements leaf-like and densely crowded together in a straight series. 3rd pair of maxillipeds generally very large, with the joints more or less expanded. The 4 posterior pairs of legs in both sexes simple, without natatory exopodites. Pleopoda in male present on all the caudal segments except the last. Uropoda with the outer ramus biarticulate, the inner uniarticulate or biarticulate. Telson wanting.

Remarks.—This family is prominently distinguished by the absence in both sexes of natatory exopodites on the 4 posterior pairs of legs. The male, on the other hand, is provided with 5 well-developed pleopoda, a number which is only found in one of the other families, viz., the *Vaunthompsoniidae*. The family as yet comprises 6 genera, viz., *Cuma*, *Iphinoë*, *Cyclaspis*, *Cyclaspoides*, *Cumopsis* and *Stephanomma*. Of these the first 3 are represented in the fauna of Norway, and will be characterised below.

Gen. 1. *Cumâ*, M.-Edw., 1828.Syn: *Bodotria*, Goodsir (male).

Generic Characters.—Body of female less slender than in male. Integuments strongly incrustated, squamous. Carapace not at all vaulted above, slightly carinated along the middle, sides sculptured with one or 2 carinæ, pseudo-rostral projection short, but distinct. 1st pedigerous segment inconspicuous, being almost wholly concealed; 2nd segment very large. Eye distinct, much larger in male than in female. Superior antennæ with the outer flagellum biarticulate and carrying 2 sensory filaments, inner flagellum quite rudimentary, knob-like. Inferior antennæ in female with 3 plumose setæ of the basal joint; those in male equalling the body in length. Posterior lip with the lateral lobes narrowly rounded at the tip and finely ciliated. Palp of anterior maxillæ very slender, with 2 unequal apical setæ. 3rd pair of maxillipeds with the basal joint expanded at the end outside to a large linguiform lobe. 1st pair of legs not much prolonged; 2nd pair with the basal and ischial joints coalesced; the 3 posterior pairs rather small, and but sparingly setiferous. Uropoda with the rami much shorter than the basal part, the inner one uniarticulate or biarticulate.

Remarks.—This genus may be regarded as the type of the family Cumidæ and indeed of the whole order, as from it the name generally used has been derived. It is easily recognised from the other genera comprised in this family, by the greatly incrustated, squamous integuments, the form and sculpture of the carapace, and the almost wholly concealed 1st pedigerous segment. We know as yet of only 4 species, 2 of which belong to the fauna of Norway, and will be described below.

1. *Cuma scorpioides*, (Mont.).

(Pl. I, II, III.)

Cancer (Astacus) scorpioides, Montagu, Transactions of the Linnean Society, Vol. IX, p. 70, Pl. VI, fig. 5.Syn: *Cuma Audouini*, M.-Edw." *Bodotria arenosa*, Goodsir (male)." *Cuma pusilla*, G. O. Sars.

Specific Characters.—Body of female moderately slender, with the anterior division oblong oval in form, and, like the tail, slightly keeled along the back. Carapace about the length of the exposed part of the trunk, and exhibiting on each side, somewhat above the middle, a very conspicuous, horizontal carina extending from the lower side of the pseudo-rostral projection to the hind edge;

upper margin straight, lower strongly arcuate, pseudo-rostral projection short but distinct. 1st pedigerous segment only visible in its epimeral parts; 2nd segment rather large, but scarcely elevated above the level of the carapace, and exhibiting on each side a well marked carina meeting that of the carapace; the last 2 segments much smaller than the preceding ones, and rather widely separated. Eye in both sexes with 8 distinct corneal lenses. 1st pair of legs scarcely longer than the carapace, basal joint rather broad in its proximal part, and much longer than the succeeding joints combined; 2nd pair moderately curved, with 3 apical spines on the terminal joint. Uropoda exceeding in length the last 2 segments combined, rami scarcely half the length of the basal part, the inner one uniarticulate, with the inner edge serrate and carrying 3 ciliated spinules, tip narrowly truncate and armed with 2 unequal spinules. Adult male much more slender than female, with the carapace comparatively larger, and the pedigerous segments less tumid; caudal segments with distinct epimeral plates; uropoda clothed inside the basal part with ciliated setæ. Colour yellowish brown, with a whitish transversal band across the carapace in front of the middle. Length of female reaching to 7 mm., that of male about the same.

Remarks.—This is probably the form at first recorded by Montagu as *Cancer scorpioides*, though his description and figure would equally well apply to the succeeding, very nearly allied species. The form subsequently described by Milne-Edwards as *Cuma Andouini* seems to be identical with Montagu's species, and *Bodotria arenosa* of Goodsir is unquestionably the male. The form at first recorded by the present author as *Cuma pusilla*, I now consider to be only a young specimen of this species. It is quite distinct from the 3 other known species, from the fact that the inner ramus of the uropoda is uniarticulate, instead of biarticulate.

Occurrence.—I have met with this form in several places, both on the south and west coasts of Norway, up to Appelvær in Namdal. It generally occurs at a few fathoms' depth on a sandy bottom, in which it is able to bury itself with great dexterity, so as wholly to escape attention. As usual, the adult males (*Bodotria*) are much more agile than the females, swimming about with great rapidity, especially with the aid of the well-developed pleopoda. In spite of the indurated integuments, the flexibility of the body in both sexes is very great, the tail admitting of being twisted in various directions.

Distribution.—British Isles (Montagu), coast of France (M.-Edwards), Kattegat (Meinert).

2. *Cuma Edwardsii*, Goodsir.

(Pl. III).

Cuma Edwardsii, Goodsir, Edinburgh New Phil. Journal 1843, Vol. XXXIV, Pl. 2, p. 123, figs. 1--13.Syn: *Cuma Audouini*, Bell.

Specific Characters.—Body of female very like that of the type species, but somewhat shorter and thicker, with the 2nd pedigerous segment more sharply carinated dorsally, and somewhat elevated above the level of the carapace. Uropoda scarcely longer than the last 2 caudal segments combined, rami slightly exceeding half the length of the basal part, the inner one distinctly biarticulate, distal joint rather short, coarsely serrate inside and carrying 2 rather strong apical spines, proximal joint with 4 spinules inside. Adult male much more slender than female, and very like that of *C. scorpoides*, though, like the female, having the inner ramus of the uropoda distinctly biarticulate. Colour light yellow, with scattered patches of a darker brownish hue. Length of adult female scarcely exceeding 5 mm., that of male reaching to 6 mm.

Remarks.—Of this species established by Goodsir, a detailed description with figures has been given by the present author in his account of the Mediterranean Cumacea. It is very nearly allied to the type species, with which it may easily be confounded. On a closer comparison, however, some well marked specific differences may be found to exist. Of these, the different structure of the uropoda is especially very obvious.

Occurrence.—This species seems to be very rare off the Norwegian coast. I have only found a few specimens, some in Rækefjord, south coast of Norway, some at Skudesnæs, north of Stavanger. They occurred in similar localities to those in which the type species is found.

Distribution.—British Isles (Goodsir), coast of France (Bonnier), Mediterranean at Syracuse, Naples and Spezia (the present author).

Gen. 2. *Iphinoë*, Sp. Bate, 1856.Syn: *Halia*, Sp. Bate." *Venilia*, Sp. Bate (male)." *Cyrianassa*, Sp. Bate (male)." *Iphithoë*, Norman.

Generic Characters.—Body slender, subcompressed, carinated dorsally. Integuments rather thin. Carapace in female generally cristated dorsally, but

without lateral keels; antero-lateral corners in female acutely produced, in male obtuse; pseudo-rostral projection rather prominent. 1st pedigerous segment distinctly exposed dorsally. Eye distinct in both sexes, but much more fully developed in male. Superior antennæ of exactly same structure in the 2 sexes, peduncle rather slender, flagella extremely small, the outer one tipped with a single large, annulated sensory filament. Inferior antennæ in female with 4 plumose setæ on the proximal joint; those in male about as in *Cuma*. Posterior lip with the lateral lobes coarsely dentate at the anterior corners. 3rd pair of maxillipeds, as in *Cuma*, having the basal joint produced at the end outside to a rather prominent linguiform lobe; meral joint likewise forming outside a broad lamellar expansion, fringed with strong plumose setæ. 1st pair of legs rather slender and nearly naked; the remaining pairs comparatively short, and more densely setiferous than in *Cuma*; 2nd pair with the basal and ischial joints coalesced. Uropoda rather strongly built, with the basal part spinulose inside, inner ramus distinctly biarticulate, proximal joint short and thick, distal one slender linear, both densely spinulose inside.

Remarks.—This genus was established by Sp. Bate, to include the *Cuma trispinosa* of Goodsir. The generic name first proposed, *Halia*, being already appropriated, it was subsequently changed by the same author to *Iphinoë* (sometimes erroneously spelt *Iphithoë*). Two other generic names proposed by that author, viz., *Venilia* and *Cyrianassa*, ought to be wholly withdrawn, being only founded on the adult male of this species. The genus, though evidently belonging to the same family as *Cuma*, is quite distinct from the latter by the very slender form of the body, the thin integuments, and the clearly exposed 1st pedigerous segment. Moreover the structure of the antennæ is rather peculiar, and some of the other appendages also exhibit well marked differences. Of this genus, the present author has described 3 species from the Mediterranean, and Dr. Hansen has recently added 3 other species from the German Plankton-Expedition, making, together with the type species, 7 in all. To the fauna of Norway belongs only the type species, to be described below.

3. *Iphinoë trispinosa*, (Goodsir).

(Pl. V & VI.)

Cuma trispinosa, Goodsir, Edinburgh New Phil. Journal 1843, Vol. XXXIV, p. 126, Pl. III, figs. 1—7.Syn: *Halia trispinosa*, Sp. Bate." *Venilia gracilis*, Sp. Bate (male)." *Cyrianassa gracilis*, Sp. Bate (male)." *Iphithoë trispinosa*, Norman." *Iphinoë gracilis*, Meinert.

Specific Characters.—Body in both sexes extremely slender and elongated. Carapace in female scarcely longer than the exposed part of the trunk, its upper edge somewhat elevated in the middle, and at this place armed with 3 or 4 closely-set denticles; pseudo-rostral projection rather prominent, horizontal and acutely produced at the tip, antero-lateral corners triangular. Carapace of male quite smooth above and having the antero-lateral corners blunted. 1st pedigerous segment partly covered at the sides by the succeeding segment, its dorsal part, however, quite conspicuous. Tail, not including the uropoda, longer than the anterior division. Eye in male much more fully developed than in female, with the corneal lenses exceedingly prominent. Superior antennæ with the last joint of the peduncle almost twice as long as the preceding one, outer flagellum very short, uniarticulate, inner much smaller, but distinctly biarticulate. Inferior antennæ of male equalling the body in length. 3rd pair of maxillipeds with the basal joint about twice the length of the succeeding joints combined, outer expansion of meral joint with about 10 plumose setæ. 1st pair of legs scarcely longer than the carapace, basal joint about the length of the succeeding joints combined; 2nd pair of legs shorter than the 3rd, its last joint about the length of the 2 preceding joints combined; this pair, as also the 3 posterior ones, rather abundantly supplied with bristles. Uropoda with the basal part in female armed with about 10 spinules, in male with numerous short ciliated bristles; inner ramus a little shorter than the outer, its proximal joint scarcely half the length of the distal one, and armed inside with 5 spines, the outermost of which is rather strong. Body straw-coloured, without any distinct pigmentary ornament. Length of adult female reaching to 10 mm., that of male somewhat less.

Remarks.—The female of this species was first described by Goodsir as *Cuma trispinosa*, and subsequently included by Sp. Bate in his genus *Halia*, afterwards changed to *Iphinoë*. Sp. Bate also observed the adult male, but did not recognise it as such, describing it as the type of a new genus under the name of *Venilia* (*Cyrianassa*) *gracilis*. A very closely-allied species was established by Norman as *I. serrata*. Of this form, a detailed description with

figures has been given by the present author in his account of the Mediterranean Cumacea, but it was at that time regarded as only a variety of the type species. Now, however, I am inclined to regard this form as specifically distinct from Goodsir's species, as it slightly differs, not only in the armature of the carapace, but also in some other structural details.

Occurrence.—Of this form, a single adult male was found by the present author in the year 1875 at Flekkerø, near Christiansand. This specimen, which is figured in Pl. V, is the only proof of the occurrence of the present form off the Norwegian coast. The figures of the female here given are from British specimens kindly sent to me by the late David Robertson.

Distribution.—British Isles (Goodsir), coast of France (Bonnier), Kattegat (Meinert).

Gen. 3. **Cyclaspis**, G. O. Sars, 1864.

Generic Characters.—Body slender and elongated, with the anterior division rather tumid in front, but abruptly tapered behind. Integuments hard, calcareous. Carapace very large and deep, being strongly vaulted dorsally, pseudo-rostral projection small or obsolete. 1st pedigerous segment wholly concealed both dorsally and laterally. Tail exceeding in length the anterior division, last segment rather elongated and obtusely produced behind. Eye present or wanting. Superior antennæ with the flagella very small, the outer one biarticulate and tipped with 2 very slender sensory filaments, the inner rudimentary, knob-like. Inferior antennæ in female with only 2 plumose setæ of the proximal joint; those in male shorter than the body. Posterior lip with the lateral lobes incurved at the tip, and armed with lamellar teeth. 3rd pair of maxillipeds with the basal joint very large, and produced at the end outside to a broad setiferous lobe. 1st pair of legs slender, but having the proximal part of the basal joint lamellarly expanded. The remaining pairs very small and but sparingly setous; 2nd pair with the full number of joints. Uropoda comparatively short, with both rami lanceolate, the outer biarticulate, the inner uniarticulate.

Remarks.—This genus was established by the present author in the year 1864, to include a peculiar deep-water Cumacean found off the Norwegian coast. 3 other species, undoubtedly belonging to the same genus, were added by him

from the Challenger Expedition, and recently Mr. G. Thomson has made known a New Zealand species, *C. lævis*. On the other hand, the anomalous form described by the present author from the Mediterranean as *Cyclaspis cornigera* is scarcely congeneric, and, indeed, this form has recently been included by the French zoologist Jules Bonnier, in a new genus, *Cyclaspoides*. The species belonging to the present genus are easily recognized by the peculiar form of the carapace, the long and slender tail, and the structure of the uropoda. Only a single Norwegian species is as yet known.

4. *Cyclaspis longicaudata*, G. O. Sars.

(Pl. VII & VIII.)

Cyclaspis longicaudata, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea og dens nordiske Arter. Chr. Vid. Selsk. Forh. 1864, p. 82.

Specific Characters.—Carapace of female very large and tumid, almost globose in form, and perfectly smooth, with the upper margin boldly vaulted, pseudo-rostral projection distinct, though rather short, sub-rostral incisions well marked; that in adult male much less deep and more evenly vaulted above, pseudo-rostral projection less prominent, antero-lateral corners blunted. 1st pedigerous segment not visible at all; 2nd segment well developed; the 3 succeeding ones narrowing abruptly. Tail exceedingly slender and elongate, much longer than the anterior division, all the segments contracted in their anterior part; last segment nearly as long as the preceding one, gradually widening distally, and considerably produced behind. Eye wholly absent. Superior antennæ with the sensory filaments of the outer flagellum extremely elongate; those in male with an additional bundle of such filaments at the base of the flagellum. Palp of anterior maxillæ with a single apical seta. 2nd pair of maxillipeds with the basal joint unusually large, lamellar, and coarsely denticulated in the distal part of the outer edge. 3rd pair of maxillipeds with the basal joint strongly developed, being more than twice as long as the succeeding joints combined, and angularly bent in the middle; terminal expansion very large, reaching beyond the meral joint. 1st pair of legs exceeding the carapace in length, basal joint large and lamellarly expanded in the middle, terminal part very slender, with the propodal joint the longest; 2nd pair longer than the succeeding pairs, and terminating in 4 diverging spines. Uropoda in female scarcely longer than the last segment, basal part very short and perfectly smooth, rami twice the length of the former and sub-equal, both terminating in a sharp point, the inner one without spines or setæ; those in adult male considerably more slender, basal part much longer

than in female, and carrying inside 7 ciliated bristles, inner ramus armed inside with a dense row of small, ciliated spinules. Colour pure white. Length of female reaching to 8 mm., of male 7 mm.

Remarks.—This is an easily recognizable form, highly remarkable for the exceedingly tumid, almost globose carapace, and the slender and elongated tail. From the other known species it is at once distinguished by the perfectly smooth and boldly vaulted carapace, the distinctly projecting pseudorostral prominence, and the total absence of eye. Moreover, in the structure of the several appendages several well-marked differences are to be found.

Occurrence.—I first detected this interesting form off the Lofoten Islands, and have subsequently met with it occasionally in several other places on the Norwegian coast, for instance in the Trondhjem and Hardanger Fjords, at Aalesund and Christiansund. It is a true deep-water form, being only found in depths of more than 100 fathoms. Of the adult male, only a solitary specimen, that here figured, has come under my notice. Young males are, however, almost as frequent as females.

Distribution.—Off the Spanish coast (Porcupine Exp.) and in the North Atlantic (Valorous Exp.), in both places, according to the Rev. A. M. Norman, in very considerable depths, down to 1450 fathoms; Gulf of Gascogne (Bonnier) in 960 metres.

Fam. 2. Lampropidæ.

Characters.—Body more or less slender, somewhat resembling in form that of the *Cumidæ*. Integuments, as a rule, thin, distinctly squamous. Carapace, as a rule, rather small, with no sinus below the pseudorostral projection; the latter generally very small. 1st pedigerous segment well defined. Last caudal segment truncated behind, and carrying a well-developed telson. Eye present or wanting. Superior antennæ with both flagella distinctly developed and not very unequal in length. Inferior antennæ in female less rudimentary than usual, being nearly as large as the superior, and divided into 4 or 5 successive joints. Oral parts on the whole normal. Palp of anterior maxillæ short, bisetose, in some cases wholly wanting. Branchial apparatus

less fully developed than in the *Cumidæ*, branchial elements scattered, digitiform. 3rd pair of maxillipeds with the outer corner of the basal joint not produced. 1st pair of legs generally very slender; 2nd pair likewise slender, with the full number of joints, and in both sexes provided with well developed natatory exopodites; 3rd and 4th pairs in female with a small biarticulate appendage near the base (rudimentary exopodite). All the legs in male, except the last, provided with natatory exopodites. Pleopoda in male generally present on the 3 anterior caudal segments, more rarely wholly wanting as in the female. Uropoda very slender, with the inner ramus always longer than the outer, and distinctly 3-articulate. Telson with more than 2 apical spines.

Remarks.—The forms belonging to this family are at once distinguished from the *Cumidæ*—to which they bear considerable resemblance in the general form of the body—by the presence of a well-developed telson, a character only found in 2 of the other families, viz., the *Platyaspidae* and the *Diastylidae*. Moreover the structure of the antennæ and uropoda is essentially different, and in no case are there more than 3 pairs of pleopoda in the male. On the other hand, unlike what is the case in the *Cumidæ*, in this sex all the legs, except the last pair, are provided with well-developed natatory exopodites. The family comprises, as yet, 3 genera, viz., *Lamprops*, *Hemilamprops* and *Paralamprops*. Of these genera, the first 2 are represented in the fauna of Norway, and will be treated of below.

Gen. 1. **Lamprops**, G. O. Sars, 1862.

Generic Characters.—Body less slender than in the other genera, with the anterior and posterior divisions more sharply marked off from each other. Carapace of moderate size, upper margin straight, pseudorostral projection more or less prominent, antero-lateral corners obtuse. 2nd and 3rd pedigerous segments rather large, with broad epimeral plates. Tail, exclusive of the caudal appendages, scarcely longer than the anterior division. Eye well developed, with distinct corneal lenses. Superior antennæ with the flagella not much elongated, the outer one in female 3-articulate, the inner biarticulate. Inferior antennæ in male much shorter than the body, and in some cases pronouncedly prehensile. 1st pair of legs of moderate length; 2nd pair not much smaller. Pleopoda in

male altogether wanting. Uropoda with the basal part and inner ramus spinulose inside. Telson sublaminal, tapering distally, tip obtusely truncate and spiniferous.

Remarks.—This genus was established by the present author as early as in the year 1862, and may accordingly be regarded as the type of the present family, though the characters of the adult male have turned out to be rather anomalous. It contains, as yet, only 2 species, to be described below.

1. *Lamprops fasciata*, G. O. Sars.

(Pl. IX & X.)

Lamprops fasciata, G. O. Sars, Zoolog. Reise i Sommeren 1862, p. 44.

Specific Character.—Body moderately slender, with the anterior division oblong oval in form. Carapace much shorter than the exposed part of trunk, blunt in front, and exhibiting on each side 3 obliquely curved folds crossing the branchial regions; pseudorostral projection very short and obtuse, scarcely projecting beyond the blunt antero-lateral corners. Tail, inclusive of the telson, nearly as long as the anterior division. Eye rather conspicuous, with dark red pigment. Inferior antennæ of male about half the length of the body, and less distinctly prehensile than in the next species. 1st pair of legs with the basal joint about the length of the succeeding joints combined, and but slightly curved; 2nd pair with the last joint scarcely as long as the preceding one, both together equalling in length the antepenultimate one; the 3 posterior pairs densely setiferous. Uropoda somewhat exceeding in length the last 2 segments combined, inner ramus but little longer than the outer. Telson nearly twice as long as the last segment, and rather broad at the base, but rapidly tapering distally, being provided with a single pair of slender lateral spines, apical spines 5 in number, the middle one and the 2 outermost much larger than the remaining 2, and strongly divergent. Body ornamented with a very conspicuous dark brownish violet pigment, forming more or less distinct transversal bands across the segments, and in the carapace occupying the greater part of the branchial regions behind the anterior fold. Length of adult female reaching to 9 mm., that of male considerably less.

Remarks.—This form is easily recognizable by its very conspicuous colouring, which is retained for a long time even in preserved specimens. The adult male, unlike what is generally the case in Cumacea, does not differ much in its external appearance from the young female, with which it may easily be confounded. On a closer examination, however, it may be recognized by the presence of natatory exopodites on all the legs except the last pair, and by the structure of the inferior antennæ. The latter organs, which are generally concealed are

exserted during copulation, and are used as a pair of claspers, by which the female is embraced at the boundary between the last 2 pedigerous segments. The hold is so firm, that I have succeeded in preserving the 2 sexes still locked together (see the figure given on Pl. IX).

Occurrence.—I have met with this beautiful form along the whole coast of Norway, from the Christiania Fjord to Vadsø, in a few fathoms' depth, on a sandy bottom. In some places, for instance off the Jæderen coast and at Sørvær and Vardø in Finmark, I have taken it in great abundance and of very large size. It moves rather quickly, and is able to bury itself with great ease in the sand, so as to be quite hidden.

Distribution.—British Isles (Norman), Kattegat (Meinert), Heligoland (Ehrenbaum).

2. *Lamprops fuscata*, G. O. Sars.

(Pl. XI.)

Lamprops fuscata, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea og dens nordiske Arter, p. 67.

Specific Character.—Body comparatively short and robust, with the anterior division in female rather tumid, ovoid, and considerably vaulted above. Carapace about the length of the exposed part of the trunk, conically tapering in front and slightly keeled dorsally in its anterior part, sides perfectly smooth, pseudorostral projection rather produced, acute, antero-lateral corners sub-obsolete. Tail, including the telson, scarcely as long as the anterior division. Eye distinct, though rather small. Inferior antennæ in male unusually short, and pronouncedly prehensile, the flagellum being divided into two sharply-defined parts, of which the proximal one is thickened and armed inside with small hook-like projections. 1st pair of legs comparatively more slender than in the type species, with the basal joint more strongly curved; 2nd pair nearly as long as the 1st, terminal joint much longer than the penultimate one; the remaining pairs comparatively more slender and less richly setous than in *L. fasciata*. Uropoda with the inner ramus much longer than the outer. Telson in female tapering considerably distally, and provided with 2 pairs of short lateral spinules, apical spines 5 in number, the middle one the shortest, the 2 outermost longer than the others. Telson in male less tapered distally, with the 2 pairs of lateral spinules more widely apart, and the middle apical spine much shorter than the other 4, which are about equal-sized and less divergent than in female. Colour more or less fuscous, carapace mottled in front with opaque white. Length of adult female 6 mm., that of male scarcely reaching 5 mm.

Remarks.—This species is easily distinguishable from the preceding one by the much shorter and more robust form of the body, the acutely produced pseudorostral projection, and the absence of the oblique lateral folds on the carapace. Moreover, the 2nd pair of legs and the caudal appendages exhibit well marked differences, and the colour is also different. Finally, the adult male is well characterised by the peculiar structure of the inferior antennæ, the prehensile nature of which is more pronounced than in any other known Cumacean. Of this species also I have succeeded in preserving specimens of the 2 sexes still locked together in copulation. The mode in which the female is grasped by the male is exactly as in the preceding species.

Occurrence.—This species seems to be a true arctic form, as I have never met with it off the south and west coasts of Norway, whereas in the arctic region it is very common, from the Lofoten Islands to Vadsø. It is generally found in places similar to those in which the preceding species occurs.

Distribution.—Greenland (Hansen), Franz Joseph Land (Th. Scott).

Gen. 2. **Hemilamprops**, G. O. Sars, 1882.

Generic Characters.—Body, as a rule, very slender, with the anterior and posterior divisions generally less sharply marked off from each other. Carapace not very large, without any subrostral sinus, the antero-lateral corners being quite obsolete, pseudorostral projection more or less distinct. Eye well developed or wanting. Superior antennæ with the flagella comparatively longer than in *Lamprops*; inferior antennæ in male normally developed. 1st pair of legs slender and elongated, with the terminal part much longer than the basal joint; 2nd pair likewise slender. 3rd pair in male more or less transformed. 3 pairs of well developed pleopoda present in the male. Telson and uropoda of a similar structure to that in *Lamprops*.

Remarks.—This genus was proposed by the present author in the year 1882, to include some species formerly referred by him to the genus *Lamprops*, but materially differing in the sexual characters of the adult male. Otherwise the 2 genera are closely related, exhibiting the very same structure of the terminal caudal appendages. The genus comprises, as yet, 5 species, one of which, *H. Normani*, has recently been recorded by M. Bonnier from the Gulf of Gasconne, the 4 others belonging to the Norwegian fauna.

3. *Hemilamprops rosea* (Norman).

(Pl. XII, XIII, XIV.)

Vaunthompsonia rosea, Norman, Transact. of the Tyneside Nat. Club; Vol. 5, p. 271, Pl 13, figs. 1—3.Syn: *Cyrianassa elegans*, Norman (male)." *Lamprops rosea*, G. O. Sars.

Specific Characters.—Body rather slender, especially in the male, with the tail exceeding the anterior division in length. Integuments thin, semipellucid. Carapace in female rather small, much shorter than the exposed part of the trunk, upper margin straight, horizontal, lower evenly arcuate, sides perfectly smooth, pseudorostral projection very small, almost obsolete. Carapace of male comparatively larger with the lower edges less regularly arcuate. Eye very large and conspicuous, with beautiful red pigment and 8 corneal lenses. 1st pair of legs exceedingly slender and elongated, when extended, fully twice the length of the carapace, penultimate joint longer than the 3 preceding ones combined. 2nd pair with the last joint longer than the penultimate one. 3rd pair in female slender, with the basal joint narrow linear and more than twice as long as the remaining part of the leg; those in male, as usual, with the basal joint greatly expanded, and moreover marked by the presence of 2 peculiar, smooth, falciform spines appended to the inside of the ischial joint. Uropoda very slender, equalling in length the last 3 caudal segments combined, inner ramus much longer than the outer, with the 1st joint much the largest and armed inside with about 15 spinules. Telson rather broad, lamellar, fully twice as long as the last segment, and but slightly narrowed distally, with generally 2 pairs of slender setiform spines laterally, and 8 spines issuing close together from the rounded apex, the 2 outermost of which are longer than the others. Body ornamented with a beautiful crimson pigment arranged in ramified, stellate patches both on the carapace and the several segments. Length of female 6 mm., of male 7 mm.

Remarks.—This form was first described by the Rev. A. M. Norman, but erroneously referred by him to the genus *Vaunthompsonia* of Sp. Bate, which is very different. The adult male was described by the same author, but was not recognized as such. It was recorded in the same paper under the name of *Cyrianassa elegans*. Some years afterwards the present author found this species off the Norwegian coast, and referred it to his genus *Lamprops*, not being at that time aware of the sexual differences in that genus. It is a very beautiful form, easily recognizable in fresh condition by the bright crimson pigment ornamenting the body and especially the carapace. In the adult male the natatory exopodites of the legs are very fully developed, and in order to receive the strong muscles

moving them, the basal joint is much dilated, not only in the 2 anterior pairs, but also in the 2 succeeding pairs. The 3rd pair of legs, as in several other male Cumacea, are moreover characterised by the presence of 2 peculiar, smooth, falciform spines appended to the inside of the ischial joint, and much resembling those found in the adult male of *Leucon nasicus* (= *Leuconopsis ensifer* Walker).

Occurrence.—I have found this beautiful form rather frequently along the whole south and west coasts of Norway, and occasionally also off the Finmark coast as far as Vardø. It generally occurs in moderate depths, from 20 to 50 fathoms, on a muddy bottom. Owing to the abundant supply of natatory organs, the adult male moves with great agility through the water, whereas the female leads a much more sedentary life on the bottom.

Distribution.—British isles (Norman).

4. *Hemilamprops assimilis*, G. O. Sars.

(Pl. XV.)

Hemilamprops assimilis, G. O. Sars, Oversigt af Norges Crustaceer I, p. 55, Pl. 1, figs. 23, 24.

Specific Characters.—Very like the preceding species as to external appearance, but with the eye imperfectly developed, without corneal lenses, and having the pigment whitish. Inferior antennæ of male extending about to the end of the penultimate caudal segment. 1st pair of legs somewhat less slender than in *H. rosea*, with the penultimate joint scarcely as long as the 3 preceding joints combined; 3rd pair in male with the 2 peculiar spines of the ischial joint more slender, not falciform, their distal part closely annulated and denticulate on one side. Uropoda nearly as in *H. rosea*. Telson, however, more narrowed distally, with only a single pair of slender lateral spines, apical spines only 6 in number, the 2 outermost much longer than the others, which are about equal-sized. Body in both sexes semipellucid, without any pigmentary ornament. Length of adult female 5 mm., of male 6 mm.

Remarks.—This species is very nearly allied to *H. rosea*, though easily distinguishable by the rudimentary condition of the visual organ, as also by the absence of the beautiful pigmentary ornament constantly found in that species. On a closer comparison, some other slight differences are also to be found in the structure of the several appendages, proving the validity of the species.

Occurrence.—I have only met with this form off the Finmark coast, at Vardø, Hammerfest and Hasvig, in depths varying from 60 to 200 fathoms. It is accordingly a much more pronounced deep-water form than the preceding species. Out of Norway, this form has not yet been recorded.

5. *Hemilamprops uniplicata*, G. O. Sars.

(Pl. XVI, XVII)

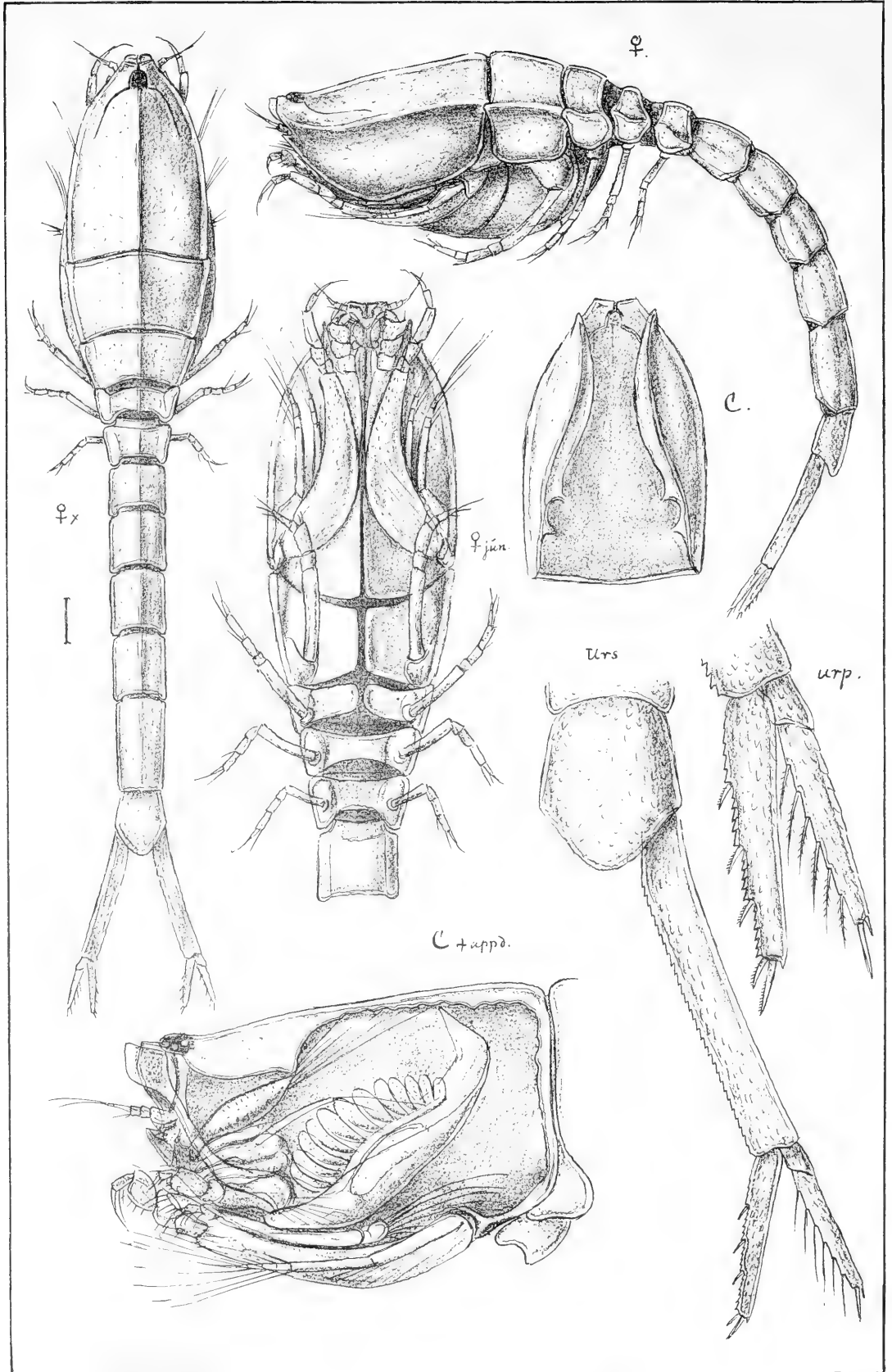
Lamprops uniplicata, G. O. Sars, Undersøgelser over Hardangerfjordens Fauna I, Chr. Vid. Selsk. Forh. 1871, p. 27.

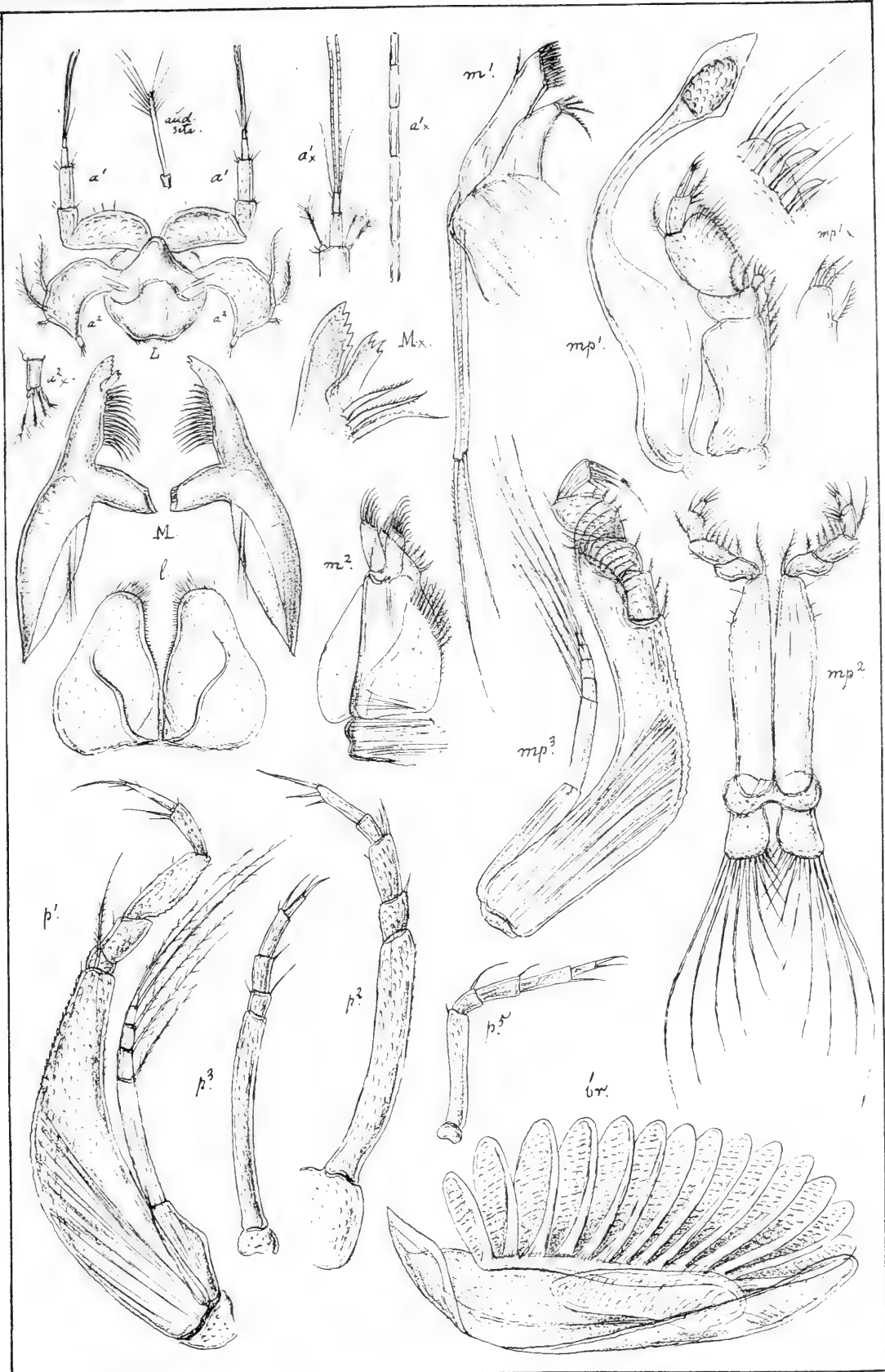
Specific Characters.—Body in both sexes exceedingly slender and elongated, with the anterior division somewhat vaulted dorsally and rather sharply marked off from the posterior, though its last segment is not much broader than the 1st caudal one. Tail considerably exceeding the anterior division in length and gradually attenuated distally. Carapace about the length of the exposed part of the trunk, and exhibiting on each side, somewhat in front of the middle, a single very conspicuous, obliquely curved fold or carina, upper margin straight, lower evenly arcuate, anterior extremity, viewed laterally, conically tapered, viewed dorsally, bluntly rounded; pseudorostral projection somewhat produced, though rather short; frontal lobe slightly keeled dorsally. Eye very small, though distinct, with red pigment. Inferior antennæ of male not attaining the length of the body. 1st pair of legs slender and elongated, almost equalling in length the anterior division of the body, last joint very narrow and fully as long as the penultimate one; 2nd pair with the antepenultimate joint longer than the last 2 combined, and coarsely spinous inside; 3rd pair in male with the outer 2 joints peculiarly transformed. Uropoda very slender, exceeding in length the last 2 caudal segments combined, inner ramus much longer than the outer, and armed inside with numerous short spinules, outside with about 16 setæ. Telson about the length of the basal part of the uropoda, narrow linguiform in shape, and armed with from 12 to 16 marginal spines, 3 of which issue from the rounded tip and are somewhat longer than the others. Colour bright orange. Length of female 7 mm., of male about the same.

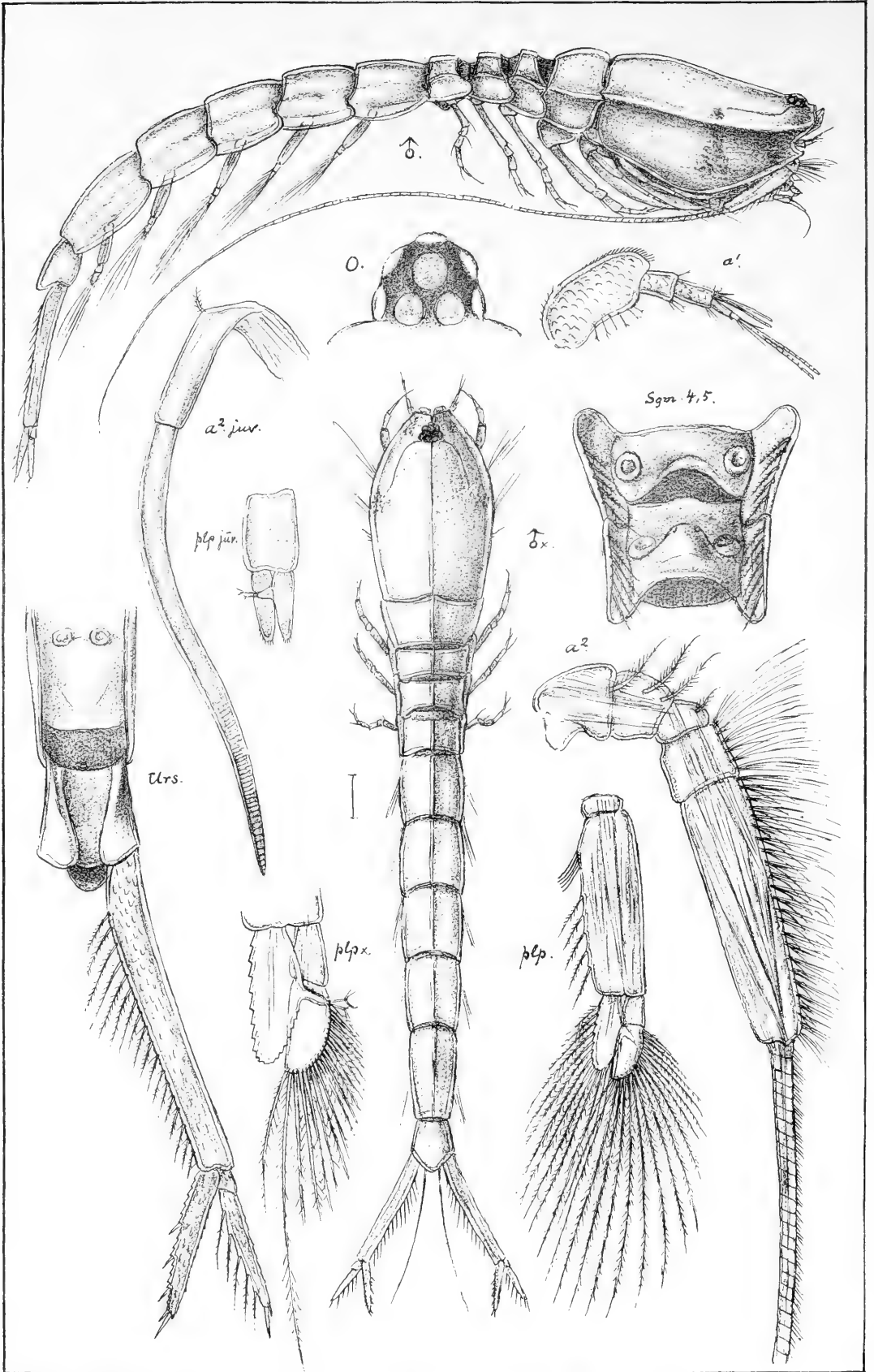
Remarks.—The present species is easily distinguishable from the 2 preceding ones by the form and sculpture of the carapace, as also by the structure of the terminal caudal appendages. The colour also is rather characteristic.

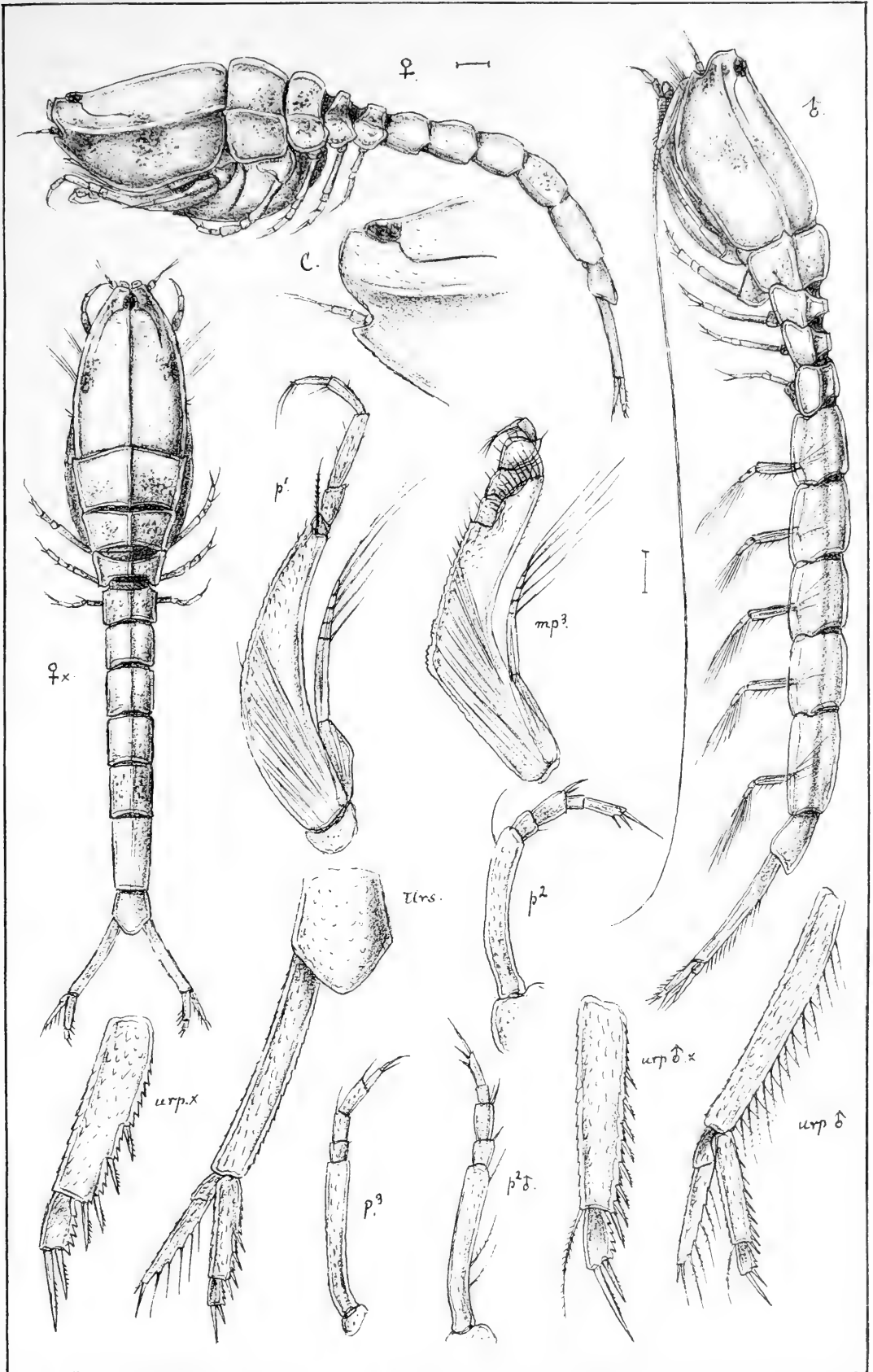
Occurrence.—I first detected this species at Møsterhavn in the outer part of the Hardanger Fjord, and have subsequently also met with it in 3 other localities of the west coast, viz., at Aalesund and Christiansund, in the Trondhjem Fjord, and finally off the Lofoten Islands. It is a true deep-water form, only occurring in depths of from 60 to 150 fathoms, sandy bottom.

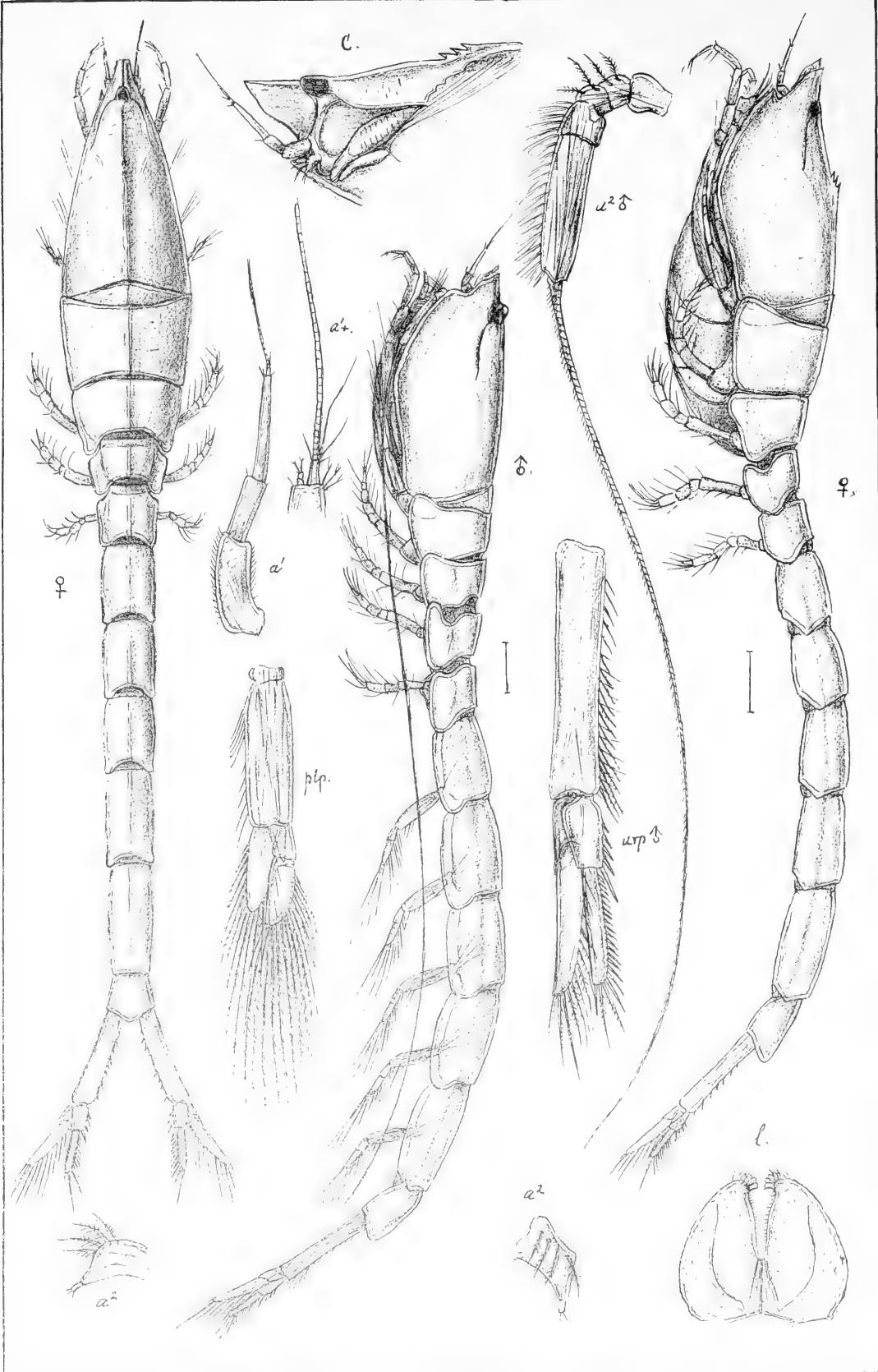
Distribution.—Stat. 31 & 124 of the Norwegian North Atlantic Expedition, both belonging to the cold area, outside the Norwegian coast.





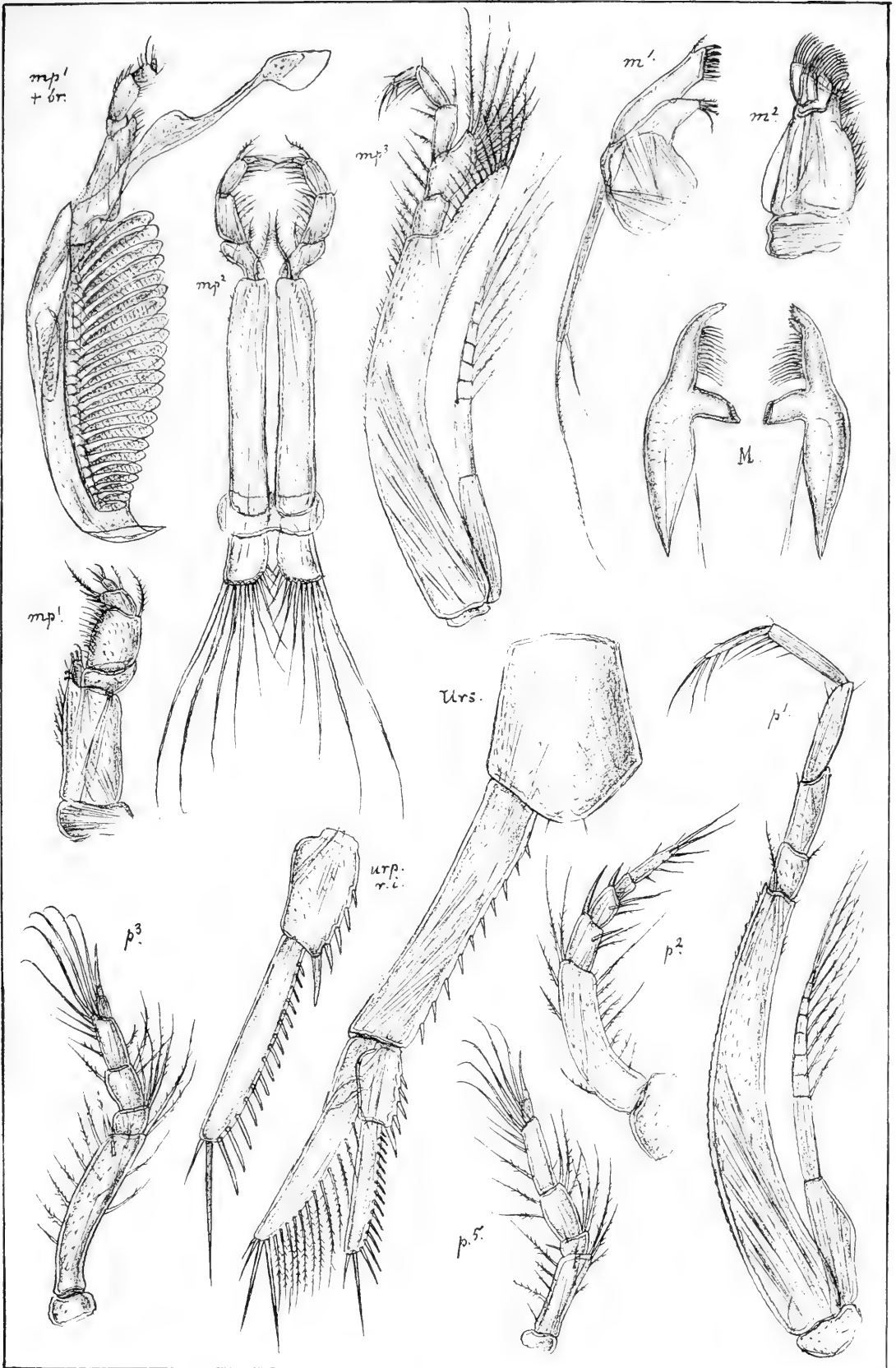






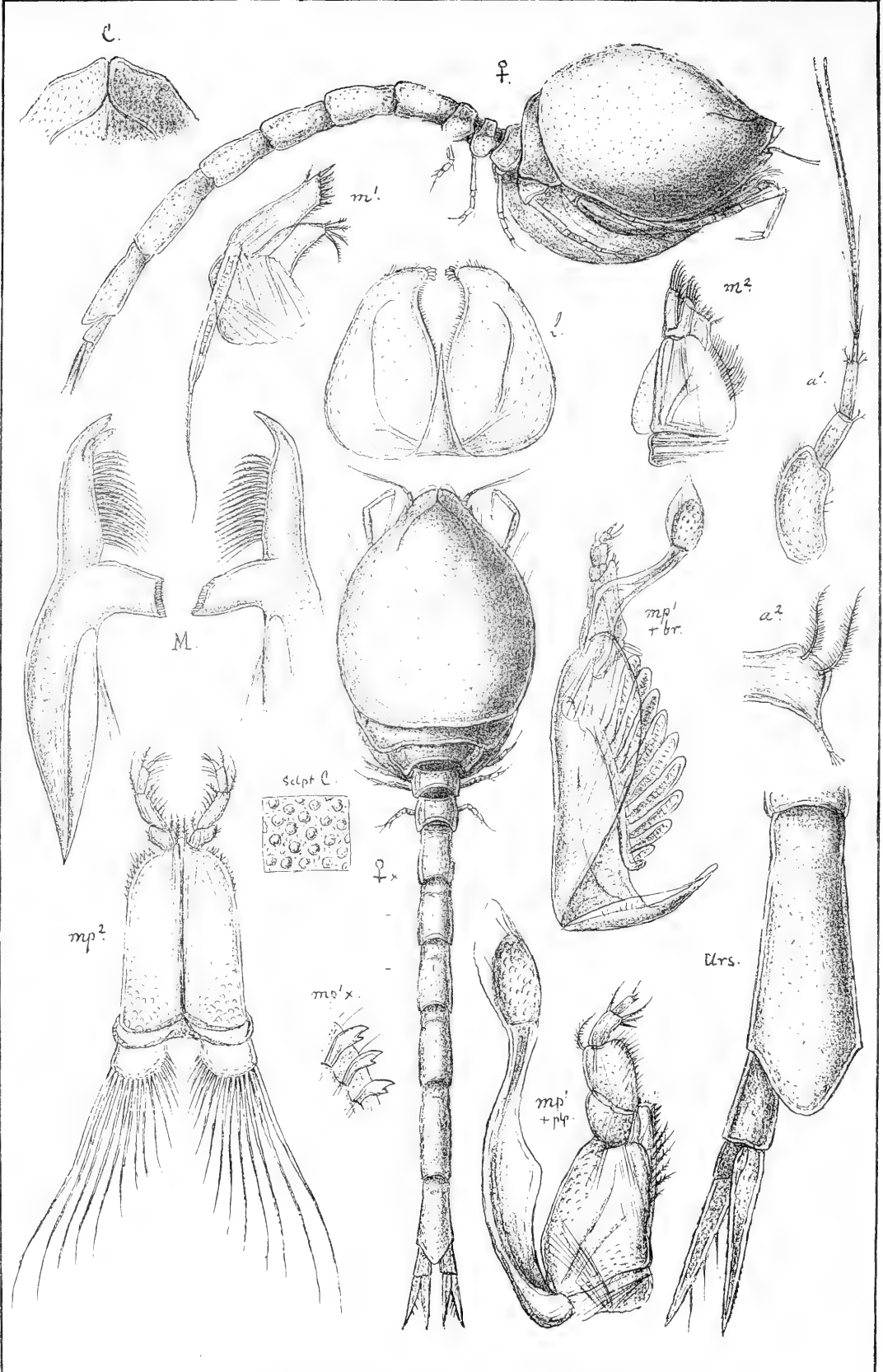
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Iphinoë trispinosa, (Goodsir).



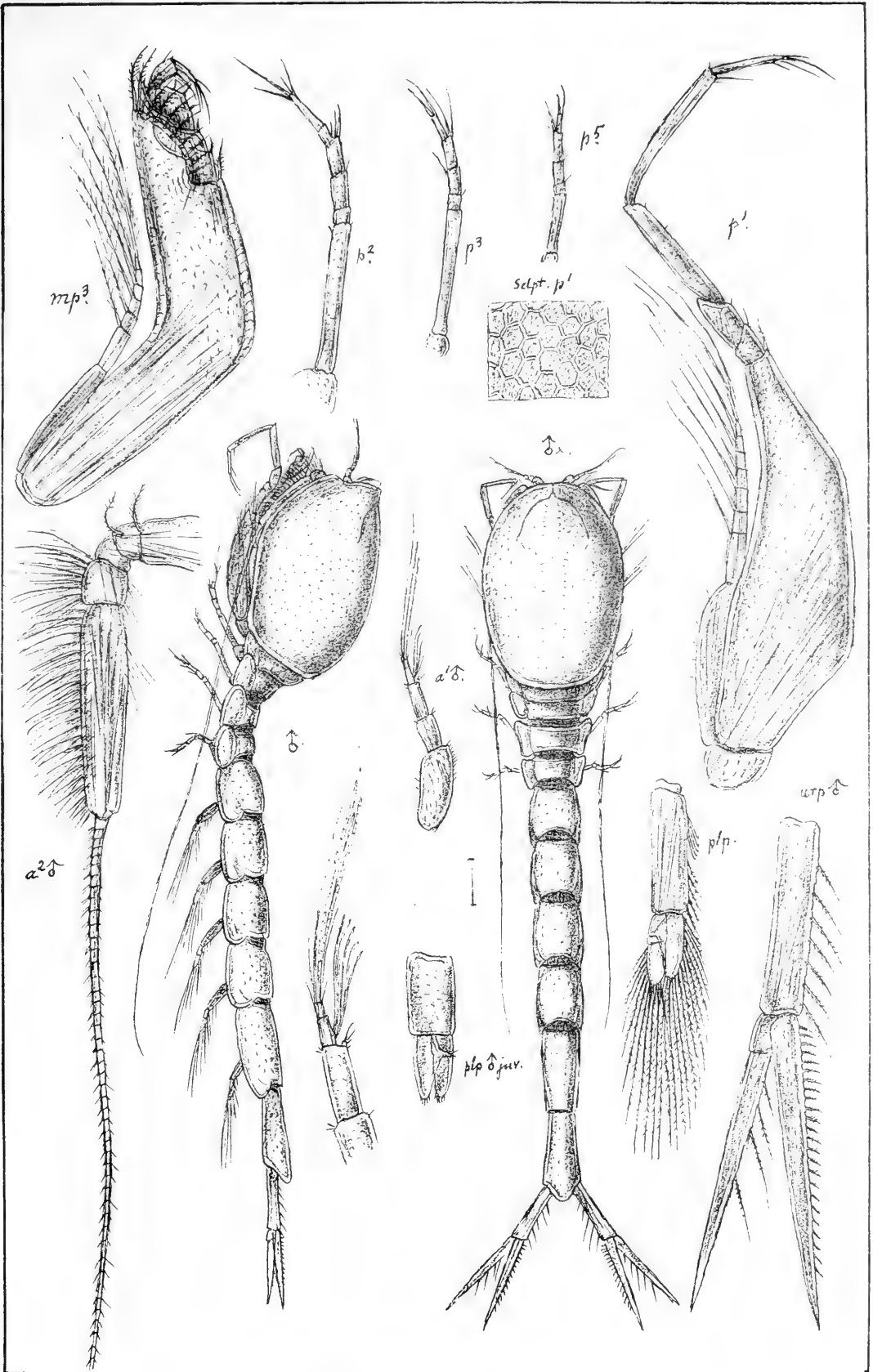
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Iphinoë trispinosa, (Goodsir).
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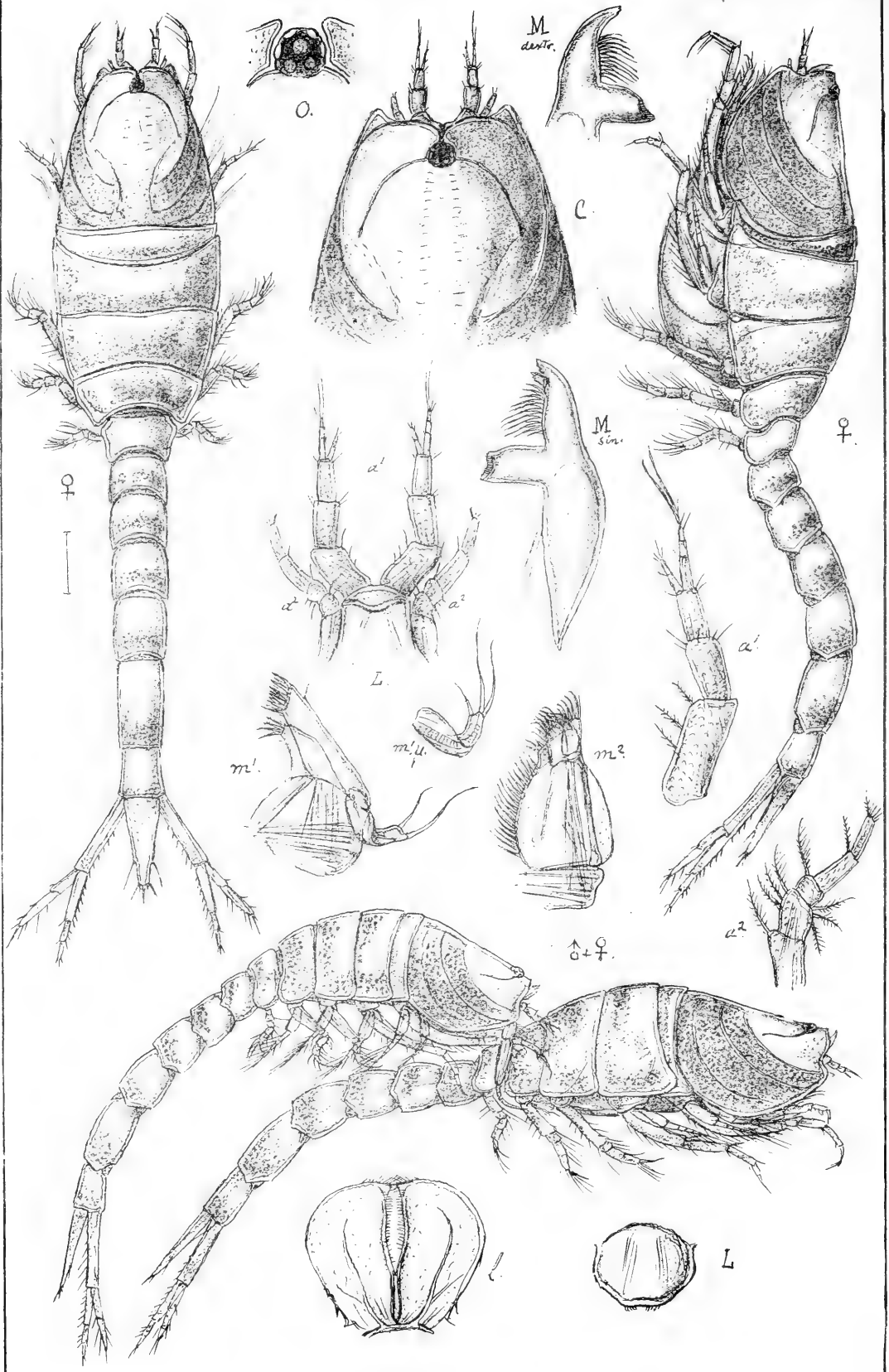
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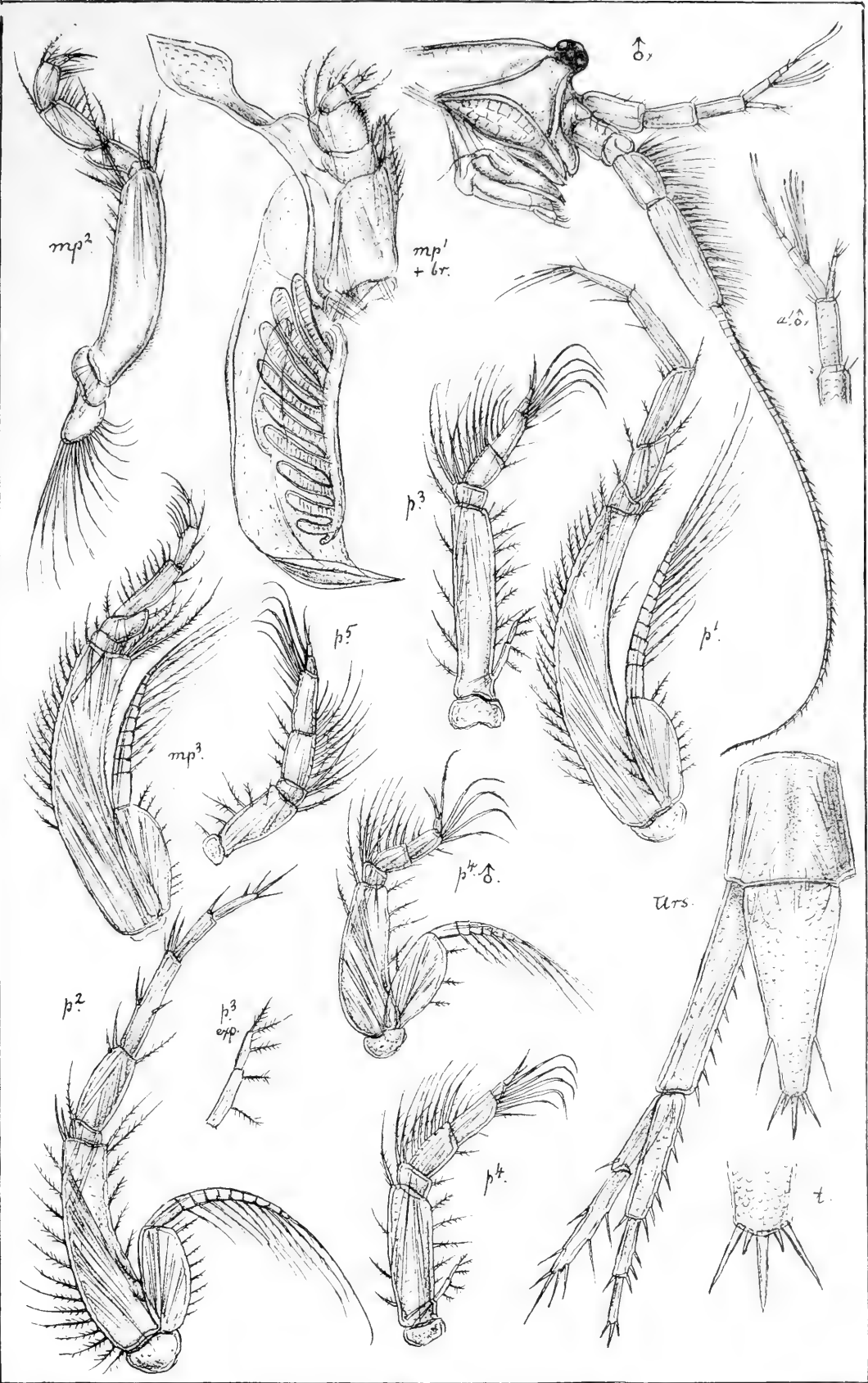
Cyclops longicaudata, G.O. Sars.



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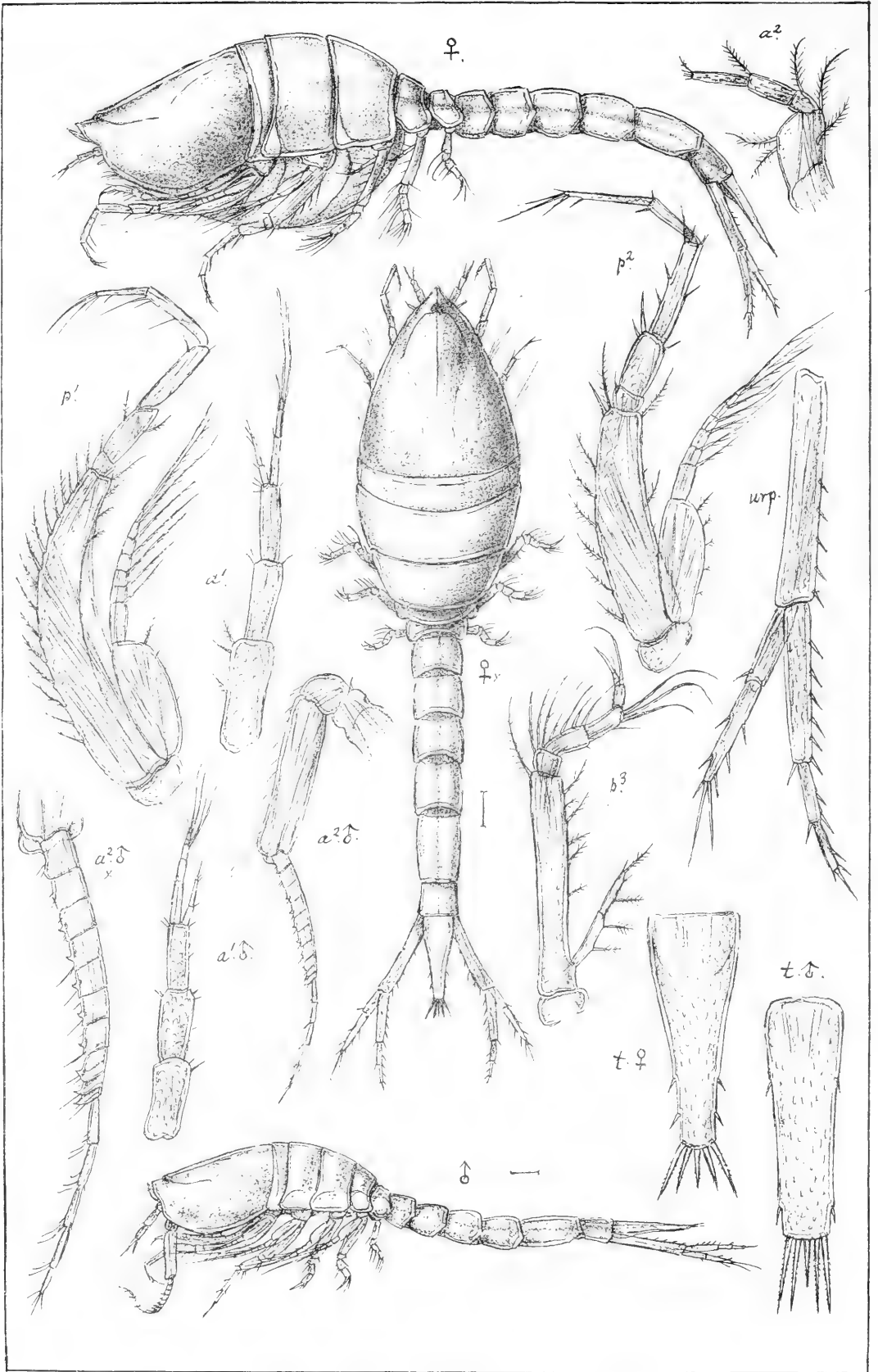
Cyclops longicaudata, G.O. Sars.
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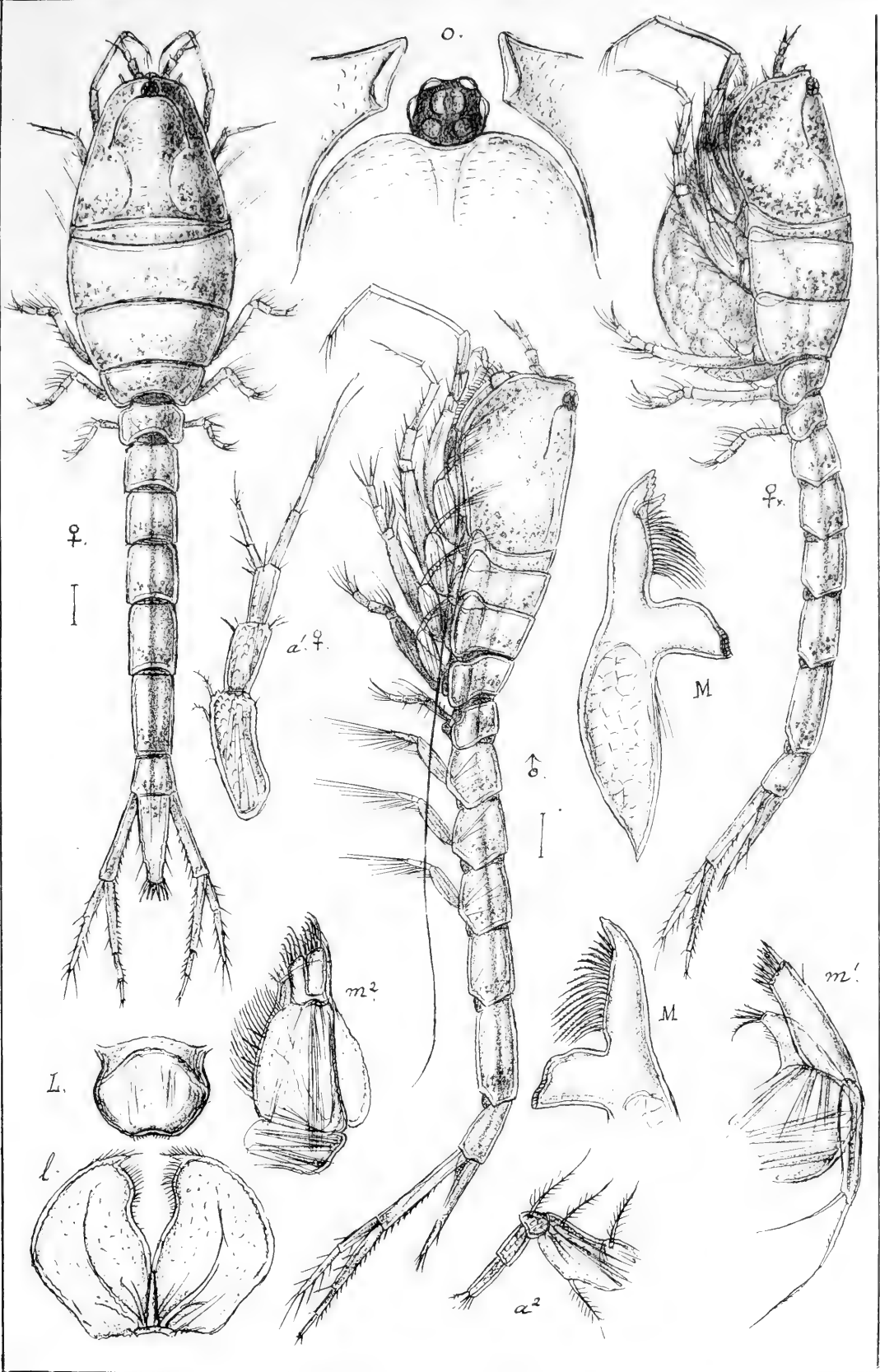
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Lamprops fasciata, G.O. Sars.
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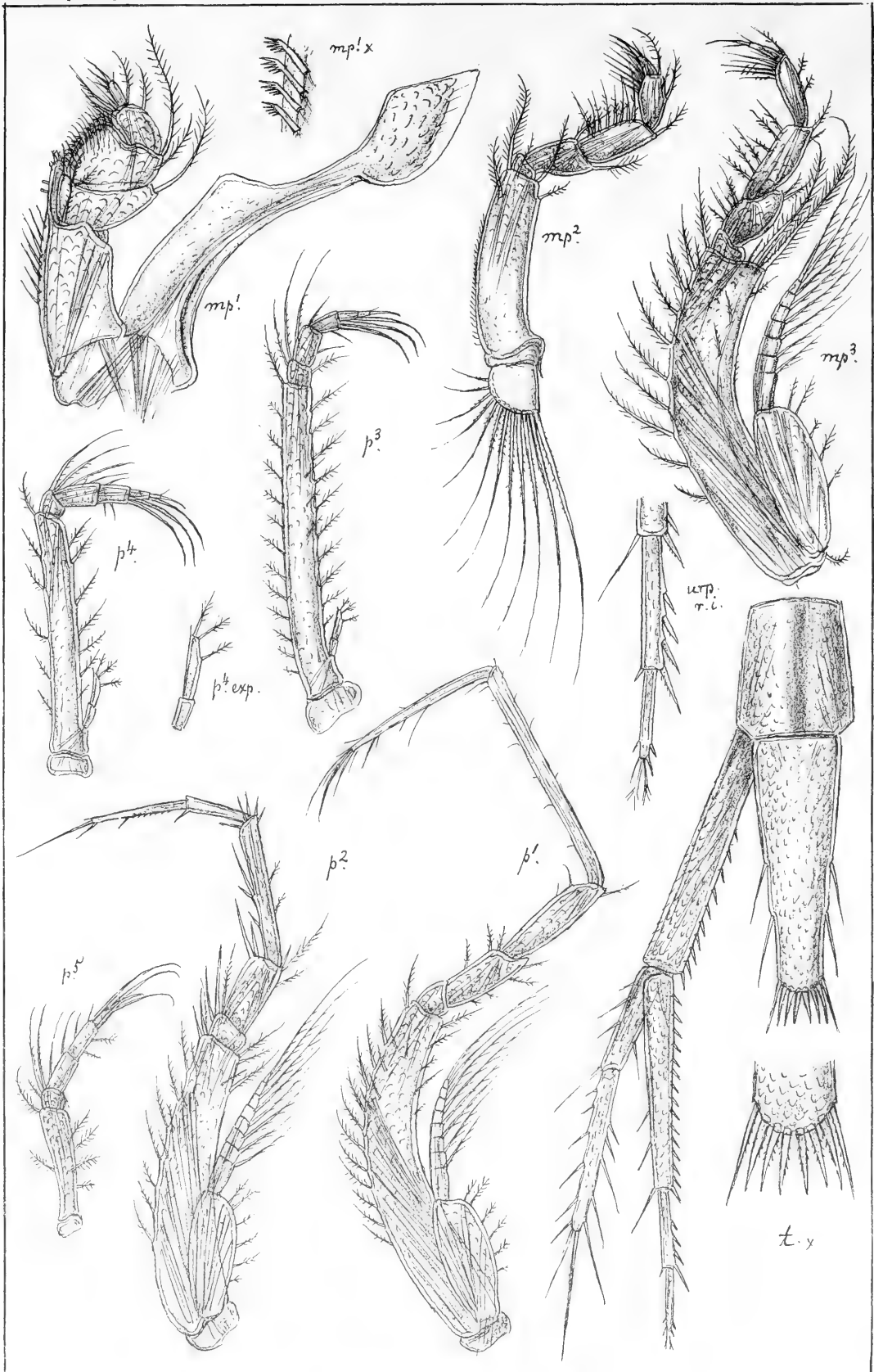


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Lamprops fuscata., G.O.Sars.

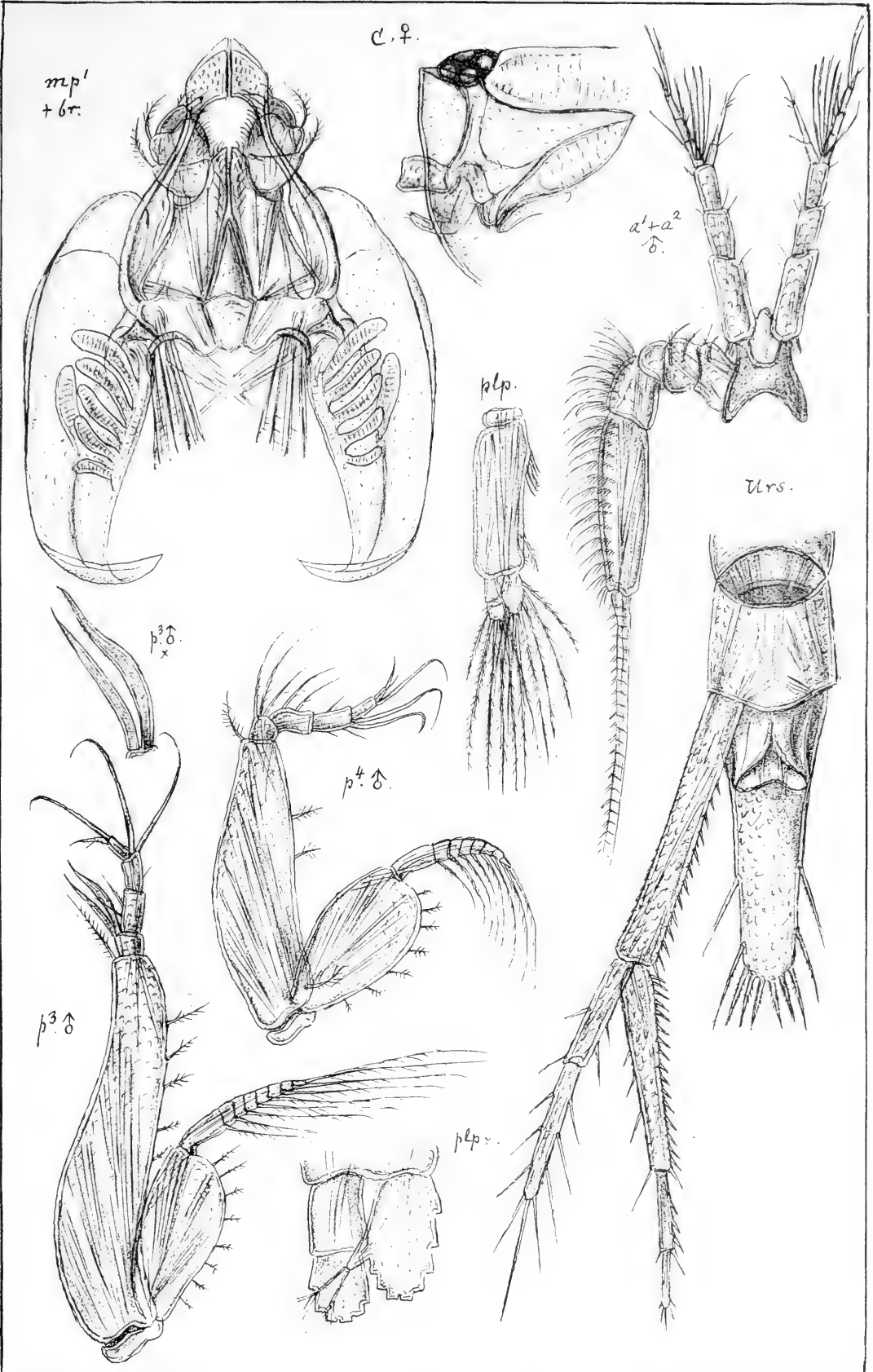


Hemilamprops rosea, (Norman.)



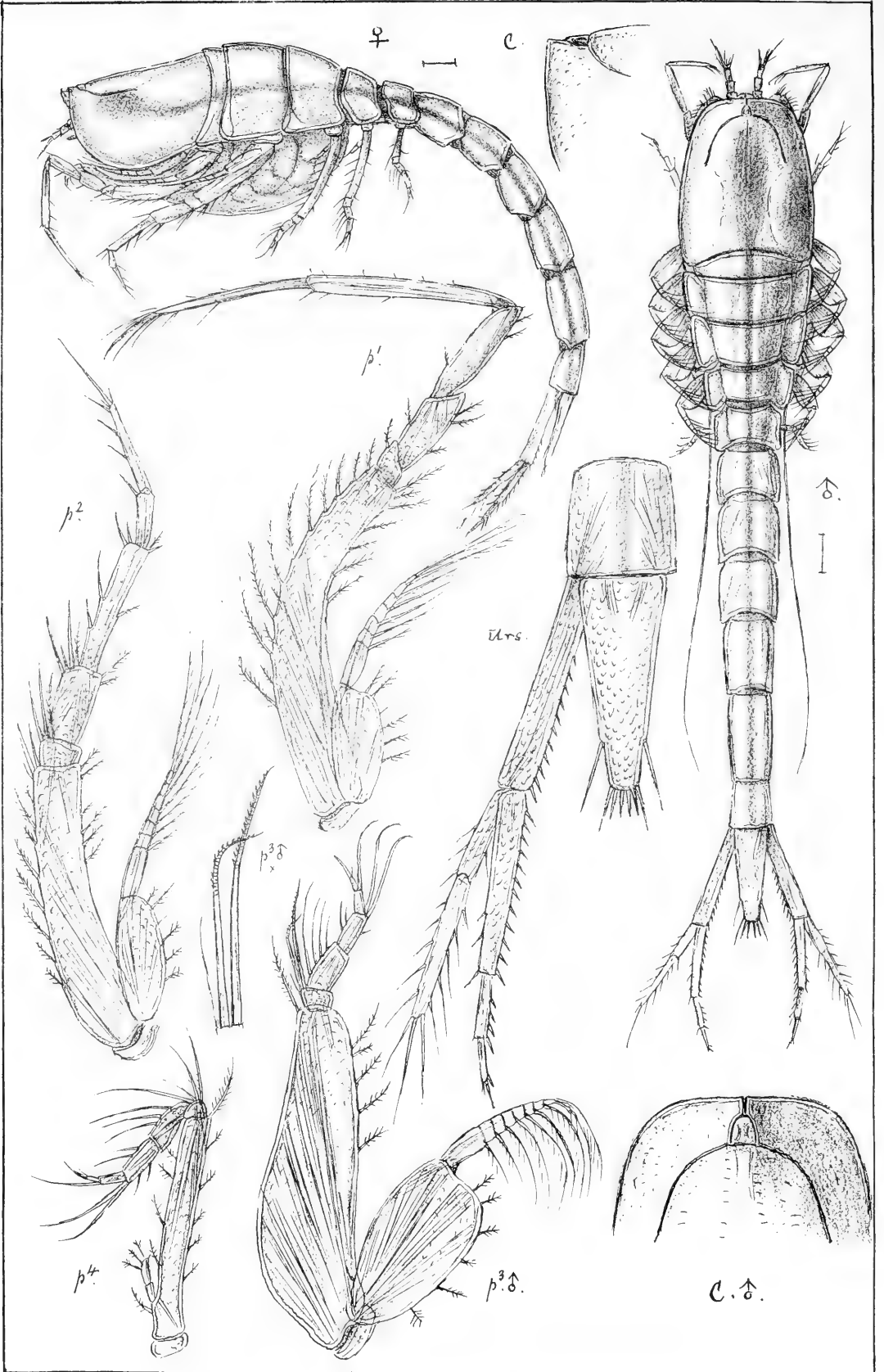
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Hemilamprops rosea, (Norman.)
(continued).



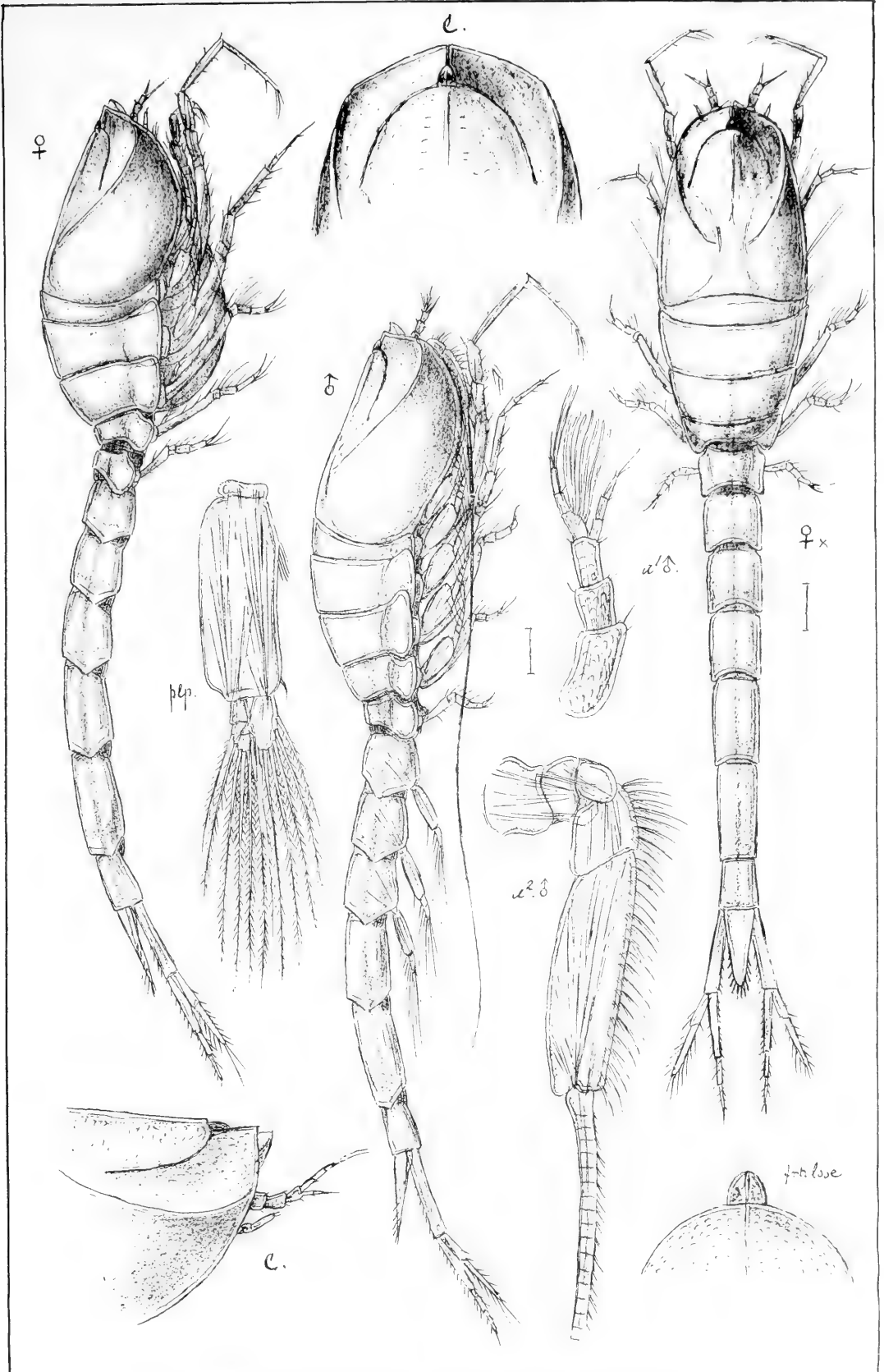
trykti i den priv. Opmaaling Chra.

Hemilamprops rosea, (Norman.)
(continued).



Trykt i den priv. Opmaalng Chra.

Hemilamprops assimilis. G.O.Sars.



trykt i den priv. Opmaaling Chra.

Hemilamprops uniplicata.G.O.Sars.



AN ACCOUNT
OF THE
CRUSTACEA
OF
NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY

G. O. SARS

VOL. III

CUMACEA

PART III & IV

LAMPROPIDÆ (concluded), PLATYOSPIDÆ, LEUCONIDÆ

WITH 16 AUTOGRAPHIC PLATES



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1900



6. *Hemilamprops cristata*, G. O. Sars.

(Pl. XVIII.)

Lamprops cristata, G. O. Sars, Nye Dybvandskrustaceer fra Lofoten.
Chr. Vid. Selsk. Forh. 1869, p. 13.

Specific Characters.—Body slender and elongated, somewhat resembling that of *H. uniplicata*. Carapace, however, rather different, conically tapered in front, and without any lateral folds, gastric region surmounted by a distinctly elevated longitudinal crest, which in female is finely denticulated throughout, the denticles being also continued on the ocular lobe; branchial regions very prominent; pseudorostral projection short, but distinct, acute. Tail much longer than the anterior division, and very slender, attenuated distally. Eye small, but distinct, with bright red pigment. 1st pair of legs very slender, equalling in length the anterior division of the body, terminal joint exceedingly narrow, linear, and longer than the penultimate one; the remaining pairs about as in *H. uniplicata*; 3rd pair in male but slightly transformed. Uropoda slender and elongated, exceeding in length the last 2 segments combined, inner ramus but slightly longer than the outer, the latter densely setiferous along both edges. Telson comparatively short, being scarcely longer than the last segment, and not nearly attaining the length of the basal part of the uropoda, sub-lageniform in shape, with the outer part abruptly contracted, and exhibiting 2 or 3 pairs of lateral spinules; apical spines 3 in number, much larger than the spinules and subequal in length. Colour light orange, or golden yellow. Length of female 7 mm., of male about the same.

Remarks.—This form is easily distinguishable from any of the preceding species by the finely denticulated crest surmounting the gastric region of the carapace, in which respect it agrees with the species recently described by M. Jules Bonnier from the Gulf of Gascogne as *H. Normani*; but in other respects, this form is rather different. It is moreover easily distinguished from *H. uniplicata*, to which it bears some resemblance in the slender and elongated form, by the absence of lateral folds on the carapace, and by the form and armature of the telson.

Occurrence.—I first detected this species off the Lofoten Islands, and have subsequently also taken it in several other localities, for instance at Mosterhavn in the outer part of the Hardanger Fjord, at Christiansund and in the Trondhjem Fjord. It is a pronounced deep-water form, only occurring in depths of more than 100 fathoms.

Distribution.—British Isles (Robertson), Stat. 23 of the Porcupine Expedition (Norman).

Fam. 3. *Platyaspidae*.

Characters. Body considerably dilated in front, with the carapace very large and applanated, pseudorostral projection distinct, antero-lateral corners obsolete. All 5 pedigerous segments distinctly exposed, the 1st being of unusual size. Tail slender and narrow. Antennæ and oral parts of a similar structure to that in the *Lampropidae*. Legs, however, very different, the 4 posterior pairs being quite simple in female, without any traces of exopodites; all pairs in male, except the last, provided with well-developed natatory exopodites. 3 pairs of pleopoda present in male. Uropoda slender, resembling somewhat in structure those in the *Lampropidae*. Telson distinctly defined, conically tapered, terminating with 3 spines.

Remarks.—I have felt justified in establishing this new family, to include the anomalous genus *Platyaspis*, formerly referred to the *Lampropidae*. It is true that in certain points this genus seems to approach that family, namely, as regards the structure of the antennæ, oral parts and terminal caudal appendages, as also in the number of pleopoda in the male; but there are several other characters, in which it differs so very essentially, as scarcely to allow of its being included in the said family. The carapace, for instance, is of quite a peculiar structure, unlike that in any other known Cumacea, and the 1st pedigerous segment exhibits a development likewise unique in this order. Finally, the structure of the legs is very unlike that in the *Lampropidae*, and more resembles that in the *Cumidae*, at least as regards the female, in which only the 1st pair is provided with exopodites. Besides the typical genus *Platyaspis*, I am of opinion that the genus *Chalarostylis* of Norman ought to be referred to this family. The latter genus, however, is still but imperfectly known, having only been founded upon a solitary specimen of the male sex.

Gen. *Platyaspis*, G. O. Sars, 1869.

Generic Characters.—Carapace large and broad, slightly vaulted above, sides greatly expanded, fornicate; pseudorostral projection triangular. 1st pedigerous segment much larger than any of the others. Integuments rather thin, squamous. Eye wholly absent. Superior antennæ with both flagella well developed and nearly equal, the outer one in male provided at the base with numerous,

closely set sensory filaments. Inferior antennæ in female 4-articulate, in male much shorter than the body. Anterior maxillæ without any traces of palps. 3rd pair of maxillipeds rather unlike those in other Cumacea, the basal joint being quite straight, and not expanded distally. 1st pair of legs comparatively short, resembling in structure the 3rd pair of maxillipeds, the outer joints partly lamellar. 2nd pair of legs slender and elongated, with the full number of joints, outer part spinous; the 3 posterior pairs exceedingly narrow, and almost naked. Uropoda with the inner ramus longer than the outer and 3-articulate. Telson without lateral spinules.

Remarks.—This genus was established by the present author in the year 1869, to comprise the peculiar Cumacean described below, the name being derived from the pronouncedly depressed form of the carapace. The genus is as yet only represented by the type species.

Platyaspis typica, G. O. Sars.

(Pl. XIX, XX.)

Platyaspis typica, G. O. Sars, Nye Dybvandserustaceer fra Lofoten. Chr. Vid. Selsk. Forh. 1869, p. 14.

Specific Characters.—Body moderately slender, with the anterior division considerably dilated, though rapidly tapering behind. Carapace more than twice as long as the exposed part of the trunk, and, viewed dorsally, of oval quadrangular form, the greatest width occurring behind in female, in male quite in front, dorsal face gently vaulted, with an obtuse keel along the middle, sides lamellarly expanded, forming a horizontally projecting smooth carina, which extends on each side throughout the whole length of the carapace; pseudorostral projection short, almost rectangular. 1st pedigerous segment nearly as long as the 3 succeeding segments combined, and rather broad in front, exhibiting dorsally a saddle-like depression. Tail, including the telson, about the length of the anterior division, and extremely slender. Superior antennæ with the outer flagellum in female 3-articulate, in male 5-articulate, inner flagellum in female biarticulate, in male triarticulate. Inferior antennæ in female with 3 plumose setæ, in male scarcely longer than the anterior division of the body. 3rd pair of maxillipeds with the carpal joint rather large, and dilated in its proximal part. 1st pair of legs with the terminal part scarcely longer than the basal joint, ischial joint extremely small, the 3 succeeding joints of about equal size and sublamellar, terminal joint much smaller. 2nd pair of legs scarcely shorter than the 1st, but much narrower, antepenultimate joint about the length of the last 2 joints combined, and strongly spinous inside. The 3 posterior pairs extremely slender, and gradually

diminishing in length, propodal joint in all of them unusually produced and carrying at the tip, outside the dactylus, a single spiniform seta. Uropoda fully as long as the last 3 segments combined, inner ramus somewhat shorter than the basal part, but projecting considerably beyond the outer, its 1st joint with 2 spinules, each of the other 2 joints with one; outer ramus with the proximal joint quite short. Telson about twice the length of the last segment, and much shorter than the basal part of the uropoda, gradually tapering distally to an obtuse point carrying 3 subequal spines. Colour light yellow, with a whitish band across the carapace. Length of adult female about 6 mm., of male 5½ mm.

Remarks.—This is an easily recognizable form, being at once distinguished from all our other Cumacea by the peculiar development of the carapace, the fornicate character of which, indeed, makes it rather difficult to obtain an exact lateral view of the animal.

Occurrence.—I first found this remarkable form off the Lofoten Islands, and have subsequently met with it occasionally also in some other localities of the Norwegian coast, for instance, in the outer part of the Hardanger Fjord, at Aalesund, and in the Trondhjem Fjord. It is a pronounced deep-water species, only occurring in greater depths ranging from 120 to 400 fathoms. Out of Norway, this form has not as yet been recorded.

Fam. 4. Leuconidæ.

Characters.—Body more or less slender, with no sharp demarcation between the anterior and posterior divisions. Integuments rather thin. Carapace generally small, with the antero-lateral corners more or less produced, pseudorostral projection in some cases distinctly prominent, in other cases obsolete. 1st pedigerous segment well defined. Tail with the last segment obtusely produced behind. Eye, in all the known forms, absent. Superior antennæ with the outer flagellum 3-articulate, the inner uniaarticulate. Inferior antennæ in female very small, in male well developed, attaining the length of the body. Mandibles comparatively short, with the body triangular in form, or forming outside an angular expansion, masticatory part strongly incurved, with only 2 small setæ behind the cutting edge, molar expansion short and massive. Anterior maxillæ with the

palp unisetose; posterior maxillæ very small, without any setæ inside. Branchial apparatus with a limited number of digitiform gill-elements. 3rd pair of maxillipeds comparatively short, with the basal joint dilated distally, and carrying on the projecting outer corner a number of very strong setæ. The 3 anterior pairs of legs in female provided with well-developed natatory exopodites; 2nd pair strongly built, conspicuously fossorial in character, and having the ischial and meral joints coalesced. Adult male with very fully developed natatory exopodites on all the legs except the last pair, but with only 2 pairs of pleopoda. Uropoda with both rami biarticulate, the inner spinulose, the outer setiferous. Telson absent.

Remarks.—This family comprises forms of rather different external appearance, but very closely agreeing in some of the anatomical details. The structure of the oral parts in particular, is very characteristic, and rather unlike that found in most other Cumacea. The presence in the female of well-developed natatory exopodites not only on the 2 anterior pairs of legs, but also on the 3rd pair, is another character by which the present family is distinguished, only the family *Vaunthompsoniidae* agreeing with it in this respect. But, whereas in that family, the male has 5 well-developed pairs of pleopoda, the number of these appendages in the present family is limited to 2 pairs only, as in the family *Diastylidae*. By the total absence of the telson, the family *Leuconidae* is, however, at once distinguished both from the last-named family and from the 2 immediately preceding it.

We only know at present of 3 genera belonging to this family, and all of these are represented in the fauna of Norway, and will be treated of below.

Gen. 1. **Leucon**, Krøyer, 1846.

Generic Characters.—Body, as a rule, slender, with the anterior division more or less compressed. Carapace in female with a serrated crest along the middle, pseudorostral projection prominent, and defined from the antero-lateral corners by an angular cleft, lower edges of carapace bent in the middle, with the anterior half serrate. Carapace of male generally without any dorsal crest, and having both the pseudorostral projection and the antero-lateral corners blunted. Tail slender and very mobile. Superior antennæ of moderate size, with the peduncle not geniculate, inner flagellum quite rudimentary, knob-like. Inferior

antennæ in female with the distal joint well defined. 1st pair of legs slender, with the terminal part much longer than the basal joint, last joint compressed and densely clothed with slender curved spines; 2nd pair rather robust, last joint armed with diverging spines; the succeeding pairs comparatively short, and densely setiferous; 3rd pair in male with 2 or 3 peculiar appendages attached to the ischial joint inside. Uropoda with the rami scarcely differing in size.

Remarks.—This genus was established by Krøyer as early as in the year 1846; but he also comprised within it species of the other 2 genera belonging to this family. In the restriction here adopted, the genus is easily recognized, at any rate in the female sex, by the crested carapace, the distinctly prominent pseudorostral projection, and the angular incision below the latter. The genus comprises, as yet, no less than 11 species, 5 of which belong to the fauna of Norway, and will be described below.

1. *Leucon nasiceus*, Krøyer.

(Pl. XXI, XXII.)

Cuma nasica, Krøyer, Nat. Tidsskr. Vol. III, p. 524, Pl. VI, figs. 31—33.

Syn: *Leuconopsis ensifer*, Walker (male).

Specific Characters.—Body exceedingly slender and elongated, with the tail very fully developed, and longer than the anterior division. Carapace in female shorter than the exposed part of the trunk, dorsal crest extending beyond the middle, and reappearing for some distance also in the hindmost part, pseudorostral projection exceedingly prominent and somewhat upturned, obliquely truncate at the tip, with the terminal edges very minutely denticulate and setiferous, infero-lateral corners triangularly produced, and defined above by a deep angular cleft. Carapace in male comparatively larger and less compressed, without any trace of a dorsal crest, pseudorostral projection shorter and almost transversely truncated at the tip, infero-lateral corners blunted, subrostral sinus obsolete. Superior antennæ with the last joint of the peduncle fully as long as the 2nd, and conically tapered. 1st pair of legs rather elongated, and but slightly attenuated, with numerous plumose setæ both on the basal and terminal parts, penultimate joint almost as long as the antepenultimate, and twice the length of the terminal joint; 2nd pair with the last joint shorter than the antepenultimate one, and carrying about 9 diverging ciliated spines. 3rd pair in male with 2 very conspicuous, ensiform appendages of somewhat unequal size, originating from inside the ischial joint. Uropoda about the length of the last 2 segments combined, and rather robust, rami of about equal length, the inner one with numerous unequal spinules

inside, and a row of ciliated setæ outside, its distal joint scarcely half as long as the proximal one, and carrying on the tip a remarkably strong spine accompanied by a long seta; outer ramus densely clothed with ciliated setæ. Body without any pigmentary ornament, of whitish colour, changing in female to pale yellow. Length of adult female reaching to 12 mm., of male to 10 mm.

Remarks.—This form was first described by Krøyer as a species of *Cuma*, but was subsequently separated as the type of his genus *Leucon*. It is the largest of the Norwegian species, and moreover easily recognizable by its very slender form and the nose-like, upturned pseudorostral projection. In the young, not yet sexually mature state, the male does not exhibit any pronounced difference in its general appearance from the female, the form and armature of the carapace being the very same in both. It is quite otherwise when the male has reached full sexual maturity. In this state, on account of the peculiar transformation of the carapace, it looks so very different from the female that even in quite recent times, its true relation has been wholly misapprehended. Indeed, there cannot be any doubt that the form recently recorded by Mr. Walker as *Leuconopsis ensifer* is nothing else than the adult male of the present species. As will be shown farther on, an altogether analogous transformation of the male is proved to take place in all our other species of this genus.

Occurrence.—This is one of the commonest Cumacea of the Norwegian coast, occurring very frequently throughout its whole length, from the Christiania Fjord to Vadsø, in depths from 30 to 100 fathoms, soft muddy bottom. The adult males seem, only at certain seasons, to appear in some numbers. They are extremely agile, swimming about with great rapidity by the aid of the very fully developed exopodites, and the likewise well-developed 2 pairs of pleopoda. The females, on the other hand, lead a much more stationary life, mostly dwelling on the bottom, in which they are able to bury themselves with great dexterity.

Distribution.—British Isles (Norman), Kattegat (Meinert), Heligoland (Ehrenbaum), Greenland (Hansen), the Kara Sea (Hansen), Atlantic coast of North America (Verrill).

2. *Leucon nasicoides*, Lilljeborg.

(Pl. XXIII.)

Leucon nasicoides, Lilljeborg, Öfvers. af Vet. Akad. Förh. 1855, p. 122.

Specific Characters.—Body of female considerably shorter and more robust than in the type species, with the tail scarcely exceeding in length the anterior division. Carapace rather deep, and about the length of the exposed part of

the trunk, dorsal crest extending to the hind edge, frontal lobe moreover armed on each side with 3 small denticles, 2 successive subdorsal, and one lateral, pseudorostral projection much shorter than in *L. nasicus*, horizontal and obtusely truncated at the tip, its terminal edges being cut off into 4 denticles, infero-lateral corners but slightly produced. Adult male much more slender than the female, and having the carapace smooth, with only 2 small successive denticles close to the end of the frontal lobe; pseudorostral projection transversely truncated, with only 2 denticles on the terminal edges below, infero-lateral corners obtusangular. Superior antennæ smaller than in the type species, with the last joint of the peduncle shorter than the 2nd. 1st pair of legs comparatively feebler in structure, with the penultimate joint much shorter than the antepenultimate one. 2nd pair of legs with the last joint about the length of the antepenultimate one, and armed with several rather unequal spines, which are not ciliated. 3rd pair of legs in male with 2 subequal, narrow lanceolate appendages of the ischial joint. Uropoda with the rami subequal in length, and somewhat longer than the basal part, the inner one without any ciliated setæ outside, its distal joint not nearly attaining half the length of the proximal one, and carrying about 6 ciliated spines gradually increasing in length distally; outer ramus with only a very limited number of setæ. Colour whitish, with a faint yellowish tinge. Length of adult female 6 mm., of male about the same.

Remarks.—This form, first described by Prof. Lilljeborg, is easily distinguishable from the type species by its much shorter and more robust body, the fuller development of the dorsal crest of the carapace, and the shorter pseudorostral projection. In the structure of the several appendages also, well-marked differences are found to exist.

Occurrence.—I have met with this form, though nowhere in any abundance, in several localities of the Norwegian coast, from the Christiania Fjord to the Lofoten Islands, in depths varying from 10 to 50 fathoms.

Distribution.—Kattegat (Lilljeborg), Greenland (Hansen).

3. *Leucon fulvus*, G. O. Sars.

(Pl. XXIV.)

Leucon fulvus, G. O. Sars, Om den aberrante Krebsdyrgruppe Cumacea og dens nordiske Arter. Chr. Vid. Selsk. Forh. 1864, p. 55.

Specific Characters.—Body rather slender, especially in the male, with the tail unusually narrow and scarcely as long as the anterior division. Carapace in female about the length of the exposed part of the trunk, dorsal crest well

developed, extending beyond the middle, and reappearing for a short distance in the hindmost part; pseudorostral projection not much produced, almost horizontal, and obtuse at the tip, terminal edges cut off into 5 denticles; antero-lateral corners somewhat produced. Carapace of male quite smooth, with only a single small denticle at the end of the frontal lobe; pseudorostral projection obtusely rounded at the tip, with the terminal edges smooth; antero-lateral corners blunted. 1st pair of legs rather feeble, with several plumose setæ outside the terminal part, penultimate joint nearly as long as the antepenultimate; 2nd pair with the last joint about the length of the 2 preceding joints combined, and linear in form, with about 8 unequal spines. 3rd pair in male with 2 comparatively short, falciformly curved appendages of the ischial joint. Uropoda rather slender, with the rami much narrower than in the 2 preceding species, the inner one with the distal joint scarcely shorter than the proximal one, and armed with 5 or 6 spines, the outermost very much elongated; outer ramus with scattered setæ. Colour bright fulvous, somewhat lighter in male. Length of adult female scarcely 5 mm., of male 5½ mm.

Remarks.—This form, in the fresh state, is at once recognized by its beautiful bright orange or fulvous colour, a character which has indeed given rise to the specific name. The species is also otherwise easily distinguishable from the 2 preceding ones, both as regards the general form and the structure of some of its appendages, especially that of the uropoda.

Occurrence.—I found this form many years ago rather plentifully at the Lofoten Islands, in a depth of from 6 to 12 fathoms sandy bottom covered with a thin layer of mud, and have subsequently also met with it in several places of the Finmark coast, as far east as Vardø; but south of the Lofoten Islands, I have never come across it, and we must conclude from this, that it is a true Arctic form.

Distribution.—Iceland, at Rejkjavik, Spitsbergen (Norw. North Atlantic Expedition).

4. *Leucon pallidus*, G. O. Sars.

(Pl. XXV.)

Leucon pallidus, G. O. Sars, Om den aberrante Krebsdyrgruppe Cumacea og dens nordiske Arter, p. 57.

Specific Characters.—Body slender and highly compressed, with the tail about the length of the anterior division. Carapace in female somewhat exceeding the length of the exposed part of the trunk, dorsal crest very fully developed, extending to the hind edge; pseudorostral projection considerably produced, horizontal, at-

tenuated distally, tip obtusely acuminate, and exhibiting on each side a small semilunar notch; antero-lateral corners triangular, defined above by a deep sinus. Carapace of male less compressed, exhibiting, however, a complete series of denticles along the middle of the dorsal face; pseudorostral projection much shorter than in female, with the lower edges serrate; antero-lateral corners blunted. 1st pair of legs about as in *L. fulvus*; 2nd pair likewise rather similar, though having the last joint shorter than the 2 preceding ones combined. 3rd pair of legs in male with 3 very largely developed lanceolate appendages of the ischial joint. Uropoda scarcely attaining the length of the last 2 segments combined, rami exceeding in length the basal part, outer ramus much the longer, and carrying 9 or 10 ciliated setæ, inner ramus with the distal joint gradually tapered to a mucroniform point. Colour pure white. Length of adult female 4 mm., of male 4½ mm.

Remarks.—This form is easily distinguishable from the 3 preceding species, not only by its small size and pale colour, but, in the female sex at least, by the comparatively long and attenuated, horizontally extended pseudorostral projection, as also by the different structure of the uropoda. The adult male, too, differs conspicuously from the males of the other species in the presence of a distinct series of denticles along the middle of the dorsal face of the carapace; moreover, in the 3rd pair of legs there are 3, instead of 2 appendages of the ischial joint.

Occurrence.—I first found this form in the Christiania Fjord, at Drøbak, and have subsequently met with it also in a few other places of the Norwegian coast, for instance in the Trondhjem Fjord and off the Lofoten Islands. It is a true deep-water form, only occurring in greater depths, from 60 to 400 fathoms.

Distribution.—South of Spitsbergen (Norw. North Atl. Exped.).

5. *Leucon acutirostris*, G. O. Sars.

(Pl. XXVI.)

Leucon acutirostris, G. O. Sars, Om den aberrante Krebsdyrgruppe Cumacea og dens nordiske Arter, p. 56.

Specific Characters.—Body in female rather short and thick, with the tail scarcely as long as the anterior division. Carapace about the length of the exposed part of the trunk, dorsal crest only confined to the anterior half; pseudorostral projection rather small, horizontal, and terminating in a sharp point, below which the edges for some distance are finely denticulate and setiferous; antero-lateral corners distinctly produced, and defined above by an angular cleft. Adult male much more slender than the female, with the carapace quite smooth above,

pseudorostral projection considerably shorter, antero-lateral corners blunted. 1st pair of legs with the penultimate and antepenultimate joints of about equal size, the latter with only a few very short setæ outside; 2nd pair with the last joint scarcely longer than the antepenultimate one, and carrying about 8 unequal spines. 3rd pair of legs in male with 3 lanceolate appendages of the ischial joint, similar to those in the male of *L. pallidus*, but comparatively smaller. Uropoda with the inner ramus about the length of the basal part, but shorter than the outer, its distal joint much smaller than the proximal, and linear in form, with from 6 to 8 spines, the apical one rather elongated; outer ramus with about 8 ciliated setæ. Colour whitish, with a faint olivaceous tinge. Length of adult female scarcely exceeding 3 mm., of male 3½ mm.

Remarks.—This is the smallest of the Norwegian species, and is, moreover, easily recognized, in the female sex at least, by the comparatively small, acutely produced pseudorostral projection, and the limited extent of the dorsal crest of the carapace.

Occurrence.—I have found this form rather frequently in the inner part of the Christiania Fjord, in depths varying from 30 to 60 fathoms, and have also occasionally met with it in many other places of the Norwegian coast as far as Vadsø. Out of Norway, however, this form has not as yet been recorded.

Gen. 2. **Eudorella**, Sp. Bate, 1867.

Syn: *Leucon*, Krøyer (part.).

" *Eudora*, Sp. Bate.

Generic Characters.—Body in all the known species slender and elongated, with the anterior division club-shaped and shorter than the posterior. Carapace comparatively small, but rather deep, quite smooth above, and subtruncate in front, without any distinct pseudorostral projection, the antero-lateral lappets ascending perpendicularly, to meet with their tips in close approximation to the frontal lobe, the usual opening for the expulsion of the water from the branchial cavities being, of course, placed quite dorsally. Anterior edges of carapace more or less distinctly insinuated and dentated below, lower edges serrate in their anterior half. Not the slightest trace of any eye or even of an ocular lobe present. Superior antennæ rather strongly built and coarsely setiferous, exhibiting in the middle, or between the 2 outer peduncular joints, a very conspicuous elbow-shaped bend, inner flagellum well developed, though consisting of only a single

joint. Inferior antennæ in female with 3 plumose setæ in front, distal joint imperfectly defined. Oral parts exactly as in *Leucon*. Legs likewise rather similar, though comparatively more strongly built, especially the 2nd pair. 3rd pair in male scarcely transformed. Uropoda with the inner ramus longer than the outer, otherwise of a very similar structure to that in *Leucon*.

Remarks.—This genus was established by Sp. Bate in the year 1856; but as the name, *Eudora*, at that time proposed, had already been appropriated in zoology, it was changed in 1867 by the same author to *Eudorella*. The genus is closely related to *Leucon*, exhibiting a very similar structure both of the oral parts and of the legs and uropoda; but still this genus is very easily recognizable by the apparently very different structure of the carapace, and the superior antennæ also exhibit a rather characteristic appearance. We know as yet of 8 species belonging to this genus, 3 of which belong to the fauna of Norway, and will be described below.

6. *Eudorella emarginata*, (Krøyer).

(Pl. XXVII, XXVIII.)

Leucon emarginatus, Krøyer, Nat. Tidsskr. Vol. 2 (new series), p. 181, Pl. 1, fig. 7,
Pl. 2, figs 3 a—h.

Syn: *Cyrianassa ciliata*, Norman (male).

Specific Characters.—Body slender and elongated, though rather strongly built, and finely hairy all over, with 2 unusually long, juxtaposed bristles at the end [of the penultimate caudal segment dorsally]. Carapace about the length of the 4 anterior exposed segments combined, and almost transversely truncated in front; anterior edges in female with a broad simulnar emargination below, defined above by a rounded dentated prominence, below by a very prominent, somewhat upturned spiniform process, upper part of the edges smooth and fringed with short uniform hairs. Carapace of male with the antero-lateral parts more expanded, and the emargination much smaller than in female. Superior antennæ very strongly built, 1st joint of the peduncle broad and massive, the other 2 of about equal length, all 3 joints clothed on both edges with strong ciliated setæ, outer flagellum about the length of the last peduncular joint, and likewise clothed outside with strong setæ, inner flagellum about half the length of the outer, and tipped with 3 subequal setæ; those of male with a dense fascicle of sensory filaments at the base of the outer flagellum, which is distinctly 4-articulate. Inferior antennæ in female with 2 plumose setæ inside the base, in addition to the 3 usual setæ of the anterior edge. 1st pair of legs projecting far beyond the

limits of the carapace, penultimate joint much longer than the antepenultimate one; 2nd pair exceedingly robust, with the terminal joint broad and spatulate in form, carrying numerous radiating spines. Uropoda with the inner ramus considerably produced, exceeding the basal part in length, its proximal joint armed inside with numerous somewhat unequal spinules, outside with a row of short ciliated setæ, the distal joint rather small, and exerted at the tip to a mucronate point, outside which a long seta is attached. Uropoda of male with a number of slender setæ inside the basal part and the proximal half of the inner ramus. Colour whitish, with a more or less distinct grayish or yellowish tinge. Length of adult female reaching to 12 mm., of male about the same.

Remarks.—This is by far the largest of the known species, and is, moreover, easily recognizable, at least in the female sex, by the large semilunar emargination in the lower part of the anterior edges of the carapace, and the strongly prominent process defining this emargination below. The *Cyrianassa ciliata* of Norman is unquestionably the adult male of this species.

Occurrence.—It is one of our commonest Cumacea, occurring rather plentifully along the whole Norwegian coast, from the Christiania Fjord to Vadsø, in depths varying from 30 to 150 fathoms, soft muddy bottom. In habits it agrees very closely with *Leucon nasicus*, together with which it is generally found, possessing, like the latter, great dexterity in burying itself in the loose bottom material.

Distribution.—British Isles (Norman), Kattegat (Meinert), Heligoland (Ehrenbaum). Greenland (Hansen), Atlantic coast of North America (Verrill).

7. *Eudorella truncatula*, Sp. Bate.

(Pl. XXIX.)

Eudora truncatula, Sp. Bate, On the British Diastylidæ. Ann. Mag. Nat. Hist. Vol. 17, p. 457, Pl. 14, fig. III.

Syn: *Eudorella inermis*, Meinert (male).

Specific Characters.—General form of body about as in the preceding species, though perhaps somewhat less elongated, and with the tail narrower. Carapace in female with the anterior edges smooth in their upper part, and moderately setiferous, lower part cut off into 2 successive dentated prominences, having between them a narrow sinus, antero-lateral corners not at all produced. Carapace of male with the anterior edges quite entire, antero-lateral corners rounded off, and armed with 3 or 4 denticles. Superior antennæ resembling those in *E. emarginata*, but less abundantly setiferous, and having the last joint of the

peduncle shorter than the 2nd. 1st pair of legs less robust, with the penultimate joint fully as long as the 2 preceding joints combined; 2nd pair with the terminal joint narrower, and carrying a smaller number of spines. Uropoda with the rami less unequal, the inner one with only a limited number of spinules, the outer one but scantily setiferous. Colour whitish. Length of adult female scarcely exceeding 5 mm., that of male about the same.

Remarks.—This species, first described by Sp. Bate, is very closely allied to the preceding one, though on a closer examination, it is easily distinguishable by the rather different armature of the anterior edges of the carapace. It is also much inferior in size. The *Eudorella inermis* of Meinert is undoubtedly the adult male of this species.

Occurrence.—Along the south and west coasts of Norway this form is far from being rare, occurring not infrequently in moderate depths, from 6 to 30 fathoms. The most northern locality in which I have observed it, is the Lofoten Islands; farther north, off the Finmark coast, I have never met with it, and its foreign distribution also shows it to be evidently a more southern form than the preceding species.

Distribution.—British Isles (Sp. Bate), Kattegat (Meinert), Heligoland (Ehrenbaum), Mediterranean at Naples and Spezia (the present author).

8. *Eudorella hirsuta*, G. O. Sars.

(Pl. XXX.)

Eudora hirsuta, G. O. Sars, Undersogelser over Christianiafjordens Dybvandsfauna, p. 43.

Specific Characters.—Body extremely slender and elongated, with the integuments rather densely hairy. Carapace with the anterior edges coarsely denticulate throughout their whole length, and in the upper part clothed with numerous stiff, anteriorly curving bristles, exhibiting, moreover, below the middle a well-marked, though rather small sinus; antero-lateral corners not produced. Carapace of (young) male with the anterior edges unarmed, and without any distinct sinus. Superior antennæ about as in *E. truncatula*. 1st pair of legs comparatively more robust, with the penultimate joint scarcely longer than the antepenultimate one; 2nd pair with the antepenultimate joint unusually elongated and narrowed, last joint comparatively short. Uropoda resembling in structure those in *E. truncatula*, but having the apical spine of the inner ramus well defined at the base. Colour whitish. Length of adult female 5 mm.

Remarks.—This form is about same size as *E. truncatula*, and may easily be confounded with that species. On a closer examination, however, it is found to differ in the still more slender and elongated form of body, and

still more in the rather different armature of the anterior edges of the carapace. In the structure of the 2 anterior pairs of legs also, well-marked differences are found to exist. I have not yet met with fully adult males of this species; but even in young specimens the carapace has become somewhat transformed, both the marginal denticles and the sinus of the anterior edges having been lost.

Occurrence.—I have found this form in 2 widely-distant localities of the Norwegian coast, viz., in the Christiania Fjord and off the Lofoten Islands. In both places it only occurred in considerable depths, from 150 to 200 fathoms, muddy bottom. Out of Norway, this form has not yet been recorded.

Gen. 3. **Eudorellopsis**, G. O. Sars, 1882.

Generic Characters.—Body short and compact, club-shaped. Carapace of a structure similar to that in *Eudorella*, the pseudorostral projection being obsolete, and the efferent branchial orifice placed dorsally in close approximation to the frontal lobe. Tail comparatively short. Superior antennæ strongly built, and conspicuously geniculate, the geniculation, however, occurring between the 1st and 2nd peduncular joints, not, as in *Eudorella*, between the 2nd and 3rd, inferior antennæ in female very small, unarticulate, with 2 very strong and densely hirsute setæ. Oral parts as in the 2 preceding genera. Legs comparatively robust, and densely setiferous. Uropoda likewise robust, with the outer ramus much larger than the inner, and partly spinous.

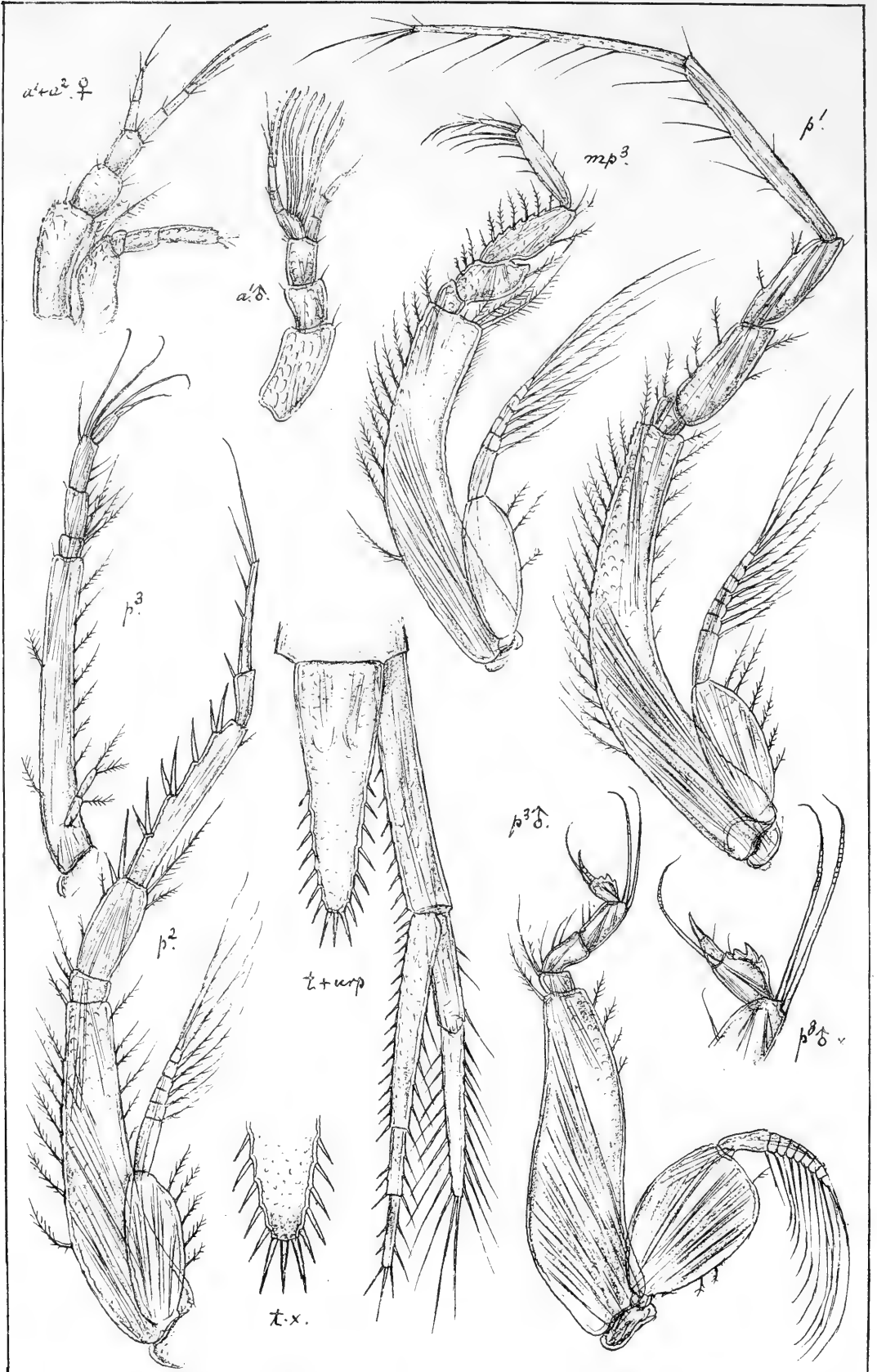
Remarks.—This genus was proposed by the present author in the year 1882, to comprise the anomalous form recorded by Krøyer as *Leucon deformis*, which I at first had referred to the genus *Eudorella*. Indeed, this form agrees more nearly with the latter genus than with *Leucon*, yet exhibits several well-marked differences from any of these genera, both as regards the general form of the body, and the structure of some of its appendages, especially the antennæ and uropoda. Besides the type species described below, another species has been recorded by Prof. Sidn. Smith from the east coast of North America, as *E. integra*.

9. *Eudorellopsis deformis*, (Krøyer).

(Pl. XXXI, XXXII.)

Leucon deformis, Krøyer, Nat. Tidsskr. Vol. 2 (2nd series) p. 194, pl. 4.Syn: *Eudorella deformis*, G. O. Sars.

Specific Characters—Body of female exceedingly short and stout, with the anterior division rather dilated, and considerably longer than the posterior. Carapace comparatively large and deep, exceeding in length the exposed part of the trunk, and transversely truncated in front, tips of the lateral lappets appearing above as 2 juxtaposed horn-like projections, in front of which the rather wide efferent branchial orifice occurs; anterior edges of carapace perfectly straight, without any sinus, but fringed throughout their whole length with broad lamellar teeth; antero-lateral corners triangularly produced. Adult male somewhat more slender than the female, and exhibiting the usual sexual characters, carapace differing in the circumstance that the anterior edges are dentate only in the middle, and the antero-lateral corners not produced. Superior antennæ with the last peduncular joint longer than the 2nd, both armed at the end with a circlet of strong spines, outer flagellum about the length of the last peduncular joint, inner much smaller, scale-like, with 3 short apical spines. Palp of anterior maxillæ with a small ciliated projection at the base outside. Branchial apparatus with only 2 digitiform gill-elements on each side. 1st pair of legs moderately slender, with a row of long plumose setæ outside the meral and carpal joints, propodal joint about the length of the carpal one, terminal joint somewhat shorter and very narrow, sublinear, carrying on the tip 3 slender spines and 2 unequal bristles; 2nd pair with the last joint fully as long as the antepenultimate one, and provided with 5 apical, and 2 lateral spines. Uropoda in female very strongly built, with the basal part short and thick, and the rami very unequal, the outer one being much the larger, with the distal joint rather expanded and obliquely truncated at the tip, which carries about 7 ciliated setæ, the dorsal face of the joint being, moreover, armed with several rows of strong spines; inner ramus conically tapered, with scattered spinules inside, and carrying on the tip of the comparatively small distal joint, a short spine and a slender seta. Uropoda in male less robust, with the inner ramus more produced and, like the basal part, provided with ciliated setæ in addition to the spinules; outer ramus with the distal joint narrower and less spinous. Colour whitish. Length of adult female 5 mm., of male 4½ mm.



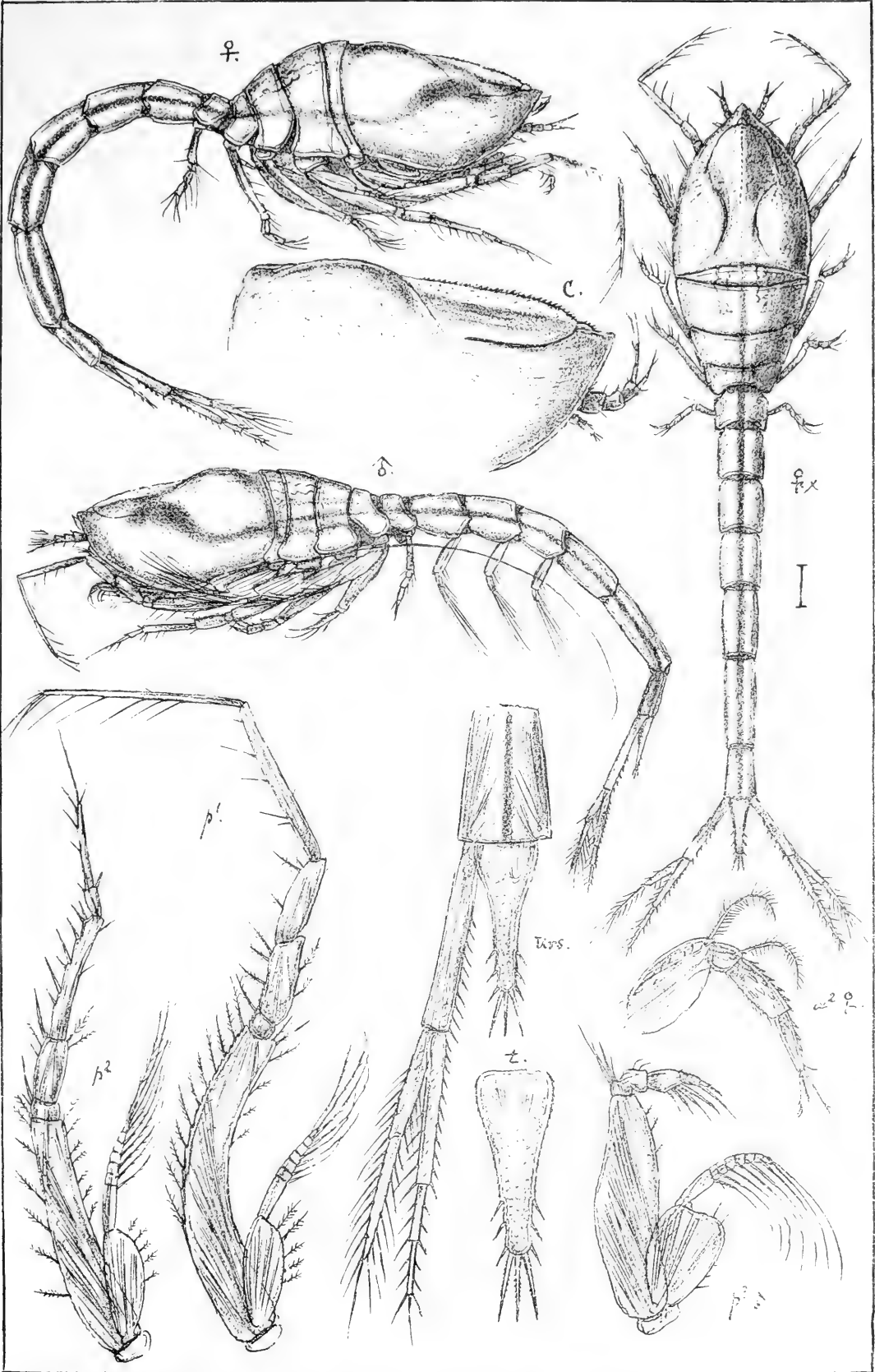
Trykt i den priv. Opmaaling Chr.

Hemilamprops uniplicata. G.O.Sars.
(continued).

Cumacea.

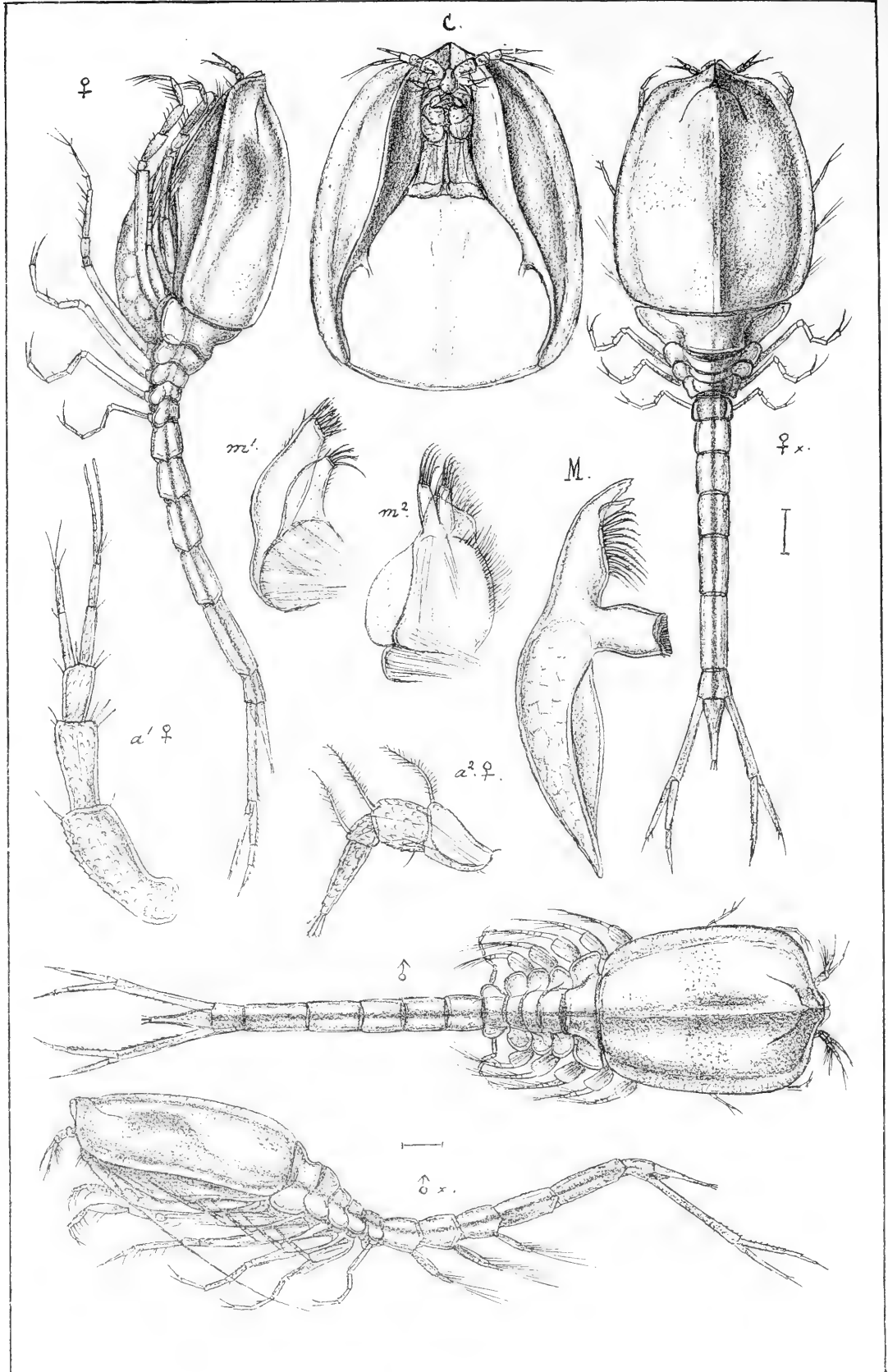
Lampropidæ.

Pl. XVIII.



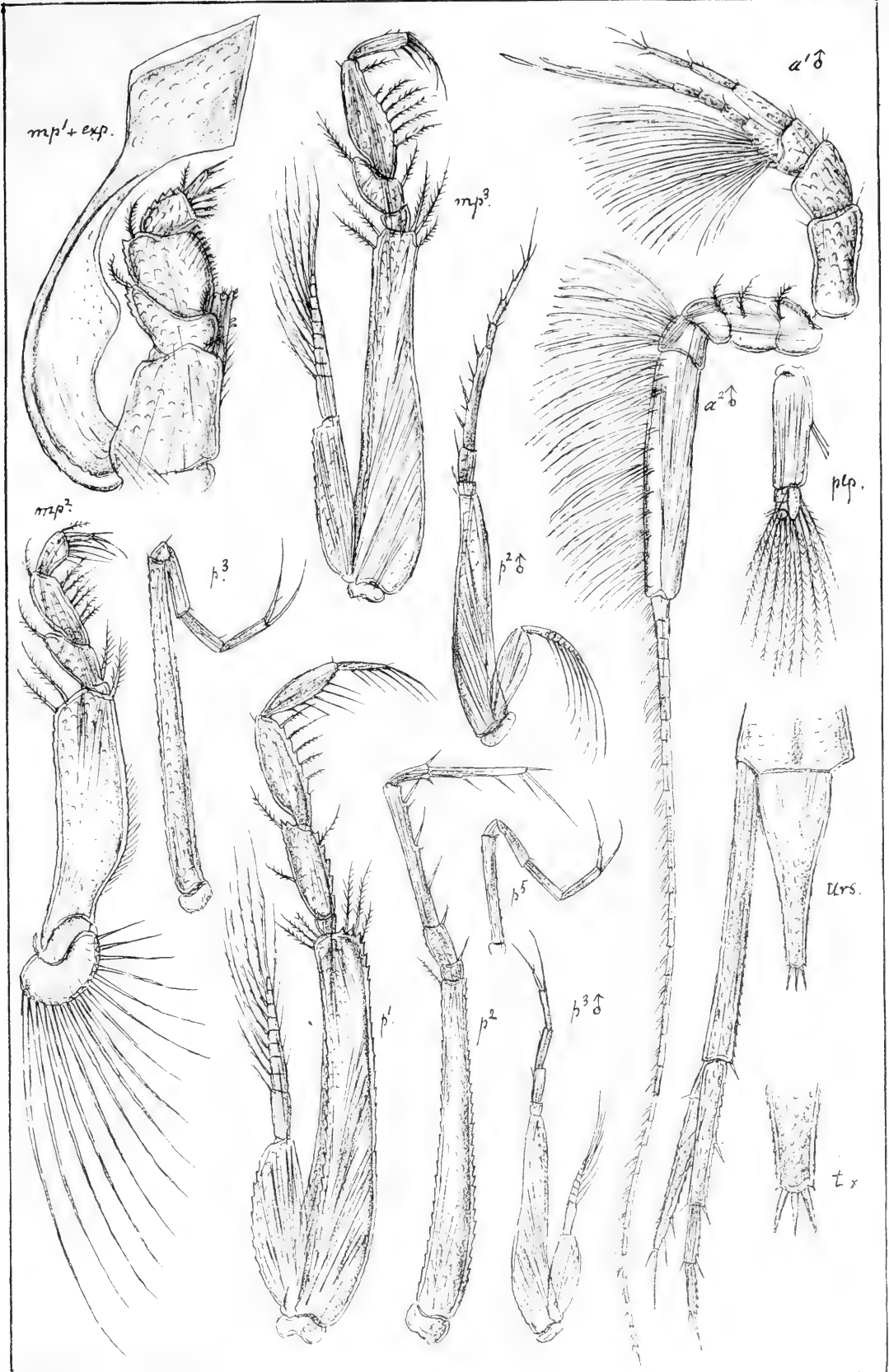
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Hemilamprops cristata, G.O.Sars.



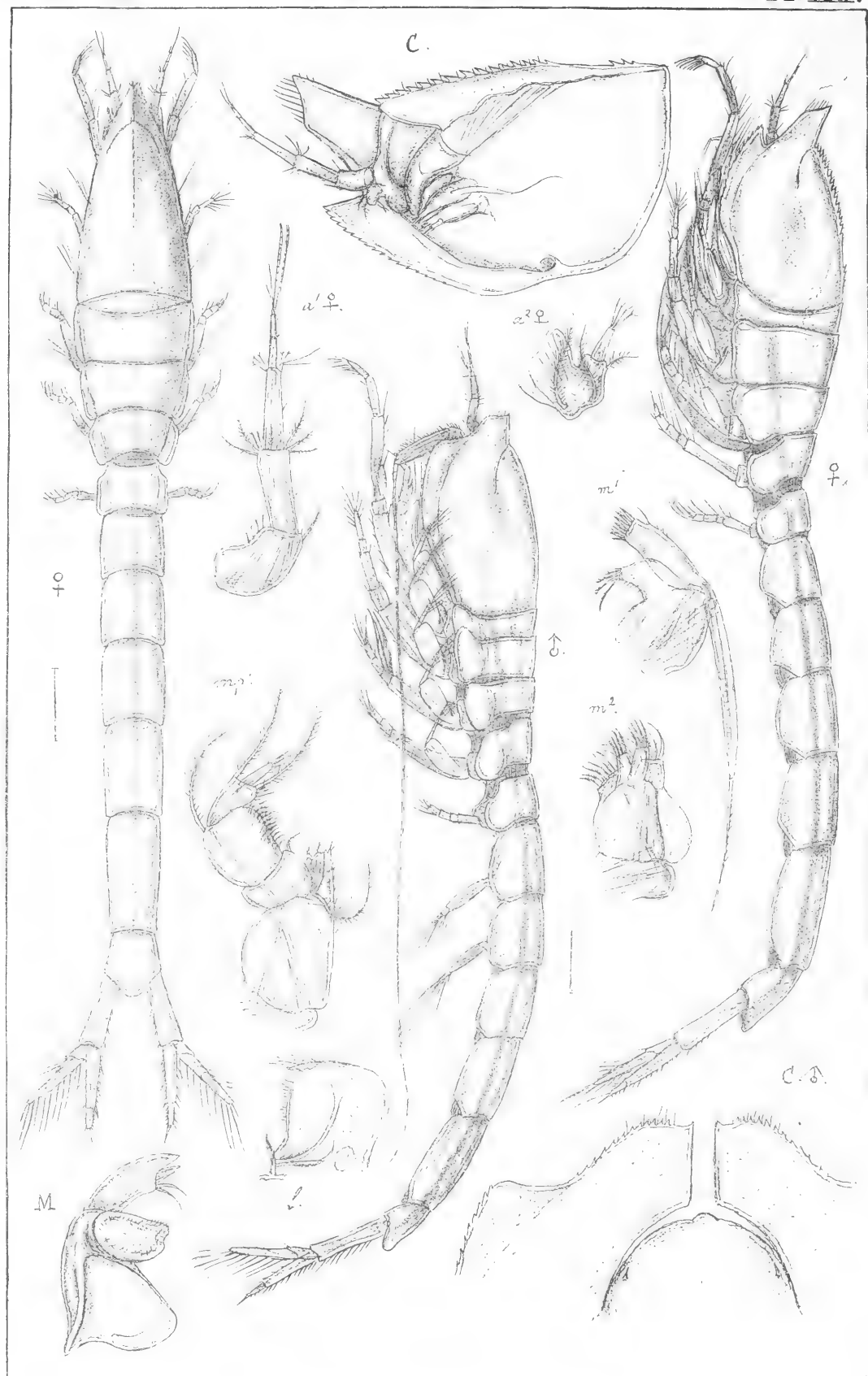
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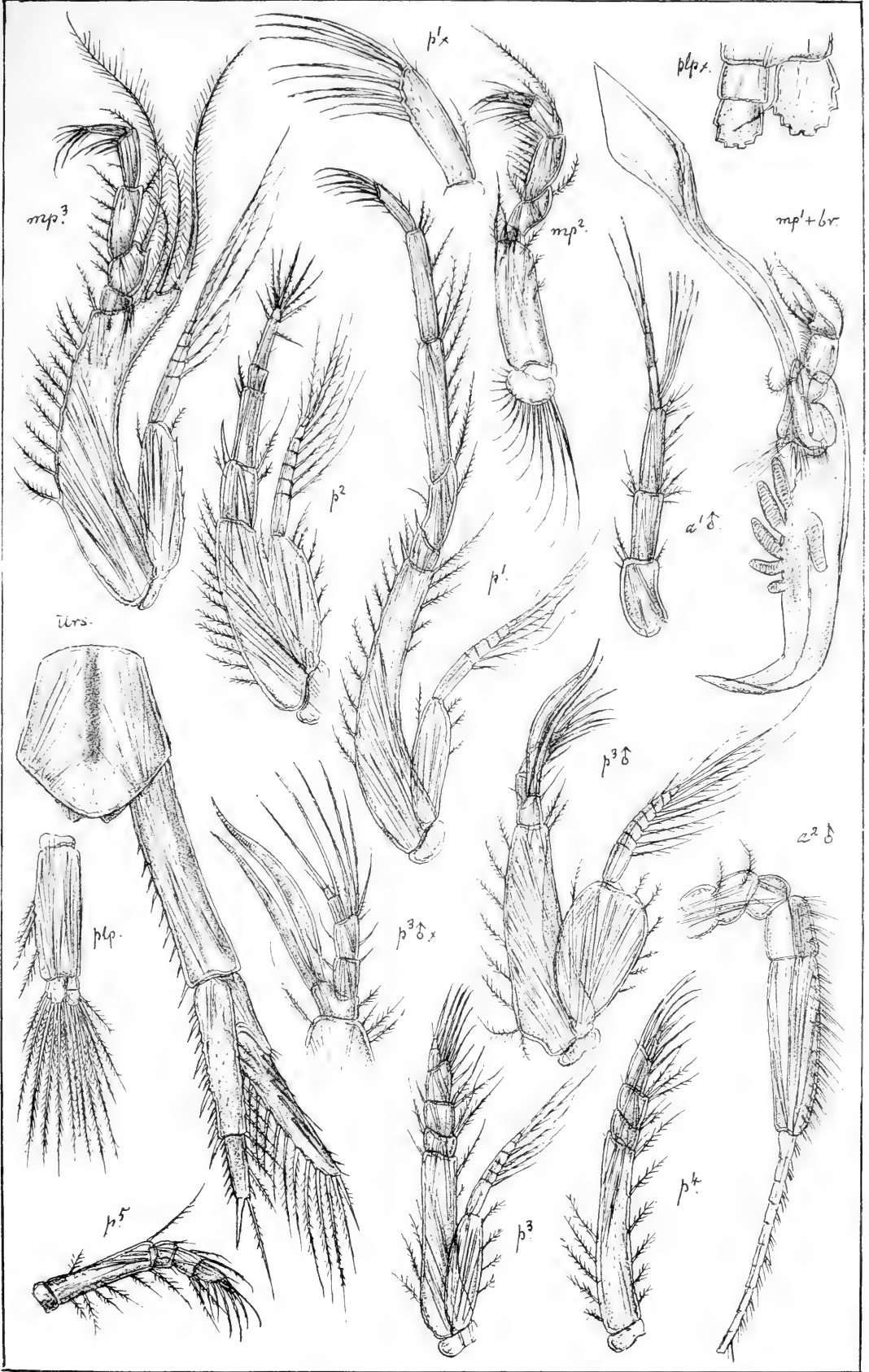
Platyaspis typica, G.O. Sars.



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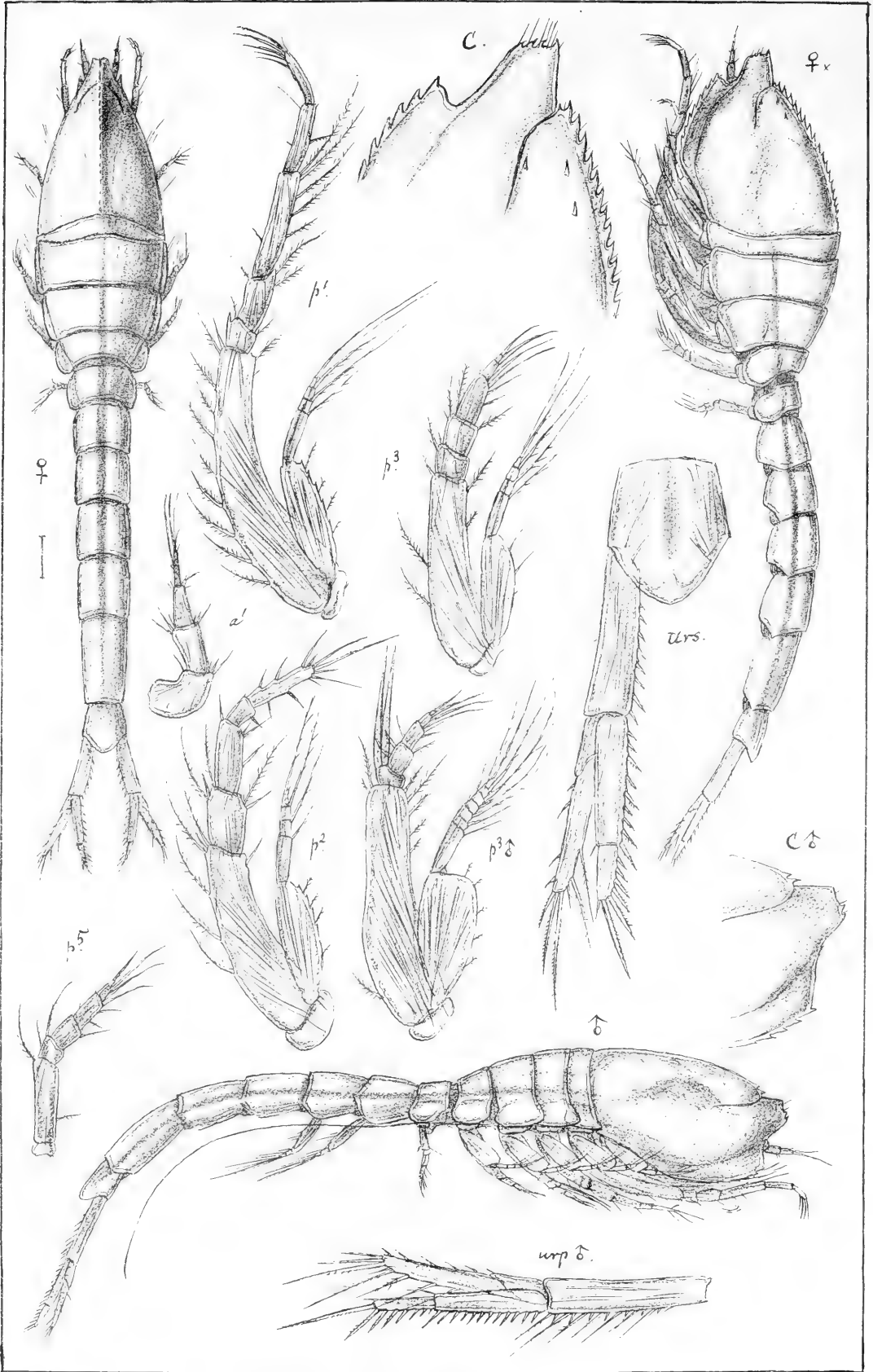
Platyaspis typica, G.O. Sars.
(continued).





Trykt i den priv. Opmaalning Chr.

Leucon nasicus, Kröyer.
(continued).



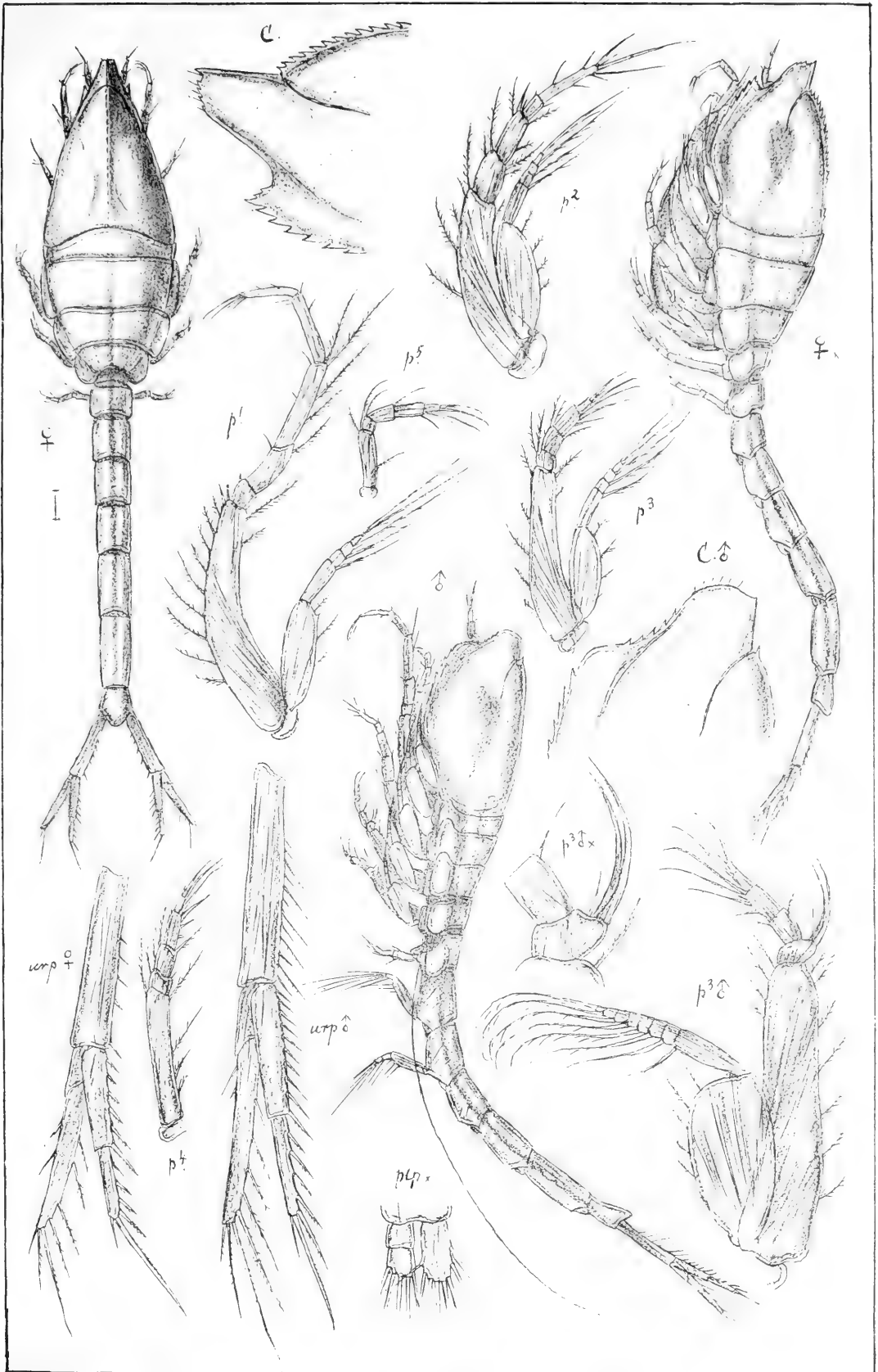
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Leucon nasicooides, Lilljeb,

Cumacea.

Leuconidæ.

Pl. XXIV.



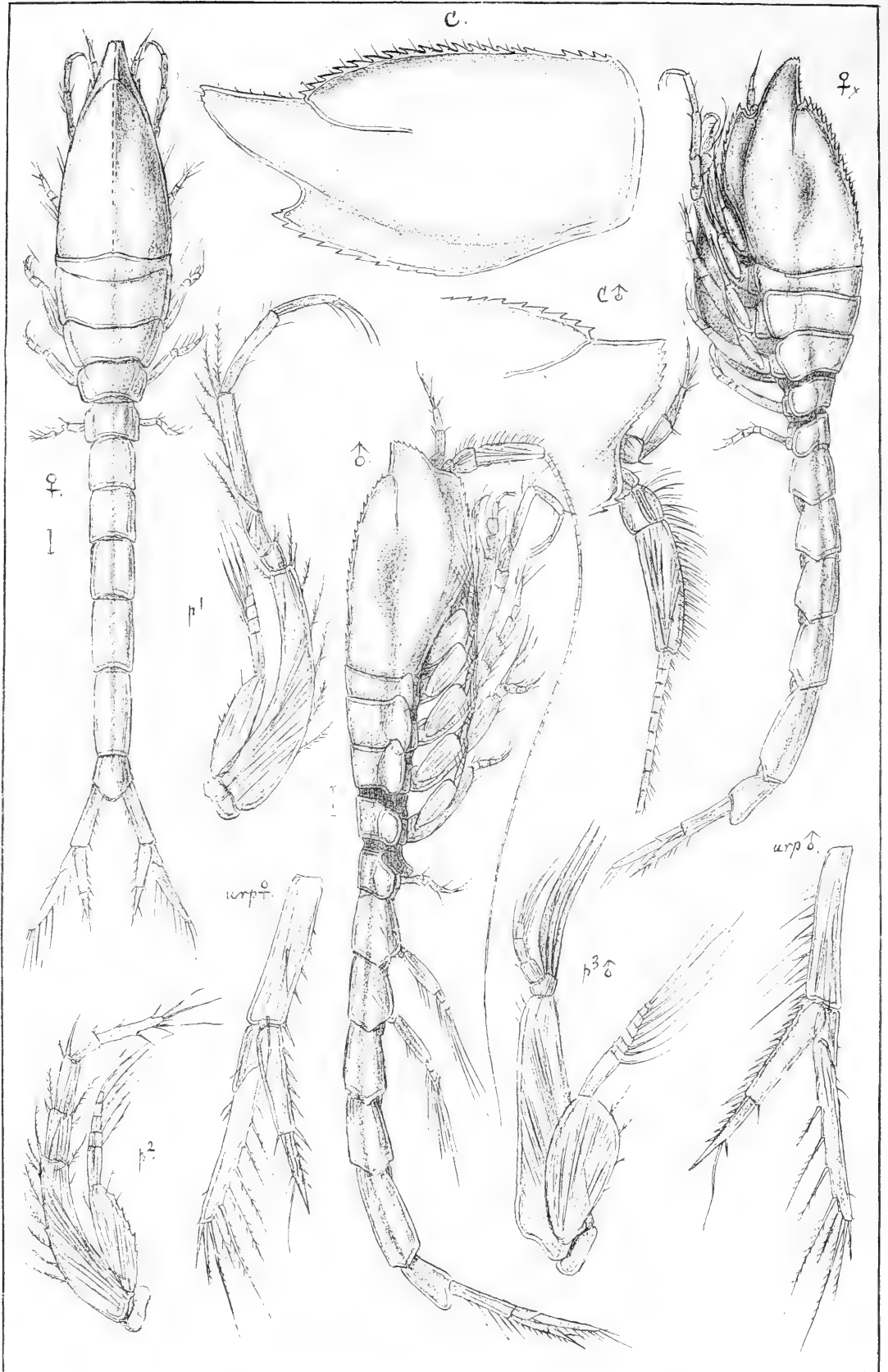
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Leucon fulvus, G.O.Sars.

Cumacea.

Leuconidæ.

PL. XXV



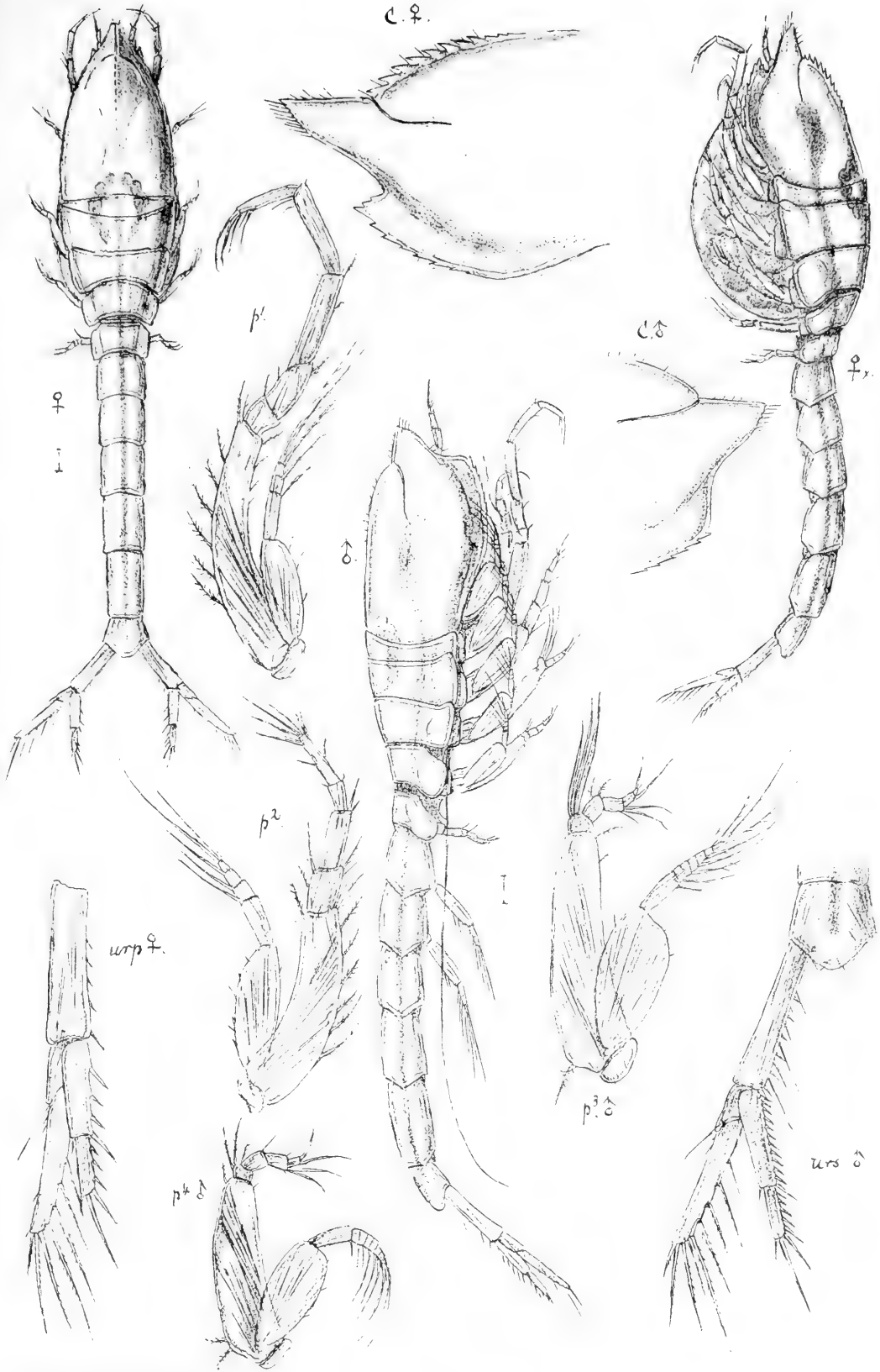
Trykt i den priv. Opmaalning Chr.

Leucon pallidus, G.O. Sars.

Cumacea.

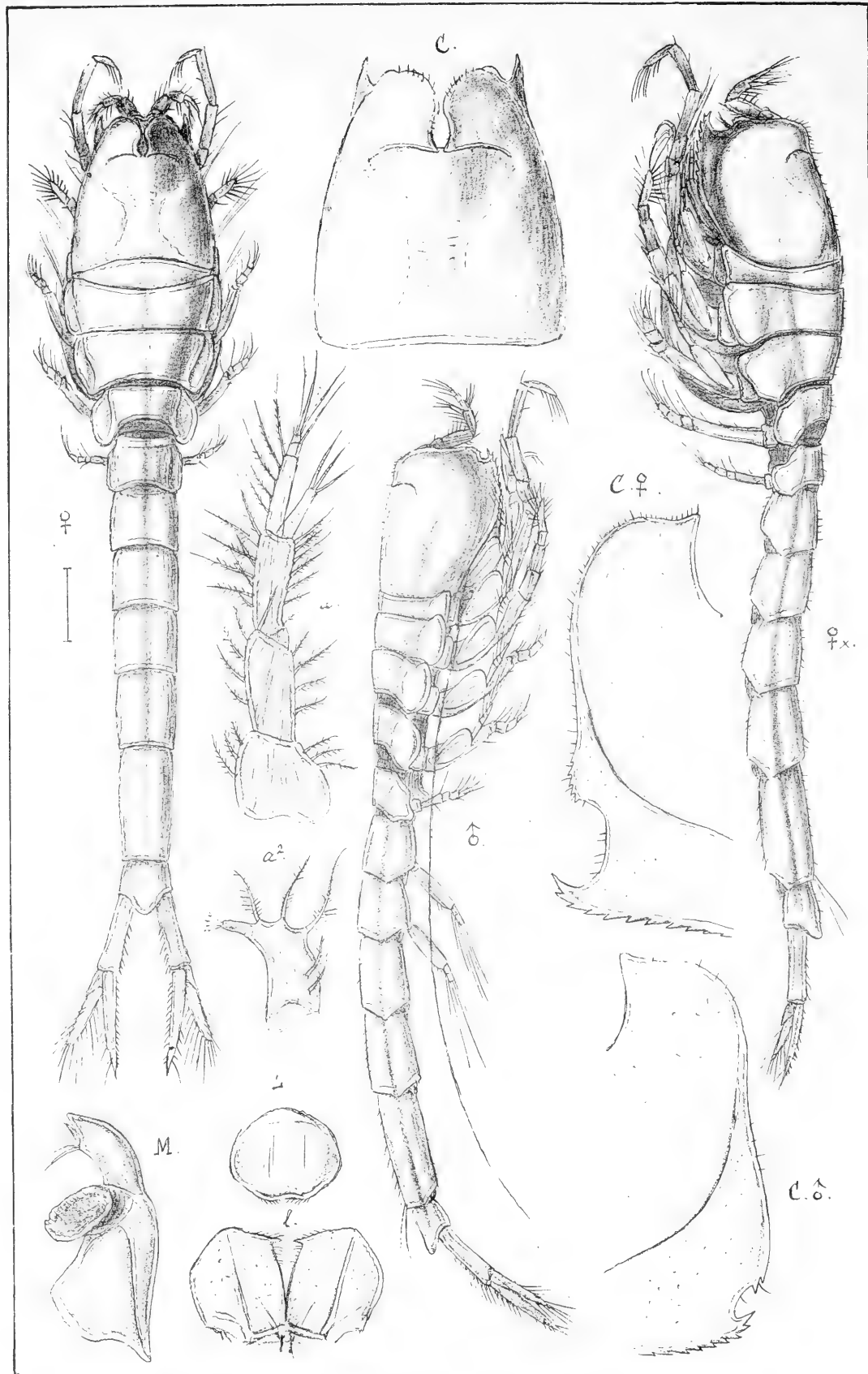
Leuconidæ.

PL. XXVI.



Trykt i den priv. Opmaalning Chr.

Leucon acutirostris, G.O.Sars.



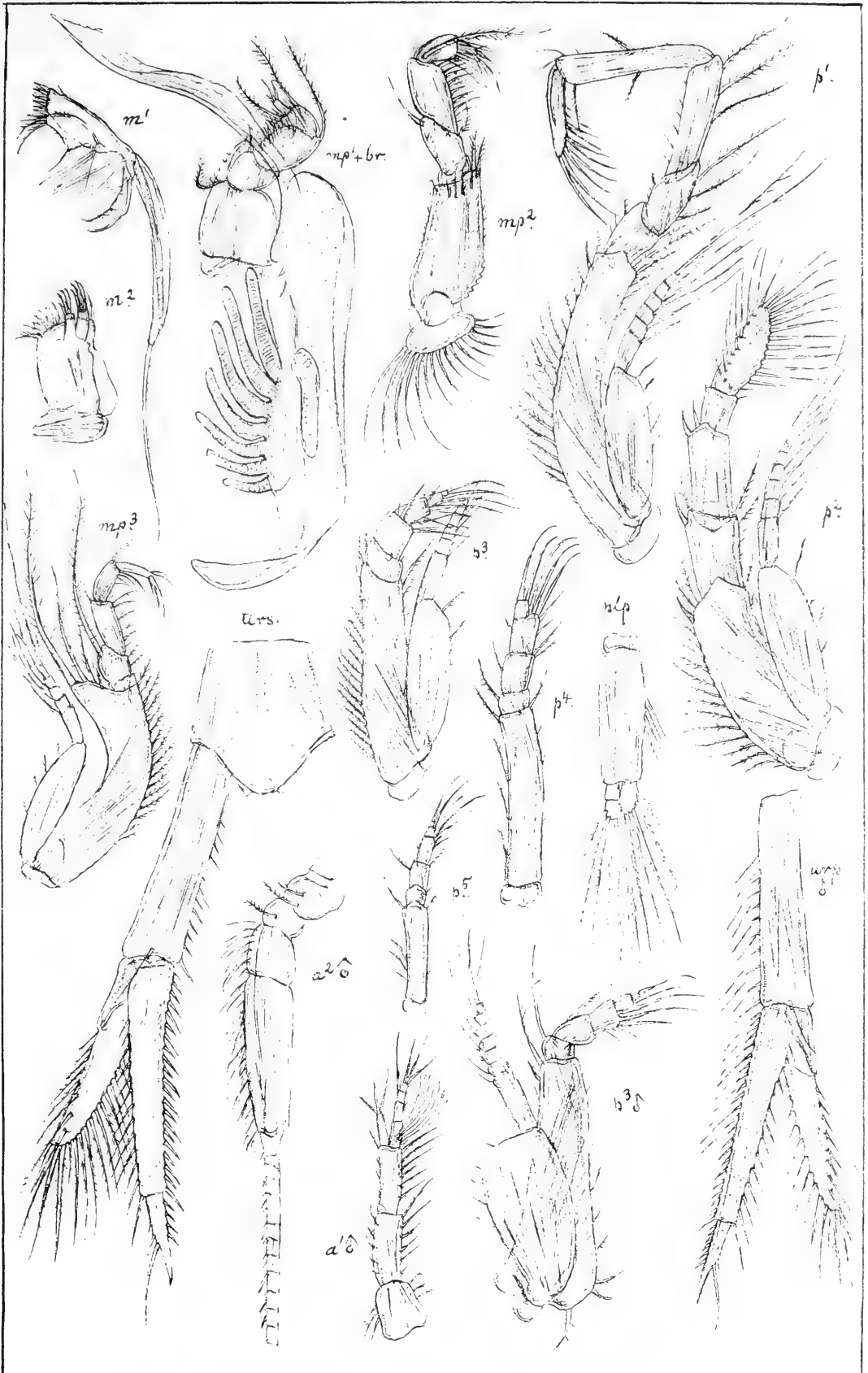
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Eudorella emarginata, (Kröyer).

Cumacea.

Leuconidæ.

PL. XXVIII.



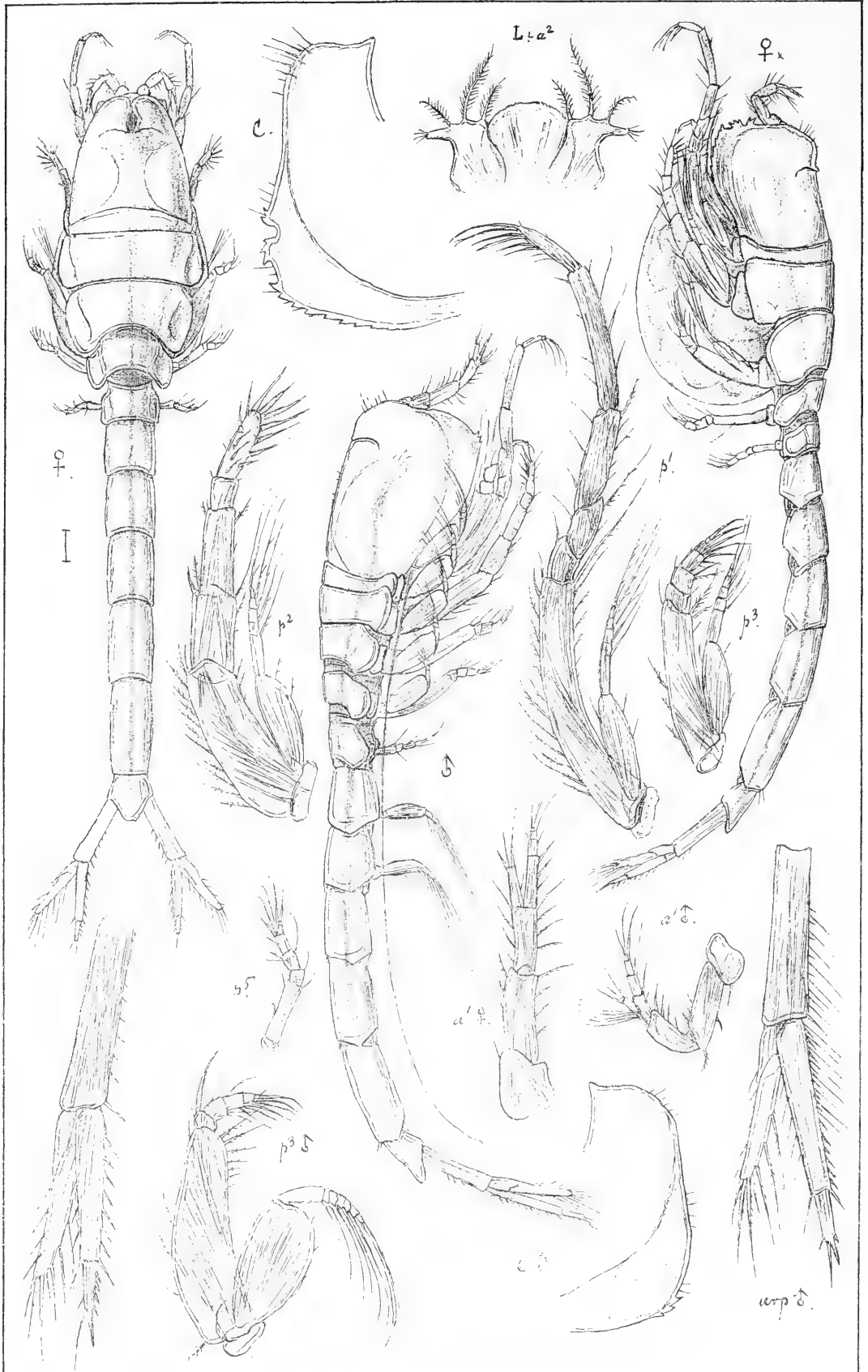
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Eudorella emarginata (Kröyer).
(continued).

Cumacea.

Leuconidæ.

Pl. XXIX.



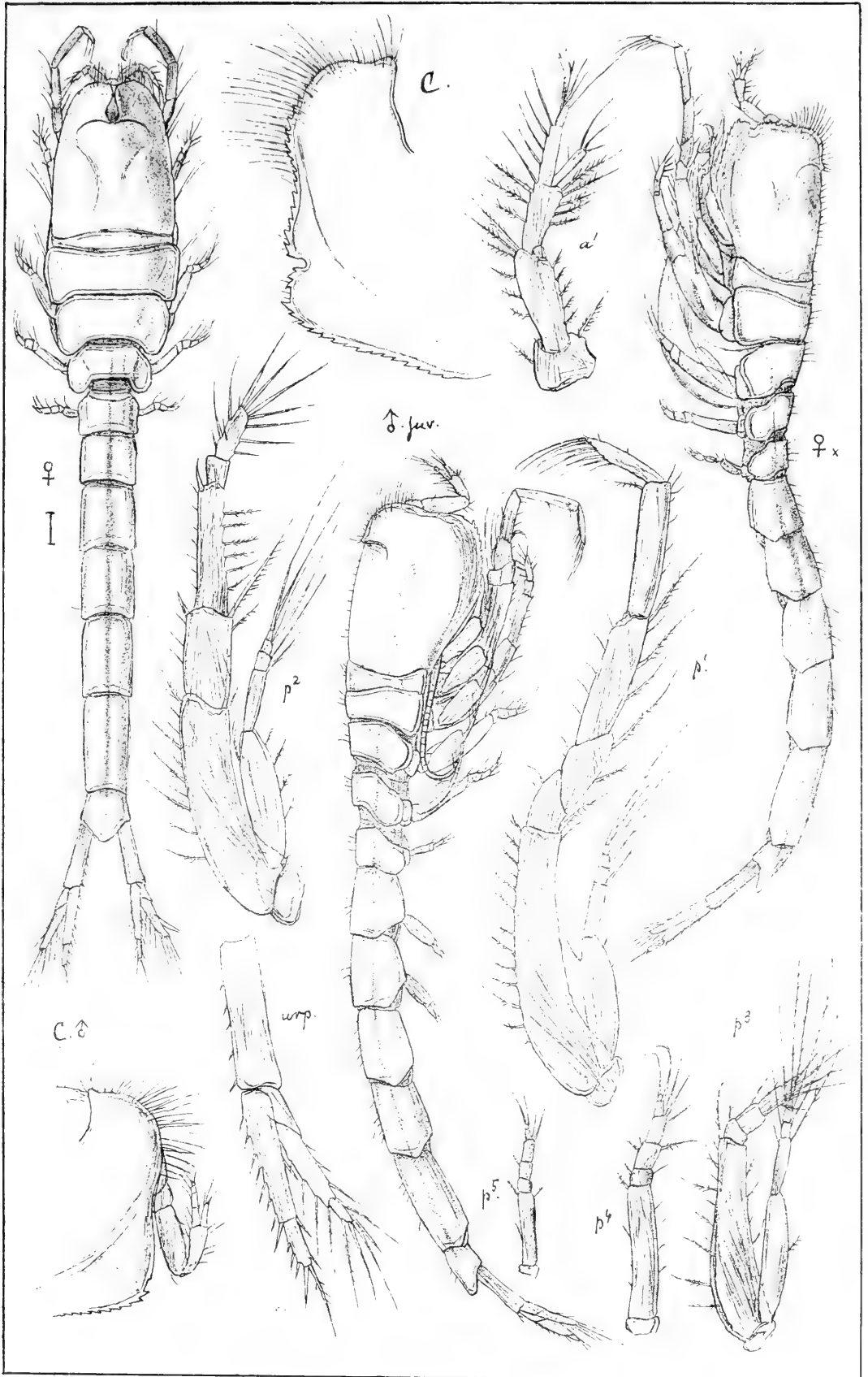
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Eudorella truncatula (Sp. Bate).

Cumacea.

Leuconidæ.

Pl. XXX.



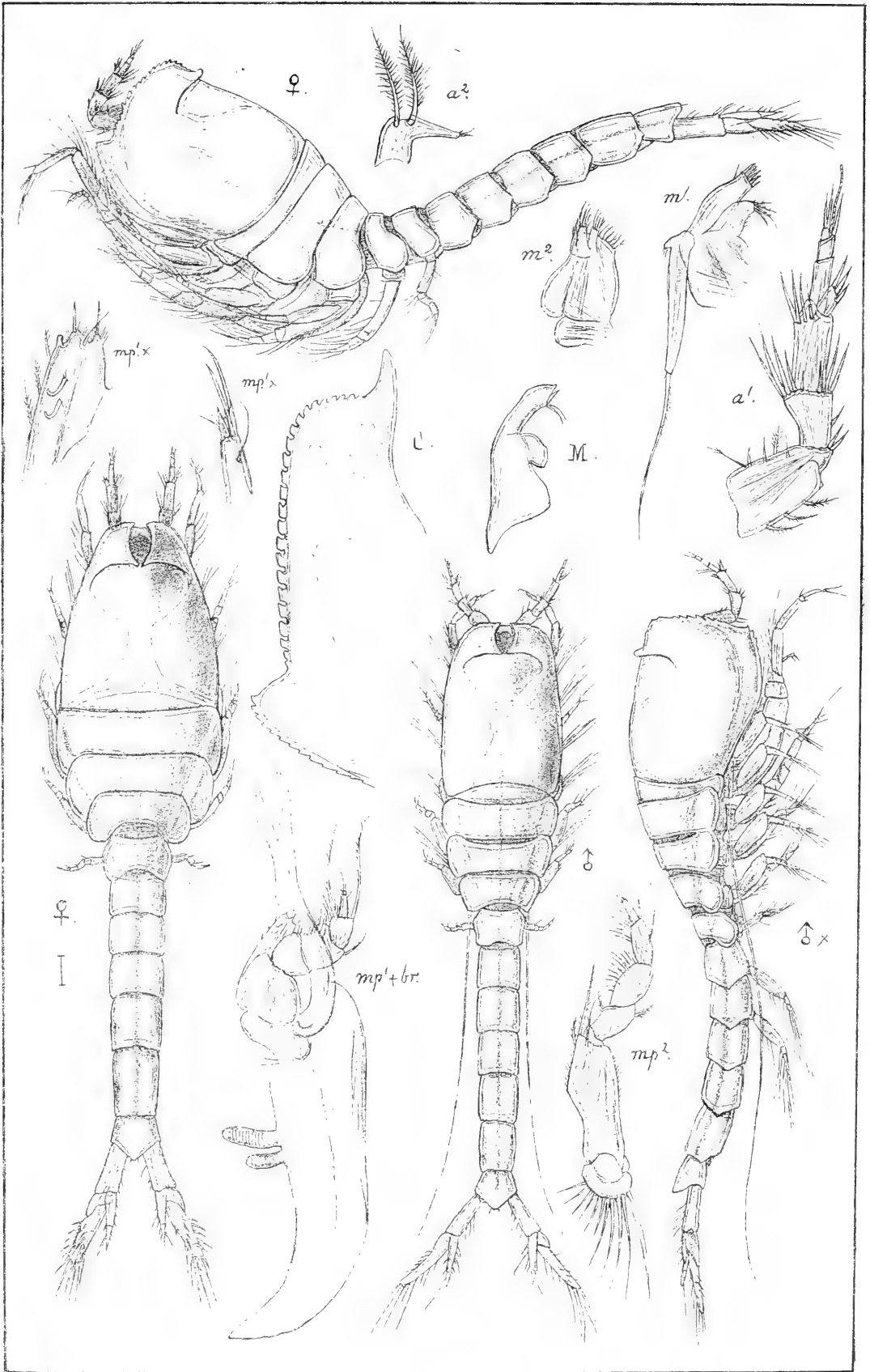
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Eudorella hirsuta, G.O.Sars.

Cumacea.

Leuconidæ.

Pl. XXXI.



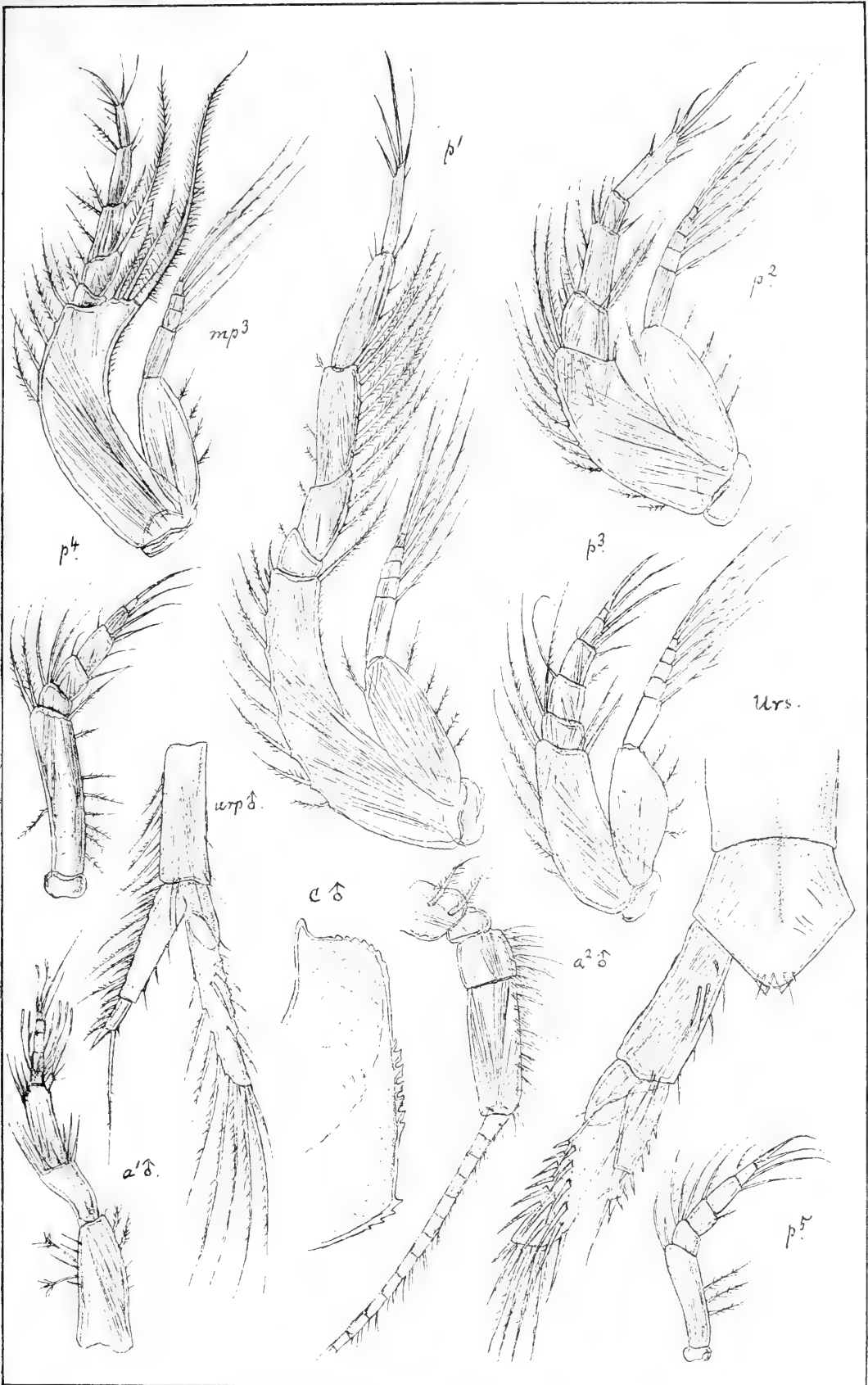
Trykt i den priv. Opmaalning Chr.

Eudorellopsis deformis, (Kröyer).

Cumacea.

Leuconidæ.

Pl. XXXII.



Trykt i den priv. Opmaalning Chr.

Eudorellopsis deformis (Kröyer).
(continued).

AN ACCOUNT
OF THE
CRUSTACEA
OF
NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY

G. O. SARS

VOL. III

CUMACEA

PART V & VI

DIASTYLIDÆ

WITH 16 AUTOGRAPHIC PLATES



BERGEN

PUBLISHED BY THE BERGEN MUSEUM

SOLD BY

ALB. CAMMERMEYER'S FORLAG, CHRISTIANIA

1900



Remarks.—This form is very easily recognizable from our other Cumacea by its short, club-shaped body, and, indeed, its form appeared to Krøyer so unusual that he applied to it the specific name *deformis* (misshapen). A detailed description of the female of this species, accompanied by figures, has been given by the present author in his account of the Cumacea from the 'Josephine' Expedition.

Occurrence.—Off the Norwegian coast this form seems to be rather rare. It was first found here by the late Dr. A. Boeck, who collected a few specimens at Haugesund, west coast of Norway; and I have myself subsequently taken it occasionally in 2 other places, viz., at Skudesnæs and off the Jæderen coast. In both these places it occurred in comparatively shallow water, on a sandy bottom.

Distribution.—Greenland (Krøyer), Kattegat (Meinert), Heligoland (Ehrenbaum), Atlantic coast of North America (Verrill).

Fam. 5. Diastylidæ.

Characters.—Body, as a rule, not very slender, with the anterior division more or less tumefied, and sharply marked off from the slender, cylindrical tail. Carapace large, more or less vaulted above, pseudorostral projection distinct, lower edges serrate at least in their anterior half. First pedigerous segment well defined, though rather narrow, band-shaped. Segments of tail generally strongly emarginated above on the hind edge, and exhibiting a more or less pronounced nodular appearance. Eye present or wanting. Superior antennæ slender, with both flagella distinctly developed. Inferior antennæ in female forming a cylindrical stem divided into several successive joints. Mandibles well developed, with numerous curved spines behind the cutting edge, its body of different shape in the different genera. Anterior maxillæ with the palp bisetose; posterior maxillæ normal. Branchial apparatus with the gill-elements much more fully developed in male than in female, and generally arranged along a spiral line; ends of the exopodal portions forming together a thin-skinned, protractile tube. 3rd pair of maxillipeds with the basal joint very much elongated and slightly dilated at the end, its outer corner carrying several long plumose setæ, terminal part comparatively short. 1st pair of legs very slender, with the 3 outer

joints narrow and elongated, forming angular bends with each other; 2nd pair likewise slender, though shorter, and exhibiting the full number of joints. Both these pairs in female with well-developed natatory exopodites, the 3 posterior pairs simple. All the legs in male, except the last pair, provided with very fully developed exopodites. Pleopoda in male only 2 pairs. Uropoda slender, with the basal part very narrow and spinulose inside, inner ramus triarticulate, outer biarticulate. Telson well defined, with the outer part generally narrowly produced and spinulous, tip with only two spinules. Sexual dimorphism generally very pronounced.

Remarks.—This family is well distinguished from the other Cumacean families by a number of easily recognizable characters. As to the external appearance, the sharp demarcation between the anterior and posterior divisions of the body is rather characteristic, the former being generally very tumid, whereas the latter is always extremely narrow, with the segments connected in a particular manner, so as to admit of very great mobility, not only in a ventral, but also in a dorsal direction. In all the known forms, the anterior extremity of the body is produced in a nose-shaped prominence, the pseudorostral projection, and the posterior in a more or less elongated, narrowly lageniform piece, the telson, which projects between the slender, diverging uropoda. The structure of the antennæ is rather unlike that in other Cumacea, and in the structure of the other appendages also, several peculiarities are to be found. As to the number of pleopoda in the male, this family agrees with the *Leuconidae*, but is otherwise very different. The family comprises as yet 5 genera, 4 of which are represented in the Norwegian fauna and will be treated of below, the 5th, *Pachystylis*, having recently been established by Dr. Hansen, to include an exotic form from the German Plankton-Expedition.

Gen. 1. *Diastylis*, Say, 1818.

Syn: *Condylura*, Latreille (not Illiger).
 „ *Alauna*, Goodsir.
 „ *Cuma*, Krøyer (not Edwards).

Generic Characters.—Body in female rather robust, in male much more slender. Integuments generally hard and brittle, exhibiting an irregular reticulated structure, and more or less densely hairy. Carapace large and tumid, not infrequently armed with spiniform projections, sometimes also with lateral folds, but never

with any dorsal crest; pseudorostral projection always distinct, triangular, and horizontally extended; antero-lateral corners only slightly produced. Epimeral plates of the pedigerous segments generally narrow and incrassated, those of last segment sometimes produced to posteriorly-pointing spines. Caudal segments constricted at the base and also immediately in front of the posterior end, with the lateral corners more or less projecting; last segment flattened, sub-pentagonal. Eye generally present, and much larger in male than in female. Superior antennæ in female with the peduncle very slender, outer flagellum 4-articulate, inner 3-articulate and much the smaller; those in male not very different, though having the peduncle somewhat thicker, and the outer flagellum 5-articulate with the usual additional fascicle of sensory filaments at the base. Inferior antennæ in female 4-articulate, with 4 plumose setæ, one apical; those in male, as a rule, exceeding the body in length, last joint of the peduncle large and compressed, being clothed below with comparatively short sensory appendages, flagellum very slender, filiform, with rather elongate articulations. Mandibles large, oblong, with the body regularly navicular in form. 3rd and 4th pairs of legs in female with no rudiments of exopodites. Both pairs of pleopoda in male normally developed, with the rami well defined, the outer one biarticulate, the inner uniarticulate. 3rd and 4th caudal segments in male with 4 plumose setæ in place of the pleopoda. Uropoda with the rami much shorter than the basal part, the inner one mucroniform and, as a rule, shorter than the outer, which is very narrow, linear, and sparingly setiferous. Telson narrow lageniform, with the outer part conically tapered and densely spinulous on each side; that in male geniculate in the middle, or exhibiting a projecting angle dorsally.

Remarks.—Of all the Cumacean genera this is the oldest as regards date, having been established by the North American zoologist, Th. Say, as early as in the year 1818. According to the general rule, the order should therefore more properly have been named from this genus, and not from the genus *Cuma*, which was established 10 years afterwards; but the term *Cumacea* is now so universally accepted, that a change would be rather inconvenient. At any rate, the term *Diastylidæ* proposed by Sp. Bate cannot, in consequence of its composition, be used to designate the whole order, but must be restricted to one of the families into which the order is divided. The present genus is the type of this family, and even in the restriction here adopted, it is, of all the Cumacean genera, that which comprises the greatest number of species, amounting at present to about 30 in all. 10 of these species belong to the fauna of Norway, and will be described below; among them are some of the largest known Cumacea.

1. *Diastylis Rathkei* (Krøyer).

(Pl. XXXIII, XXXIV).

Cuma Rathkei, Krøyer, Nat. Tidsskr. Vol. 3, p. 513, pl. 5, 6, figs 17—30.Syn: *Cuma angulata*, Krøyer (adult male).

Specific Characters.—*Female*: Body more slender than in most other species of this genus, with the anterior division scarcely at all tumefied, and oblong in form. Carapace exceeding the exposed part of the trunk by about $\frac{1}{3}$ of its length, and but slightly vaulted above; frontal lobe armed along the middle with a double row of strong, anteriorly-curving denticles, sometimes crossed by one or 2 imperfect transverse rows, lateral faces below the frontal lobe exhibiting a somewhat varying number of scattered small denticles; pseudorostral projection conically produced, horizontal; subrostral corners more or less distinct. Last pedigerous segment with the anterior edge coarsely serrate, lateral parts produced behind to rather large acute processes, extending almost to the end of the 1st caudal segment. Tail somewhat exceeding the length of the anterior division, segments simple, without any spiniform projections. Eye rather small, though distinct. Superior antennæ not very slender, the peduncle scarcely reaching beyond the tip of the pseudorostral projection, 1st joint about the length of the other 2 combined, and armed at the end inside with a small denticle. First pair of legs scarcely longer than the carapace, basal joint equalling in length the remaining part of the leg, and denticulate in its distal part, the last 3 joints of about equal length; 2nd pair with the terminal joint not much longer than the preceding one, both together scarcely exceeding half the length of the antepenultimate one; 3rd and 4th pair very strongly built and densely setiferous. Uropoda about half the length of the tail, outer ramus rather robust, being considerably larger than the inner, though scarcely exceeding half the length of the stem, and densely setiferous along the outer edge and the tip; inner ramus with the 1st joint fully as long as the other 2 combined, spinules of the inner edge about 11 in number (6 of the 1st, 3 of the 2nd, and 2 of the last joint), apical spine strong, mucronate. Telson rather produced, extending fully as far as the stem of the uropoda, its proximal thickened part comparatively short, scarcely occupying more than $\frac{1}{4}$ of the length of the telson, distal part gradually attenuated, and armed on each side with numerous (about 15) spinules, apical spinules of exactly the same appearance as the lateral. Colour whitish, with a more or less distinct carneous tinge. Length amounting to 16 mm.

Remarks.—This form was first described by Krøyer in the year 1841 as a species of the genus *Cuma*. The form subsequently recorded by the same

author as *Cuma angulata*, is, according to my opinion, in which I am supported by Dr. Hansen, the adult male of this species. It is one of our largest and finest species, and in the polar sea it attains a still larger size. I have examined some specimens kindly sent to me by Dr. Stuxberg from the Siberian polar sea, and which had a length of no less than 26 mm. It is, moreover, easily recognized from our other species by its comparatively slender form and by the large spiniform processes formed by the lateral parts of the last pedigerous segment. The species which most closely resembles it is *D. Bradyi* Norman (not yet found off the Norwegian coast), and indeed some forms of *D. Rathkei* exhibit by their more spiny carapace, as it were, a transition to this species.

Occurrence.—I have met with this form along the whole coast of Norway, from the Christiania Fjord to Vadsø, and in some places in great abundance. It is generally found in moderate depths varying from 10 to 30 fathoms, especially where the bottom consists of very loose mud, in which it buries itself with great dexterity. Sometimes I have found it rather abundantly on a bottom covered with a thick layer of putrid dark mire avoided by most other Crustacea. Although young males are nearly as frequent as females, I have not yet met with any sexually mature male specimen (= *Cuma angulata* Kr.), probably owing to the circumstance that the existence of such specimens is limited to certain short periods of the year.

Distribution.—Kattegat (Meinert), Bay of Kiel (Moebius), Pommerian coast (Zaddach), the Baltic (Lindstrøm), Heligoland (Ehrenbaum), Dutch coast (Hoek), British Isles (Sp. Bate), Atlantic coast of North America (Verrill), Greenland (Hansen), Spitsbergen (Norw. North Atl. Exp.), Franz Joseph Land (Heller), the Barents Sea (Hoek), the Kara Sea (Hansen), the Siberian Polar Sea (Stuxberg).

2. *Diastylis cornuta* (Boeck).

(Pl. XXXV & XXXVI).

Cuma cornuta, Boeck, Christiania Vid. Selsk. Forh. 1863, p. 190.

Syn: *Diastylis bispinosa*, G. O. Sars (not Stimpson).

„ „ *bicornis*, Sp. Bate.

Specific Characters.—*Female*: Body less slender than in the preceding species, with the anterior division rather tumid and oval in form. Carapace comparatively large, about twice as long as the exposed part of the trunk, and somewhat vaulted above, surface rather uneven, owing to numerous unequal spiniform projections, some of which are very conspicuous, 2 of them especially, issuing one on each side of the frontal lobe, being distinguished by their size, looking like a

pair of anteriorly-curving horns, frontal lobe itself unarmed and somewhat depressed; pseudorostral projection of moderate size, conically produced, horizontal; subrostral corners distinct, obtusangular. Exposed part of trunk with small scattered spinules forming dorsally a double row; last segment with a median spinule behind, lateral parts produced to comparatively short acute projections. Tail (exclusive of the terminal appendages) somewhat shorter than the anterior division, and clothed with numerous small spinules. Eye very small and imperfectly developed. Superior antennæ rather slender, with the peduncle projecting far beyond the tip of the pseudorostral prominence, its 1st joint somewhat shorter than the other 2 combined, and coarsely denticulate along the outer edge and at the end, last joint very slender, linear. First pair of legs considerably longer than the carapace, basal joint not nearly attaining the length of the remaining part, and rather spiny in its distal part, penultimate joint much longer than the antepenultimate one, last joint comparatively short, not even attaining half the length of the penultimate one; 2nd pair with the ischial joint produced below to a strong spiniform projection, antepenultimate joint somewhat longer than the last 2 combined; 3rd and 4th pairs comparatively less robust than in *D. Rathkei*, and having the basal joint coarsely denticulate behind. Uropoda exceeding half the length of the tail, stem very narrow, rami more slender than in *D. Rathkei*, and scarcely differing in length, being about half as long as the stem, outer ramus with scattered short bristles outside, inner with the 1st joint shorter than the other 2 combined, spinules of the inner edge about 10 in number (6 on the 1st, and 2 on each of the last 2 joints) apical spine very strong and forming the immediate continuation of the joint. Telson not reaching quite as far as the stem of the uropoda, its proximal third part of uniform width, cylindric, distal part gradually tapering, with about 8—9 spinules on each side, apical spinules somewhat longer than the lateral, and pointing straight behind. Colour greyish white, with a yellowish tinge. Length amounting to 12 mm.

Adult male. Body much more slender than in female, with the anterior division considerably narrowed behind. Carapace very large and tumid, more than twice as long as the exposed part of the trunk, and nearly smooth, having, however, along each side a low, minutely serrated carina, joining, at about the anterior 3rd part of the length of the carapace, an obliquely transverse plica extending downwards; the horn-like spines found in the female replaced by 2 very slight tubercles; pseudorostral projection minutely denticulated on each side, and having at the base 2 juxtaposed rounded protuberances, between which the eye is, as it were, sunk; subrostral corners produced in the form of rounded, coarsely dentated lobes. Exposed part of trunk perfectly smooth above, lateral projections

of last segment much larger than in female. Caudal segments coarsely spinulose both dorsally and ventrally. Antennæ and legs exhibiting the usual transformation. Pleopoda of the structure characteristic of the genus. Uropoda much more elongated than in female, inner ramus with numerous small ciliated spinules inside. Telson exhibiting the usual abrupt bend at about the middle, distal part very narrow. Colour uniformly greyish white. Length amounting to 14 mm.

Remarks.—This form was briefly noticed in the year 1863 by the late A. Boeck as a new species of the genus *Cuma*. The same species was subsequently recorded by Dr. Danielssen as *Diastylis bispinosa* Stimpson, and I myself likewise at first believed it to be identical with the North American form. Having, however, subsequently had an opportunity of examining the latter, I found that both forms, though nearly allied, were evidently specifically distinct. It is an easily recognizable species, at least in the female sex, being highly distinguished by the strong horn-like processes projecting on each side of the frontal lobe of the carapace. The adult male, as usual, looks so very different from the female, that it is not easy at once to recognize its true relation, whereas in the young, not yet sexually mature state the males closely resemble the females, both as to the general form of the body and the armature of the carapace.

Occurrence.—This is one of our most common species, being found rather abundantly along the whole south and west coasts of Norway, and northwards at least to the Lofoten Islands. It is, however, a true deep-water form, only occurring in greater depths, from 50 to 300 fathoms, especially where the bottom consists of loose mud and clay. Owing to its spiny armature, the body is often so thickly covered with muddy particles, that it is rather difficult at once to recognize its form exactly. Adult male specimens are, as usual, only found quite occasionally. They are much more agile than the females, swimming about with great speed by the aid of their powerfully developed exopodites and pleopoda. The females, on the other hand, generally dwell on the bottom, burying themselves more or less deeply in the loose mud, and only seldom making a short swimming trip through the water.

Distribution.—Kattegat (Meinert), British Isles (Sp. Bate), coast of France (Fischer), Stat. 21 of the Porcupine Expedition (Norman).

3. *Diastylis rugosa*, G. O. Sars.

(Pl. XXXVII).

Diastylis rugosa, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea og dens nordiske Arter, p. 41.

Syn: *Diastylis strigata*, Norman (adult male).

Specific Characters.—*Female.* General form of body rather robust, somewhat resembling that of *D. cornuta*, the anterior division being sharply marked off from the posterior, and oval in form, with the dorsal face highly arched. Carapace comparatively large and deep, with the surface rather uneven, exhibiting laterally several transverse plicæ, some of which, however, are rather indistinct and partly interrupted, dorsal face moreover armed with 2 pairs of well-marked spiniform projections, the anterior pair occupying the very same place as the horn-like processes found in *D. cornuta*, but not nearly so large, the posterior pair being more approximate and occurring behind the frontal lobe on the most prominent part of the branchial regions; pseudorostral projection of moderate size, conically produced, horizontal; subrostral corners very slight. Exposed part of trunk without any spinules, but, like the carapace, clothed with scattered hairs; last segment with the anterior edge minutely crenulate, lateral parts scarcely at all produced behind. Tail a little shorter than the anterior division and without spinules. Eye well developed and rather conspicuous. Superior antennæ moderately slender, with the peduncle projecting somewhat beyond the tip of the pseudorostral prominence, its 1st joint shorter than the other 2 combined and unarmed. First pair of legs of a similar structure to those in *D. cornuta*, but having the basal joint scarcely at all spinous, and the last joint about half the length of the penultimate one; 2nd pair with the antepenultimate joint about the length of the last 2 combined; 3rd and 4th pairs without any spinules on the basal joint. Uropoda moderately slender, outer ramus very narrow and somewhat longer than the inner, the latter with about 12 spinules inside (6 on the 1st, 3 on each of the last 2 joints), apical spine of moderate size. Telson not reaching as far as the stem of the uropoda, proximal part rather thick, distal part conically tapering, and armed on each side with about 9 spinules, apical spinules of same appearance as the lateral ones. Colour greyish white. Length 8 mm.

Adult male very similar, as to general appearance, to that of *D. cornuta*, but of smaller size, and having 2 distinct transverse plicæ on each side of the carapace anteriorly, the longitudinal carinæ being less prominent and quite

smooth; eye much larger and more prominent. The several appendages very nearly as in the male of *D. cornuta*. Length 9 mm.

Remarks.—This species is nearly related to *D. cornuta*, but is easily distinguishable in both sexes, the female especially being at once recognized by the peculiar sculpture of the carapace, which has given rise to the specific name *rugosa*. The *Diastylis strigata* of Norman seems to be the adult male of this species, judging from the diagnosis given by that author.

Occurrence.—I have met with this form in several places, both on the south and west coasts of Norway, from the Christiania to the Trondhjem Fjord. It is generally found at less considerable depths than most other species, from 10 to 20 fathoms, occurring not infrequently at the roots of Laminariæ and between the red algæ, where no other *Diastylis* is met with.

Distribution.—Kattegat (Meinert), Heligoland (Ehrenbaum), British Isles (Norman), coast of France (de Folin), Mediterranean at Spezia, Messina and Syracusa (the present author).

4. *Diastylis lucifera* (Krøyer).

(Pl. XXXVIII).

Cuma lucifera, Krøyer, Nat. Tidsskr. Bd. 3, p. 527.

Syn: *Diastylis borealis*, Sp. Bate.

Specific Characters.—*Female.* Body comparatively short and thick, with the anterior division ovoid in form and but slightly arcuate dorsally. Carapace not very large, but slightly exceeding in length the exposed part of the trunk, and somewhat sloping in front; dorsal face rather densely clothed with small denticles arranged on the frontale lobe in transverse rows, one of them originating from the ocular lobule itself; pseudorostral projection conically produced, horizontal; subrosiral corners almost obsolete. Exposed part of trunk smooth above, last segment with the lateral parts not produced behind. Tail shorter than the anterior division, segments simple, unarmed. Eye distinct, though rather small. Superior antennæ slender, with the peduncle projecting far beyond the tip of the pseudorostral prominence, its 1st joint somewhat shorter than the other 2 combined and unarmed. First pair of legs not much elongated, and having the 3 distal joints of about equal length; 2nd pair with the antepenultimate joint much shorter than the last 2 combined, and scarcely longer than the terminal joint; 3rd and 4th pairs without any denticles on the basal joint. Uropoda with the outer ramus somewhat longer than the inner, and considerably exceeding half the

length of the stem, inner ramus with the 1st joint scarcely longer than the 2nd, spinules of the inner edge about 7 in number (3 on each of the 2 first joints, and one on the last), apical spine rather strong, mucronate, forming the immediate continuation of the joint. Telson not extending as far as the stem of the uropoda, and of the usual narrow lageniform shape, distal part sublinear, and having on each side only 3 or 4 spinules, apical spinules somewhat larger than the lateral. Colour greyish white, with a faint olivaceous tinge. Length scarcely exceeding 6 mm.

Adult male much more slender than the female, with the anterior division considerably narrowed behind. Carapace rather large and somewhat vaulted above, being only armed in front with 3 small denticles, one originating from the ocular lobule, the other 2 occurring on each side of the anterior part of the frontal lobe, lateral carinæ sub-obsolete. Last pedigerous segment with the lateral parts acutely produced behind. Tail unarmed. Uropoda and telson much more elongated than in female, exhibiting, like the other appendages, the usual transformation. Body whitish, semipellucid. Length amounting to 8 mm.

Remarks.—This form was first described by Krøyer in the year 1841 as *Cuma lucifera*, the specific name apparently referring to the fact that by the discovery of ovigerous females of this form, the hitherto much disputed question about the true nature of the Cumacea as perfect animals, could be finally settled. This form is easily distinguishable from the other Norwegian species in both sexes by the form and armature of the carapace. The *Diastylis borealis* of Sp. Bate is unquestionably identical with Krøyer's species.

Occurrence.—This species occurs rather plentifully along the whole Norwegian coast, from the Christiania Fjord to Vadsø, in moderate depths, varying from 20 to 50 fathoms, muddy bottom. In the Christiania Fjord it is one of the commonest Cumacea, occurring rather abundantly even in the innermost part of the Fjord, in the immediate vicinity of the town. Adult males are sometimes found in considerable numbers, but only at certain limited periods of the season. They are extremely agile, being in almost constant motion, whereas the females lead a much more sedentary existence on the bottom, burying themselves more or less deeply in the loose mud.

Distribution.—Kattegat (Meinert), Heligoland (Ehrenbaum), British Isles (Sp. Bate), Atlantic coast of North America (Verrill).

5. *Diastylis rostrata*, (Goodsir).

(Pl. XXXIX.)

Alauna rostrata, Goodsir, Edinburgh New Phil. Journal 1843, Vol. XXXIV.Syn: *Diastylis levis*, Norman.

Specific Characters.—*Female.* Body moderately robust, with the anterior division ovoid in form and but slightly arcuate above. Carapace comparatively larger than in *D. lucifera* and more evenly vaulted above, surface perfectly smooth, but clothed with scattered hairs; pseudorostral projection rather produced, acuminate, horizontally extended, subrostral corners very slight. Exposed part of trunk, like the carapace, smooth, with scattered hairs, last segment with the anterior edge minutely serrate and setiferous, lateral parts slightly produced behind. Tail about the length of the anterior division, exclusive of the pseudorostral projection, and perfectly smooth. Eye well developed and somewhat convex. Superior antennæ very slender, with the peduncle extending far beyond the tip of the pseudorostral projection, its 1st joint much shorter than the other 2 combined and unarmed, last joint very narrow, linear. First pair of legs much longer than the carapace, basal joint densely fringed with plumose setæ, penultimate joint considerably longer than the antepenultimate one, last joint somewhat exceeding half the length of the penultimate one; 2nd pair rather densely setiferous, antepenultimate joint about the length of the last 2 joints combined; 3rd and 4th pairs, like the 2 preceding pairs, without any denticles on the basal joint. Uropoda with the outer ramus about half the length of the stem, inner ramus somewhat shorter, and having the 1st joint as long as the other 2 combined, spinules of the inner edge about 12 in number (7 on the 1st, 3 on the 2nd, and 2 on the last joint), apical spine strong, forming the immediate continuation of the joint. Telson rather produced, reaching as far as the stem of the uropoda, proximal thickened part occupying about $\frac{1}{3}$ of the length of the telson, distal part very narrow, with about 12 spinules on each side, apical spinules scarcely different from the lateral. Colour greyish white. Length amounting to 10 mm.

Adult male resembling in external appearance that of *D. cornuta*, the carapace having on each side a distinct longitudinal carina crossed in front by an obliquely transverse plica; but this carina is quite smooth, not, as in the male of *D. cornuta*, serrate. Last pedigerous segment with the lateral parts considerably produced behind. Caudal segments spinulous. Eye larger than in the female, though, in the lateral view of the animal, partly concealed by a

slight swelling of the carapace on each side at the base of the pseudorostral projection. Appendages of the usual structure. Length 11 mm.

Remarks.—I cannot doubt that this is the form originally recorded by Goodsir as *Alauna rostrata*. There is no other species of *Diastylis*, which agrees better with the figure and description given by that author, and its occurrence in comparatively shallow water would also seem to point to the identity of these 2 forms. The *Diastylis laevis* of Norman is unquestionably the same species. By the perfectly smooth carapace, this form is easily distinguished from any of the preceding species, somewhat resembling in this respect the next species, *D. tumida* Lilljeborg, which, however, is a true deep-water form, and differs, among other things, in the larger size of the carapace, and in the different shape of the telson.

Occurrence.—I have met with this form only in a few places on the south coast of Norway, viz, in the outer part of the Christiania Fjord, at Farsund, and at Egersund. In all 3 places it occurred in only a few fathom's depth, on a sandy bottom covered by a thin layer of mud.

Distribution.—Kattegat (Meinert), Heligoland (Ehrenbaum), British Isles (Goodsir), Stats. 6, 11, 18 of the Porcupine Expedition (Norman).

6. *Diastylis tumida*, (Lilljeborg).

(Pl. XL.)

Cuma tumida, Lilljeborg, Öfvers. af Vetensk. Akad. Forhandl. 1855. p. 119.

Specific Characters.—*Female.* Body rather robust, with the anterior division greatly tumefied, and of rounded ovoid form, with the dorsal face boldly arched. Carapace very large and deep, more than twice as long as the exposed part of the trunk, and considerably vaulted in its posterior part; surface perfectly smooth, only clothed with scattered short hairs; pseudorostral projection not much produced, with the tip very slightly upturned; subrostral corners well marked, almost rectangular. Last pedigerous segment with the lateral parts rounded off behind. Tail about the length of the anterior division, segments simple, unarmed. Eye well developed and rather conspicuous, appearing as a distinctly projecting tubercle at the end of the frontal lobe. Superior antennæ slender, with the peduncle reaching far beyond the tip of the pseudorostral projection, its 1st joint shorter than the other 2 combined and unarmed. First pair of legs about the length of the carapace, basal joint much shorter than the remaining part of the leg, the last 3 joints of rather unequal length, the penultimate one being much the longest, last joint comparatively short, not even attaining half the length of the penultimate one; 2nd pair with the ischial joint produced below to

2 short successive dentiform projections, antepenultimate joint about the length of the last 2 joints combined; 3rd and 4th pairs, like the 2 preceding pairs, with the basal joint unarmed. Uropoda with the rami subequal in length and about half as long as the stem, inner ramus rather narrow, with the 1st joint shorter than the other 2 combined, spinules of the inner edge about 12 in number (7 on the 1st, 3 on the 2nd, and 2 on the last joint), apical spine rather produced, mucronate. Telson scarcely reaching as far as the stem of the uropoda, proximal half thick, cylindrical, distal half gradually narrowed, and armed on each side with about 9 spinules, apical spinules a little larger than the lateral. Colour whitish, joints of the superior antennæ and 1st pair of legs tinged at the end with reddish brown. Length amounting to 9 mm.

Adult male of the usual slender form. Carapace much shallower than in the female and almost 3 times as long as the exposed part of the trunk, exhibiting on each side a slight longitudinal keel, pseudorostral projection comparatively shorter than in female, ocular tubercle rather large and prominent. Last pedigerous segment considerably produced at the lateral corners. Caudal segments armed dorsally with scattered denticles. The several appendages transformed in the usual manner. Length amounting to 10 mm.

Remarks.—This form was first described by Prof. Lilljeborg from Kullaberg in Skåne as *Cuma tumida*, and was subsequently observed by Dr. Danielsen on the west coast of Norway. At first I believed it to be the *Alauna rostrata* of Goodsir, and that it was the same species as *Diastylis lewis* of Norman; but, as stated above, this supposition has turned out to be wrong. It is unquestionably specifically different from that form, and easily distinguished both by its more robust form of body, and by several structural details, mentioned in the above diagnosis.

Occurrence.—I have found this form in several places on the Norwegian coast, from the Christiania Fjord to the Lofoten Islands, though nowhere in any considerable number. It is a true deep-water form, scarcely occurring in shallower water than 30 fathoms, whereas it descends to depths of more than 300 fathoms. Only a few specimens of the adult male have come under my notice.

Distribution.—Kullaberg (Lilljeborg), Kattegat (Meinert).

7. *Diastylis Goodsiri* (Bell)

(Pl. XLI.)

Alauna Goodsiri, Bell, in Belcher's Last of the Arctic Voyages, Vol. II, p. 403,
Pl. XXXIV, fig. 3.

Syn: *Diastylis plumosa*, M. Sars.

Specific Characters.—*Female.* Body of very robust form, and thickly covered all over with short plumose hairs, anterior division considerably tumefied and broadly oval in form, with the dorsal face boldly arched. Carapace large and deep, fully twice as long as the exposed part of the trunk, and greatly vaulted above, surface without any spines or denticles; pseudorostral projection rather produced, conical, horizontal, subrostral corners obsolete. Last pedigerous segment with the lateral parts scarcely produced behind. Tail (exclusive of the terminal appendages) somewhat shorter than the anterior division, lateral corners of the 5 anterior segments much produced, spiniform. Eye inconspicuous. Superior antennæ with the 1st joint of the peduncle very large, much longer than the other 2 combined, and clothed at the tip with numerous long plumose setæ, last joint shorter than the 2nd. Inferior antennæ with the terminal joint unusually large, conically produced, apical seta very much elongated. First pair of legs scarcely longer than the carapace, basal joint almost attaining the length of the remaining part of the leg, and spinulose in its distal part, being moreover fringed with numerous long plumose setæ, the last 3 joints not very different in length; 2nd pair with the basal joint rather large and curved, being minutely denticulate outside, and fringed along the lower edge with a dense row of long plumose setæ, antepenultimate joint longer than the last 2 combined; 3rd and 4th pairs comparatively strongly built and densely setiferous, basal joint partly denticulate. Uropoda with the rami subequal in length, and about half as long as the stem, inner ramus mucronate, with the joints imperfectly defined, spinules of the inner edge about 12 in number and, like those of the stem, unusually slender, setiform. Telson rather produced, reaching as far as the stem of the uropoda, proximal thickened part comparatively short, distal part armed on each side with numerous slender, setiform spinules, amounting to 20 in all, apical spinules very small. Colour whitish. Length about 25 mm.

Remarks.—This form was first recorded by Bell from the polar islands of America as *Alauna Goodsiri*, and was some years afterwards found off the Finmark coast by my late father, who regarded it as new, and described it briefly under the name of *Diastylis plumosa*. It is by far the largest of all

known Cumacea, growing in the polar sea to a still larger size than off the Norwegian coast. Dr. Hansen gives the length of a specimen from the Kara Sea to no less than 35 mm., a truly gigantic size for a Cumacean. Like the 2 preceding species, this form is distinguished by the total absence of any spines or denticles on the carapace, being however well distinguished not only by its much larger size, but also by several other characters mentioned in the above diagnosis. Dr. Hansen has given a most elaborate description of both sexes in his paper on the Crustacea procured during the Danish "Djimpha" Expedition.

Occurrence.—I have not infrequently taken this huge form in the Varanger Fjord at Vadsø, where it was also found by my late father. It occurred here at a depth of about 60 fathoms, on a bottom consisting of very soft clay, with which the specimens were generally thickly covered. This form has also been found more recently in the fjords near Tromsø, for instance the Malangen Fjord; but farther south it has not been observed. No fully adult male specimen has yet come under my observation; but Dr. Hansen describes such specimens from the Kara Sea, and from his figure and description, it appears that the transformation is perfectly analogous to that observed in other species of the genus.

Distribution. Polar Islands of North America (Bell), Greenland (Hansen), Jan Mayen (Norw. North Atl. Exped.), Spitsbergen (do.), the Barents Sea (Hoek), the Kara Sea (Hansen), the Siberian Polar Sea (Stuxberg).

8. *Diastylis spinulosa*, Heller.

(Pl. XLII.)

Diastylis spinulosa, Heller, Crust., Pycn. und Tunic. Oestr. Ungar., Nordpol Expd. p. 28,

Pl. I, fig. 5.

Specific Characters.—*Female.* Body somewhat resembling in its general form that of *D. Goodsiri*, but at once differing in its coarse spiny armature; anterior division rather tumid, and boldly arched dorsally. Carapace very large, more than twice as long as the exposed part of the trunk, and somewhat depressed in its anterior part, the dorsal face sloping rather steeply towards the base of the pseudorostral projection, surface without hairs, but exhibiting a number of very strong anteriorly-curving spiniform projections, especially densely crowded together on the upper part of the branchial regions, about 15 being counted on each side; a row of 4 strong spines also extends forwards to each side of the frontal lobe, occupying, in the dorsal view of the animal, the lateral edges, the frontal lobe itself having, somewhat in front of the middle, 2 somewhat smaller and more erect, juxtaposed spines; pseudorostral prominence horizontally

projecting and somewhat depressed, minutely spinulose laterally, and terminating in a conical point; subrostral corners obsolete. Exposed part of trunk with scattered spiniform projections, two of which on each of the 4 anterior segments are very conspicuous, forming together dorsally a double longitudinal row, last segment with a median spine above, its lateral parts but slightly produced behind, terminating in an acute corner. Caudal segments with the lateral corners produced in a similar manner to that in *D. Goodsiri*, and moreover coarsely denticulate. Eye inconspicuous. Superior antennæ with the peduncle scarcely extending beyond the tip of the pseudorostral projection, its 1st joint longer than the other 2 combined. First pair of legs of moderate length, basal joint spinulous in its distal part, penultimate joint somewhat longer than both the preceding and succeeding joints; 2nd pair with the basal, ischial and meral joints spinulous, antepenultimate joint scarcely longer than the last 2 combined; 3rd and 4th pairs rather strong, with the basal joint partly denticulate. Uropoda with the rami somewhat exceeding half the length of the stem, the inner one having the joints well defined, the 1st being somewhat shorter than the other 2 combined; spinules of the inner edge of usual appearance and about 8 in number (4 on the 1st, and 2 on each of the last 2 joints), apical spine rather slender. Telson very much produced, extending far beyond the stem of the uropoda, proximal thickened part occupying somewhat more than $\frac{1}{3}$ of the length, distal part armed on each side with about 8 spinules, apical spinules somewhat thicker, but scarcely longer than the lateral. Colour pale carneous. Length 18 mm.

Remarks.—This form was first described under the above name by Heller from specimens procured at Franz Joseph Land during the Austro-Hungarian Expedition. It is one of the largest known Cumacea, and clearly distinguished by the coarse spiny armature of the body. The form described by the present author from a single young male specimen procured during the Norwegian North Atlantic Expedition as *D. nodosa*, is very nearly allied to the present species, and is even regarded by Dr. Hansen as merely a variety of *D. spinulosa*.

Occurrence.—A few specimens of this beautiful form were taken by the present author, many years ago, in the Varanger Fjord at Vadsø, from a depth of about 100 fathoms. During the Norwegian North Atlantic Expedition 2 other specimens were found at about the same depth in the Porsanger Fjord. These are the only localities of the Norwegian coast where this species has hitherto been found. Among the specimens procured are also 2 young males, and both of these agreed exactly with the females as regards the armature of the carapace.

Distribution.—Franz Joseph' Land (Heller), the Barents Sea (Hoek), the Kara Sea (Stuxberg), Greenland (Hansen).

9. *Diastylis echinata*, Sp. Bate.

(Pl. XLIII.)

Diastylis echinata, Sp. Bate, Ann. & Mag. Nat. Hist. ser. 3, Vol. XV, p. 81, Pl. I, fig. 1.

Specific Characters.—Female. Body less robust than in the 2 preceding species, and minutely spiny all over, anterior division evenly vaulted above, and having its greatest width in front of the middle. Carapace very large and tumid, the width considerably exceeding the height, surface finely spinulose, with scattered somewhat larger spines, lateral faces partly mapped out by rows of small spinules into polygonal areas having, as a rule, at each corner an anteriorly-pointing spine, 3 or 4 somewhat larger spines forming on each side a lateral series extending forwards to the base of the pseudorostral projection, the latter of moderate size, conically produced, horizontal and finely spinulose laterally; subrostral corners obsolete. Exposed segments of trunk each with 2 very conspicuous juxtaposed spines dorsally forming together a double longitudinal row, epimeral parts of the 3 posterior segments dentiformly produced. Caudal segments coarsely denticulate both dorsally and laterally. Eye inconspicuous. Superior antennæ not much elongated, the peduncle scarcely extending beyond the tip of the pseudorostral projection, its 1st joint about the length of the other 2 combined. First pair of legs rather slender, through scarcely exceeding the length of the carapace, basal joint fully as long as the remaining part of the leg, and coarsely spinulose at the edges, the last 2 joints of about equal length and shorter than the antepenultimate one; 2nd pair with the basal, ischial and meral joints coarsely spinulose, antepenultimate joint rather slender, exceeding the length of the last 2 combined; 3rd and 4th pairs slender, with the basal joint partly spinulose. Uropoda not much elongated, rami exceeding half the length of the stem, the inner one a little shorter than the outer, and having only 6 spinules inside (3 on the 1st, 2 on the 2nd, and 1 on the last joint), apical spine strong, mucroniform. Telson extending beyond the stem of the uropoda, and less narrowed than usual, its proximal half being of nearly uniform width throughout, distal half slightly tapered, and armed on each side with only 3 spinules, apical spinules a little larger than the lateral. Colour whitish. Length amounting to 10 mm.

Adult male, as usual, much more slender than the female, with the carapace less deep and more evenly vaulted above, having on each side behind, a coarsely denticulated lateral keel, which however scarcely extends beyond the middle; anterior part of carapace fringed on each side with a row of densely

crowded spinules continued along the side of the pseudorostral projection, lateral faces otherwise nearly smooth, with only very slight traces of the polygonal areas found in the female. Exposed part of trunk with the dorsal spines less distinct than in female. Caudal segments partly denticulate also on the ventral face. The several appendages transformed in the usual manner. Length 11 mm.

Remarks.—This form was first described by Sp. Bate in the year 1865 from Shetland specimens, and was subsequently found by the present author also off the Norwegian coast. It is an easily recognizable species, being markedly distinguished by the elegant manner in which the spiny armature of the carapace is arranged.

Occurrence.—Though occurring nowhere in any considerable number, this form seems to be distributed along the whole south and west coasts of Norway, from the Christiania Fjord to Hasvig in West Finmark. It is, however, a very pronounced deep-water form, being only found in greater depths ranging from 100 to 400 fathoms. Of the adult male, I have as yet seen only 2 specimens, one of which is figured on the accompanying plate.

Distribution.—Shetland Isles (Sp. Bate), off the Skagen Lighthouse (Meinert), Stat. 9 of the Lightning Expedition (Norman), Stats 31 & 124 of the Norwegian North Atlantic Expedition (the present author).

10. *Diastylis scorpioides* (Lepechin).

(Pl. XLIV.)

Oniscus scorpioides, Lepechin, Acta Petropol. 1778. Vol. I.

Syn: *Cuma Edwardsii*, Krøyer.

„ *Cuma brevirostris*, Krøyer (adult male).

„ *Diastylis Edwardsii* (auctorum).

Specific Characters.—*Female.* Body comparatively robust, with the anterior division of ovoid form and boldly arched dorsally. Carapace of moderate size, with the dorsal margin considerably sloping in front, surface without any spines, but sculptured on each side with 5 rather conspicuous, obliquely transverse plicæ minutely crenulated at the edge, the 2 anterior rather short and curved anteriorly, the 3 succeeding ones extending throughout the whole depth of the carapace from the most prominent part of the branchial region to the anterior part of the lower edge, where they unite; hind edge of carapace likewise elevated in the form of a crenulated plica; pseudorostral projection rather short, conical, horizontal; subrostral corners very slight. Exposed segments of trunk with the anterior edge more or less distinctly elevated and finely crenulated,

epimeral parts of last segment scarcely produced behind. Tail (exclusive of the terminal appendages) about the length of the anterior division, segments simple, unarmed. Eye fairly well observable and somewhat convex. Superior antennæ of moderate length, the peduncle reaching somewhat beyond the tip of the pseudorostral projection, its 1st joint about the length of the other 2 combined. First pair of legs a little longer than the carapace, basal joint densely fringed with setæ and slightly spinulose in its distal part, the last 3 joints scarcely differing in length; 2nd pair with the antepenultimate joint nearly twice the length of the last 2 combined; 3rd and 4th pairs of moderate size and scarcely spinulose. Uropoda with the outer ramus about half the length of the stem, inner ramus somewhat shorter, and armed inside with about 8 spinules (4 on the 1st, 2 on each of the last 2 joints), apical spine, as usual, strong, mucronate, not defined at the base. Telson extending as far as the stem of the uropoda, proximal thickened part occupying about $\frac{1}{3}$ of the length, distal part rather narrow, and armed on each side with about 8 spinules, apical spinules of about the same appearance as the lateral. Colour reddish brown. Length 10 mm.

Adult male much more slender than the female, with the anterior division of the body less strongly arcuate above. Carapace, as usual, less deep and more tumid in its anterior part, exhibiting, however, the very same sculpture as in the female; pseudorostral projection shorter and more obtuse. Last pedigerous segment with the lateral corners very little produced, though clothed with the usual plumose setæ. Tail unarmed. Inferior antennæ remarkably short, scarcely exceeding in length the anterior division of the body; the other appendages transformed in the usual manner. Length 11 mm.

Remarks.—According to Dr. Stuxberg, the species generally known as *Diastylis* (Cuma) *Edwardsii* Krøyer is without any doubt identical with the form recorded by Lepechin as early as in the year 1778 as *Oniscus scorpioides*, and the specific name proposed by that author ought accordingly to be retained for this species. The *Cuma brevirostris* of Krøyer is unquestionably the adult male of this species. It is an easily recognizable form, being at once distinguished from the other northern species by the peculiar sculpture of the carapace, which is equally distinct in both sexes. The shortness of the inferior antennæ in the adult male is a unique character as regards the species of the present genus.

Occurrence.—I have found this form rather abundantly in several places on the Finmark coast, as also off the Lofoten Islands. During the Norwegian North Atlantic Expedition it was also taken in the inner part of the Saltenfjord; but it has not yet been observed outside the polar circle.

Distribution.—Greenland (Krøyer), Jan Mayen (Norw. North Atl. Exp.), the Kara Sea (Stuxberg), the Siberian Polar Sea (Stuxberg).

Gen. 2. **Diastyloides**, G. O. Sars, n.

Generic Characters.—General appearance that of the genus *Diastylis*, the anterior division being sharply marked off from the posterior and rather tumid, at least in the female. Carapace large, with the pseudorostral projection strongly prominent. Tail slender. Eye wanting. Superior antennæ about as in *Diastylis*. Inferior antennæ in female with the last joint very small, tuberculiform, and without the apical plumose seta, which is replaced by a few very small auditory bristles; those in male fully attaining the length of the body. Mandibles rather unlike those in *Diastylis*, the body forming, as in *Leucon*, a broad lateral expansion, and having at the base of the thick molar process a conical projection; masticatory part comparatively short and stout, cutting teeth indistinct, spines of the inner edge few in number. The other oral parts, as also the legs, about as in *Diastylis*. Pleopoda of male less perfectly developed than in that genus, 1st pair with both rami uniaarticulate, 2nd pair with the rami confluent to a single piece. Uropoda with the rami very slender, the inner one generally longer than the outer, and scarcely mucroniform, apical spine well defined at the base. Telson less produced than in *Diastylis*, with the apical spinules much larger than the lateral ones; in male very much bent, forming above at the flexure a projecting angle.

Remarks.—I have felt justified in establishing this new genus to comprise 2 Norwegian species formerly referred by me to the genus *Diastylis*, but differing from it very pronouncedly in some characters of apparently generic value. The structure of the mandibles especially is very unlike that in *Diastylis*, and much more resembling that found in the family *Leuconidæ*. Moreover, the inferior antennæ of the female are rather different, and the pleopoda of the male are less fully developed. It is as yet scarcely possible to state with certainty, if there are any species among the exotic Diastylidæ referable to this genus, though it may probably be the case.

11. *Diastylodes serrata*, G. O. Sars.

(Pl. XLV.)

Diastylis serrata, G. O. Sars; Om den aberrante Krebsdyrgruppe Cumacea, p. 44.

Specific Characters.—*Female.* Body moderately slender, with the anterior division oval in form, and considerably vaulted dorsally. Carapace very large more than twice as long as the exposed part of the trunk, and evenly arcuate above, frontal lobe short and broad, ocular lobule almost obsolete, surface nearly smooth throughout, though, on a closer examination, the upper part of the branchial regions appears clothed with very small, anteriorly-curving denticles; pseudorostral projection greatly produced, horizontal, tip acuminate and slightly deflexed, subrostral corners obsolete, lower edges of carapace coarsely serrate throughout their whole length. Last pedigerous segment with the lateral parts scarcely produced behind, though terminating in an acute corner. Tail slender, with the segments quite simple. Superior antennæ with the peduncle not reaching to the tip of the pseudorostral projection, its 1st joint somewhat shorter than the other 2 combined. First pair of legs scarcely longer than the carapace, basal joint not nearly attaining the length of the remaining part of the leg, and strongly spinous on the lower edge, penultimate joint longer than the antepenultimate, last joint comparatively short, not even attaining half the length of the penultimate one; 2nd pair with the basal joint produced at the end below to a strong spiniform projection, antepenultimate joint about the length of the last 2 combined; 3rd and 4th pairs rather slender and having the basal joint coarsely denticulate behind. Uropoda with the rami nearly equal in length, and not much shorter than the stem, the inner one slender and attenuated, with the 1st joint almost twice as long as the other 2 combined, spinules of the inner edge about 12 in number (9 on the 1st, 2 on the 2nd, and 1 on the last joint), apical spine slender and well defined at the base. Telson comparatively short, scarcely exceeding in length $\frac{1}{3}$ of the uropoda, its proximal part rather thick, distal part but slightly tapered, and armed on each side with about 5 small spinules, apical spines rather large and pointing straight behind. Colour whitish with a faint yellowish tinge. Length 6 mm.

Adult male very slender, with the anterior division far less tumid than in the female, and but slightly vaulted above. Carapace perfectly smooth and less deep than in female, pseudorostral projection somewhat shorter and more horizontal. Last pedigerous segment with the lateral parts narrowly produced behind. Tail very slender and having the segments unarmed. Antennæ and

legs exhibiting the usual transformation. Pleopoda of the structure characteristic of the genus. Uropoda very slender, with the inner ramus somewhat longer than the outer, and armed inside with about 20 ciliated spinules. Telson considerably more produced than in the female, and exhibiting above at the flexure a very distinct angular projection, distal part narrow, linear. Length amounting to 7 mm.

Remarks.—The present species, first described in the year 1864 by the present author, may be easily recognized in both sexes by the evenly vaulted carapace, the very prominent pseudorostral projection, and the coarse serration of the lower edges of the carapace, which latter character has given rise to the specific name *serrata*.

Occurrence.—Of the south and west coasts of Norway, this form is by no means unfrequent, occurring in some places, for instance in the Christiania Fjord, rather abundantly in depths ranging from 30 to 100 fathoms, muddy bottom. Its northern distribution extends to Hasvig in west Finmark, and I have found it there, as also in some other places, down to a depth of 300 fathoms. Male specimens (in the adult state) are found at some periods of the year not infrequently. They are extremely agile and in almost constant motion.

Distribution.—Off the Skagen Lighthouse (Meinert).

12. *Diastylodes biplicata*, G. O. Sars.

(Pl. XLVI).

Diastylis biplicata, G. O. Sars, Om den aberrante Krebsdyrgruppe Cumacea, p. 46.

Syn: *Diastylis lamellata*, Norman.

„ *Diastylis Calveri*, Norman (adult male).

Specific Characters.—*Female.* General form of body resembling that of the preceding species, anterior division, however, still more tumefied, approaching the globular shape. Carapace large and broad, the width considerably exceeding the height, dorsal face somewhat gibbously vaulted behind, lateral faces sculptured with 2 very distinct oblique plicæ extending from the most prominent part of the branchial region, and joining at the anterior part of the lower edge, hind edge of carapace elevated to a similar plica; pseudorostral projection rather large and slightly upturned, being somewhat hollowed at the base, subrostral corners inconspicuous, anterior half only of the lower edges coarsely serrate. Exposed segments of trunk with the anterior edge more or less distinctly elevated, lateral parts of last segment scarcely produced behind, though terminating in an acute corner. Caudal segments simple, unarmed. Superior antennæ with the peduncle

extending about to the tip of the pseudorostral projection, its 1st joint shorter than the other 2 combined. First pair of legs very much elongated, about equalling in length, when fully extended, the whole anterior division, basal joint scarcely half as long as the remaining part of the leg, and coarsely spinous on the lower edge, penultimate joint fully as long as the 3 preceding joints combined, last joint not attaining half the length of the former; 2nd pair of legs with both the basal and ischial joints produced at the end below to a strong spiniform projection, antepenultimate joint rather slender, exceeding the last 2 combined; 3rd and 4th pairs with the basal joint coarsely denticulate. Uropoda rather slender, with the inner ramus considerably longer than the outer, and almost attaining the length of the stem, its 1st joint more than twice as long as the other 2 combined, spinules of the inner edge about 12 in number (9 on the 1st, 2 on the 2nd and one on the last joint), apical spine very slender. Telson more produced than in *D. serrata*, though scarcely reaching as far as the stem of the uropoda, being abruptly constricted near the base, distal part very narrow, linear, with about 6 small spinules on each side, apical spines rather large, slightly diverging. Colour more or less tinged with reddish brown. Length 7 mm.

Adult male exhibiting the usual slender form, with the anterior division of the body considerably narrowed behind. Carapace more evenly vaulted above than in female and very tumid in its anterior part, lateral faces exhibiting a low longitudinal keel in addition to the 2 oblique plicæ, which are fully as distinct as in the female. Last pedigerous segment with the lateral corners acutely produced. Tail nearly smooth. Antennæ and legs transformed in the usual manner. Pleopoda about as in the male of *D. serrata*. Uropoda exceedingly slender, inner ramus exceeding the outer by its last joint, and armed inside with about 28 spinules. Telson abruptly geniculate at about the first third of its length. Length about 8 mm.

Remarks.—Though nearly allied to the preceding species, as regards the chief structural details, this form is at once distinguished by the still more tumid anterior division of the body, and especially by the form and sculpture of the carapace. The *D. lamellata* of Norman is unquestionably the same species, and the *D. Calveri* of the same author must also be withdrawn as only founded on the adult male of this species.

Occurrence.—I have found this form not unfrequently in several places, both on the south and west coasts of Norway, from the Christiania Fjord to the Lofoten Islands. It is generally found together with the preceding species, and, like it, has a very great range in depth.

Distribution.—Skagerak and Kattegat (Meinert), British Isles (Norman), Several Stations of the Porcupine Expedition, down to 1630 fathoms (Norman).

Gen. 3. **Diastylopsis**, Sidn. Smith, 1880.

Generic Characters.—General appearance resembling that of *Diastylis*. Carapace, however, less tumid, and having the antero-lateral corners well marked; pseudorostral projection more or less produced. Third and 4th exposed segments of trunk more or less completely consolidated, at least in the female. Tail slender and very flexible. Eye wanting. Superior antennæ comparatively strongly built, with the 1st joint of the peduncle unusually short, 3rd rather large and clothed with plumose setæ. Inferior antennæ in female very small, in male almost attaining the length of the body. Oral parts about as in *Diastylis*. First pair of legs with the outer 3 joints very slender; 2nd pair comparatively short; the 3 posterior pairs very robust and adapted for digging. Pleopoda of male of a similar structure to that in *Diastylis*. Uropoda and telson likewise of essentially the same structure as in that genus.

Remarks.—This genus was established in the year 1880 by Prof. Sidn. Smith, to comprise a North American species, *D. Dawsoni*, and the Rev. T. R. Stebbing has recently pointed out, that Krøyer's *Cuma vesima* ought to be referred to the same genus. It was chiefly founded upon the supposed unique character, that the 3rd and 4th exposed segments of the trunk appeared wholly consolidated. It is true that these segments are very firmly connected; but in the Norwegian species at least, a well-marked suture may in reality be proved to exist between them. There are, however, otherwise sufficient differences from *Diastylis* to warrant the maintenance of this genus. The species recorded by Dr. Bonnier from the Gulf of Gascogne as *Diastylopsis* (?) *tumida* scarcely belongs to this genus, as, like *Leptostylis*, it has rudimentary exopodites to the 3rd and 4th pairs of legs.

13. *Diastylopsis resima* (Krøyer).

(Pl. XLVII.)

Cuma resima, Krøyer, Nat. Tidsskr. new series, Vol. II, pp. 165 & 206, Pl. II, figs. 2a, 2b.Syn: *Diastylis resima* (auctorum)

Specific Characters.—Female. Body comparatively short and clumsy, with the anterior division, seen dorsally, oblong oval in form. Carapace rather large, though scarcely twice as long as the exposed part of the trunk, dorsal face evenly vaulted, frontal lobe rather broad, with a double row of small denticles along the middle (3 in each row), lateral parts with a row of 3 similar denticles on each side of the frontal lobe, surface otherwise perfectly smooth; pseudorostral projection rather large and abruptly upturned, nose-like, with a number of long plumose setæ issuing from the tip and diverging in a radiating manner; lower edges of carapace coarsely denticulate in their anterior halves, the 2 distal denticles placed somewhat more widely apart, the foremost one rather strong and occupying the antero-lateral corner, being defined from the pseudorostral projection by a slight sinus. The 3 posterior pedigerous segments remarkably flattened above, with the epimeral parts abruptly recurved and very large, rounded behind; dorsal part of 3rd segment very narrow, band-shaped. Tail (exclusive of the terminal appendages) scarcely as long as the anterior division, segments simple, unarmed. Superior antennæ with the peduncle more or less bent upwards, 1st joint armed at the end on each side with a strong spine, accompanied above by a plumose seta, last joint about the length of the other 2 combined, and carrying along the outer edge 9 strong plumose setæ. First pair of legs about the length of the carapace, basal joint scarcely more than half as long as the remaining part of the leg, and armed in its distal part below with 3 strong spiniform projections, the middle one especially being very prominent, penultimate and antepenultimate joints of about equal length, last joint considerably shorter; 2nd pair not attaining even half the length of the 1st, basal joint about the length of the remaining part of the leg and fringed with a limited number of long plumose setæ, antepenultimate joint scarcely attaining the length of the last 2 combined; 3rd and 4th pairs very strongly built, and considerably larger than the 2nd, carpal joint unusually short, lamelliform, and fringed along the inner edge with 6 strong, unciliated setæ. Uropoda with the outer ramus almost the length of the stem, and clothed along the outer edge and at the tip with numerous setæ increasing in length distally, inner ramus considerably shorter than the outer, and narrowly attenuated, with only 3 spinules inside (1 on each of the 3 joints), apical spine long and slender. Telson scarcely

extending to the end of the stem of the uropoda, proximal half thick and cylindrical, distal half abruptly attenuated, and armed on each side with about 4 slender, almost setiform spinules, apical spinules likewise slender and about the length of the lateral. Colour greyish, with a more or less distinct yellowish brown tinge. Length about 5 mm.

Adult male much more slender than the female, with the carapace less deep and quite unarmed, pseudorostral projection of a rather different appearance from that of the female, being nearly horizontal, with the apical setæ very small, subrostral corners rectangular, unarmed. Exposed segments of trunk of altogether normal appearance, epimeral parts of last segment acutely produced behind. Each of the 3 anterior caudal segments with a median denticle ventrally. The several appendages transformed in a manner similar to that in *Diastylis*. Length 6 mm.

Remarks.—This peculiar form was first described in the year 1846 by Krøyer from Greenland specimens, and was subsequently found by the present author also off the Norwegian coast. From the upturned, nose-like pseudorostral projection with its long, radiating, apical setæ, the peculiar form of the exposed segments of the trunk, and the generally much bent, narrow tail, the female acquires a rather extraordinary appearance, well represented by Krøyer in Pl. 3 of the great work, Gaimard's "Voyage en Scandinavie", Zoology. The hitherto unknown adult male, on the other hand, exhibits a much more normal aspect, resembling on the whole the males of other *Diastylidæ*.

Occurrence.—I have found this form in great abundance in the Varanger Fjord at Vadsø, as also in another place on the Finmark coast, viz, Hammerfest. More recently I have also met with it in certain localities on both the west and south coasts of Norway, for instance in the Trondhjem Fjord, at Christiansund, and at Mærdø, off Arendal. From this occurrence it would seem, that the present species is distributed along the whole coast of Norway, though it must evidently be regarded as originally a true arctic form. It is generally found in moderate depths, ranging from 6 to 20 fathoms, on a bottom consisting of muddy clay, with which the body is generally thickly covered. As indicated by the very strongly built posterior pairs of legs, it possesses very great dexterity in rapidly burying itself deeply in the mud, so that often only the tip of the upturned pseudorostral projection with its circle of apical setæ is visible above the surface. When taken up, it generally curves its tail abruptly upon the dorsal face of the anterior division. The adult males, as is generally the case, are much more agile than the females, and are often found swimming about with great speed, whereas it is rather unusual to see the females ever leave the bottom.

Distribution.—Greenland (Krøyer), Atlantic coast of North America (Verrill), Spitsbergen (Norw. North Atl. Exped.), the Kara Sea (Stuxberg, Skagerak and Kattegat (Meinert).

Gen. 4. **Leptostylis**, G. O. Sars, 1869.

Generic Characters.—General form of body that of *Diastylis*, being sometimes very slender, sometimes rather robust, anterior division (at least in female) considerably tumefied and sharply marked off from the tail. Eye wanting. Superior antennæ in female about as in *Diastylis*, in male conspicuously transformed, the peduncle being greatly dilated, claviform, and clothed at the end with numerous diverging sensory filaments forming a dense brush, which almost conceals the flagella. Inferior antennæ in male much more feebly developed than in *Diastylis*, and scarcely exceeding the anterior division of the body in length. Oral parts and anterior pairs of legs about as in *Diastylis*. Third and 4th pairs of legs in female with a very small, though distinct biarticulate appendage (rudimentary exopodite) outside the basal joint. Pleopoda in male less fully developed than in *Diastylis*. Uropoda with the rami very slender, the inner one being much the longer, and distinctly 3-articulate. Telson remarkably short, with only a single pair of lateral spinules.

Remarks.—This genus was established in the year 1869 by the present author, to comprise some species formerly referred by him to the genus *Diastylis*, but, on a closer examination, found to differ in certain characters rather conspicuously, especially as regards the structure of the antennæ and pleopoda of the male. Another distinguishing character of the female, at first overlooked, is the presence of rudimentary exopodites on the 3rd and 4th pairs of legs, like those found in the genera *Lamprops* and *Hemilamprops*. The generic name *Leptostylis* is derived from the unusually slender rami of the uropoda; and the very short telson, with its single pair of lateral spinules, also forms an easily recognizable character of the present genus. We know as yet of 6 species, 4 of which belong to the Norwegian fauna, and will be described below. Moreover, Dr. J. Bonnier has recorded a form from the Gulf of Gascogne as *Leptostylis longicaudata*, which however, in my opinion, cannot properly be referred to the present genus, in spite of its being provided with rudimentary exopodites on the 3rd and 4th pairs of legs.

14. *Leptostylis longimana*, G. O. Sars.

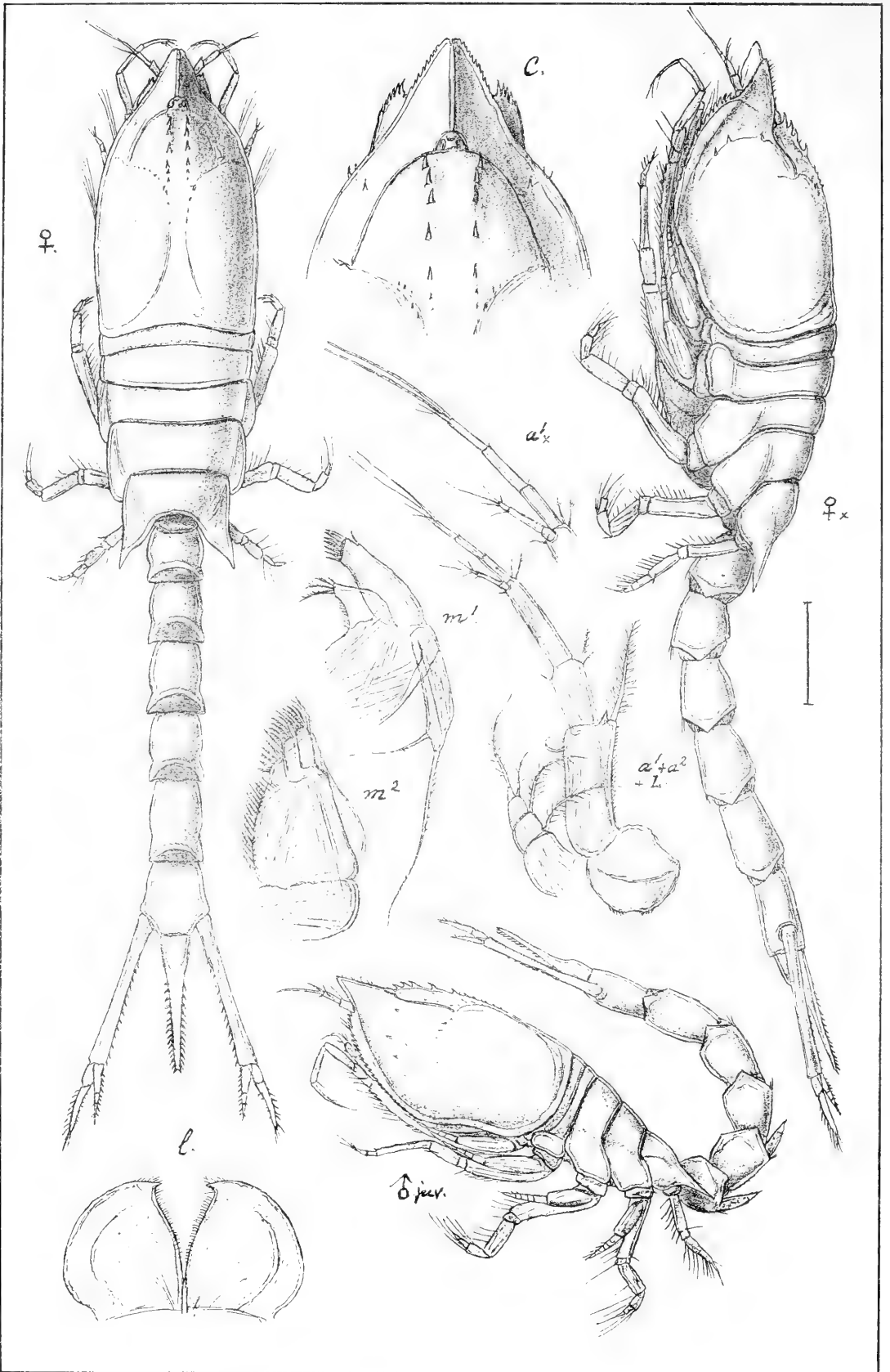
(Pl. XLVIII).

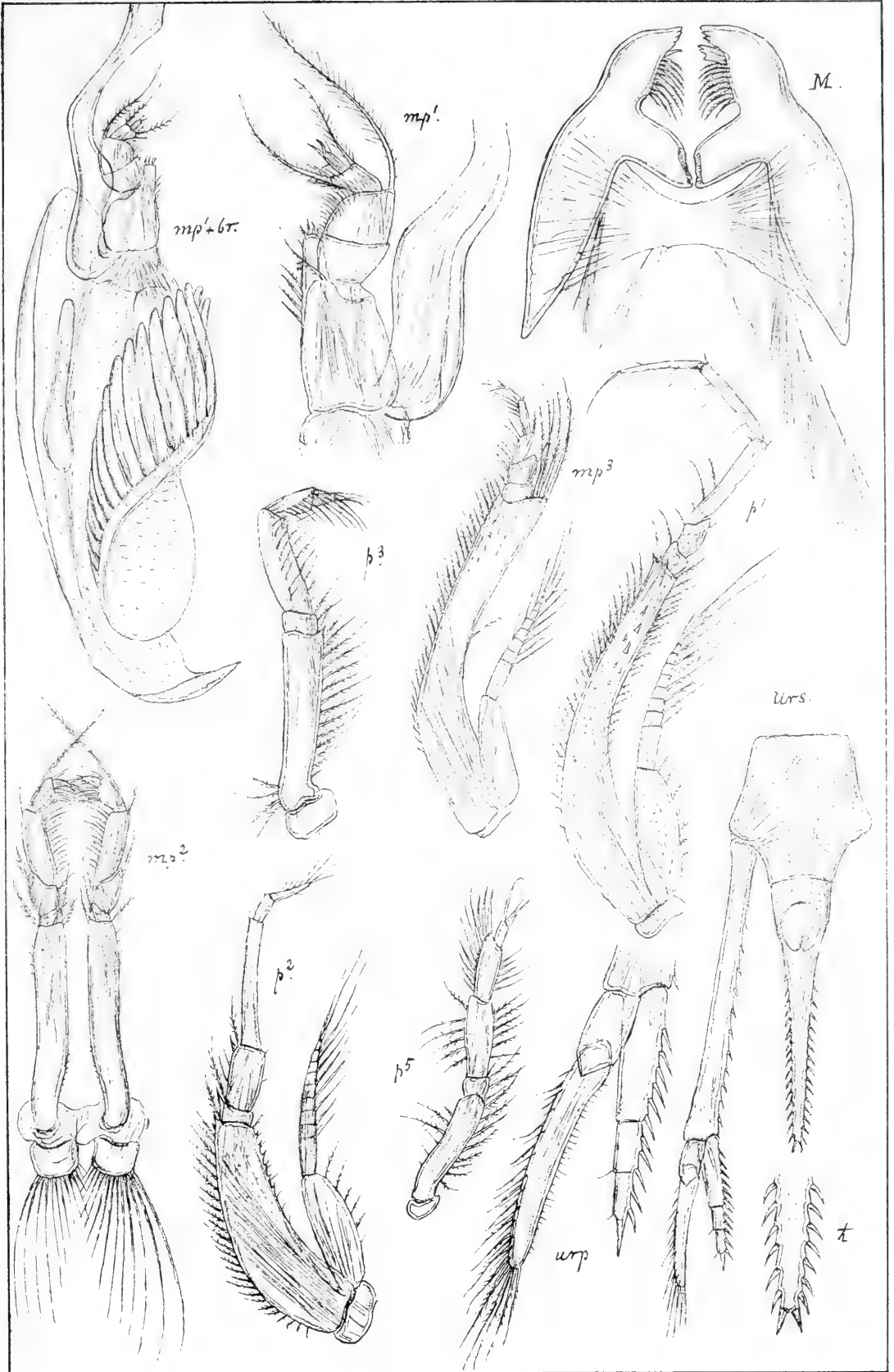
Diastylis longimana, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea, p. 48.

Specific Characters.—*Female.* Body comparatively slender, though having the anterior division considerably tumefied and rounded oval in form. Carapace large and deep, more than twice as long as the exposed part of the trunk, and slightly vaulted above, surface perfectly smooth throughout, and only clothed with scattered small hairs; pseudorostral projection of moderate size, triangular, subrostral corners obsolete, lower edges of carapace abruptly curved in the middle, with the anterior half minutely denticulate. Epimeral parts of the 3 posterior pedigerous segments comparatively small and rounded off behind. Tail (exclusive of the terminal appendages) exceeding the length of the anterior division and very slender. Superior antennæ rather elongated, the peduncle extending far beyond the tip of the pseudorostral projection, its last joint scarcely shorter than the 1st, but much narrower, and, like the 2nd, clothed on both edges with slender bristles. First pair of legs exceedingly slender and elongated, and, when fully extended, exceeding half the length of the body, basal joint occupying scarcely more than $\frac{1}{3}$ of the length of the leg, and without any spinules, penultimate joint of extraordinary length, fully equalling that of the 3 preceding joints combined, last joint comparatively short, not attaining even $\frac{1}{3}$ of the length of the penultimate one; 2nd pair likewise rather slender and much curved, basal joint comparatively short, last joint very slender, exceeding the length of the antepenultimate one; 3rd and 4th pairs rather narrow, with the rudimentary exopodite easily observable and carrying a single apical bristle. Uropoda much elongated, with the inner ramus very narrow, and exceeding the outer by its last joint, 1st joint longer than the other 2 combined, spinules of the inner edge only 5 in number (3 on the 1st, and 1 on each of the last 2 joints), apical spine very slender, almost setiform. Telson not attaining even the length of the last caudal segment, and rather thick at the base, distal part abruptly narrowed and, as in the other species, provided with only a single pair of lateral spinules near the tip, apical spines somewhat larger, and extended straight behind. Colour whitish. Length $5\frac{1}{2}$ mm.

Adult male scarcely more slender than the female, but having the carapace less deep, and the pseudorostral projection more prominent. Tail scarcely exceeding in length the anterior division, and very narrow, unarmed, terminal appendages scarcely different from those in the female. Length about 5 mm.

Remarks.—This form was first described by the present author as a species of the genus *Diastylis*, the specific name proposed being derived from the





G. O. Sars autogr.

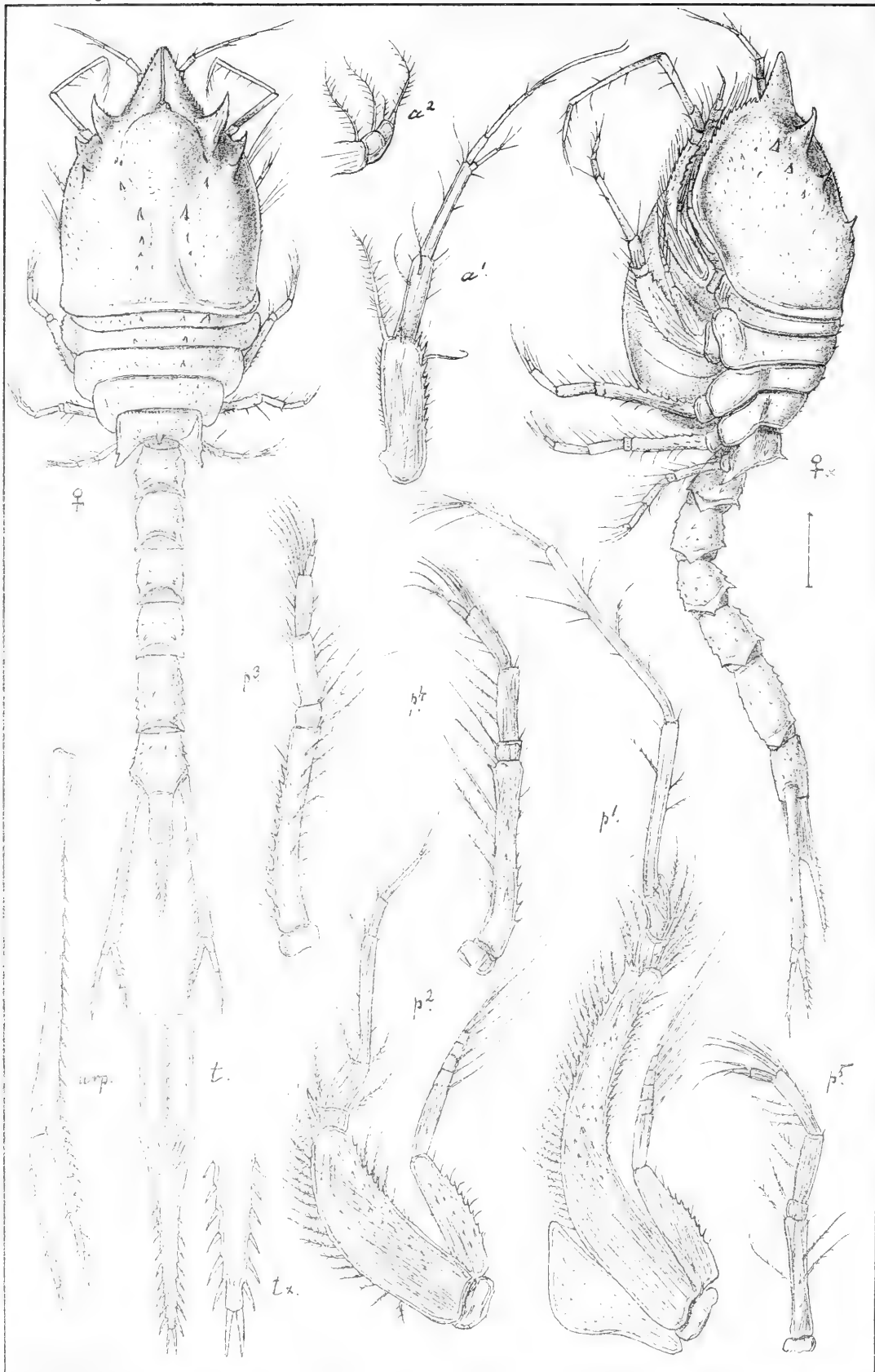
Diastylis Rathkei, (Kröyer.)
(continued).

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Cumacea.

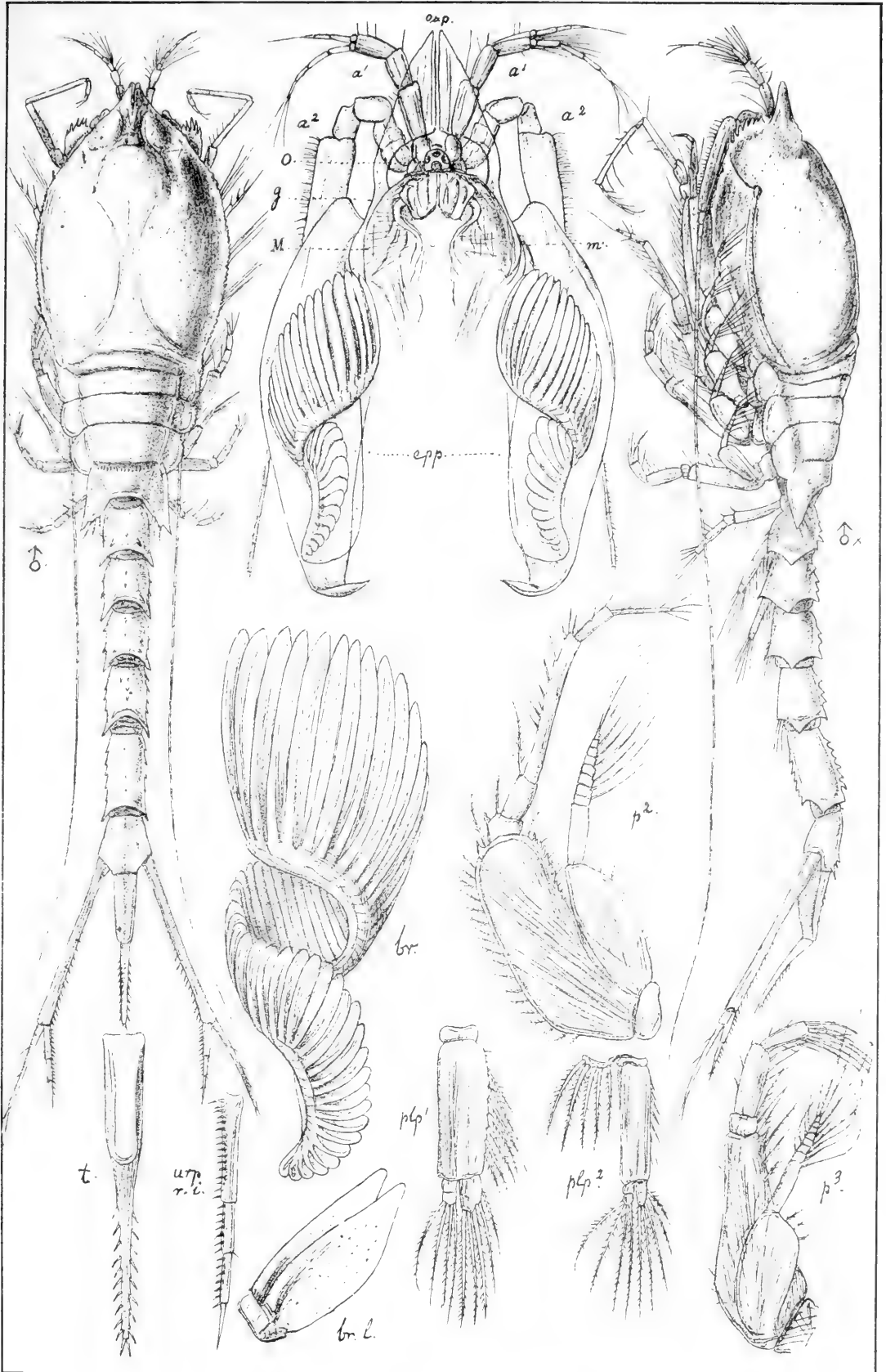
Diastylidæ.

Pl. XXXV.



Diastylis cornuta, Boeck.

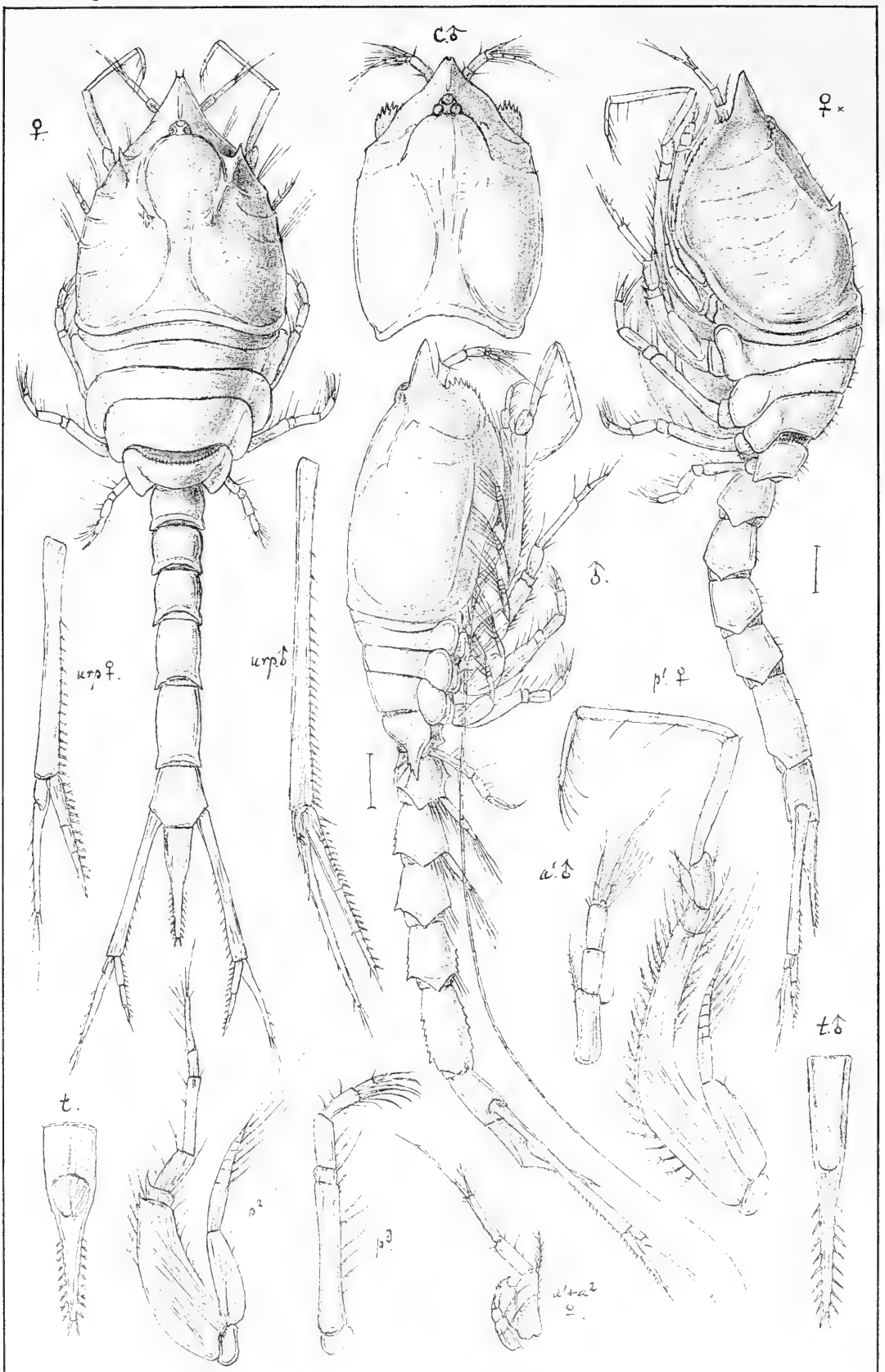
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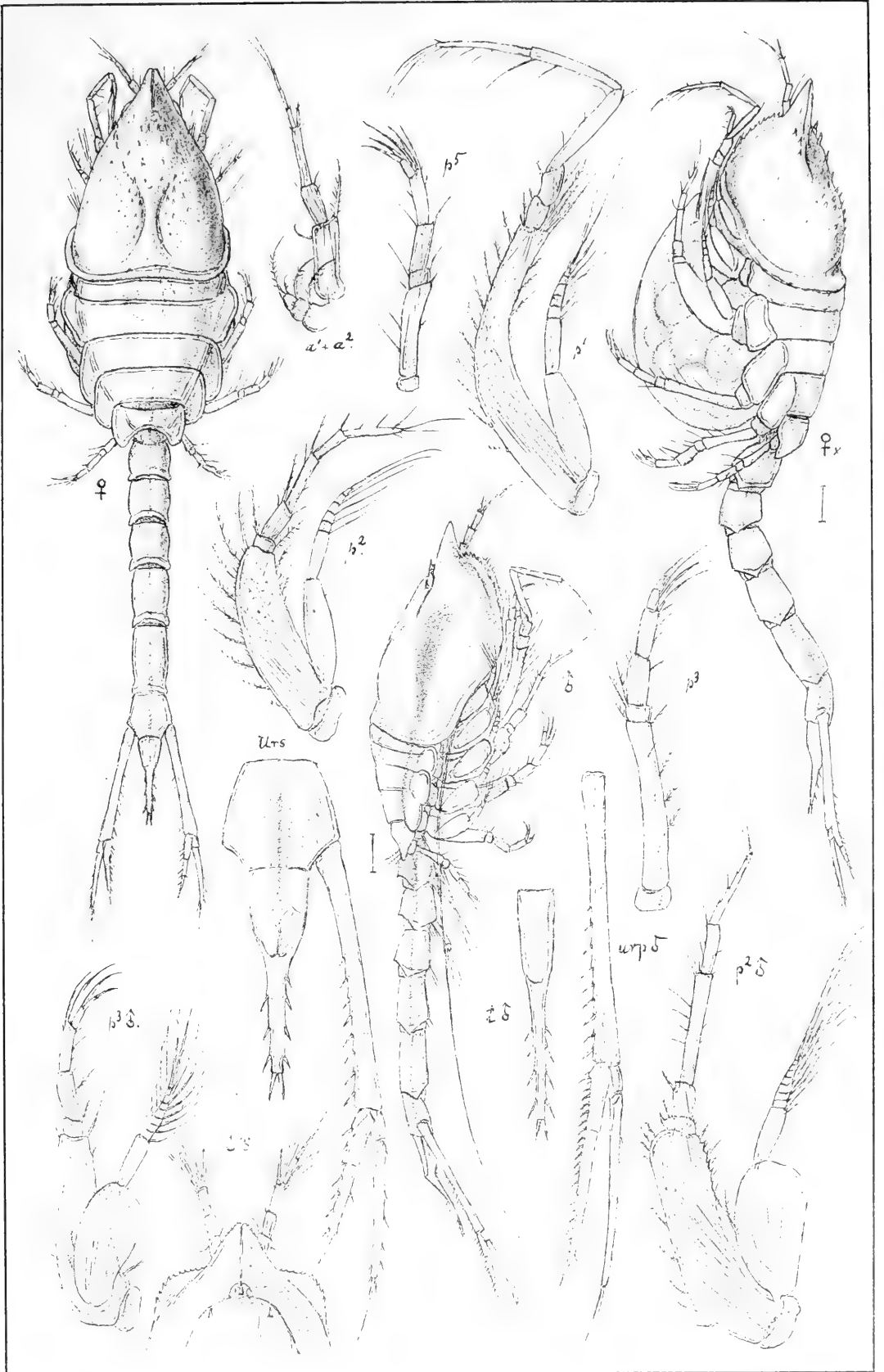
G. O. Sars autogr

Diastylis cornuta, Boeck.
(adult male).

Trykt i den private Opmaaling, Chra.



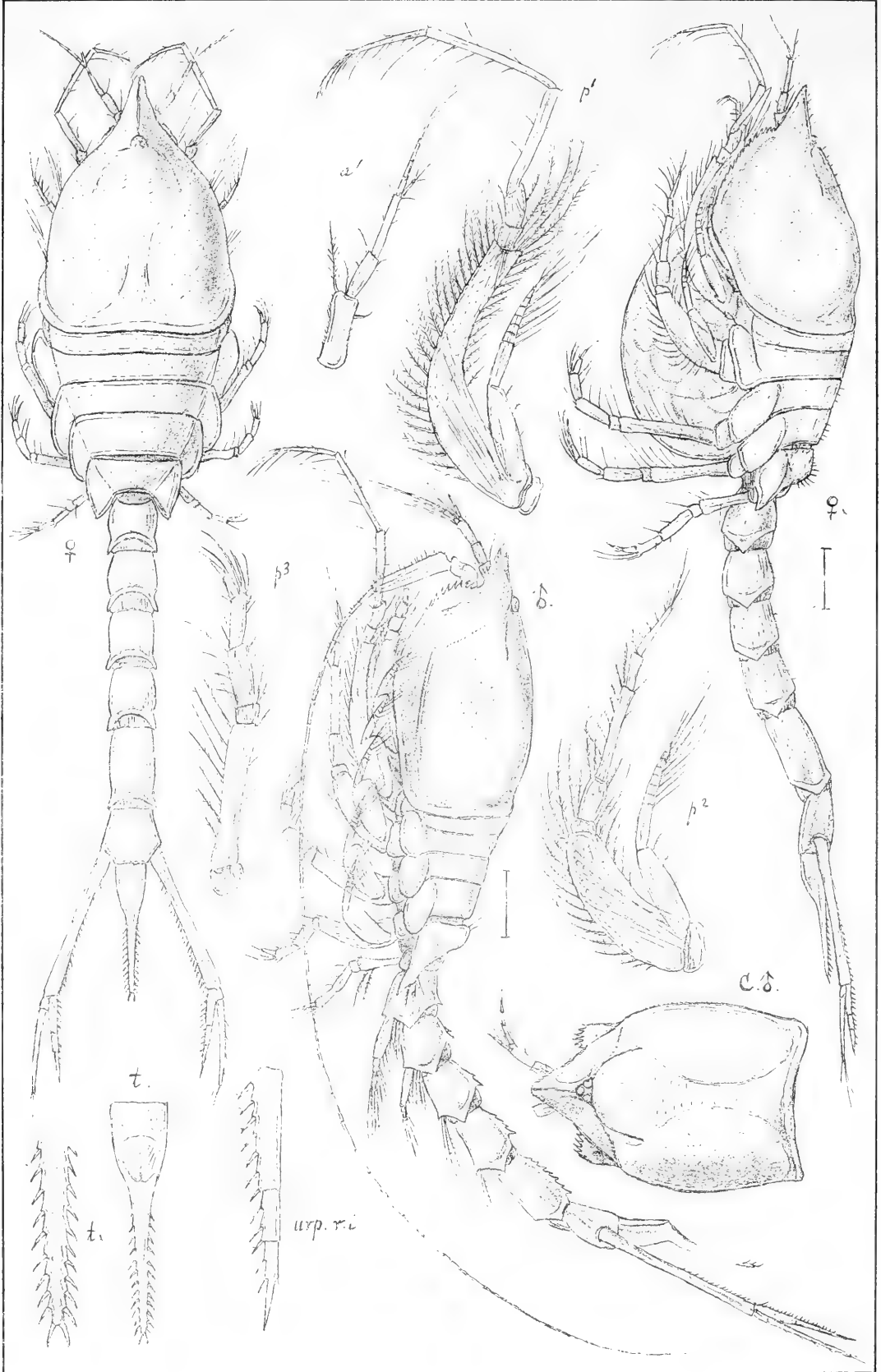
Diastylis rugosa, G. O. Sars.



Cumacea.

Diastylidæ.

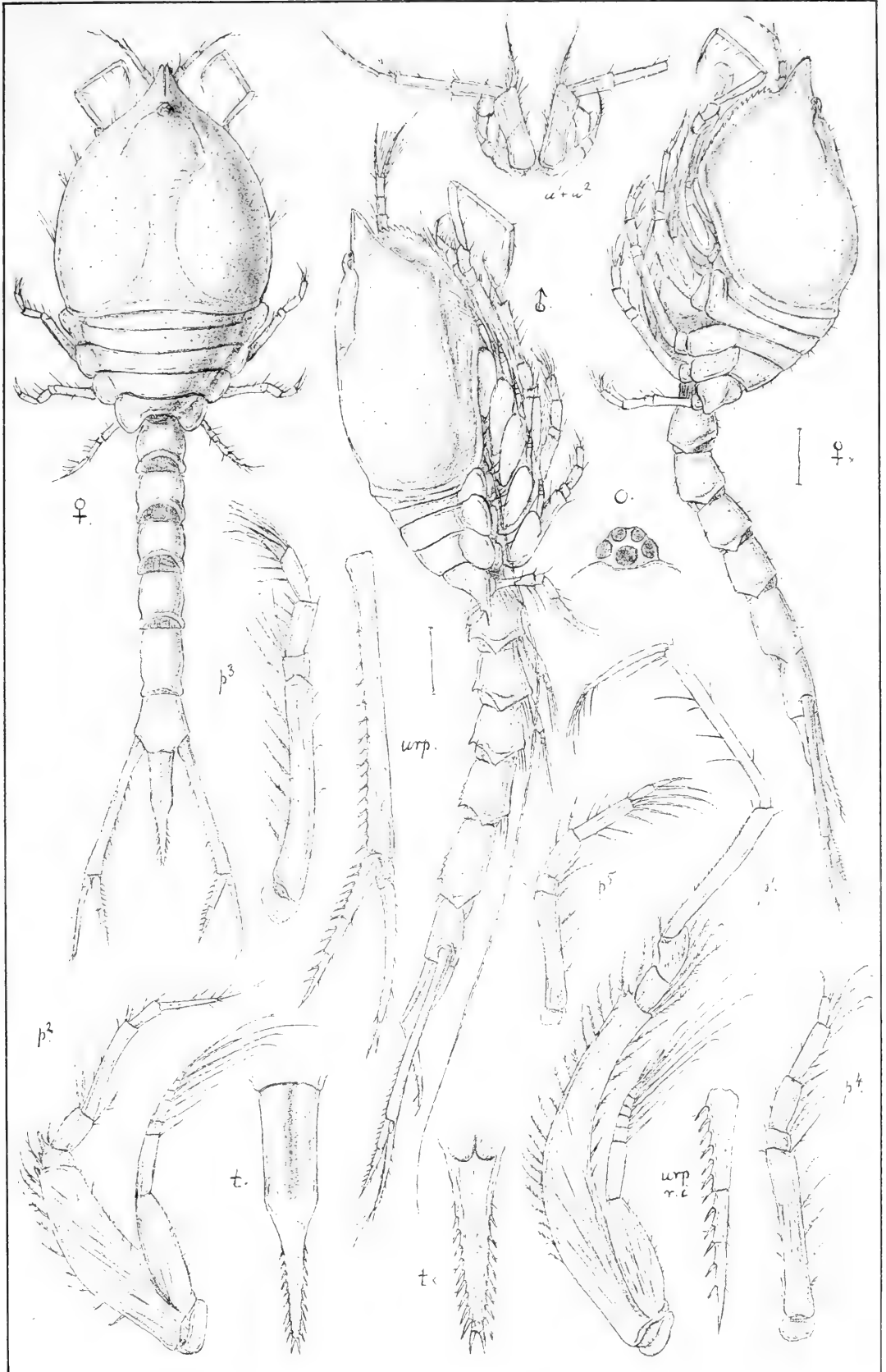
Pl. XXXIX.

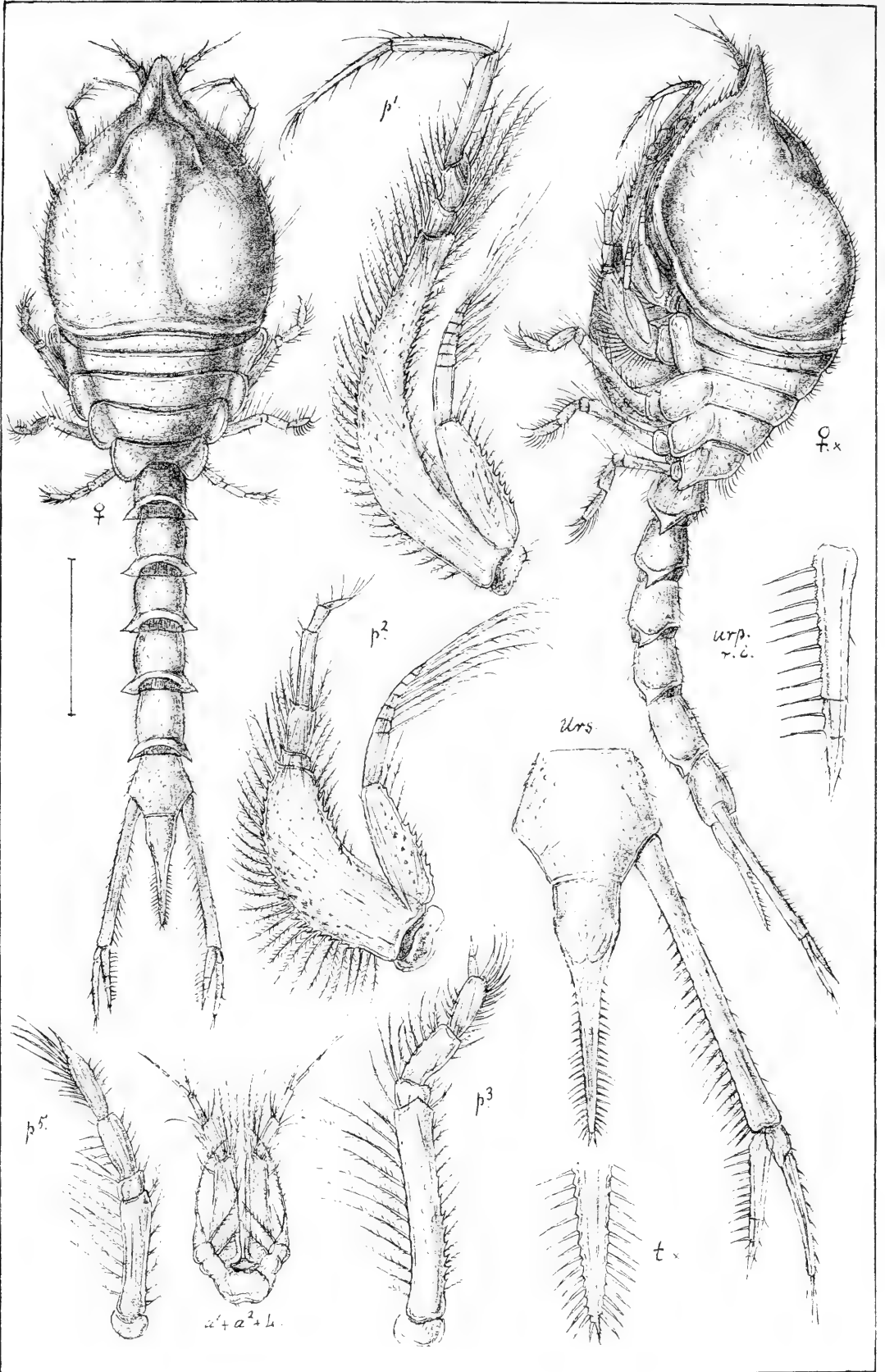


G. O. Sars autogr.

Diastylis rostrata, (Goodsir).

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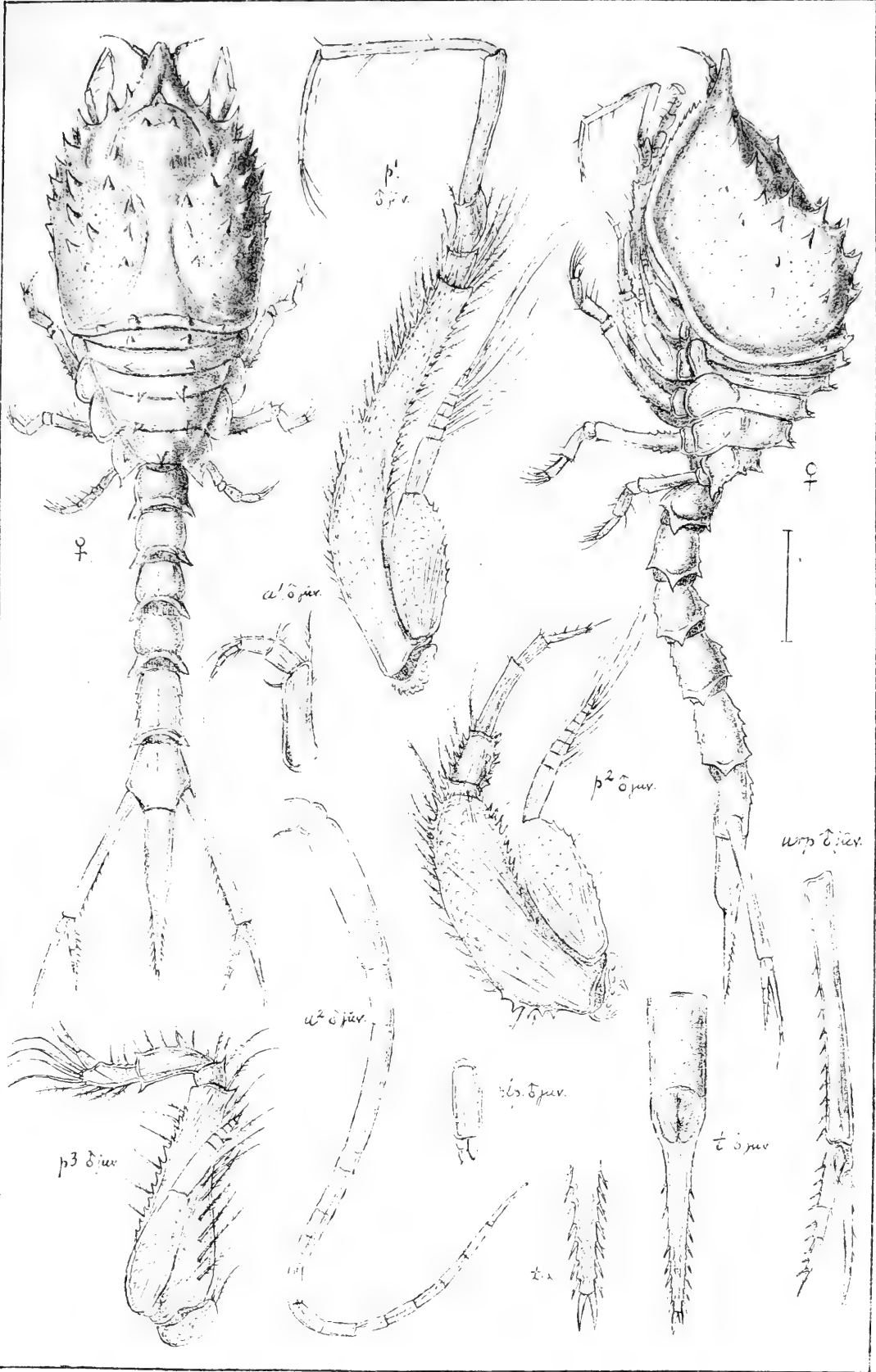




G.O. Sars autogr

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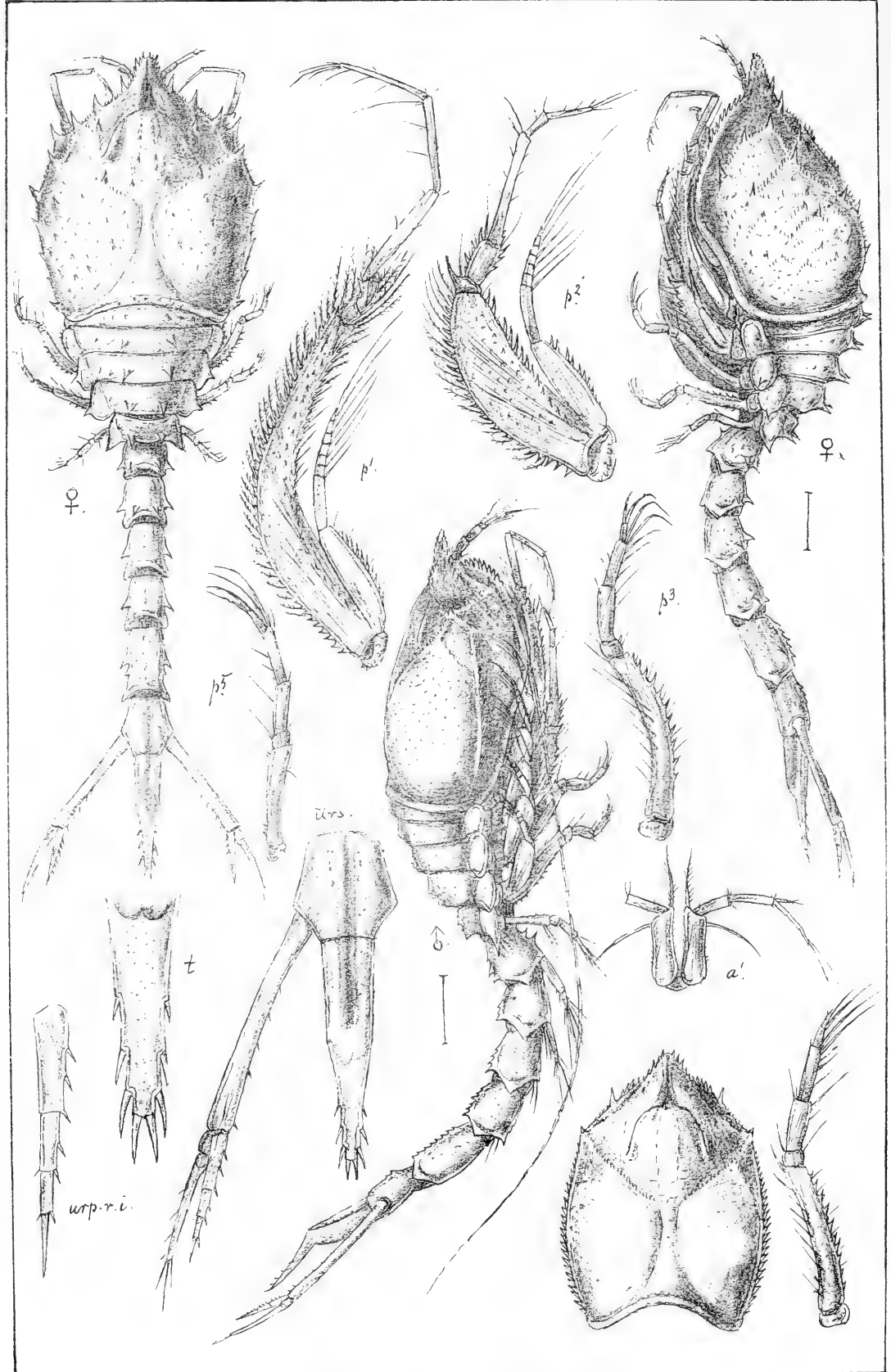
Diastylis Goodsiri, Bell.



G.O. Sars autogr.

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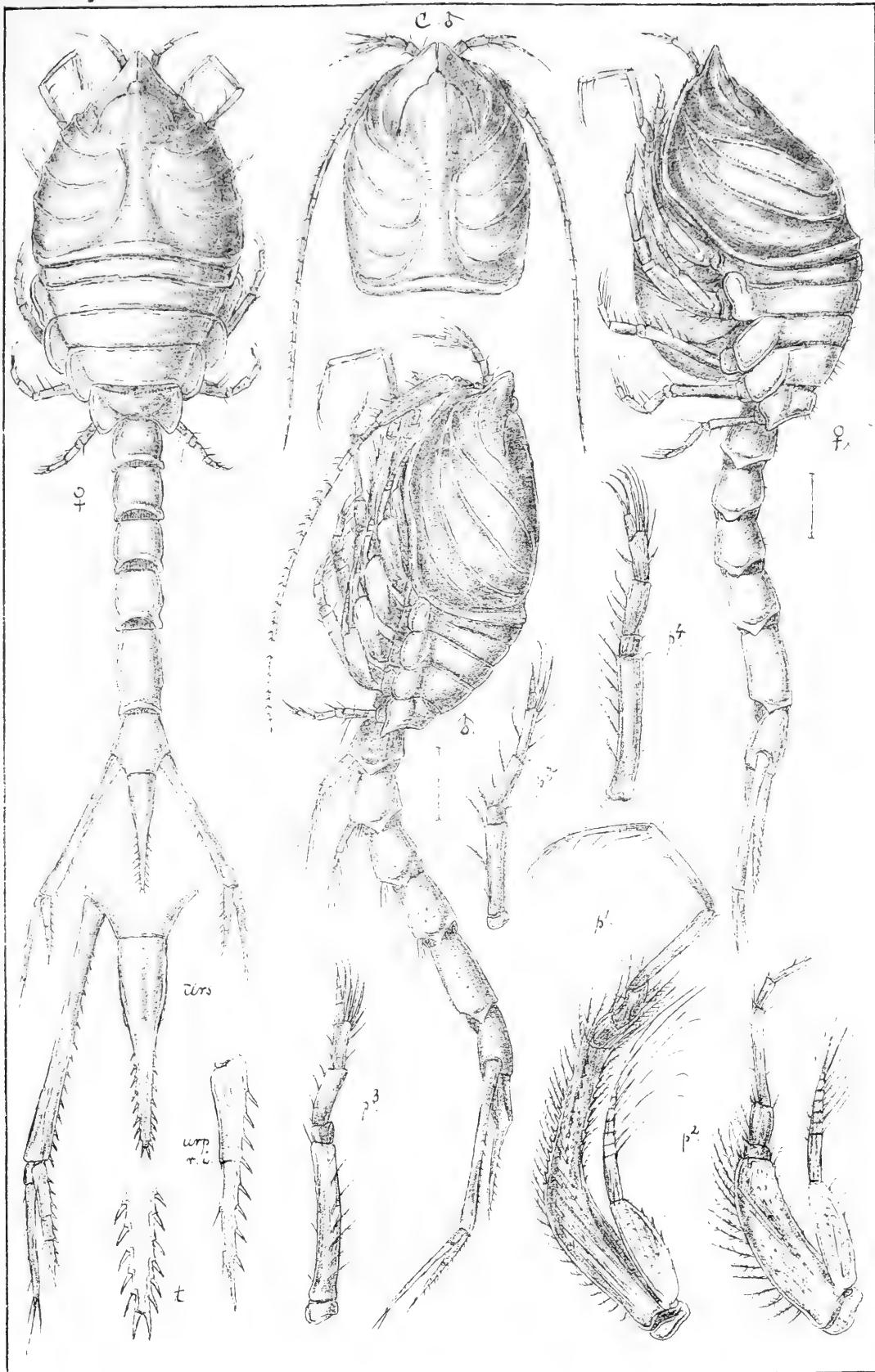
Diastylis spinulosa, Heller.



G. O. Sars autogr.

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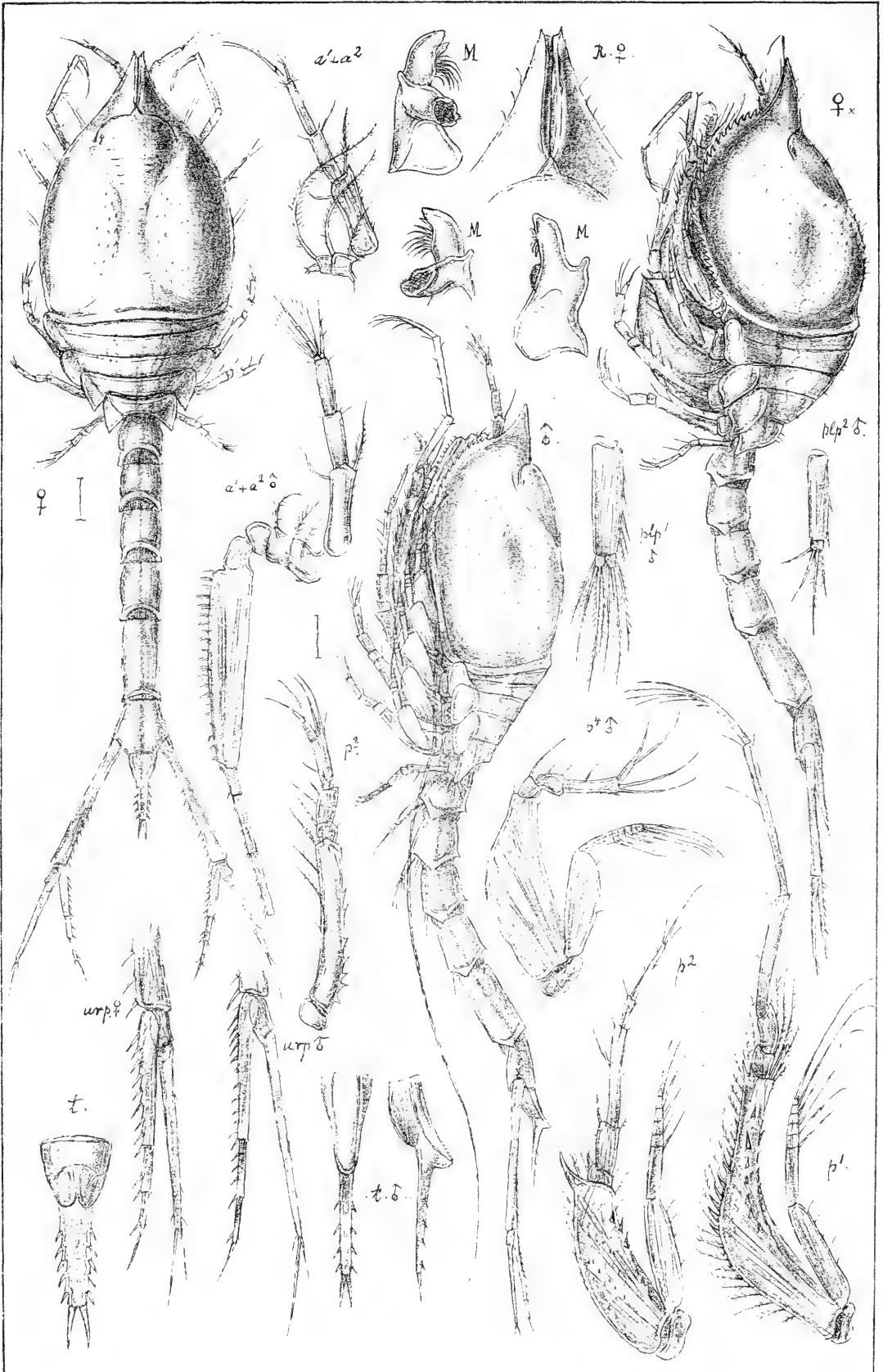
Diastylis echinata, Sp. Bate.



G.O. Sars autogr.

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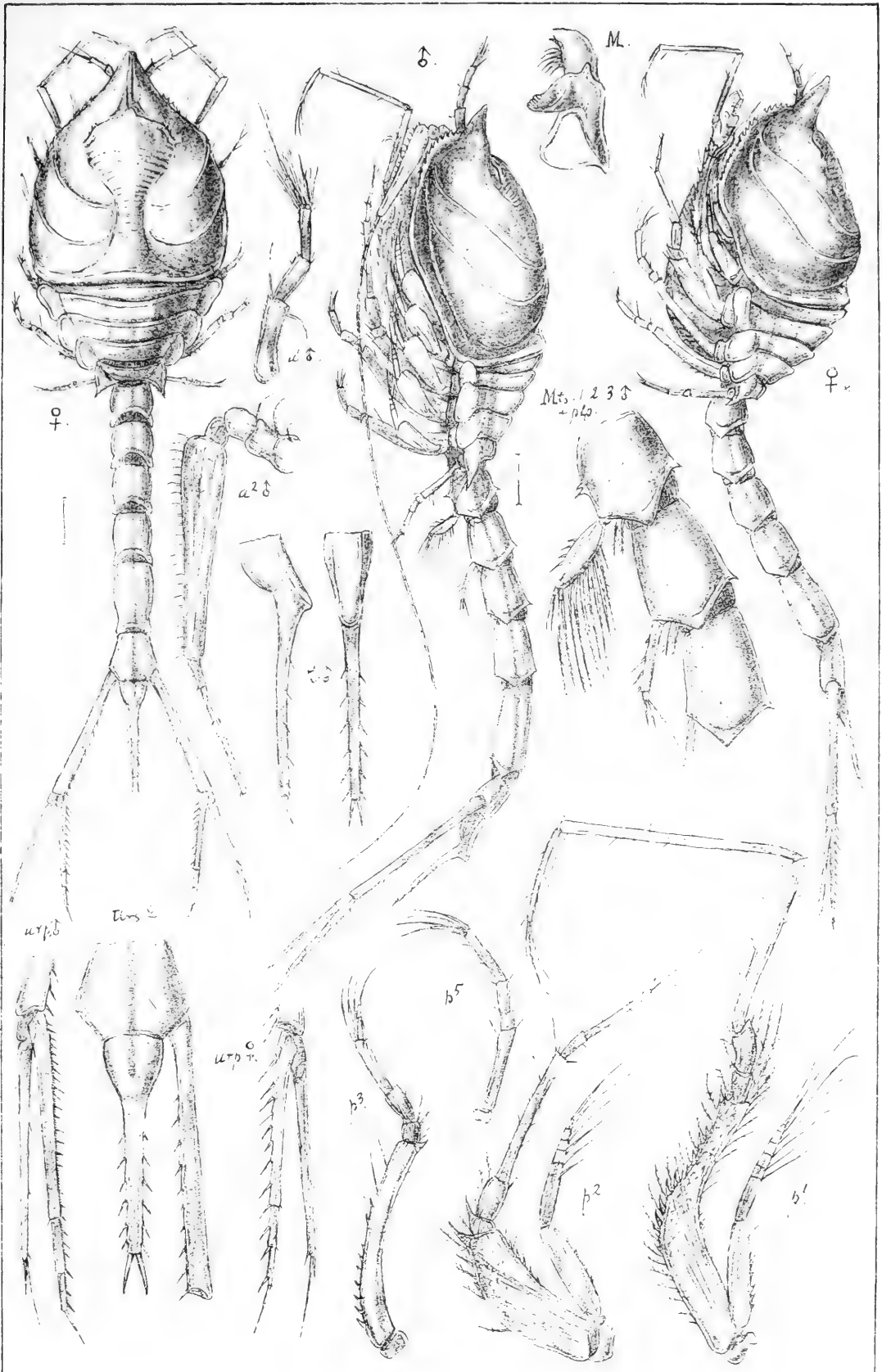
Diastylis scorpioides (Lepechin).



G. O. Sars autogr.

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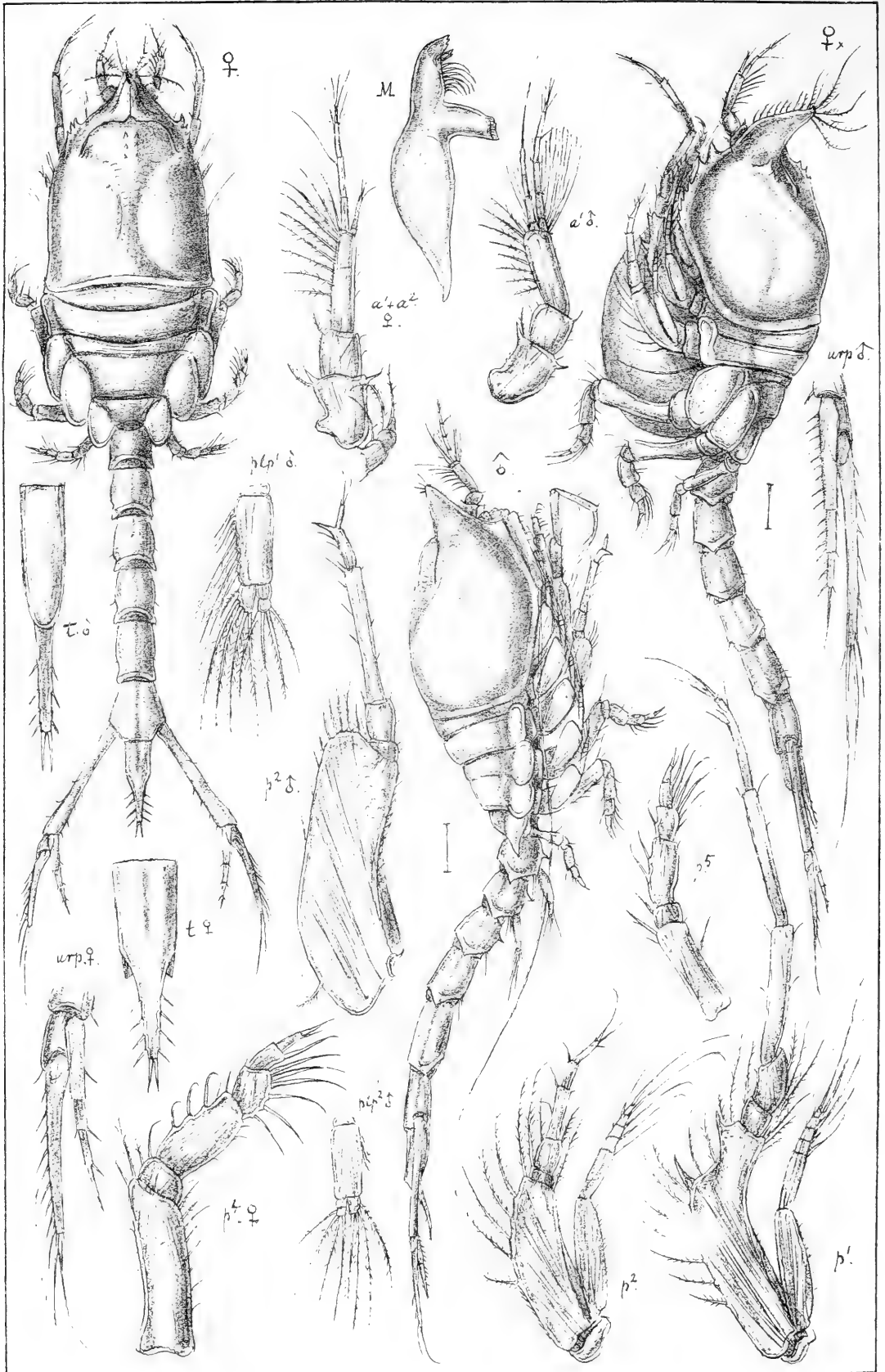
Diastylodes serrata, G. O. Sars.



G. O. Sars autogr.

Trykt i den private Opmaaling, Osna

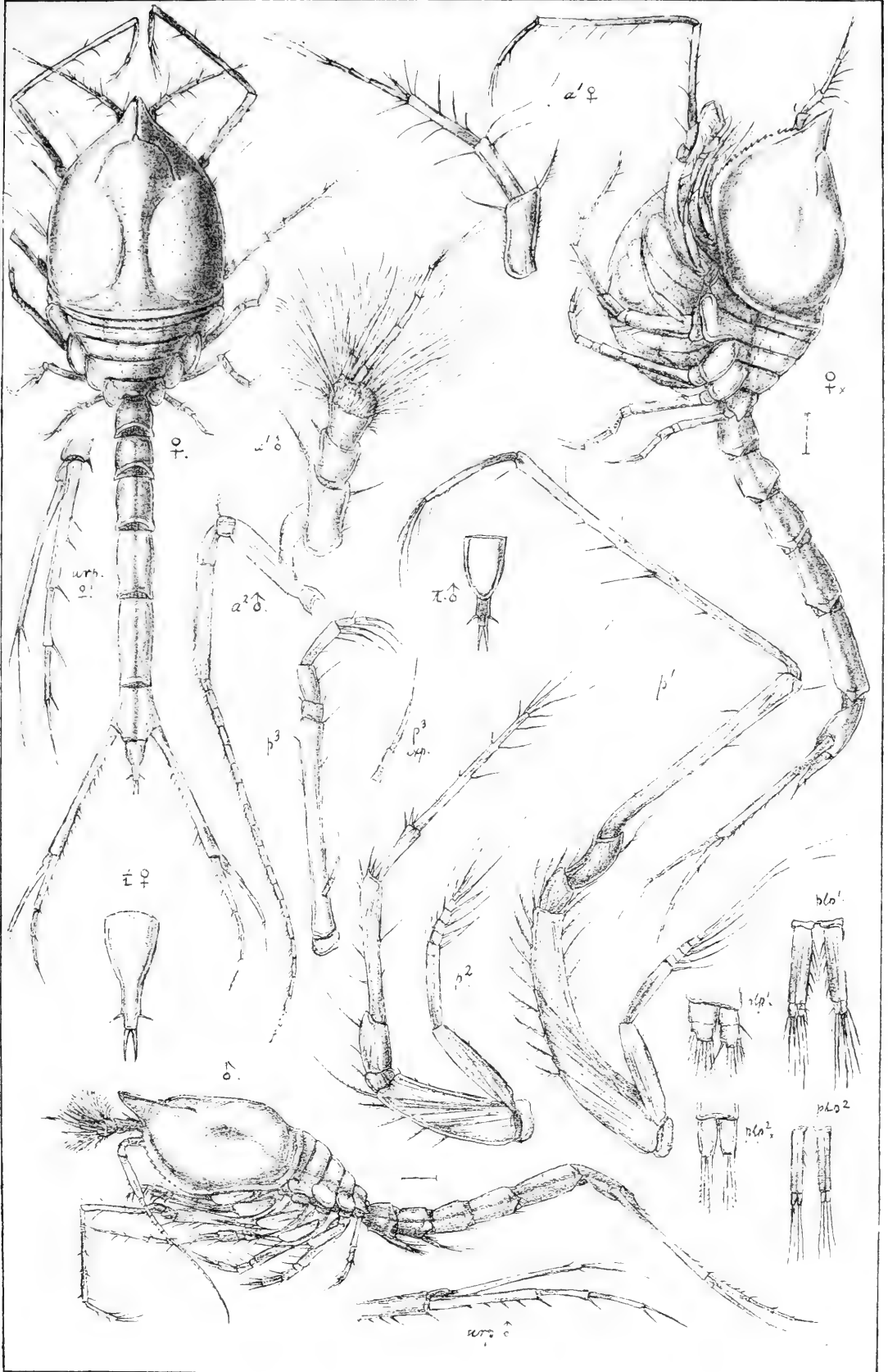
Diastylodes biplicata, G. O. Sars.



G. O. Sars autogr.

...Trykt i den private Opmaaling, Chra.

Diastylopsis resima, (Krøyer.)





AN ACCOUNT
OF THE
CRUSTACEA
OF
NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY
G. O. SARS

VOL. III
CUMACEA

PART VII & VIII
PSEUDOCUMIDÆ, NANNASTACIDÆ, CAMPYLASPIDÆ

WITH 16 AUTOGRAPHIC PLATES



BERGEN
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1900

unusually prolonged 1st pair of legs. It may be regarded as the type of the present genus, and also in other respects is easily recognizable from the 3 other Norwegian species.

Occurrence.—I first found this form in the Christiania Fjord, both in the immediate vicinity of Christiania, and at Drøbak. Subsequently I have also met with it, though rather sparingly, in some other places on the south and west coasts of Norway, as far north as the Lofoten Islands. It generally occurs in depths ranging from 30 to 100 fathoms, muddy bottom.

Distribution.—Off the Skagen Lighthouse (Meinert), Atlantic coast of North America (Verrill).

15. *Leptostylis macrura*, G. O. Sars.

(Pl. XLIX).

Leptostylis macrura, G. O. Sars. Nye Dybvandscrustaceer fra Lofoten. Chr. Vid. Selsk. Forhandl. 1869, pag. 156.

Specific Characters.—*Female.* General form of body resembling that of the preceding species, the anterior division being very tumid, almost globose in form, and sharply marked off from the slender tail. Carapace large, more than twice as long as the exposed part of the trunk, and but slightly vaulted above, surface smooth, though rather densely clothed with hairs, pseudorostral projection comparatively shorter than in the type species. Tail (exclusive of the terminal appendages) much longer than the anterior division, and very narrow. Superior antennæ less elongated than in *L. longimana*, last joint of the peduncle much shorter than the 1st, and setiferous only at the end. First pair of legs slender, though not nearly so elongate as in the type species, basal joint exceeding half the length of the remaining part of the leg, penultimate joint about the length of the 3 preceding joints combined, last joint rather short; 2nd pair with the terminal joint shorter than the antepenultimate one; 3rd and 4th pairs very narrow, rudimentary exopodite with 3 apical setæ. Uropoda less elongated than in *L. longimana*, inner ramus with the last joint longer than the 1st, spinules of inner edge 5 in number (2 on the 1st joint, 1 on the 2nd, and 2 on the last), apical spine very slender, setiform. Telson very small and but slightly narrowed distally, exhibiting a similar armature to that in *L. longimana*. Colour greyish white. Length about 5 mm.

Adult male comparatively more slender than that of the type species. Carapace somewhat more depressed than in female, and provided on each side with a very conspicuous, coarsely serrated carina extending throughout its entire

length. Appendages transformed in a similar manner to that in the male of *L. longimana*.

Remarks.—This form is nearly allied to the type species, though easily distinguishable in both sexes, being especially recognizable by the extremely slender and narrow tail, and by the coarsely serrated lateral keels of the carapace in the male.

Occurrence.—I first found this form off the Lofoten Islands, and have subsequently met with it also in several other places on the Norwegian coast, for instance, in the outer part of the Hardanger Fjord, at Aalesund, in the Trondhjem Fjord, and at Vadsø. It is generally found in depths ranging from 50 to 150 fathoms, muddy clay.

Distribution.—Stat. 33 of the Norwegian North Atlantic Expedition (the present author).

16. *Leptostylis ampullacea* (Lilljeborg).

(Pl. L, fig. 1).

Cuma ampullacea, Lilljeborg, Øfværs. Vet. Akad. Förh. 1855, p. 120.

Syn: *Diastylis ampullacea*, G. O. Sars.

Specific Characters.—*Female.* Body comparatively short and clumsy, with the anterior division much tumefied and considerably vaulted above. Carapace large and somewhat sloping in front, surface smooth and clothed with scattered slender hairs, pseudorostral projection comparatively short and bluntly triangular in form, subrostral corners rounded off, inferior edges coarsely serrate in their anterior halves. The first 2 pedigerous segments each having the anterior edge emarginated in the middle, and forming on each side of the emargination a slight appressed lappet. Tail (exclusive of the terminal appendages) scarcely longer than the anterior division, and comparatively less slender than in the 2 preceding species. Superior antennæ with the 1st joint of the peduncle almost as long as the other 2 combined. First pair of legs not much elongated, scarcely exceeding in length the carapace, basal joint about the length of the last 3 joints combined, penultimate joint somewhat longer than the antepenultimate one, last joint comparatively short; 2nd pair with the terminal joint nearly as long as the antepenultimate one; the 3 posterior pairs less slender than in the 2 preceding species. Uropoda comparatively short, inner ramus almost as long as the stem, and exceeding the outer by about $\frac{1}{3}$ of its length, 1st joint about the length of the other 2 combined, spinules of the inner edge 5 in number (3 on the 1st, and 1 on each of the last 2 joints), apical spine slender, setiform. Telson about half the length

of the stem of the uropoda, and exhibiting the form and armature characteristic of the genus. Colour dark yellowish grey or fuscous. Length 6 mm.

Remarks.—This form was briefly described in the year 1855 by Prof. Lilljeborg as *Cuma ampullacea*, and was subsequently referred by the present author to the genus *Diastylis*. It is, however, unquestionably referable to the genus *Leptostylis*, exhibiting, as it does, all the leading features of that genus, though differing remarkably from the 2 preceding species in its unusually clumsy form of body.

Occurrence.—Though nowhere in any abundance, I have found this form along the whole Norwegian coast, from the Christiania Fjord to Vadsø, in moderate depths ranging from 30 to 100 fathoms. Fully adult male specimens have not yet come under my notice; but even in the immature state, the strong development of the superior antennæ, so characteristic of the present genus, is very obvious.

Distribution.—Kullaberg (Lilljeborg), Kattegat (Meinert), Atlantic coast of North America (Verrill).

17. *Leptostylis villosa*, G. O. Sars.

(Pl. L, fig. 2).

Leptostylis villosa, G. O. Sars. Undersøgelser over Christianiafjordens Dybvandsfauna, p. 40.

Specific Characters.—*Female.* Anterior division of body greatly tumefied, almost globose in form, and very sharply marked off from the extremely slender tail. Carapace large and deep, more than twice as long as the exposed part of the trunk, and thickly covered with stiff hairs in a fur-like manner; pseudorostral projection very short and blunt, lower edges throughout divided into peculiar lamellar serrations. The first 2 pedigerous segments exhibiting a structure of the anterior edge similar to that in *L. ampullacea*. Tail (exclusive of the terminal appendages) exceeding the length of the anterior division, and exceedingly narrow. Superior antennæ with the last joint about the length of the 1st, but much narrower. First pair of legs very slender, exceeding the length of the anterior division of the body, basal joint scarcely attaining more than half the length of the leg, penultimate joint much longer than the antepenultimate, last joint comparatively short; 2nd pair with the terminal joint very slender, exceeding the length of the antepenultimate; rudimentary exopodite of 3rd and 4th pairs extremely small though distinct. Uropoda of moderate length, inner ramus much longer than the outer, and nearly attaining the length of the stem, its 1st joint not nearly as long as the other 2 combined; spinules of the inner edge only 4 in number (2 on the 1st, and 1 on each of the last 2 joints), apical spine slender,

setiform. Telson not attaining half the length of the stem of the uropoda, and exhibiting the usual shape and armature. Colour light fuscous. Length 4 mm.

Remarks.—This form is nearly allied to *L. ampullacea*, though easily distinguishable by its less strongly built body, the almost globose and densely hairy anterior division, and the extremely slender tail. It is also much inferior in size.

Occurrence.—I first found this form in the Christiania Fjord, at Holmestrand, where it occurred rather abundantly, and have subsequently met with it also in several other places on the Norwegian coast, as far north as Vadsø. It is a pronounced deep-water form, only occurring in depths below 60 fathoms, on a muddy bottom. I have not hitherto succeeded in finding adult male specimens of this species either. Out of Norway, this form has not yet been recorded.

Fam. 6. Pseudocumidæ.

Characters.—Body of various forms, sometimes very slender, sometimes comparatively short and clumsy. Anterior division generally well marked off from the posterior, and having 5 segments exposed behind the carapace; the latter of moderate size and without any spiniform protuberances, pseudorostral projection of varying form, subrostral corners generally well marked, lower edges unarmed. Tail slender, smooth. Eye generally well developed. Superior antennæ only slightly different in the two sexes, inner flagellum rudimentary. Inferior antennæ in female very small, in male well developed, resembling those in the male *Diastylidæ*. Oral parts on the whole normal. The 2 anterior pairs of legs in female, and all but the last pair in male, provided with well-developed exopodites; 3rd and 4th pairs in female with a small appendage (rudimentary exopodite) outside the basal joint. Two pairs of pleopoda present in the male, the posterior pair, however, very small and rudimentary. Uropoda with the inner ramus unarticulate, the outer biarticulate. Telson well defined from the last caudal segment, but very small, flap-shaped.

Remarks.—This family in some characters apparently approaches the *Diastylidæ*, in others the *Lampropidæ*, but evidently ought to be kept apart from all of them. With the *Diastylidæ* it agrees among other things in the structure of the inferior antennæ in the male, as also in the presence of only 2 pairs of

pleopoda; with the *Lampropidæ* in the presence of rudimentary exopodites to the 3rd and 4th pairs of legs in the female. From both these families it differs conspicuously in the structure of the telson, and the uniarticulate inner ramus of the uropoda. The marine forms of this family are very few in number, and belong to two nearly-allied genera, to be described below. On the other hand, as recently stated by the present author, this family is very abundantly represented in the Caspian Sea, exhibiting in this isolated basin quite a wonderful variety of form. No less than 13 different species have hitherto been detected, and some of these differ so widely in their external appearance from the marine forms, that at first sight they might easily be supposed to belong to quite different families. A closer examination has proved, however, that they all agree in the more essential anatomical features first pointed out in the genus *Pseudocuma*, and for this reason they have all been described as members of this genus. If, however, the establishment of the family *Pseudocumidæ* be sanctioned, of course a more general value must be ascribed to several of these characters; and indeed I am now of opinion that the Caspian species ought to be referred to several distinct genera comprised within the present family, only one of them, *P. cercaroides* belonging to the type genus. The other species I propose to arrange as follows:

Gen. 1, **Pterocuma**, G. O. Sars, with the species *pectinata*, *Sowinskyi* and *rostrata*; gen. 2, **Stenocuma**, G. O. Sars, with the species *gracilis*, *graciloides*, *tennicauda* and *diastyloides*; gen. 3, **Schizorhynchus** with the species *bilamellatus*, *eudorelloides*, *scabriusculus* and *abbreviatus*; gen. 4, **Caspicuma** with the species *campylaspoides*.

Gen. 1. **Pseudocuma**, G. O. Sars, 1864.

Syn: *Leucon*, v. Beneden (not Krøyer).

Generic Characters.—Body not very slender, with the anterior division well marked off from the posterior. Integuments thin, exhibiting a densely squamous structure. Carapace of moderate size, dorsal face flattened and sloping in front, lateral faces generally sculptured with oblique plicæ, pseudorostral projection more or less prominent, with the lateral parts contiguous along the dorsal line, subrostral corners obtusangular. Exposed segments of trunk unarmed. Tail

rather slender. Superior antennæ of normal appearance. Inferior antennæ in female extremely small, unarticulate, with a single apical seta; those in male generally shorter than the body. Branchial apparatus with the gill-elements rudimentary. Third pair of maxillipeds pediform, with the outer corner of the basal joint not produced, and carrying a single strong plumous seta. First pair of legs of normal structure, and not much produced; 2nd pair with the terminal joint in male more or less distinctly hooked at the tip. Anterior pair of pleopoda rather large, with the basal part lamellar and carrying strong setæ inside, rami confluent; posterior pair very small, claviform, without setæ. Uropoda moderately slender, rami narrow lanceolate, the inner one the longer.

Remarks.—This genus was established by the present author in the year 1864, to include a small Cumacean found off the Lofoten Islands, and at that time regarded as new, but subsequently identified with a form very imperfectly described and figured by P. van Beneden as *Leucon cercaria*. In the restriction of the genus here adopted, it comprises only 3 other species, viz., the Mediterranean form, *P. ciliata* G. O. Sars, the Caspian form, *P. cercaroides* G. O. Sars, and a new Norwegian species, to be described farther on.

1. *Pseudocuma cercaria* (v. Beneden).

(Pl. LI & LII).

Leucon cercaria, P. v. Beneden, Recherches sur la Faune littorale de Belgique.

Crustacés, p. 85, Pl. IV.

Syn: *Pseudocuma bistrinata*, G. O. Sars.

„ ? *Cyrianassa longicornis*, Sp. Bate (male).

„ *Cuma bella*, Meinert.

Specific Characters.—*Female.* Body more slender than in the other species, with the anterior division considerably vaulted dorsally and ovate in form. Carapace somewhat exceeding in length the exposed part of the trunk, and sloping considerably in front, lateral faces sculptured with 2 distinct oblique plicæ extending from the hindmost part of the branchial regions to the subrostral corners, the latter unarmed; pseudorostral projection rather prominent, terminating in an acute point. Tail very slender, slightly exceeding in length the anterior division. First pair of legs scarcely longer than the carapace, basal joint occupying about half the length of the leg, the 3 distal joints rapidly diminishing both in length and width, terminal joint very narrow, linear; 2nd pair with the terminal joint conically tapered and about the length of the antepenultimate one; 3rd and 4th pairs not very slender, rudimentary exopodite distinctly

biarticulate, and carrying 2 setæ at the tip. Uropoda moderately slender, outer ramus about the length of the stem, inner ramus considerably longer, with about 10 spinules inside, apical spine rather strong. Telson semicircular, with 3 slight serrations on each side. Body more or less richly ornamented with a dark brown pigment. Length scarcely exceeding 4 mm.

Adult male considerably more slender than the female, and having the anterior division less vaulted above. Carapace more flattened, and with the pseudorostral projection less prominent. Eye larger, with the visual elements more distinct. Basal joint of the 4 anterior pairs of legs greatly dilated; terminal joint of 2nd pair with a single apical hook. Anterior pleopoda with 4 strong setæ inside the basal part; posterior pair with 2 slender spines outside the tip. Uropoda more slender than in female, stem with 4 slender setæ inside, inner ramus rather produced, and armed inside with about 14 spinules. Telson fully as long as it is broad at the base, edges unarmed.

Remarks.—As mentioned above, this form was first recorded by P. v. Beneden as a species of the genus *Leuceon*; but both the description and the figures given are rather unsatisfactory, and on this account I did not at first recognize its identity with the Norwegian form, but described the latter as a new species under the name of *P. bistriata*. The *Cyrianassa longicornis* of Sp. Bate may perhaps be the male of this species, and if so, the specific name *longicornis* has really priority in date to that proposed by P. v. Beneden. This name, however, would, be rather inappropriate, as it only refers to the one sex, and even there is far from being significant. The *Cuma bella* of Meinert is unquestionably the female of this species. The form described by the present author from the Mediterranean as *P. cercaria*, differs slightly from the Norwegian form; but the differences do not seem to me to be great enough to warrant a specific distinction.

Occurrence.—I first found this form off the Lofoten Islands, where it is very common in the shallow sounds and bays around the fishing stations. Subsequently I have also met with it in several other places on the Norwegian coast, from the Christiania Fjord to Vadsø, though nowhere in such abundance as off the Lofoten Islands. It generally occurs in comparatively shallow water, on a bottom composed of fine sand covered with a thin layer of blackish mud. Sometimes it is even found on the beach in pools left by the tide. It is a very active little animal, being almost constantly in motion, now swimming about through the water, now burrowing in the sand, and twisting its slender tail in all directions. Adult males are not infrequently found together with the females and, as usual, are still more agile and less confined to the bottom.

Distribution.—Kattegat (Meinert), British Isles (Robertson), Heligoland (Ehrenbaum), Dutch coast (v. Beneden), coast of France (de Folin), Mediterranean at Messina, Syracuse and Goletta (the present author).

2. *Pseudocuma similis*, G. O. Sars, n. sp.

(Pl. LIII).

Specific Characters.—Very like the type species, but of larger size and less slender in form. Carapace sculptured on each side with 2 well-marked oblique plicæ similar to those occurring in *P. cercaria*, pseudorostral projection less prominent, subrostral corners armed in front with 3 distinct denticles. Tail (excluding the terminal appendages) about the length of the anterior division, and less narrow than in the type species. Eye very conspicuous, especially in the male. Antennæ, oral parts and legs about as in *P. cercaria*, terminal joint of 2nd pair of legs in male, however, with 3 denticles at the tip, the distal one hamiform. Anterior pair of pleopoda with only 2 setæ inside the basal part, posterior pair with a single spine outside. Uropoda somewhat more slender than in the type species, rami shorter than the stem, and differing very little in length, the inner one in female with about 6, in male with 12 spines inside. Telson in female rounded quadrangular in form, being transversely truncated behind, edges smooth. Colour yellowish, anterior division of body more or less variegated with a light brownish pigment. Length of female about 5 mm., of male 5½ mm.

Remarks.—This form is closely allied to the type species, and, indeed, it is only quite recently that I have become aware of its specific distinctness. It is of somewhat larger size than *P. cercaria*, and less slender in form, and also lighter in colour. On a closer examination, it may also be easily distinguished by the less prominent pseudorostral projection, the quadridentate subrostral corners, and the structure of the uropoda and telson.

Occurrence.—The only place where I have hitherto met with this form, is at Skudesnæs, west coast of Norway. It occurred here together with the type species in a depth of 6—12 fathoms, on a bottom consisting of coarse sand and gravel.

Gen. 2. **Petalosarsia**, Stebbing, 1893.

Syn: *Petalopus*, G. O. Sars.

„ *Petalomera*, G. O. Sars.

Generic Characters.—General form of body about as in *Pseudocuma*, though comparatively shorter and more compact, at least in female. Integuments greatly indurated. Carapace large, with the upper face flattened and declining obliquely to the prominent pseudorostral projection. Exposed segments of trunk smooth. Eye less perfectly developed than in *Pseudocuma*. Superior antennæ with the 2nd joint of the peduncle lamelliformly dilated, last joint very small. Inferior antennæ in female distinctly biarticulate, with an apical and a lateral seta, those in male attaining the length of the body. Oral parts about as in *Pseudocuma*. First pair of legs of a rather peculiar appearance, the ischical and meral joints being firmly connected with each other, and the carpal joint enormously developed, foliaceous, last 2 joints small and admitting of being bent in against the inner face of the carpal one. Second pair of legs comparatively short; 3rd and 4th pair in female with a very small rudimentary exopodite. Pleopoda of male resembling in structure those in *Pseudocuma*. Uropoda with the stem much shorter than the rami, the inner of which is densely hairy inside. Telson semicircular, unarmed.

Remarks.—This genus was established by the present author in the year 1864; but as the name at that time proposed, *Petalopus*, and also that substituted later, *Fetalomera*, had been previously appropriated in Zoology, the Rev. Mr. Stebbing has recently proposed to name the genus as above, a compound indeed, which is quite sure not to have been previously employed. The genus is closely allied to *Pseudocuma*, more so, indeed, than at first supposed. The peculiar structure of the 1st pair of legs still seems, however, to warrant the validity of the genus. We know at present of only a single species, to be described below.

3. **Petalosarsia declivis**, G. O. Sars.

(Pl. LIV).

Petalopus declivis, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea, p. 72.

Syn: *Petalomera declivis*, G. O. Sars.

Specific Characters.—*Female*. Body comparatively short and compact, with the anterior division rather tumid and sharply marked off from the posterior, dorsal face boldly vaulted behind the middle. Carapace nearly twice as long as

the exposed part of the trunk and rather deep, with a strongly marked carina running on each side, nearer the dorsal side, from the hindmost part of the branchial regions to the base of the pseudorostral projection, the latter rather prominent, acute, subrostral corners very small, terminating in a minute denticle. Tail (excluding the terminal appendages) shorter than the anterior division. Superior antennæ with the peduncle scarcely projecting beyond the tip of the pseudorostral projection, its 2nd joint rounded oval, with 3 blunt serrations of the inner edge, last joint extremely small. First pair of legs about the length of the carapace, ischial and meral joints forming together a rather short and broad triangular piece intercalated between the basal and carpal joints, the latter joint very large and broad, forming an oblong quadrangular plate, to the outer corner of which the 2 small distal joints are very movably attached. Second pair of legs scarcely more than half as long as the 1st, antepenultimate joint rather broad, and of same appearance as the preceding one, terminal joint conically tapered, with several long bristles at the tip. Uropoda about the length of the last 2 caudal segments combined, inner ramus somewhat larger than the outer, and almost twice the length of the stem, with only 3 spinules, 2 apical and one lateral, inner edge minutely serrate and densely hairy throughout. Colour uniformly yellow, without any pigmentary ornament. Length about 4 mm.

Adult male much more slender than the female, with the anterior division less vaulted above. Carapace with an additional carina on each side, running parallel to the other and nearer the ventral side; pseudorostral projection shorter and blunter than in female. Appendages exhibiting the usual transformation. Length nearly 5 mm.

Remarks.—This form was originally described from only 2 specimens, both of the female sex, the one not fully developed; and owing to this scantiness of material, some errors had been introduced in the original diagnosis. Thus the 1st pair of legs are described as only 5-articulate, whereas in reality, they are composed of the normal number of joints, 2 of them, however, the ischial and meral ones, being so firmly connected as to exhibit the appearance of a single joint. The eye, which was stated to be wholly wanting, is in reality present in its usual place, though in a rather imperfect condition. Moreover, the extremely small and rudimentary exopodites on the 3rd and 4th pairs of legs were at that time overlooked. The characters of the male, too, could of course not be given.

Occurrence.—The 2 specimens from which the original description was made, were taken off the Lofoten Islands in a depth of 50—60 fathoms, on a

sandy bottom. Subsequently I have met with this form not unfrequently in 2 places on the Finmark coast, viz., Hasvig and Vadsø in about the same depth.

Distribution.—Spitsbergen (Norw. North Atl. Expedition), Franz Joseph Land (T. Scott), Heligoland (Ehrenbaum).

Fam. 7. Nannastacidæ.

Syn: *Cumellidæ*, G. O. Sars.

Characters.—Body, as a rule, not very slender, sometimes even unusually short and compact, with the anterior division well defined from the posterior. Carapace large, with the pseudorostral projection more or less produced, subrostral corners well defined and sometimes very prominent, lower edges generally serrate in their anterior part. Five pedigerous segments freely exposed behind the carapace, the first very narrow, band-like. Tail slender and narrow. Eyes two in number, separated by a distinct interspace, or confluent to a single median organ, as in most other Cumacea. Superior antennæ of exactly the same appearance in the two sexes, inner flagellum rudimentary. Inferior antennæ in female very small and indistinctly articulated, in male well developed, though as a rule shorter than the body. Oral parts on the whole normal. The 2 anterior pairs of legs in female with well developed exopodites, the 3 posterior pairs simple and very narrow, terminating in a hooked claw. All legs in male, except the last pair, with exopodites, and having the basal joint greatly dilated. Pleopoda absent. Uropoda resembling in structure those in the *Pseudocumidæ*. No telson.

Remarks.—The present family comprises as yet 2 very distinct genera, viz., *Nannastacus* Sp. Bate and *Cumella* G. O. Sars, especially distinguished by the very different structure of the visual organ, the species of the first-named genus having 2 well-defined eyes, whereas those of the 2nd have but a single median eye, as in most other Cumacea. The genus *Nannastacus* being the first to be established, the family, according to the rule in Zoology, ought to be named from it, and not from the genus *Cumella*, as previously done by the present author. The family in some respects forms a transition to the last very anomalous family, *Campylaspida*, agreeing with it, among other things, in the total absence of a telson and of pleopoda in the male. The structure of the oral parts, however, is

very dissimilar in these two families, only the anterior lip exhibiting some approach to the structure characteristic of the *Campylaspidæ*. The genus *Spencebatea* of Norman may perhaps be referable to the present family; but this genus is as yet very imperfectly known, only a solitary male specimen having been procured. The genus *Diops* of Paulson, I regard as identical with Sp. Bate's genus *Nannastacus*. In the Norwegian Fauna, only one of the two genera is represented.

Gen. **Cumella**, G. O. Sars, 1864.

Generic Characters.—Body of rather different appearance in the two sexes. Carapace in female somewhat compressed, and provided with a dentated crest along the middle, in male quite smooth throughout; pseudorostral projection more or less produced. Tail in both sexes very slender and mobile, with the last segment angularly produced behind. Integuments rather thin, and exhibiting a distinctly squamous structure. Eyes confluent to a single organ occupying its usual place at the end of the frontal lobe, and much more fully developed in male than in female. Superior antennæ rather slender, with the inner flagellum biarticulate or unarticulate. Inferior antennæ in female biarticulate, with 2 plumose setæ inside, terminal joint extremely small and tipped with a simple bristle; those in male with the penultimate joint of the peduncle well defined, and clothed with unusually long sensory filaments. Anterior lip produced in front to a conical prominence. Mandibles rather slender, with the cutting part narrowly exerted, and provided with only a limited number of spines inside, molar expansion short and thick. Maxillæ of quite normal structure. First pair of maxillipeds with the terminal joint lamelliform, epipodal part of branchial apparatus in female quite simple, in male provided with a limited number of digitiform gill-elements. Second pair of maxillipeds with the basal joint much shorter than the remaining part, and carrying inside 2 unusually strong plumous setæ; 3rd pair with the basal and meral joints produced at the outer corner, the former carrying 2, the latter 1 strong ciliated seta. First pair of legs with the basal joint comparatively short and thick, terminal part slender; 2nd pair normal; the 3 posterior pairs successively diminishing in length. Uropoda moderately slender, with the rami shorter than the stem, the inner one the larger and spinulous inside.

Remarks.—This genus, established by the present author in the year 1864, is at once distinguished from *Nannastacus* of Sp. Bate by the eyes being confluent

to a single organ, as in most other Cumacea, and also by the dentated crest of the carapace in the female. Besides the type species described below, another very distinct species, *C. limicola*, has been recorded by the present author from the Mediterranean.

Cumella pygmæa, G. O. Sars.

(Pl. LV).

Cumella pygmæa, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea, p. 74.

Syn: *Cumella agilis*, Norman (male).

Specific Characters.—*Female.* Body comparatively short, with the anterior division very sharply marked off from the slender tail. Carapace exceedingly large and deep, being more than 3 times as long as the exposed part of the trunk, its anterior part rather compressed, dorsal face evenly arched, and crested throughout its entire length, the crest being armed with from 8 to 12 minute anteriorly-curving denticles; pseudorostral projection comparatively short, subrostral corners distinctly prominent, and defined above by an even emargination. Tail (excluding the terminal appendages) somewhat shorter than the anterior division, and very narrow. Eye fairly conspicuous and circular in form. Superior antennæ with the inner flagellum distinctly biarticulate. First pair of legs scarcely attaining the length of the carapace, basal joint about the length of the 3 succeeding joints combined, and strongly serrate at the end on both edges, antepenultimate joint fully as long as the last 2 joints combined; 2nd pair with the terminal joint about the length of the antepenultimate one. Uropoda with the stem coarsely serrate inside, inner ramus rather large, though shorter than the stem, and armed with about 7 spinules increasing in length distally, outer ramus very narrow, with a slender spine at the tip. Body more or less dark-coloured owing to a brown pigment, especially conspicuous on the carapace. Length about $2\frac{1}{2}$ mm.

Adult male somewhat more slender than the female, with the anterior division far less vaulted above, and scarcely at all compressed in front. Carapace shallower and quite unarmed, with the upper margin nearly straight; pseudorostral projection shorter, subrostral corners less prominent. Eye very large, and subquadrangular in form, with 7 distinct corneæ, one median and 3 lateral on each side, the former very prominent. Inferior antennæ slightly exceeding the anterior division of the body in length. Basal joint of the 4 anterior pairs of legs greatly dilated. Uropoda differing but slightly in structure from those in female.

Remarks.—This is one of the smallest known Cumacea, and may thus easily escape attention in an examination of the contents of the dredge. It is, however, an easily recognizable form, being clearly distinguished in both sexes from our other Cumacea. As is generally the case in this order, the sexual dimorphism is very pronounced, and indeed the adult male looks so different from the female, that it was at first regarded by the Rev. Mr. Norman as belonging to a distinct species, *C. agilis*.

Occurrence.—Though nowhere in any abundance, this form seems to occur along the whole south and west coast of Norway, from the Christiania Fjord to the Lofoten Islands. It is generally found in comparatively shallow water, on a sandy bottom covered with a thin layer of blackish mud, sometimes also at the roots of *Laminariæ*. The adult males are very agile, and have been taken by English naturalists (Robertson) rather abundantly in the tow-net at night.

Distribution.—British Isles (Norman), Heligoland (Ehrenbaum), Mediterranean at Messina and Spezia (the present author).

Fam. 8. Campylaspidæ.

Characters—Body comparatively short and robust, with the anterior division much dilated and boldly arched above. Carapace of unusual size, more or less depressed in front and strongly vaulted behind. Five pedigerous segments exposed behind the carapace, the 2 anterior ones, however, very short, band-like. Caudal segments more or less depressed, the last one short, pentagonal. Integuments greatly indurated. Eye present, though rather imperfectly developed. Superior antennæ of exactly the same structure in the two sexes; inner flagellum rudimentary. Inferior antennæ in female imperfectly developed and without any setæ, in male attaining the length of the body. Oral parts of a structure rather different from that in other Cumacea, some of them being very fully developed, others rather imperfect. The 2 anterior pairs of legs in female, and all but the last pair in male provided with exopodites. Pleopoda wanting in male. Uropoda with the rami comparatively short, the inner uniarticulate, the outer biarticulate. No telson.

Remarks.—This family is founded upon a single genus, *Campylaspis* G. O. Sars, which, however, in several respects, and especially in the structure of the oral parts, differs so materially from the other known Cumacea, that it should not properly be referred to any of the above-recorded families. Dr. Bonnier has recently established another genus, *Procampylaspis*, to include a very remarkable Cumacean taken in the Bay of Gascogne; but I regard it as very questionable, if this genus in reality is referable to the present family. In some respects it seems to me to approach nearer to the *Nannastacidae*.

Gen. **Campylaspis**, G. O. Sars, 1864.

Generic Characters.—Body in female short and compact, in male considerably more slender. Carapace of enormous size, and more or less bulging behind over the exposed segments of trunk, its anterior part more or less exerted, and terminating in a comparatively short pseudorostral projection, subrostral corners very slight or wanting, lower edges of carapace smooth throughout. The first 2 pedigerous segments very narrow, and generally elevated dorsally to thin procurved lamellæ, epimeral plates of the 3 succeeding ones rounded and extended laterally. Caudal segments, except the last, exhibiting laterally, in female, a projecting rim, in male a deep groove, to receive the flagellum of the inferior antennæ. Superior antennæ with the inner flagellum uniaarticulate, knob-like. Inferior antennæ in female tuberculiform, in male well developed, with the penultimate joint of the peduncle distinctly defined, and clothed with very long sensory filaments, flagellum extremely slender, with elongated articulations. Anterior lip unusually large, helmet-shaped, conically produced in front; posterior lip very delicate, with the lateral lobes quite membranous. Mandibles with the body slightly expanded inside, masticatory part distinctly incurved, and having the cutting edge strongly dentated and somewhat oblique, with an appendicular plate on the left mandible, and in both mandibles a restricted number of spiniform setæ; molar expansion very narrow, styliiform. Anterior maxillæ very strong, with both the masticatory and basal lobes abruptly incurved, and armed with strong, partly denticulated spines, palp long and narrow, with one or two apical setæ. Posterior maxillæ imperfectly developed, each forming a simple triangular plate with a limited number of simple bristles at the tip. First pair of maxillipeds with the meral joint lamellarly expanded, terminal part quite rudimentary, being

reduced to a single very small joint attached near the inner corner of the meral joint; branchial apparatus well developed, gill-elements arranged in a semicircle, digitiform in female, leaf-like in male. Second pair of maxillipeds of rather anomalous appearance, basal joint very massive and confluent with the ischial one, carpal and propodal joints connected at nearly a right angle, the former triangularly expanded inside, the latter oblong oval in form, and terminating in a setiform lappet, terminal joint very small and armed with strong diverging spines. Third pair of maxillipeds of more normal structure, with the meral joint more or less dilated. First pair of legs unusually small, and resembling in structure the 3rd pair of maxillipeds; 2nd pair much bent, with the terminal joint styli-form. The 3 posterior pairs of legs in female successively diminishing in length and rather narrow, basal joint of 3rd and 4th pairs in male greatly dilated. Uropoda with the rami shorter than the stem, the inner one the larger and spinulous inside, stem in male clothed with slender setæ inside.

Remarks.—This genus was established by the present author in the year 1864, to include the anomalous form described by Prof. Lilljeborg as *Cuma rubicunda*, and at the same time 2 new Norwegian species were added. Subsequently the number of species has been considerably augmented, amounting at present to no less than 14. One of these species, however, the Greenland form, *C. carinata* of Hansen, is, I think, scarcely referable to the present genus, and may indeed even belong to a different family, the *Nannastacidae*. As, however, neither the legs nor the oral parts of this form have been examined, it is impossible at present to settle this question. To the fauna of Norway belong 8 different species, to be described below.

1. *Campylaspis rubicunda* (Lilljeborg).

(Pl. LVI, LVII).

Cuma rubicunda, Lilljeborg. Öfvers. af Vet. Akad. Förhandl. 1855, p. 121.

Specific Characters.—*Female.* Body very short and robust, with the anterior division greatly tumefied. Carapace of quite an extraordinary size, occupying half the length of the body, and boldly arched behind, surface perfectly smooth throughout, frontal part but slightly exserted, pseudorostral projection short, though acute at the tip, subrostral corners obsolete. The first 2 pedigerous segments elevated dorsally to well-marked procurved lamellæ. Caudal segments distinctly depressed and comparatively short. Eye distinct, semicircular and somewhat prominent. Anterior maxillæ with the palp very slender and carrying a single apical seta; posterior maxillæ with only 3 apical bristles and one lateral.

Terminal joint of 1st pair of maxillipeds rather small, conical, with a single small apical bristle; that of 2nd pair with 4 strong spines increasing in length from before backwards. Third pair of maxillipeds rather robust, with the joints partly serrate on the edges, meral joint considerably expanded, equalling in length the 2 succeeding ones combined. Second pair of legs with the last joint considerably produced and very narrow, exceeding in length the 2 preceding joints taken together. Uropoda not much elongated, stem coarsely serrate inside, inner ramus about half its length, and armed with about 8 spinules increasing in length distally. Colour bright red, frontal lobe and adjacent part of the dorsal face opaque white. Length 5 mm.

Adult male considerably more slender than the female, with the anterior division of the body less tumefied. Carapace comparatively shallower, with the pseudorostral projection shorter and more obtuse. Uropoda more elongated, stem clothed inside with about 12 minutely ciliated setæ, of which the 5 outer ones are rather elongated, inner ramus comparatively longer than in female and having a greater number of spinules inside. Colour as in the female. Length about 6 mm.

Remarks.—As above stated, this form was originally described by Prof. Lilljeborg as a species of the genus *Cuma*, and was subsequently subjected to a closer examination by the present author. It is the first species noticed, and may therefore be regarded as the type of the genus. From the other known species it is easily recognizable by its bright red colour and the perfectly smooth and strongly vaulted carapace. In the latter respect it only agrees with one of the other Norwegian species, viz., *C. glabra*, whereas in the remaining species the carapace exhibits a more or less pronounced sculpture, either in the form of tuberculiform protuberances, or oblique plicæ.

Occurrence.—I have found this form in several places on the Norwegian coast, from the Christiania Fjord to Vadsø, though nowhere in any abundance. It generally occurs in depths ranging from 30 to 100 fathoms, on a muddy bottom, in which it conceals itself with great dexterity. It moves rather rapidly through the water, but only for a short while, very soon again sinking to the bottom by its own weight. Adult males are found occasionally together with the females. They are, as usual, much more agile, swimming about with great speed by the aid of their numerous well-developed exopodites.

Distribution.—Kullaberg (Lilljeborg), Kattegat (Meinert), Arctic Ocean in Lat. 75° 45' (the present author), Greenland, off Hosteinsborg (Norman), Atlantic coast of North America (Verrill).

2. *Campylaspis glabra*, G. O. Sars.

(Pl. LVIII).

Campylaspis glabra, G. O. Sars. Middelhavets Cumaceer, p. 129, Pl. 44—47.

Specific Characters.—*Female.* Very like the type species, but of considerably smaller size, and comparatively less robust in form. Carapace very large and boldly vaulted above, surface perfectly smooth throughout, frontal part as in *C. rubicunda*. The first 2 pedigerous segments less strongly produced dorsally. Tail more slender, with the segments nearly cylindric in form. Maxillæ exactly as in *C. rubicunda*. Terminal joint of 1st pair of maxillipeds still more rudimentary than in that species. Third pair of maxillipeds with the meral joint large and expanded. Second pair of legs with the terminal joint shorter than the 2 preceding ones combined. Uropoda rather slender, with the stem comparatively narrow, and scarcely at all serrate inside, inner ramus somewhat exceeding half the length of the stem, and armed with about 8 unusually slender spinules. Colour whitish. Length scarcely exceeding 3 mm.

Adult male more slender than the female, with the carapace far less vaulted above. Limbs transformed in the usual manner. Length nearly 4 mm.

Remarks.—On going through my material of *C. rubicunda* from the Norwegian coast, I have recently found some specimens of a form, which had previously escaped my attention, and which I am unable to distinguish from the Mediterranean species described in the above-mentioned paper. It is very closely allied to *C. rubicunda*, but on a closer examination is easily distinguished by its much smaller size and less robust form of body, as also by the different colour.

Occurrence.—As the specimens were found mingled together with *C. rubicunda* from different localities, it is impossible for me at present to state with certainty from which locality they were derived. I believe, however, that at least some of the specimens were collected in the Trondhjem Fjord.

Distribution.—Mediterranean at Messina and Spezia (the present author).

3. *Campylaspis sulcata*, G. O. Sars.

(Pl. LIX).

Campylaspis sulcata, G. O. Sars, Nye Dybvandscrustaceer fra Lofoten.

Chr. Vid. Selsk. Forh. 1869, p. 161.

Specific Characters.—*Female.* Form of body resembling that in the type species, though somewhat less robust. Carapace very large and boldly arched above, dorsal face somewhat uneven in front, lateral faces with a very conspi-

cuous band-like depressed area, bounded by 2 projecting plicæ, and extending obliquely from the most prominent part of the branchial region to the base of the pseudorostral projection, the latter rather short, subrostral corners very slight. The first 2 pedigerous segments elevated dorsally to very distinct procurved lamellæ. Tail somewhat more slender than in the type species. Eye easily observable, semicircular in form. Anterior maxillæ with the palp bisetose; posterior ones as in the 2 preceding species. Terminal joint of 1st pair of maxillipeds extremely small; that of 2nd pair with 4 diverging spines. Third pair of maxillipeds less robust than in the 2 preceding species, with the meral joint much smaller, and not nearly attaining the length of the 2 succeeding joints combined. Second pair of legs with the terminal joint rather produced, exceeding in length the 2 preceding joints combined. The 3 posterior pairs of legs with the antepenultimate joint serrate along the anterior edge. Uropoda comparatively slender, stem coarsely serrate inside, inner ramus scarcely more than half as long as the stem, and only armed with 3 spinules, inner edge minutely serrate. Colour whitish, with a faint reddish tinge on the median part of the carapace. Length $4\frac{1}{2}$ mm.

Adult male, as usual, more slender than the female, with the carapace less vaulted, but exhibiting the very same sculpturing. Uropoda considerably more elongated, stem clothed with slender setæ, inner ramus narrower and armed with about 10 ciliated spinules. Length 5 mm.

Remarks.—This form is easily distinguishable by the very conspicuous depressed area extending obliquely along each side of the carapace, a character which has given rise to the specific name *sulcata*. It is otherwise very nearly related to the 2 preceding species, both as regards the general appearance and the structure of the several appendages.

Occurrence.—I first found this form off the Lofoten Islands, where it is not unfrequent in depths ranging from 120 to 250 fathoms, on a bottom consisting of sandy clay. Subsequently I have also met with it occasionally in 2 other localities of the Norwegian coast, viz., in the outer part of the Hardanger Fjord at Mosterhavn, and in the Trondhjem Fjord, at about the same depth. Out of Norway this form has not yet been recorded.

4. *Campylaspis costata*, G. O. Sars.

(Pl. LX).

Campylaspis costata, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea, p. 79.

Specific Characters.—*Female.* Body of the usual short and robust form, with the anterior division greatly dilated. Carapace somewhat smaller than in

the 3 preceding species, not nearly attaining half the length of the body, dorsal face evenly vaulted behind, anterior part somewhat exerted, lateral faces sculptured with 3 distinct oblique plicæ, the hindmost being bifurcate in its upper half; pseudorostral projection slightly prominent, subrostral corners distinct, though obtuse. The first 2 pedigerous segments slightly produced dorsally, last segment, like the 4 anterior caudal segments, with 2 small juxtaposed tubercles dorsally. Eye rather narrow, of oval form. Anterior maxillæ with the palp bisetose; posterior ones with 5 apical bristles. Terminal joint of 1st pair of maxillipeds less rudimentary than in the 3 preceding species, and carrying on the tip a short spine and a bristle; that of 2nd pair with 2 diverging spines having between them a third much smaller one. Third pair of maxillipeds rather slender, with the meral joint but very little expanded. Second pair of legs with the last joint scarcely longer than the 2 preceding ones combined. Uropoda moderately slender, stem smooth, inner ramus somewhat exceeding half the stem in length, and armed with about 8 spinules. Colour (in the living state of the animal) pale reddish. Length 5 mm.

Adult male much more slender than the female, with the carapace considerably more flattened, though exhibiting the very same sculpturing. Limbs transformed in the usual manner. Length $6\frac{1}{2}$ mm.

Remarks.—By the peculiar sculpturing of the carapace, this species is at once recognizable from any of the preceding ones. Moreover the carapace is of somewhat smaller size and less vaulted above, and in the structure of the appendages also some minor differences are found to exist.

Occurrence.—I have found this form not infrequently along the whole Norwegian coast, from the Christiania Fjord to Vadsø. It generally occurs in depths ranging from 30 to 100 fathoms, on a muddy bottom.

Distribution.—British Isles (Th. Scott), Heligoland (Ehrenbaum).

5. *Campylaspis undata*, G. O. Sars.

(Pl. LXI),

Campylaspis undata, G. O. Sars. Om den aberrante Krebsdyrgruppe Cumacea, p. 80.

Specific Characters.—*Female.* General form of body resembling that in *C. costata*. Carapace, however, less strongly arched above, with the dorsal face very uneven owing to irregular protuberances and ridges, which give the upper contour an undulated appearance; lateral faces sculptured with 2 very prominent plicæ, originating from the hind part and extending in front, the upper one being continued on the side of the pseudorostral projection, the lower terminating at

the subrostral corner, both plicæ having a somewhat flexuous course. The first 2 pedigerous segments elevated dorsally to well-marked procurved lamellæ, the 3 posterior ones each with 2 juxtaposed dorsal tubercles. Caudal segments rather short, and somewhat elevated dorsally. Eye, as in *C. costata*, oval in form. Antennæ and oral parts almost exactly as in *C. costata*. Second pair of legs rather robust, with the terminal joint less narrowed than in the other species, and scarcely longer than the antepenultimate joint, its edges clothed with strong curved bristles; the 3 posterior pairs with the antepenultimate joint serrate along the anterior edge. Uropoda with the stem slightly serrate inside, rami very short, the inner one not nearly attaining half the length of the stem, and armed with only 4 spinules. Colour pale carneous. Length 6 mm.

Adult male exhibiting the usual differences from the female, the body being more slender, and the carapace shallower, with a short transverse fold connecting the 2 lateral plicæ in front. Length reaching 7 mm.

Remarks.—In its general appearance, this form very much resembles *C. costata*. It is, however, of considerably larger size, and, on a closer examination, is moreover easily distinguishable by the less vaulted carapace and its coarse sculpture. Some minor differences may also be proved to exist in the structure of the legs and uropoda.

Occurrence.—I have hitherto only met with this form off the Lofoten Islands, where it occurred rather sparingly in a depth of 100—200 fathoms. Out of Norway it has not yet been recorded.

6. *Campylaspis horrida*, G. O. Sars.

(Pl. LXII).

Campylaspis horrida, G. O. Sars. Nye Dybvandskrustaceer fra Lofoten.

Chr. Vid. Selsk. Forh. 1869, p. 162.

Specific Characters.—*Female.* General form of body about as in the 2 preceding species. Carapace large and tumid, with the anterior part rather exserted, surface very uneven owing to numerous conically produced protuberances, especially densely crowded together on the dorsal face, whereas laterally they are arranged in 2 longitudinal rows, the lower of which forms an almost continuous carina, both series being connected in front by a somewhat irregular transverse prominence continued on the side of the pseudorostral projection, which is rather prominent, subrostral corners small but well defined. The first 2 pedigerous segments, as usual, elevated dorsally to thin lamellæ, the 3 succeeding ones, like the 4 anterior caudal segments, provided with 2 juxtaposed dorsal tubercles,

lateral parts in all these segments acutely produced. Ocular lobule unusually produced, linguiform; visual elements imperfectly developed. Antennæ and oral parts as in the 2 preceding species. Second pair of legs resembling in structure those in *C. undata*, though somewhat more slender. Uropoda with the stem coarsely serrate on both edges, rami unusually small, the inner one scarcely exceeding $\frac{1}{3}$ of the length of the stem, and armed with only 4 spinules. Colour dark red. Length about 6 mm.

Adult male exhibiting the usual sexual differences from the female, being much more slender, and having the carapace shallower, with the dorsal protuberances less produced. Length nearly 7 mm.

Remarks.—Though nearly related to the 2 preceding species, as regards the structure of the several appendages, this form is at once recognizable by the densely crowded conical protuberances occurring on the carapace and giving it a very rough appearance, a character which has given rise to the specific name *horrida*. Moreover the anterior part of the carapace is unusually exerted, and the ocular lobule of a peculiar form.

Occurrence.—This form, too, was at first found off the Lofoten Islands, and subsequently I have also met with it in several other places on the Norwegian coast, for instance in the outer part of the Hardanger Fjord, at Christiansund, and in the Trondhjem Fjord. It is generally found in depths ranging from 100 to 300 fathoms, on a soft muddy bottom. This species also has not as yet been recorded out of Norway.

7. *Campylaspis verrucosa*, G. O. Sars.

(Pl. LXIII).

Campylaspis verrucosa, G. O. Sars. Zool. Reise ved Kysterne af Christianias og Christiansands Stifter 1865, p. 24.

Specific Characters.—*Female.* Body rather short and stout, with the anterior division greatly tumefied. Carapace large and swollen, evenly vaulted above, and having the anterior part but slightly exerted, surface uneven owing to scattered nodiform protuberances, which laterally have a tendency to arrange themselves in longitudinal rows; pseudorostral projection short and obtuse, subrostral corners well marked. The first 2 pedigerous segments elevated dorsally to procurved lamellæ, the 3 succeeding ones, like the 4 anterior caudal segments, with a pair of slight dorsal tubercles. Ocular lobule oblong oval in form, visual elements imperfectly developed. Antennæ and oral parts as in the 3 preceding species. Second pair of legs with the terminal joint about the length of the

antepenultimate one and comparatively narrower than in the 2 preceding species. Uropoda with the stem slightly serrate on both edges, inner ramus exceeding half the length of the stem, and armed with 5 spinules. Colour whitish with a faint greenish tinge. Length $5\frac{1}{2}$ mm.

Adult male much more slender than the female, with the carapace shallower, and scarcely at all vaulted above. Appendages exhibiting the usual transformation. Length $6\frac{1}{2}$ mm.

Remarks.—This form is allied to *C. horrida*, but may be readily distinguished by the somewhat different form of the carapace and the less numerous and more obtuse protuberances clothing its surface. Moreover the stem of the uropoda is considerably shorter, and the colour of the body very different. The species described by the present author from the Challenger Expedition as *C. nodulosa* strongly resembles the Norwegian form in its external appearance; but the remoteness of the locality (Kerguelen Islands) must put its specific distinctness beyond all doubt.

Occurrence.—I have found this species along the whole south and west coast of Norway, as far north as the Lofoten Islands, and in some places, for instance in the Trondhjem Fjord, very abundantly. It occurs in depths ranging from 60 to 100 fathoms, muddy clay. The species is hitherto only known from the Norwegian coast.

8. *Campylaspis affinis*, G. O. Sars.

(Pl. LXIV).

Campylaspis affinis, G. O. Sars. Nye Dybvandscrustaceer fra Lofoten.

Chr. Vid. Selsk. Forh. 1869, p. 160.

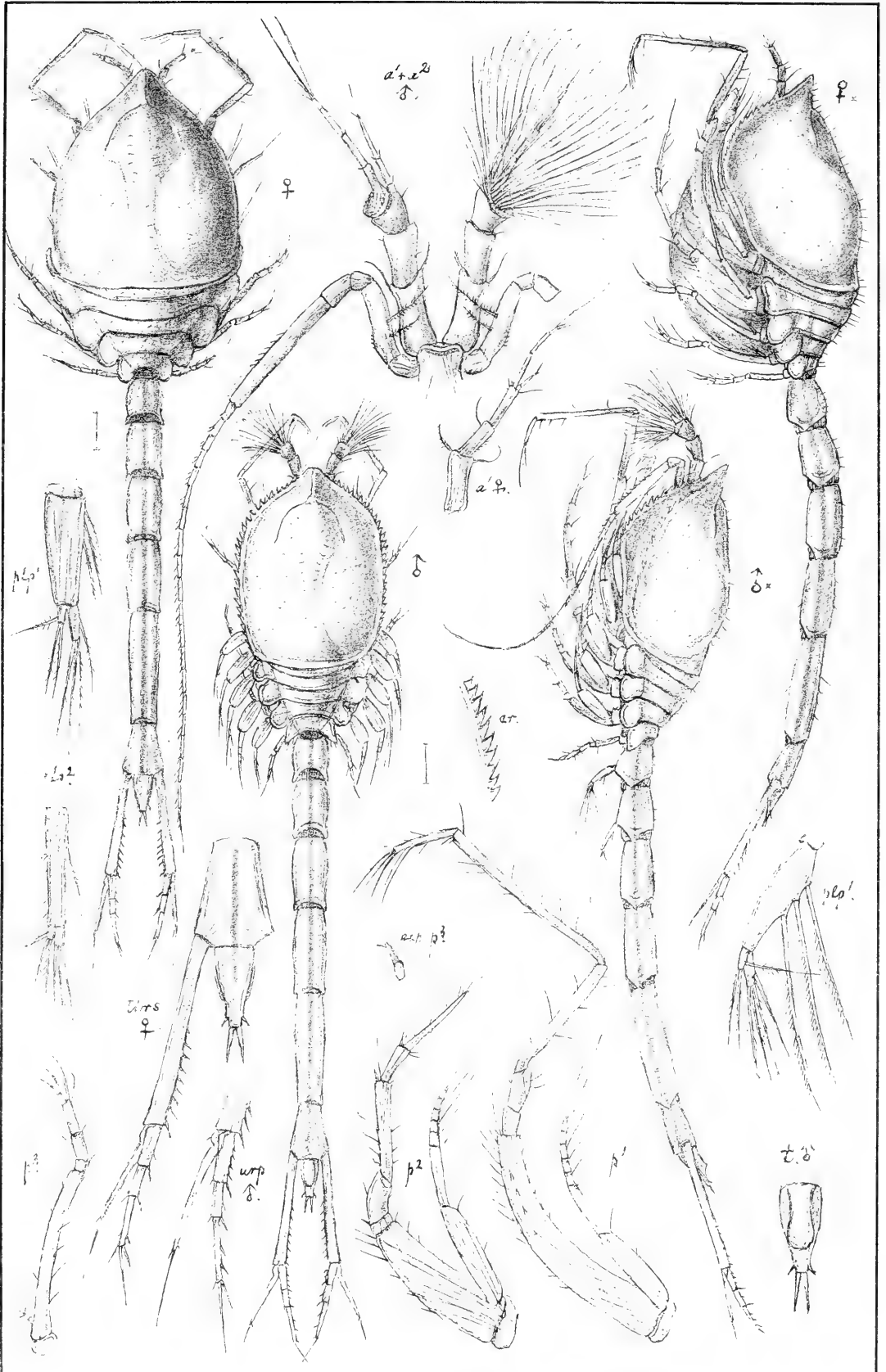
Specific Characters.—*Female.* Body comparatively more slender in form than usual, with the anterior division less tumefied. Carapace of moderate size and evenly vaulted above, with the anterior part but slightly produced, surface nearly smooth, with only slight traces of a few obtuse protuberances in the anterior part of the dorsal face; pseudorostral projection comparatively short, subrostral corners small, though distinct. The first 2 pedigerous segments less narrow than usual, and having the posterior edge but slightly elevated dorsally; the succeeding segments, as also the caudal ones, perfectly smooth. Terminal joint of 1st pair of maxillipeds less rudimentary than usual, oval fusiform in shape, and finely ciliated on the edges, tip carrying 2 unequal spines. Second pair of maxillipeds with the seta issuing from the inner corner of the basal joint peculiarly transformed, penultimate joint not nearly so large as in the other species. Structure

of the oral parts in other respects resembling that in the 4 preceding species. Second pair of legs with the terminal joint considerably produced, exceeding in length the 2 preceding joints combined. Uropoda rather slender, stem elongated and perfectly smooth, inner ramus about half the length of the stem, and armed with 8 spinules. Colour pale reddish. Length $5\frac{1}{2}$ mm.

Adult male comparatively more slender than the female, with the carapace shallower. Uropoda still more elongated, and having the stem, as usual, clothed inside with slender setæ, inner ramus more produced and armed with about 15 spinules. Length 6 mm.

Remarks.—In the nearly smooth and evenly vaulted carapace this form somewhat resembles the 2 species described at the head of this account. It is however in reality more nearly allied to some of the other species, for instance *C. verrucosa*, as regards the structural details. From any of the species it may be easily distinguished by the less tumid carapace and by the structure of the uropoda.

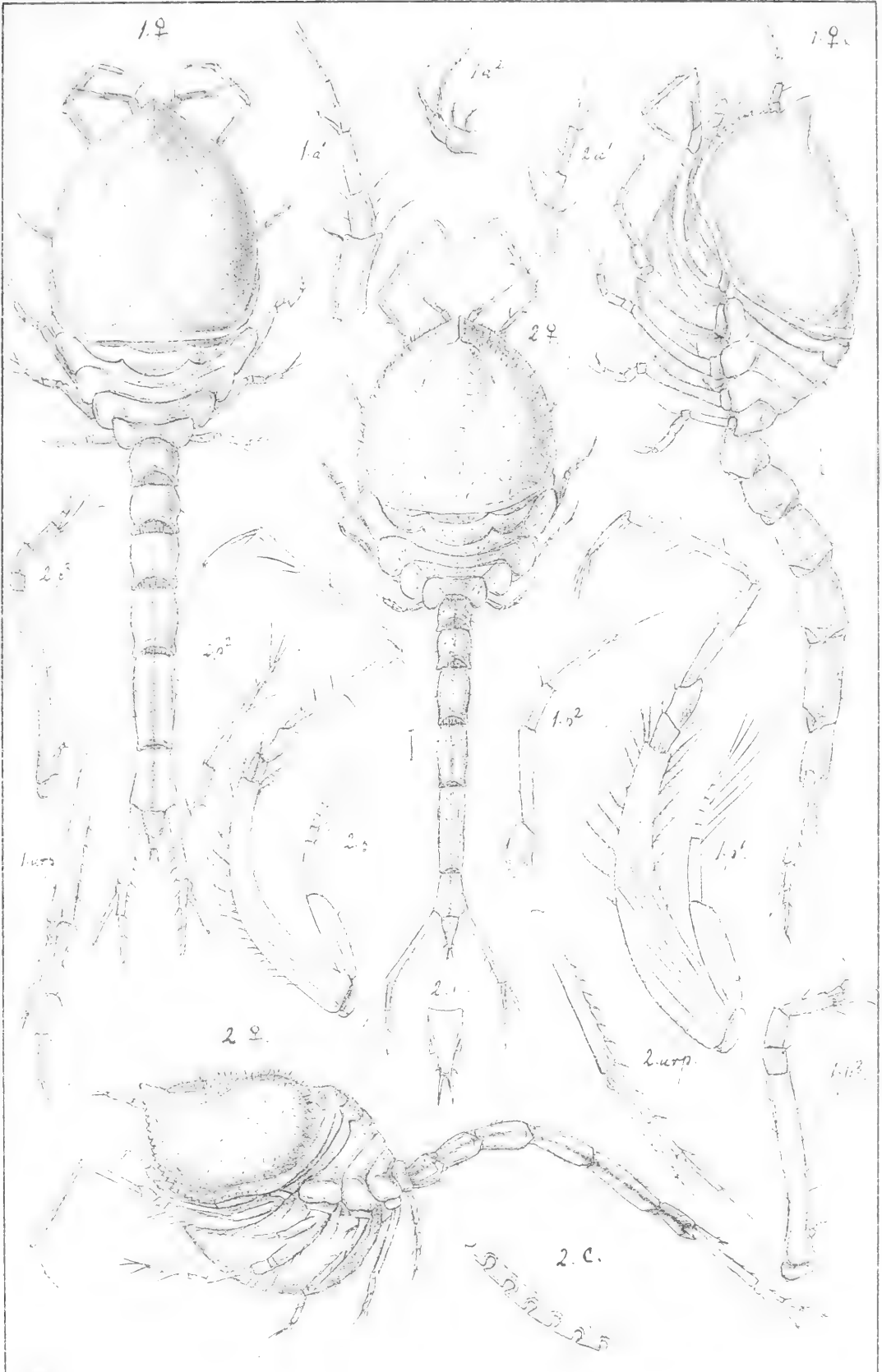
Occurrence.—Only 2 or 3 specimens of this form have hitherto come under my notice. They were taken many years ago off the Lofoten Islands in a depth of 200—250 fathoms. This species has not been recorded more recently by any author.



G.O. Sars autogr.

Leptostylis macrura, G.O. Sars.

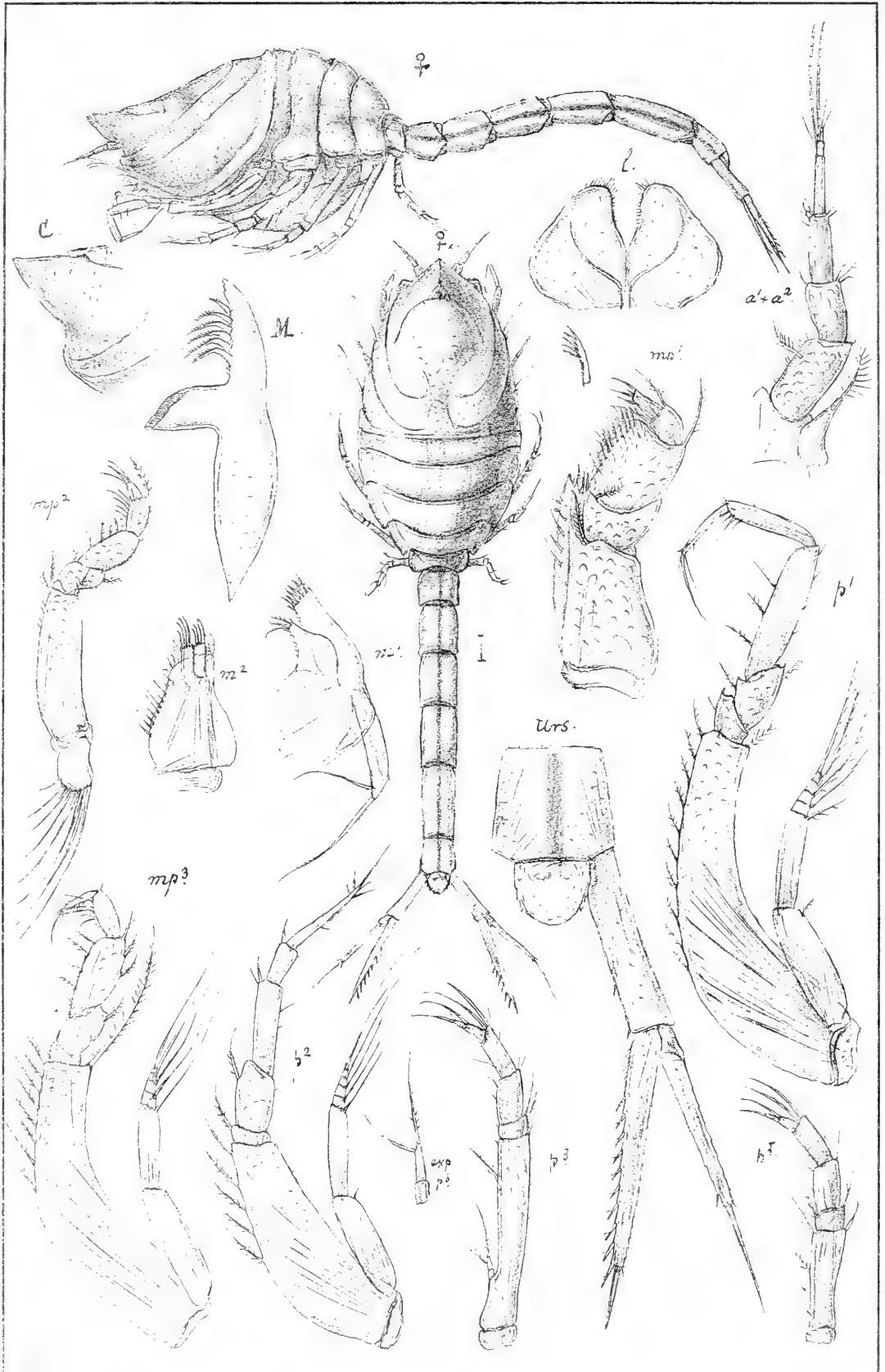
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G.O. Sars autogr.

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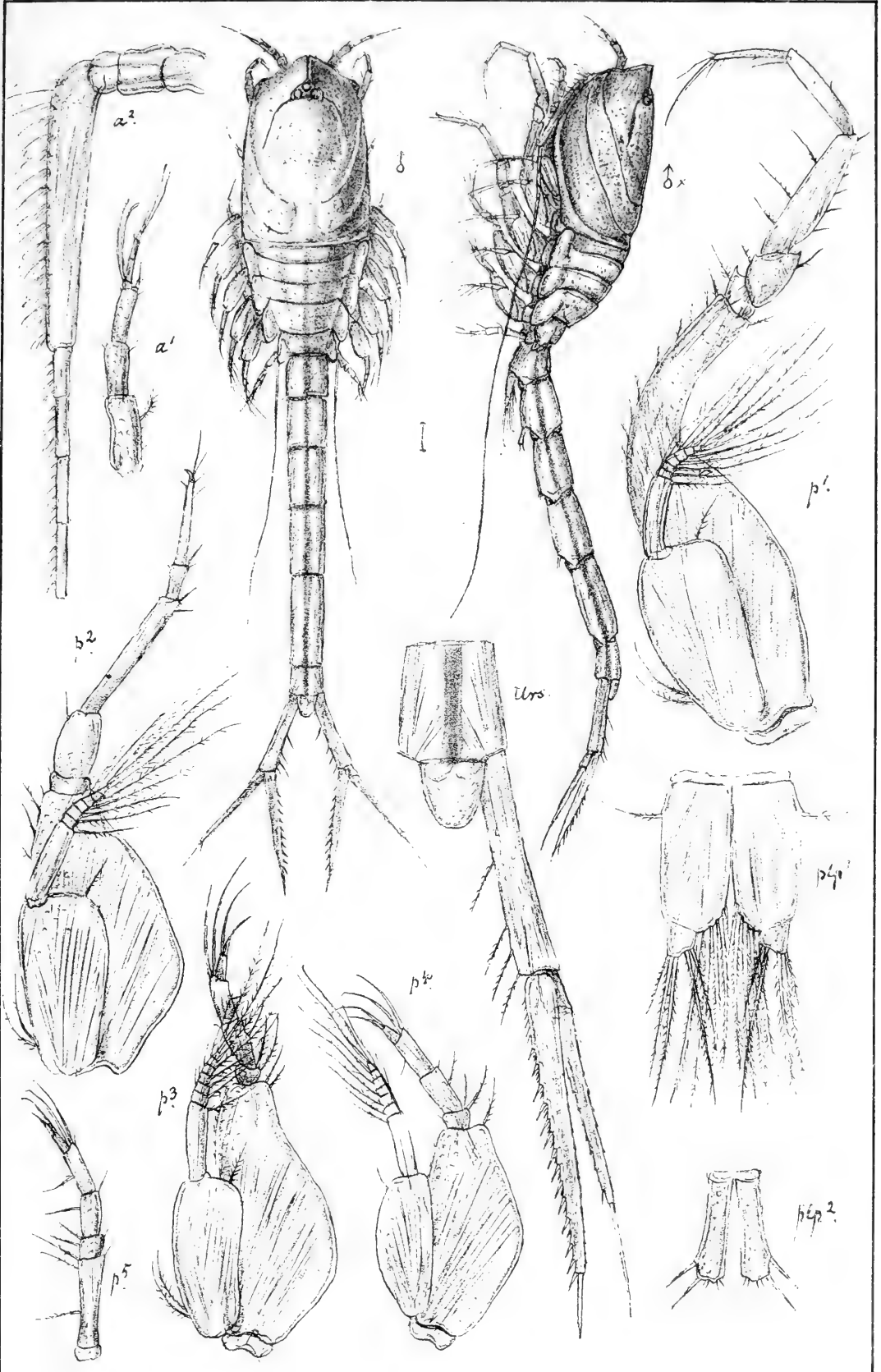
1. *Leptostylis ampullacea* (Lilljeb.)
 2. " *villosa*, G.O. Sars.



G. O. Sars's autogr.

Pseudocuma cercaria (v. Bened.) ♀

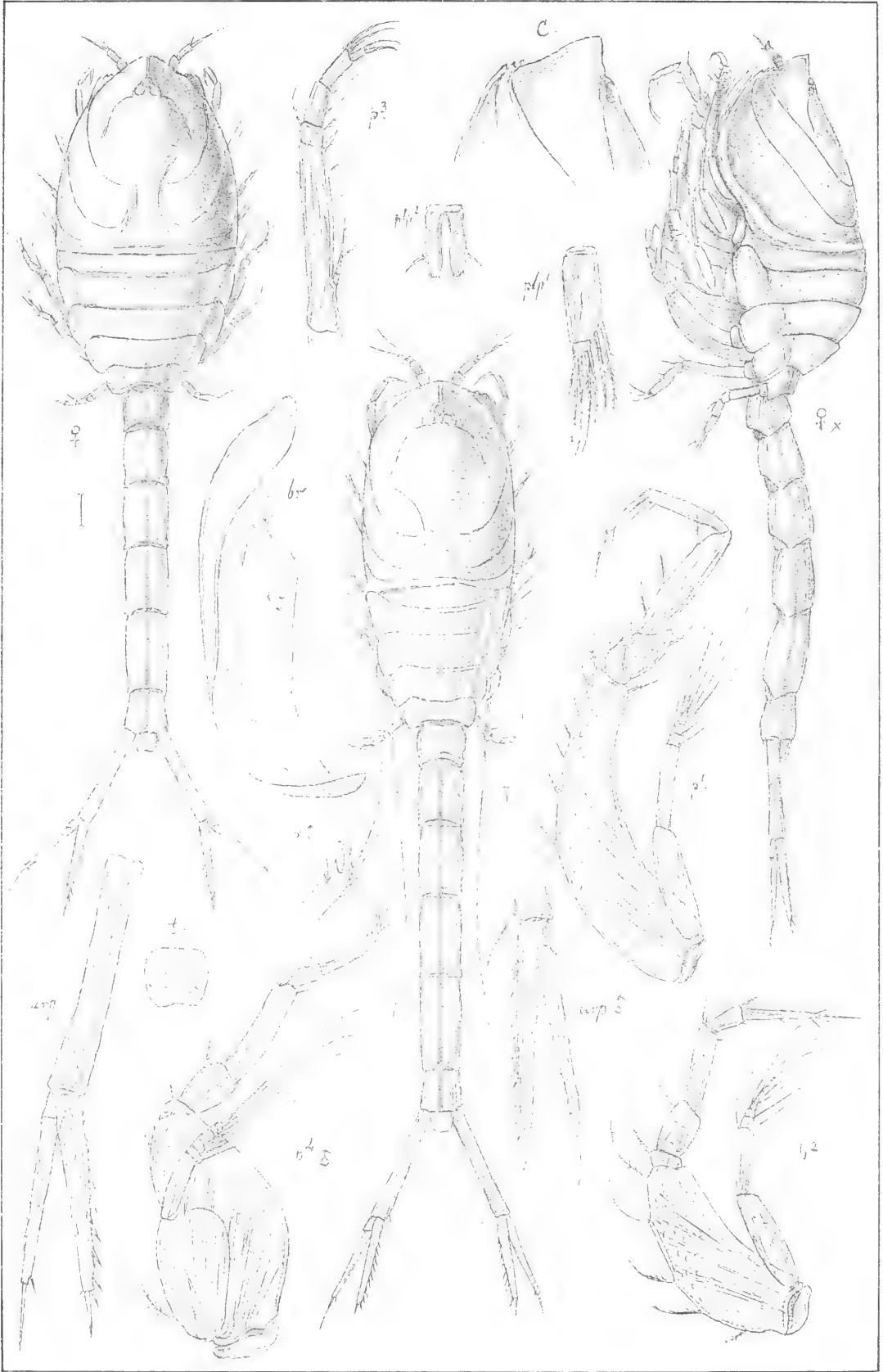
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G.O. Sars autogr.

Pseudocuma cercaria (v. Bened.)
♂

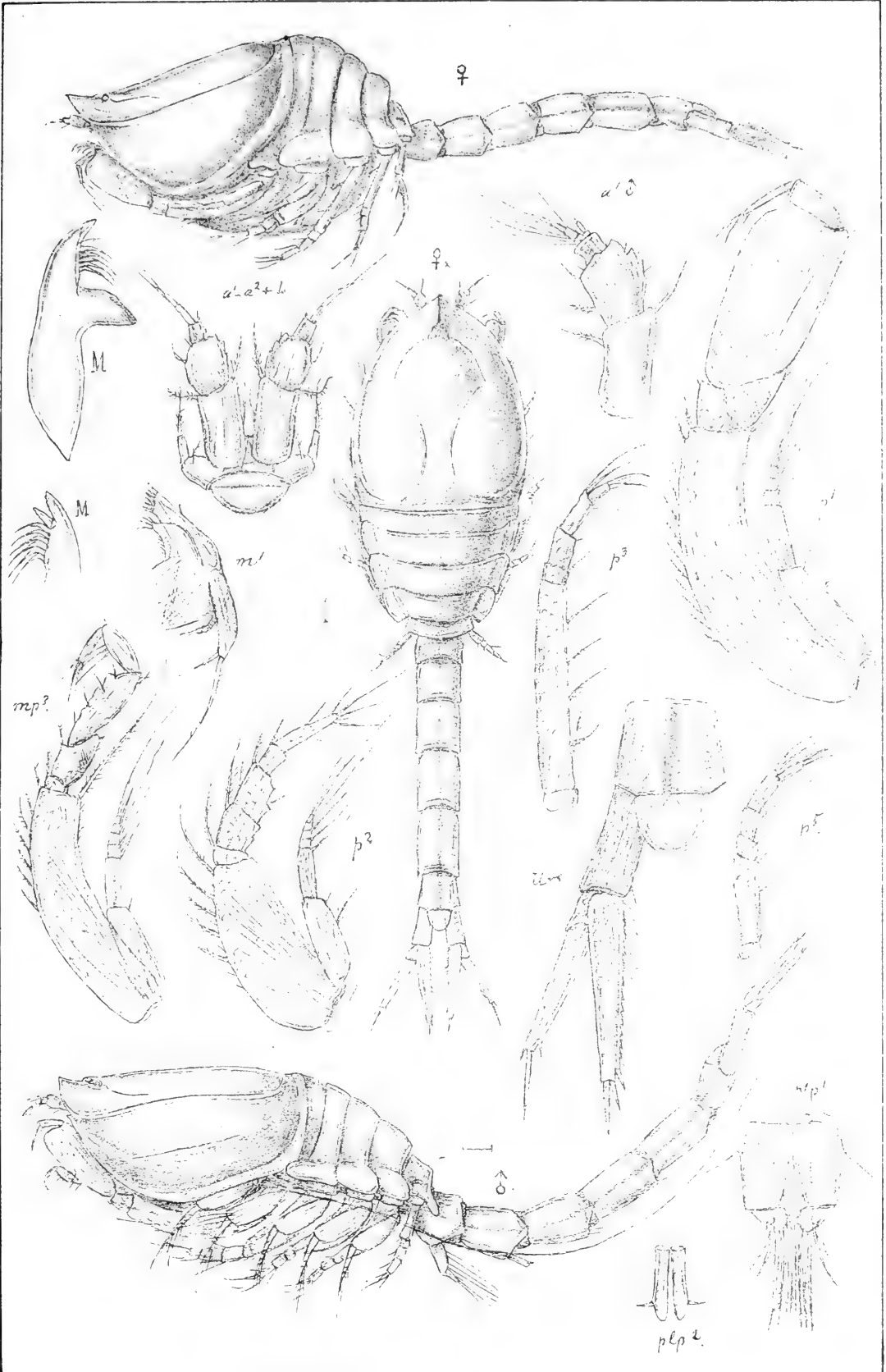
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G.O. Sars autogr.

Pseudocuma similis, G.O. Sars.

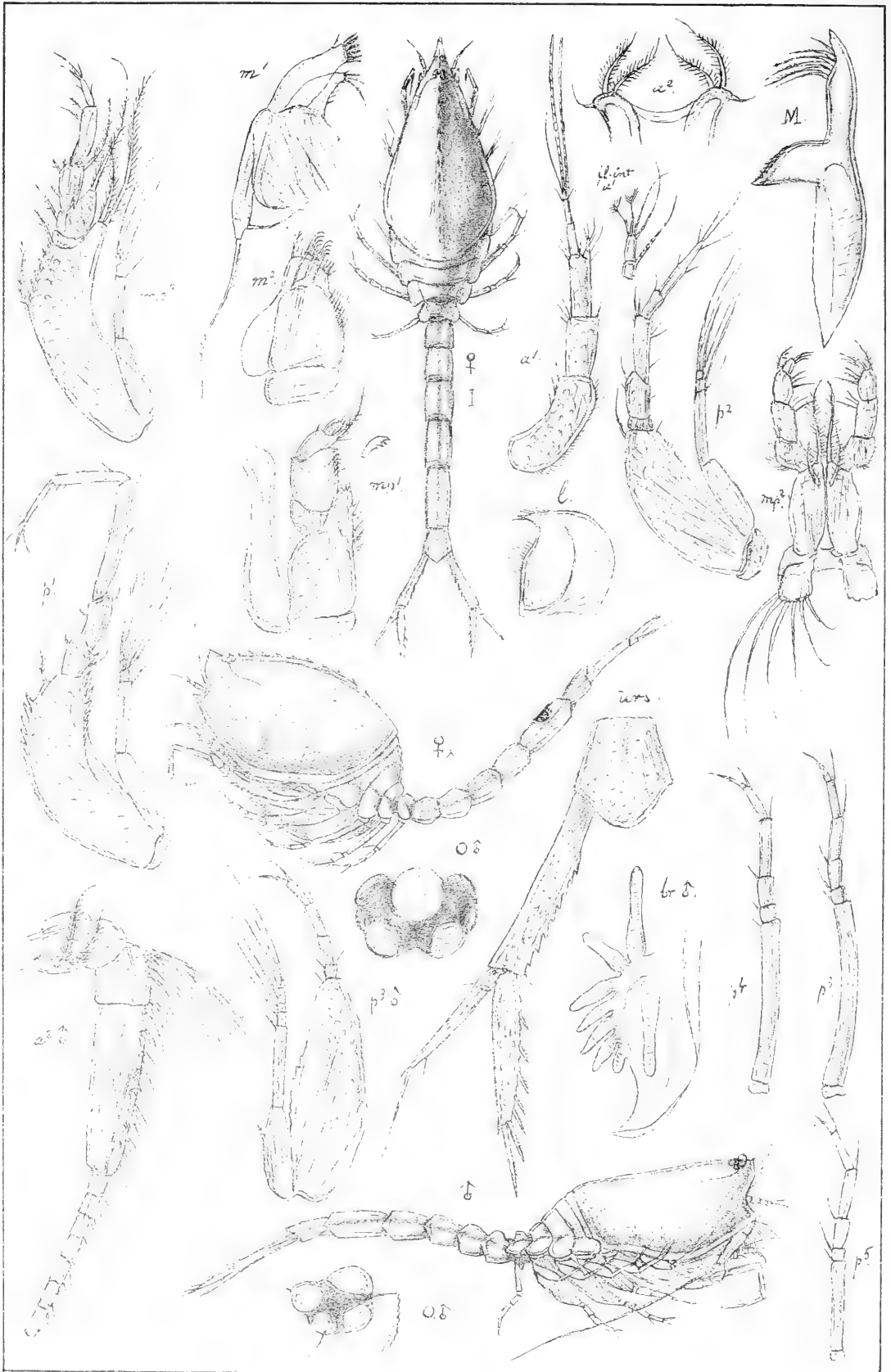
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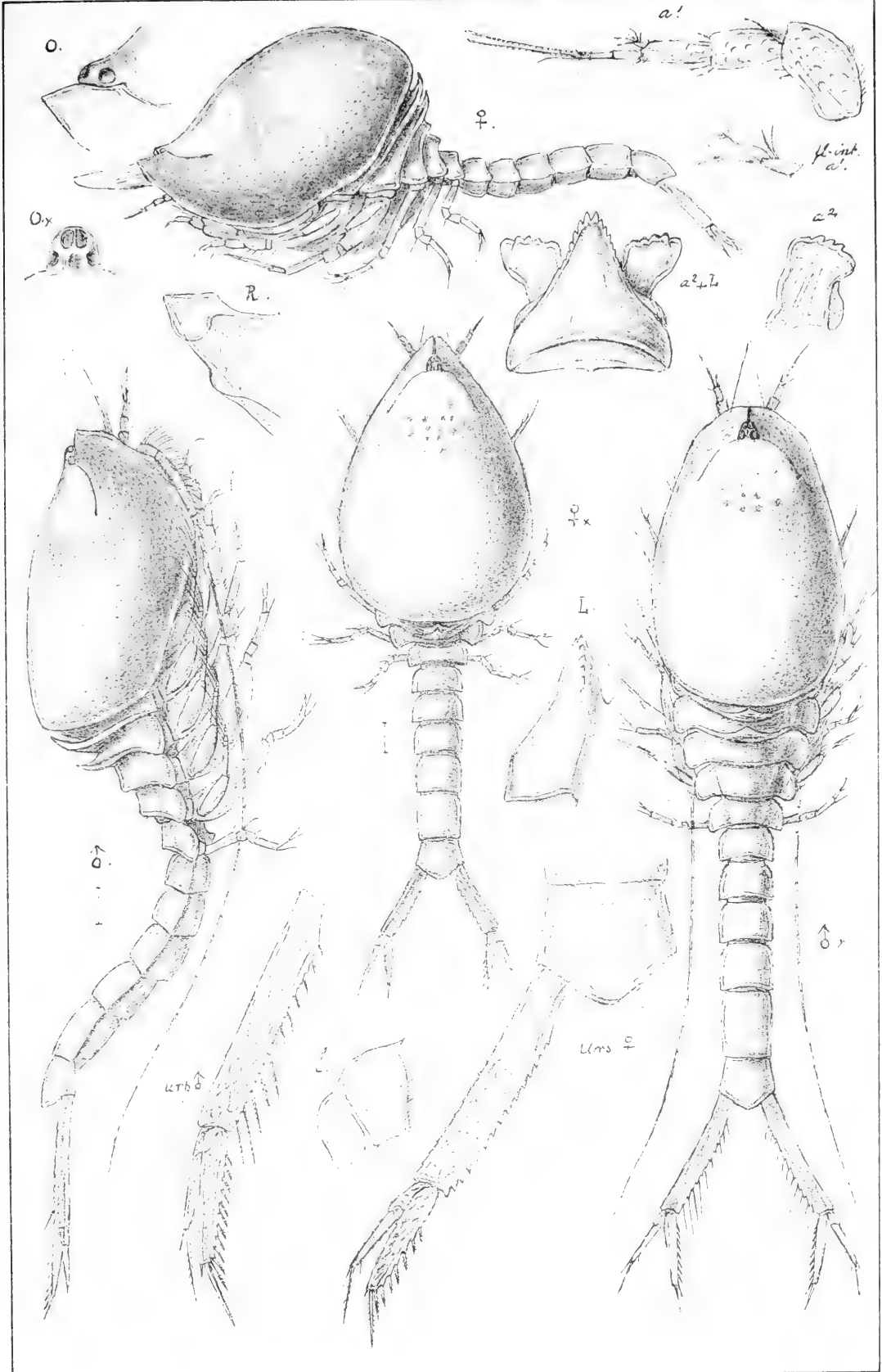


G. O. Sars autogr.

Petalosarsia declivis, G. O. Sars.

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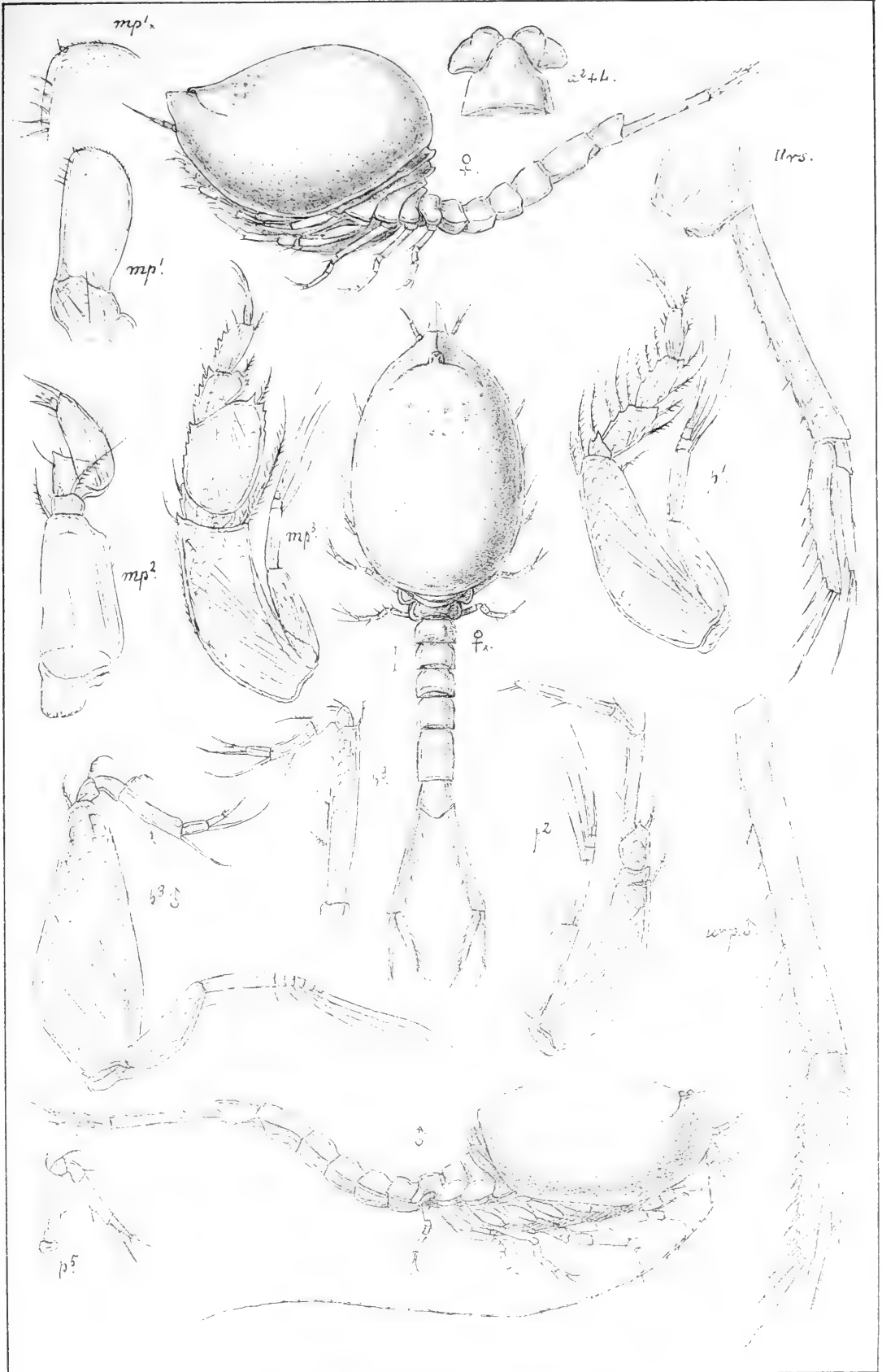


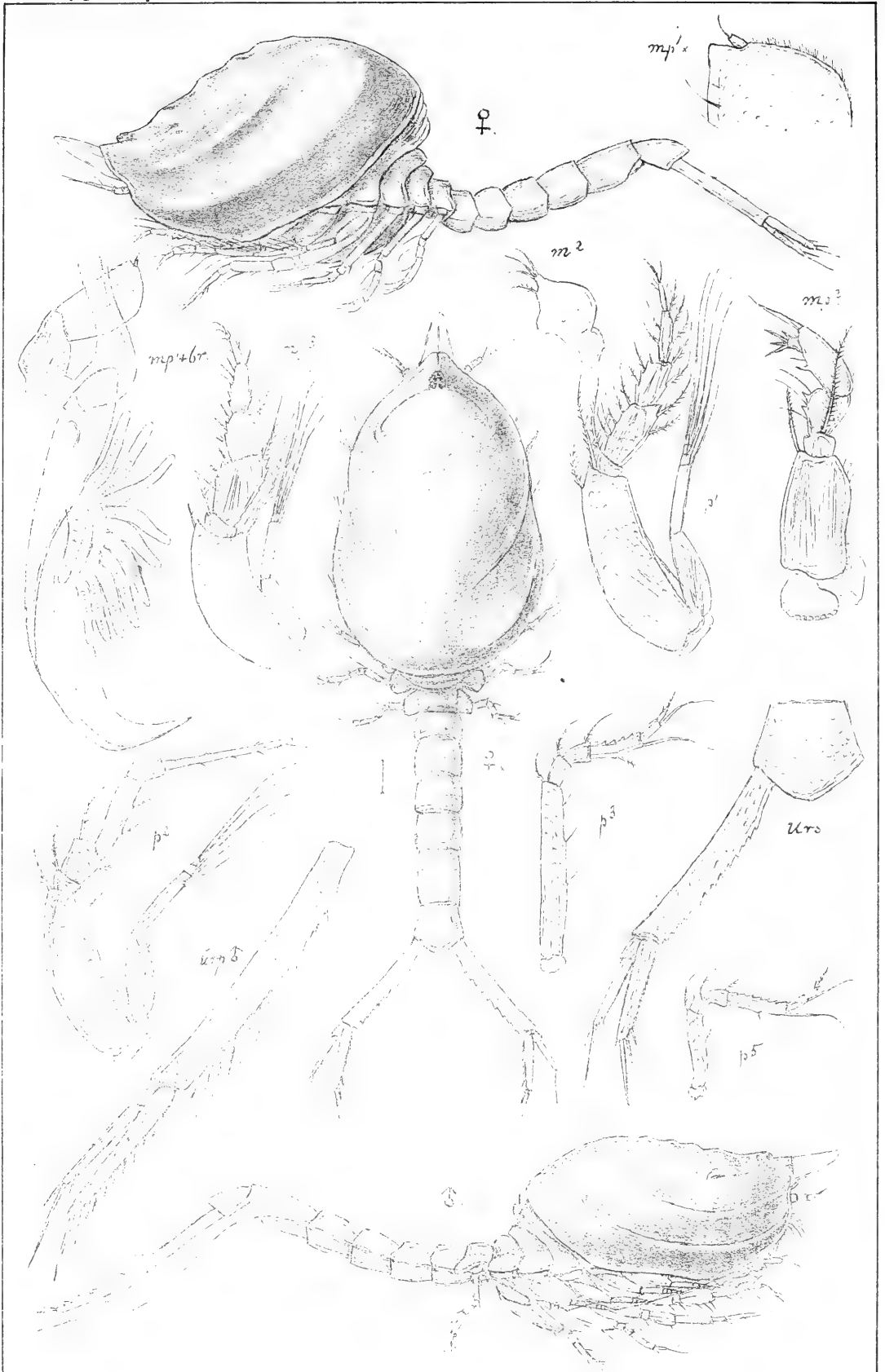


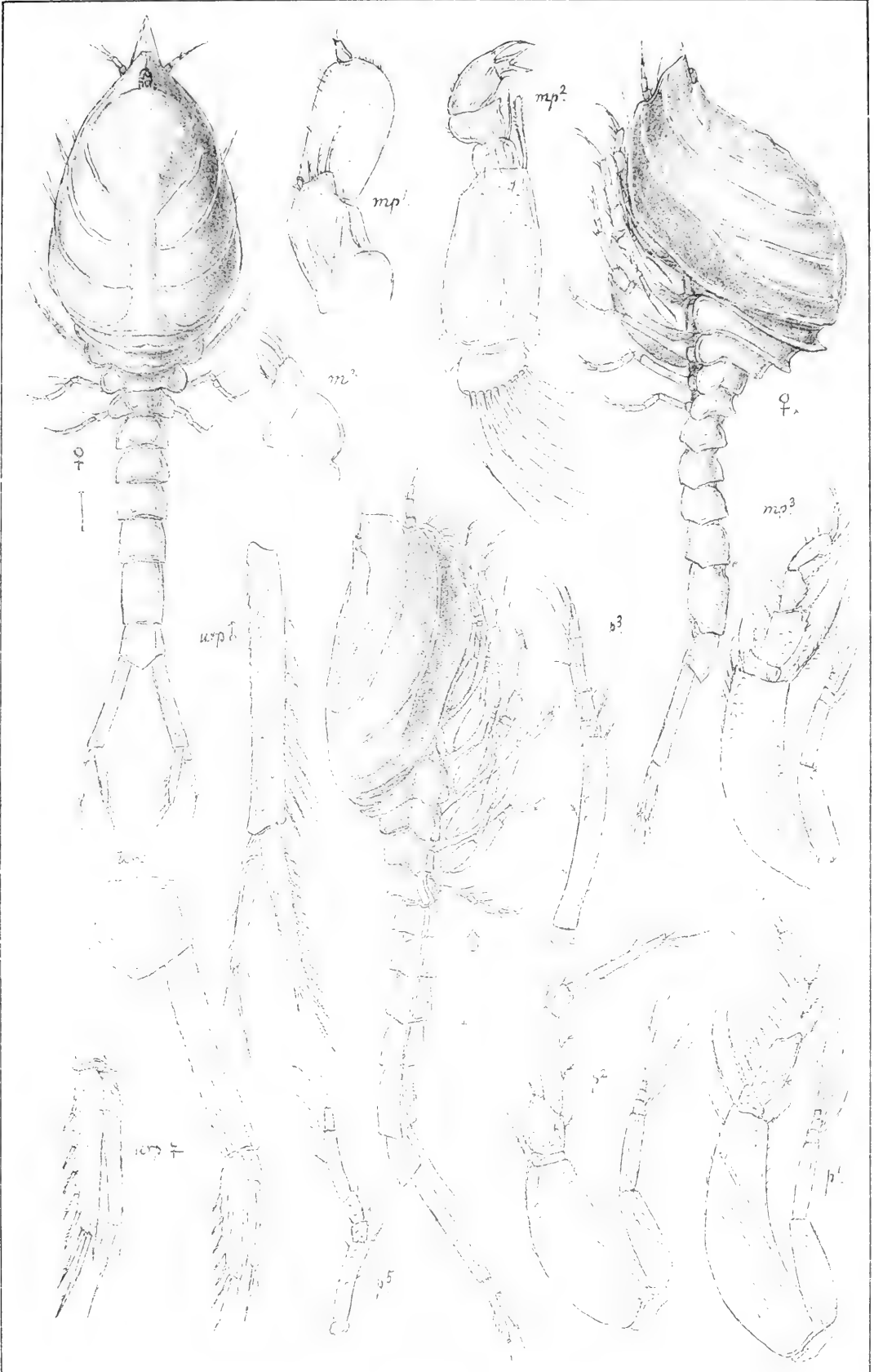
G.O. Sars autogr.

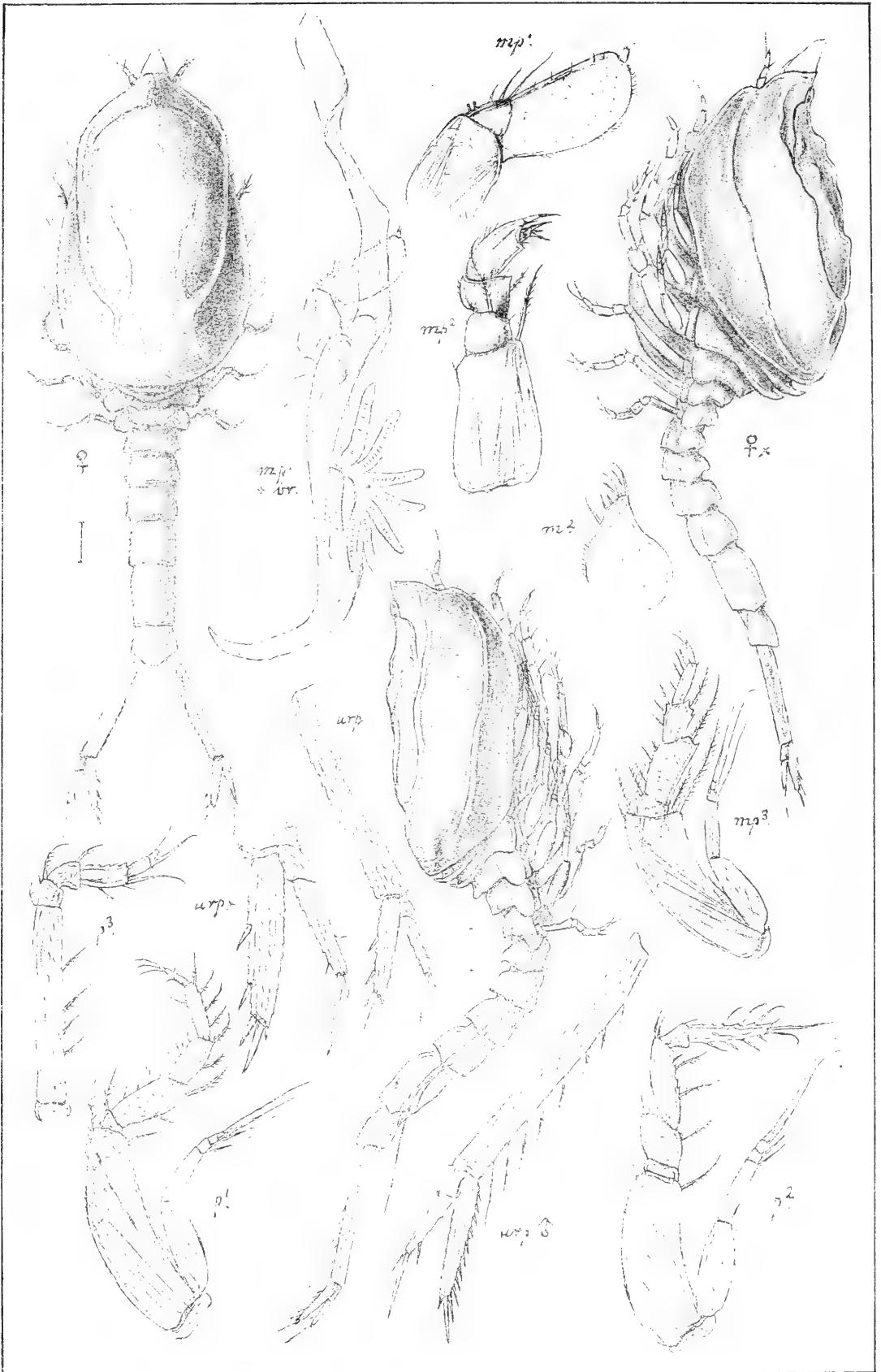
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Campylaspis rubicunda (Lilljeb.)
(continued).





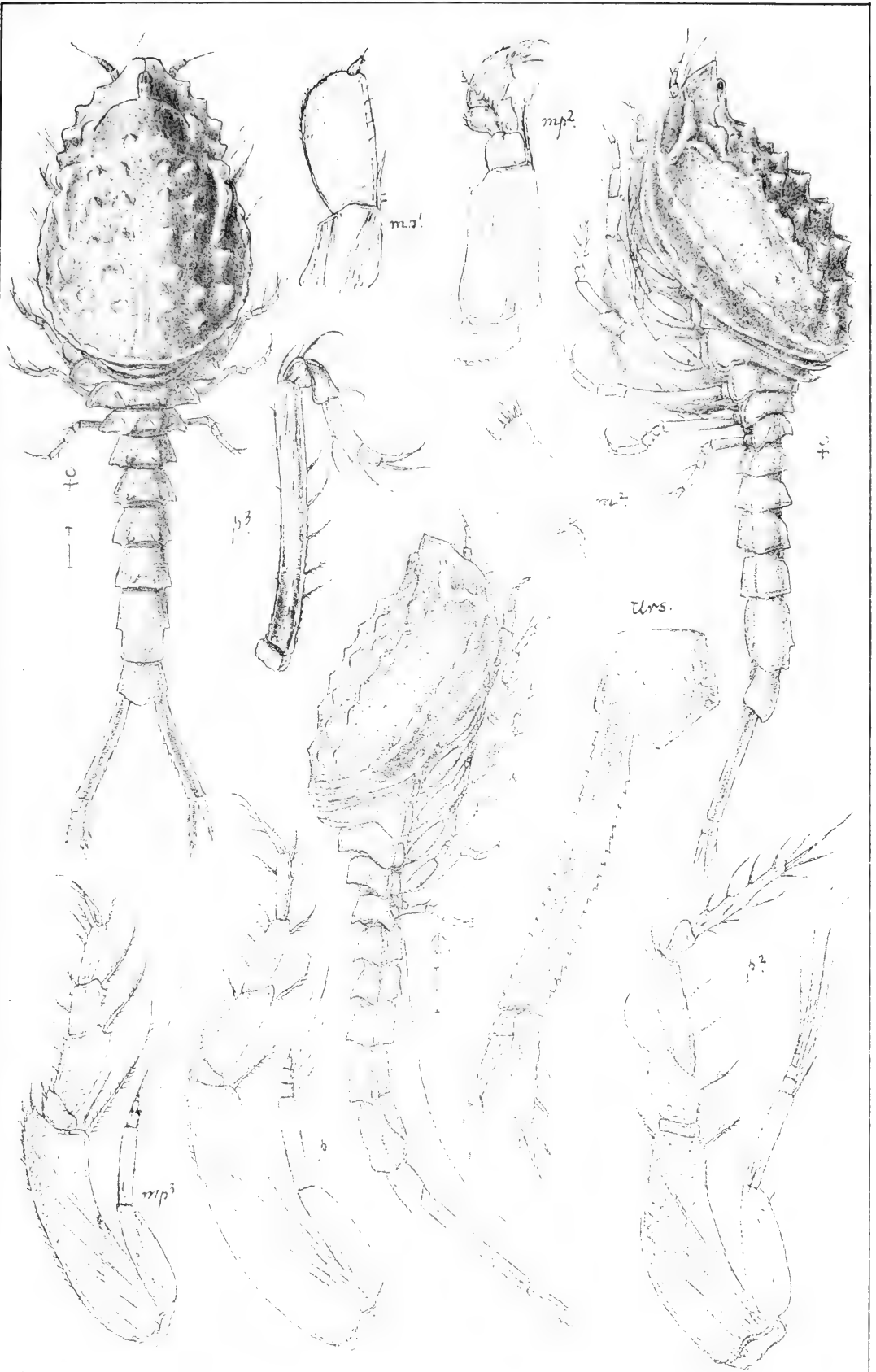




G. O. Sars auctogt

Campylaspis undata, G. O. Sars.

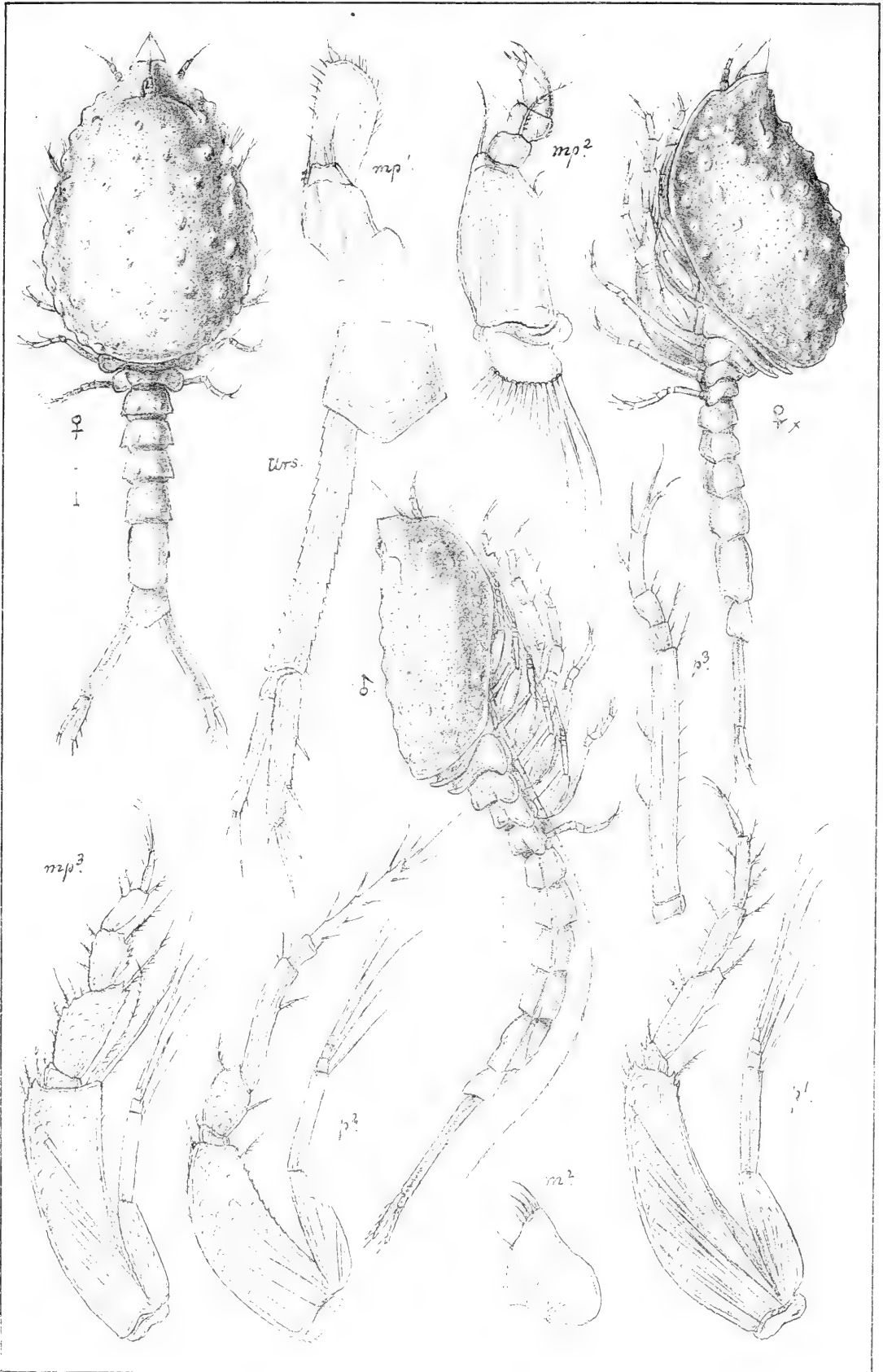
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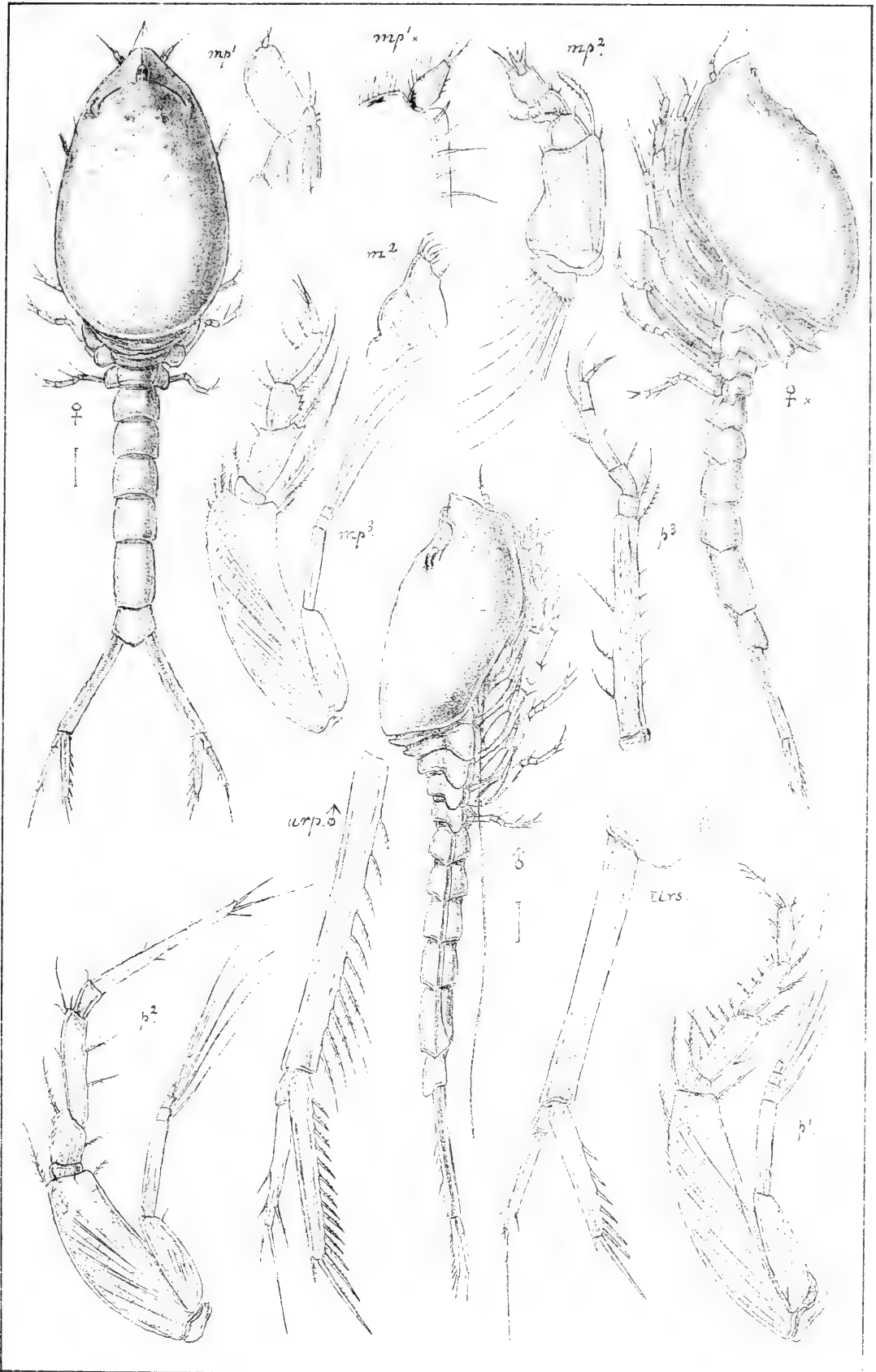


G. O. Sars autogr.

Campylaspis horrida, G. O. Sars.

Trukt. dan grav. v. Steenstrup, Copenh. 1895.





G.O. Sars autogr.

Campylaspis affinis, G.O. Sars.

Tafel 164, Plate LXIV.



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OF
NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY
G. O. SARS

VOL. III
CUMACEA

PART IX & X
ANATOMY, DEVELOPMENT, SUPPLEMENT

WITH 8 AUTOGRAPHIC PLATES



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PUBLISHED BY THE BERGEN MUSEUM
SOLD BY
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BERGEN. JOHN GRIEG

PREFACE.

This is the 3rd in succession of the long series of Volumes which will be needed to elucidate the rich carcinological fauna of Norway. It treats of a group of Crustacea, which until recently has continued to be very imperfectly known, and of which, therefore, as yet, scarcely any text-book exists. Indeed, I have myself been fortunate enough to contribute my quota to a closer knowledge of these interesting Crustacea, having been enabled to institute rather extensive studies both of indigenous and foreign forms.

In the preparation of this Volume, I have had at hand abundance of material, which has been collected almost entirely by myself at various times during my numerous voyages along our coasts. Indeed, I think that there are now very few additions to be made to the Cumacean fauna of Norway, which at present comprises in all no less than 48 species, belonging to 17 different genera, a number not as yet nearly attained by that of any other country. Of these species more than half the number (28) have been first established by the present author from Norwegian specimens, and have long been regarded as exclusively peculiar to the Norwegian fauna. Of late years, however, some of them have also been found in other places, in some cases far from Norway—for instance in the Mediterranean—and I think that on a closer investigation all of them will prove to have a much wider distribution than was at first expected. The present Volume will therefore, I hope, be useful not only for the determination of Norwegian species, but also for the future investigation of the Cumacean fauna of other countries.

The plan upon which the present Volume has been carried out, is essentially the same as that followed in the 2 preceding Volumes, with one exception, namely, that besides the strictly systematic part, a more detailed account of the internal anatomy and development has also been given at the close of the Volume, an addition which may not be out of place, considering the comparatively recent date of our knowledge regarding this peculiar group of Crustacea.

The plates, as in the preceding Volumes, have been prepared by the aid of the autographic process, and great care has been applied to make them as instructive as possible. I especially have been anxious to give good and easily recognizable habitus-figures, not only of selected female specimens of each species, but also of the respective adult males, which, as is well known, in most cases are very rarely met with, and, owing to their very conspicuous difference from the females, have given occasion to much confusion in the systematization.

As the literature referring to the Cumacea is far less extensive than that of other Crustacean groups, it has been possible for me to give a rather complete list of publications arranged alphabetically according to the names of the authors. In the greater number of these publications, however, only slight notes on Cumacea are found. The more essential works are marked with an asterisk.

Finally, I beg once more to offer my best thanks to the direction of the Bergen Museum, by whose assistance I have been enabled thus far to prosecute this great work, and which will, I hope, still assist me in continuing the work with several successive Volumes.

G. O. Sars.

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On the Internal Organisation of Cumacea.

(Pl. LXV—LXVIII).

To show more clearly the relation of the Cumacea to other Crustacea, I propose in the following pages to give a short account of the internal organs in this peculiar group. These investigations were made many years ago, chiefly by the examination of fresh specimens, and only a few additions and corrections have recently been supplied. In order to get a general view of the internal organs in their natural situation, it is necessary to select some more pellucid forms, and to examine them, while still alive, under the microscope, applying transmitted light. Several of the organs may thus be at once observed, whereas other organs are less distinctly traced, owing to the imperfect pellucidity of the integuments. In every case a close examination of the organs cannot be accomplished without dissection. This should, if possible, be performed on fresh specimens, immediately after they have been killed, as a dissection of specimens preserved for a long time in alcohol or other preserving fluids, always gives far less satisfactory results as regards this part of the anatomy. An attempt to make sections of alcoholic specimens, after applying the usual staining and imbedding method, was not successful, probably owing to the difficulty with which the integuments are permeated by the melted paraffin.

1. Intestinal System.

The intestinal tract (see Pl. LXV—LXVIII, fig. 1) commences with a very short muscular œsophagus (Pl. LXV, fig. 2, oes), which ascends almost perpendicularly from the mouth to the stomachal part of the intestine (s t), and is marked off from the latter inside by 2 projecting lips. The stomachal part forms a considerable dilation, which extends through the part of the body covered by the carapace, curving at the hindmost limit of this part abruptly downwards, and

at the same time contracting to the narrow cylindrical intestinal tube, which traverses the remaining part of the body. On a closer examination (see Pl. LXV, figs. 2, 3, 4), this dilated part, or stomach, as it may be termed, is found to consist of 2 divisions, differing in the structure of their walls. The anterior division exhibits a rather strong chitinous coating, which inside projects in several setiferous lappets and thickened fillets clothed with stiff hairs, which in some places are arranged in a fairly regular comb-like manner. It answers to the so-called triturating stomach in higher Crustacea, and forms below a rounded expansion, to the end of which the liver-sacs are appended. Along the ventral face of this expansion, the setiferous fillets are arranged in a peculiar manner (see figs. 3 & 4), serving apparently as a filter, to prevent the alimentary matter contained in the stomach from entering the liver-sacs. The walls of the posterior division of the stomach (see figs. 2 & 3) are quite soft, and exhibit numerous closely-set circular muscle-fibres, which behind gradually assume a more oblique course. They are, more-over, lined inside with large oblong, secretory cells, arranged at some distance from one another in oblique rows. The intestine proper (i) forms a narrow tube, which, in the exposed part of the trunk, runs nearer to the ventral face, whereas in the posterior division it occupies the axis of the body (see Pl. LXV—LXVIII, fig. 1). Its walls are rather thin, and, like the posterior part of the stomach, exhibit closely-set circular muscles, but are without secretory cells. In the last segment it terminates in a short muscular rectum, which opens in a longitudinal anal aperture situated on the lower side of this segment, or, if a telson is present, on the lower side of this part, more or less distant from its base.

The liver-sacs, unlike what is the case in Amphipoda and Isopoda, are comparatively short, being chiefly confined to the part of the body covered by the carapace. They are arranged in 2 sets, and, as above mentioned, are appended to the end of the ventral expansion of the stomach. Krøyer has already observed these sacs in *Diastylis*: but he erroneously believed them to originate from the dorsal face of the stomach. In the above-named genus they are 3 in number on each side (see Pl. LXV, figs. 1, 2, 10 l, Pl. LXVI, figs. 1, 9), issuing from a short common trunk, and are of about equal size, cylindrical in form, and each terminating in a short filament. They are irregularly wrinkled, owing to the large secretory cells lining their walls (see Pl. LXV, figs. 7, 9), and in the living animal exhibit a deep yellow colour, sharply contrasting with the dark-coloured stomach. In its natural position, the upper sac on each side (1¹) curves upwards at the end, beyond the dorsal face of the stomach, whereas the other 2 (1², 1³) extend straight backwards along the sides of the stomach. At first I believed that the liver-sacs in all Cumacea were of the above-described

appearance; but on a closer examination I have found them in reality to differ not a little in different genera. In the genus *Cuma* (Pl. LXVI, fig. 10) there is apparently only a single such sac on each side; but this divides at the end into 2 unequal rami, and has a slight protuberance above at the base, which may answer to the upper liver-sac in *Diastylis*. In the genus *Lamprops* (fig. 11) there are 4 liver-sacs on each side, the uppermost of which, however, is much shorter than the other 3, which have much the same appearance as in *Diastylis*. In the genus *Leucon* (Pl. LXVII, figs. 1, 7, 8) likewise, 4 liver-sacs occur on each side, but of very different size, the lowest but one being much the longest. In *Leucon fulvus* (fig. 8) the 3 other sacs are very much shortened, but less so in *Leucon Nasica* (fig. 7). In the genus *Pseudocuma* (Pl. LXVI, fig. 12) I have only found 2 liver-sacs on each side, of nearly equal size, and rather regularly annulated throughout, the secretory cells being arranged in successive circlets, and in the genus *Campylaspis* (fig. 13) these sacs are represented by a single large oval pouch on each side lined inside with unusually large, and irregularly disposed, secretory cells.

2. Vascular System.

The central part of this system, the heart, is not difficult to observe in living specimens, owing to its rapid pulsations. It is situated (see Pl. LXV—LXVIII, fig. 1, h) dorsally at about the middle of the anterior division of the body. Its anterior extremity extends for some distance within the part of the body-cavity covered by the carapace, and the posterior extremity reaches more or less far into the 3rd exposed segment of the trunk. In shape it is oblong fusiform, tapering at each extremity to a narrow neck, which is apparently continued in an arterial vessel. It exhibits 3 pairs of lateral, fissure-like openings for the reception of the blood, of which the middle one, occurring within the 1st exposed segment, is especially distinct. The walls of the heart (see Pl. LXVII, fig. 9) are strengthened by band-like, circular muscles, which, especially in the vicinity of the lateral openings, are rather strong. The heart lies imbedded within a thin membranous capsule or pericardium, by which it is attached to the dorsal walls of the body.

About the peripheric part of the vascular system, or the blood-vessels, I have very little to state. Besides the 2 arterial stems forming the immediate continuation of the heart, 2 lateral stems seem to occur in front and one ventral behind; but I have failed to trace any ramifications of these stems, which indeed seem to open into lacunæ between the organs. It may, however, be noted

that Dr. A. Dohrn has described and figured under *Cuma* a rather complicated system of arterial vessels issuing on each side from a single stem originating from the heart. Through this system, the blood is said to be carried both backwards and forwards, the vessels, especially in the walls of the carapace, exhibiting abundant ramifications. There can be no doubt that this statement is based upon direct observation; but I suspect that the existence of these vessels has merely been assumed from the course of the blood-corpuscles, which indeed circulate through the body with great regularity, though not in my opinion, enclosed in any distinctly defined vessels.

3. Renal System.

Under this head, I may mention a pair of problematic organs occurring in all Cumacea, one on each side of the heart, and easily observable owing to their opaque whitish colour (see Pl. LXV—LXVIII, fig. 1, n). These organs have the form of rather short, somewhat curved tubes, exhibiting several rounded lobules and slightly diminishing in thickness behind (see Pl. LXVI, fig. 6). They contain a uniform, finely granular mass without any cellular elements (see fig. 7), the granules, under a high magnifying power, exhibiting a somewhat irregularly angular form, and thus resembling calcareous concretions. I have failed to detect any excretory duct, and indeed, I am of opinion that strictly speaking these organs are not secretory, but that they merely serve as storing places for some unserviceable matter secreted from the blood. I long ago¹⁾ described a pair of undoubtedly homologous organs in *Asellus aquaticus*, where they likewise occur on each side of the heart, and at that occasion I expressed a similar opinion as to the significance of these organs.

4. Nervous System.

As in other Crustacea, the central parts of the nervous system consist (see Pl. LXVI, fig. 2) of the cephalic ganglion situated in front dorsally, and the nervous chord running along the ventral side of the body. The latter is composed of a series of 16 ganglia connected by double commissures. Of these ganglia the first 10 belong to the anterior division of the body, and are much larger than the remaining 6 caudal ones, which, with the exception of the last, are very slight, almost obsolete. All the ganglia consist of 2 symmetrical parts,

¹⁾ Crustacés d'eau douce de Norvège.

thereby indicating their original duplicity. The cephalic ganglion is considerably larger than the others, and of a rounded quadrangular form. It occurs, as stated above, quite in front dorsally, below the anterior part of the frontal lobe of the carapace (see Pl. LXV—LXVIII, fig. 1, C. gl). Its dorsal face (see Pl. LXVI, fig. 3) is rather uneven, being divided into several lobes by more or less deep grooves, one of which, running along the middle, is especially distinct and divides the ganglion into 2 symmetrical halves. Of the lobes, the 2 median ones, separated by the above-mentioned longitudinal groove, are narrow linear in form, and in front curve abruptly outwards. The nerves for the antennæ seem to originate from the lower face of the ganglion, and this is probably also the case with the optic nerves; but I have not been able to trace these nerves distinctly. Behind, the comparatively short œsophageal commissures are sent off (see fig. 2), connecting the cephalic ganglion with the ventral ganglionic chain. From each of these commissures, a very large nerve-stem issues, ascending to each side immediately behind the cephalic ganglion, and curving backwards along the dorsal side (see also Pl. XXXVI, middle fig.). It sends off numerous nerves to the strong mandibular muscles, and apparently also provides the stomach and the heart with nerves, thus representing the visceral part of the nervous system. Of the ganglia belonging to the ventral chain, the 3 anterior ones are placed close together, and the commissures connecting the 2 foremost ones are almost obsolete, though a small opening is seen between them in the middle. The 3rd ganglion is considerably larger than the 2 anterior ones, and also somewhat exceeds the next succeeding ones in size. It belongs to the segment carrying the 1st pair of maxillipeds with their voluminous branchial apparatus, the 2 preceding ganglia being destined for the 2 pairs of maxillæ. The 7 remaining ganglia belonging to the anterior division of the body are of rather uniform appearance, and are connected by well-defined slender commissures, between which, moreover, a median longitudinal nerve-stem is seen (see fig. 4). They each send off laterally several nerves, and from the anterior part of the commissures, issues another slender nerve extending upwards and outwards. The hindmost of these ganglia is somewhat smaller than the others, and the commissures connecting it with the preceding ones are rather short. The caudal ganglia, as above stated, are very small, and only indicated by a slight thickening of the commissures, which at this place assume a cellular structure, and are confluent in the middle (see fig. 5). The last caudal ganglion, however, (see fig. 2) is more distinctly defined, and sends off nerves behind to the telson and the uropoda.

5. Sexual System.

The *ovaries*, when fully developed (see Pl. LXV—LXVII, fig. 1, o v), have the form of two very large oblong oval sacs occupying the greater part of the body-cavity behind the carapace, often even extending for some distance within the part covered by the latter. They are generally in immediate contact with each other above, whereas below they diverge, to allow the intestine to run between them (see Pl. LXV, fig. 11). Each ovarial sac contains a somewhat variable number of ova, which are all of nearly the same size and development, and by mutual pressure assume a more or less polygonal form. In *Diastylis* I have found from 30 to 40 such ova in each sac; in *Leucon* their number is much smaller, sometimes only 7 ova being found in each ovary (see Pl. LXVII, fig. 1, o v, fig. 2). The ova are of different colour in different genera, being of a fine rose hue in *Diastylis*, whereas in *Lamprops* and *Pseudocuma* they are dark green. They contain a more or less opaque granular yolk, in the centre of which the germinal vesicle is faintly to be traced, and they are enveloped by a very thin pellucid membrane (see fig. 3). The uniform development of the ova in the ovarial sacs seems to indicate that the true germinal stratum must occur in another place, and indeed in quite young specimens of *Diastylis* I have distinctly seen a small median part connecting the 2 sacs, and exhibiting in the middle a dense stratum of small nucleated cells (see fig. 4). I have failed to detect any oviduct leading outwards from the ovarial sacs, and indeed, I believe that no oviduct in reality exists, the ova, by the rupture of the thin enveloping membrane, being simply received into the body-cavity, where they undergo their development. It is true that a marsupial pouch is found; but its cavity is confluent with the body-cavity, the thin incubatory plates being formed by the splitting of the ventral wall of the body itself. In gravid females, it is easily seen that the embryos are not confined to the marsupial pouch, but are distributed throughout the whole body-cavity behind the carapace, even up to the region of the heart. The purpose of the so-called marsupial pouch is thus merely to afford the necessary increase of breeding-space for the successive growth of the embryos. The Cumacea are accordingly true viviparous animals, and it is very probable that the females become gravid only once in their life, and soon die off after the breed has been discharged.

The *testes* (see Pl. LXVIII, fig. 1, t) are rather difficult to observe in the living animal, as they are comparatively small, of whitish colour, and lie in such close proximity to the intestine as easily to escape attention. By dissection of fresh male specimens, they admit, however, of being isolated and studied

in detail (fig. 2). They each form a slender tube extending through the exposed part of the trunk in close juxtaposition to the intestine. At the anterior extremity, which, unlike what is often the case with the ovaries, never penetrates the part of the body-cavity covered by the carapace, 4 small cœcal lobes are seen outside. These lobes, in the genus *Leucon* (figs. 2, 3), are very short and somewhat unequal in size, whereas in *Diastylis* (figs. 12, 13) they are more prominent, almost digitiform, and of about equal size. They contain the germinal stratum of cells, from which the zoosperms are developed, the tube itself being filled with densely crowded bundles of fully developed zoosperms, whereby it acquires a closely striated appearance. Behind, each tube contracts to a narrow duct, which in the last pedigerous segment curves abruptly downwards, debouching on the ventral face of the latter at the tip of 2 small juxtaposed prominences (see fig. 2). The zoosperms are of considerable size and arranged in dense bundles, each bundle being developed from a single germinal cell and containing about a dozen zoosperms. At first the bundle is enveloped by a thin membrane (see fig. 4); but this soon becomes ruptured. The zoosperms, however, still remain tied together in bundles (see fig. 5), and it is only after being evacuated from the body that they separate. Each zoosperm (see figs. 7—11, 14—16, 22) consists of 2 unequal parts uniting at an acute angle. The smaller part is of very delicate structure, and exhibits traces of a nucleus at its base. It varies somewhat in form in different Cumacea, being sometimes lanceolate in shape (figs. 9—11), sometimes more thread-like (figs. 7—8, 14—16), and in some cases distinctly twisted (fig. 22). When not fully developed, this part is curled up in a close coil, as found in young male specimens of *Diastylis* (figs. 17—20). It seems to represent the essential part of the zoosperm, answering to the so-called head in zoosperms of the usual form. The larger part of the zoosperm, answering to the tail, has the form of a slender elastic seta, several times as long as the above-mentioned part, and terminating in a very fine point.

On the Development of Cumacea.

(Pl. LXIX.)

Krøyer was the first to state that the young of Cumacea do not undergo any metamorphosis, but on leaving the mother have essentially the same appearance as the adults. A closer investigation of the embryonal development was subsequently instituted by Dr. A. Dohrn, who figured several stages of *Cumopsis Goodsiri*, and pointed out the great resemblance, at least in the earlier stages, to the development of Isopoda (Asellus). I have myself studied the development in the following genera: *Lamprops*, *Leucon*, *Diastylis* and *Pseudocuma*. In all these genera it is essentially alike, and it is sufficient therefore to describe it in one of them, viz., *Diastylis*.

The ova, immediately after they have left the ovarial sacs, are globular in form (see fig. 1), and surrounded by a very thin filmy membrane, which in some places is closely applied to the ovum, in others stands away from its surface. They undergo, as in most other Crustacea, a superficial cleavage, whereby a peripheric layer of clear nucleated cells is formed, surrounding the coarsely granular opaque yolk. In one place these cells increase considerably in number, forming a conspicuous thickening of the peripheric cell-layer. This part represents the ventral face of the embryo, and extends like a broad band around the greater part of the ovum. At the same time the central yolk-mass seems to arrange itself with tolerable regularity in relation to this thickened part of the surface, forming 2 conspicuous rounded lateral expansions (see figs. 2 & 3). In the middle, opposite the thickened part of the peripheric layer, appears a slight insinuation of the surface (see fig. 4, f); this becomes gradually deeper in the course of the development, and represents the dorsal cleft separating the two extremities of the embryo. The latter of course originally exhibits, like the embryos of Isopoda, a strong dorsal curvature. The first indications of all the limbs belonging to the anterior division of the body, with the exception of the last pair, are very soon to be traced along the thickened ventral face of the

embryo in the form of a double series of bud-like prominences. Of these, however, the 3 anterior pairs are somewhat in advance of the others in development, being rather distinctly defined, while the other 9 pairs can be but faintly traced (see fig. 4). These 3 anterior pairs of limbs represent the 2 pairs of antennæ and the mandibles, which, as is well known, are also those first appearing in other Crustacea, characterising the so-called Nauplian stage. The 1st pair (a^1), representing the superior antennæ, are much larger than the other 2, and have the form of 2 spatulate plates, slightly bilobular at the tip, and extending backwards on the sides of the embryo. The 2 succeeding pairs (inferior antennæ and mandibles, a^2 , M) also extend somewhat laterally, and are simple conic in form. Between them in the middle, the ventral face projects as a rounded prominence (L), representing the anterior lip or labrum. The remaining 9 pairs of limbs, as stated above, are at first but very faintly defined and of rather uniform appearance, causing a slight crenulation of the ventral face.

In a succeeding stage (fig. 5) the egg-membrane or chorion is cast off, and the 3 anterior pairs of limbs thereby become freely projecting, whereas the others are still enveloped by the thin larval skin. The dorsal cleft has deepened considerably, and extends somewhat obliquely behind, whereby the anterior broadly rounded extremity is defined clearly from the somewhat narrower posterior extremity. The latter has given origin on each side to a knoblike prominence (urp), indicating the developing uropoda. The 3 anterior pairs of limbs have not greatly changed their appearance. The remaining pairs, on the other hand, now appear very distinctly, and the 2 anterior of these (m^1 , m^2), representing the 2 pairs of maxillæ, distinguish themselves from the succeeding 7 pairs both by their form and more lateral position. They are also placed somewhat more apart, though the anterior pair partly cover the posterior. The former has developed a small lateral ramus (the reflexed palp), and the latter appears slightly trilobate at the end. The 7 succeeding pairs of limbs have a very similar appearance, each terminating in a conical, posteriorly-curving process (the endopodite), and having outside a knob-like protuberance (the exopodite), which, however, in the 2nd and 2 last pairs is almost obsolete. In the 3 middle pairs, representing the 3rd pair of maxillipeds (mp^3) and the 2 first pairs of legs (p^1 , p^2) this protuberance is easily observable; and in the 1st pair (mp^1), representing the 1st pair of maxillipeds, an evidently homologous outer appendage is also seen; but it here issues somewhat higher up than in the other pairs, and subsequently also becomes different in form and direction. It represents the exopodal part of the branchial apparatus, the epipodal part being apparently not yet formed. Just above the maxillæ, there is seen on each side of

the embryo a slight arched ridge (C), indicating the lower edges of the developing carapace, and above this ridge, imbedded in the yolk-mass, appears a sharply defined circular area (l), representing the first indication of the liver.

Figs. 6 and 7 represent a much later stage, in which, however, the dorsal curvature is still well marked. The larval skin has now been cast off, whereby all the appendages appear freely projecting. The caudal part of the body is still very short, as compared with the anterior division, and is abruptly curved upon the latter. It is distinctly segmented, whereas the segmentation of the adjoining part of the trunk is still imperfect. At the broadly rounded anterior extremity, just above the insertion of the superior antennæ, 2 small pigmentary masses (O), well defined from each other, are seen, representing the first intimation of the visual organ, which in this stage is double accordingly (see fig. 7). The superior antennæ (a^1) have considerably increased in size, and now exhibit a distinct boundary between the peduncle and the 2 flagella. They are, however, still extended behind along the sides of the embryo. The inferior antennæ (a^2) and mandibles (M) have retained their appearance almost unaltered. Below them in the middle, the oral aperture has appeared, being limited in front by the very prominent anterior lip (L), and behind by the 2 lappets of the posterior lip (l). The maxillæ (m^1 , m^2) are more deflexed, otherwise not very different from those in the preceding stage. The 7 succeeding pairs of limbs, on the other hand, have considerably increased in size, the endopodites having now assumed a digitiform appearance, with slight indentations indicating the incipient segmentation. In all these pairs, however, they are still curved backwards, as in the preceding stage. The exopodites in the 3 middle pairs have likewise increased in size, though they are scarcely more than half as long as the endopodites. Like the latter, they are, curved backwards, and already exhibit a distinct boundary between the basal and terminal parts, the latter being closely annulated. In the 1st of these pairs (the 1st pair of maxillipeds mp^1), the exopodite (br. exp.) has assumed the form of a thin lamella projecting downwards in front of the endopodite, and terminates in a narrow linguiform lappet. In the 2 posterior pairs, the exopodite has retained its knob-like character, and in the 2nd pair (2nd pair of maxillipeds) scarcely any trace of it is left. The uropoda (urp) now exhibit a distinctly defined, but still rather short stem and 2 lanceolate rami. They are curved downwards, embracing the hind part of the anterior division. Beyond them, the extremity of the tail projects as an obtuse prominence, the developing telson (t). The lower part of the carapace (C), only faintly indicated in the preceding stage, now appears with great distinctness, and projects in front on each side to a lanceolate lappet extending to the oral region. These lappets

(R) are the rostral plates, which in this stage lie widely apart, but will subsequently meet in front, to form the pseudo-rostral projection. In the interior of the body, the coarsely granular, opaque yolk-mass is still visible; but it has considerably diminished in volume, having been chiefly consumed to form the liver (l), which now appears as 2 rather large sac-like organs extending backwards below the yolk-mass.

The stage represented in fig. 8 at first sight looks very different from the preceding one; but in reality it immediately succeeds it. The chief difference consists in the disappearance of the dorsal curvature of the body, this having been changed to a pronounced ventral one, and in the consequent projection of the limbs forwards instead of backwards. The embryo in this stage has very little resemblance to an Isopod-embryo, whereas it agrees much more with that of a decapodous Crustacean. The anterior division of the body is still broadly rounded, or almost truncated in front; but its posterior (exposed) part has now become distinctly segmented, the number of segments agreeing with that in the adult animal. The last segment, however, is very small and still without any trace of limbs. The posterior division, or tail, is about the length of the anterior, and is bent in against the ventral face of the latter. It exhibits the normal number of segments, which are very distinctly defined and of nearly equal size, the last carrying a well-defined telson between the uropoda. At the anterior extremity the eyes (0) are distinctly seen. They are still well defined from each other, though in somewhat closer proximity than in the preceding stage, each forming a rounded capsule, in which 3 visual elements have already developed (see fig. 9). The superior antennæ (a^1) are rather large, and are extended obliquely forwards, sometimes with their outer part curved more or less upwards. The 3 joints of the peduncle are indicated by distinct constrictions, and the flagella also exhibit traces of segmentation. The inferior antennæ (a^2) have stopped in their development, being scarcely larger than in the preceding stages. The mandibles (M), on the other hand, are much more fully developed and have assumed their definite form and position, their upper pointed extremity being articulated to the carapace at the place where the rostral plates originate. The post-oral appendages are closely crowded together, and in form and mutual size approach those in the adult animal, though not yet functionally developed. The exopodites have wholly disappeared in the last 2 pairs, as also in the pair representing the 2nd pair of maxillipeds. In the preceding pair, representing the 1st pair of maxillipeds, it has considerably increased in length and extends straight forwards, its outer part (br. exp.) having the form of a narrow linguiform plate. Besides this exopodal part, the epipodal part may also be traced

inside the lower part of the carapace. The latter is now distinctly defined not only inferiorly, but also posteriorly, and projects on each side in front to the rostral plates (R), which reach somewhat beyond the anterior extremity, though still far apart. In the interior of the body the liver (l) is now very distinct, being about to divide. Of the yolk-mass only a small, but sharply-defined rounded portion is left, enclosed in the developing stomach. Dorsally, the heart (h) is in process of development.

Fig. 10 represents one of the last stages of the embryo, its size being almost twice that of the preceding stage. The Cumacean character of the animal is now very obvious, both as to its general form and the structure of the several appendages. The carapace is very large, and has assumed its characteristic shape, partly also exhibiting traces of the spiny armature of the dorsal face and the inferior edges. The rostral plates (R) are greatly prolonged, and are about to meet in front to form the pseudorostral projection. Their upper edges, however, are not yet in immediate contact with each other, nor do the plates exactly fit to the frontal part. At the end of the latter the ocular tubercle (o) is very distinct, the eyes being now confluent to a single median organ, tipped, as in the adult animal of this species (*D. lucifera*), with a pro-curved spine. Of the exposed segments of the trunk, the 4 anterior are normally developed with distinct epimeral parts, whereas the last segment is very small, without any epimeræ, and still having no traces of limbs. The tail is stretched out, so as now to extend more or less in the axis of the body, and its segments have assumed the peculiar nodular appearance characteristic of the adult animal, being defined by very deep constrictions. They are also somewhat unequal in size, increasing in length to the penultimate one, which is the largest. From both their dorsal and ventral faces scattered slender hairs have risen. Of the limbs, the mandibles and maxillæ are now wholly admitted between the lateral parts of the carapace, whereas the succeeding limbs project more or less below. They are now all distinctly segmented, but in the superior antennæ (a^1), as also in the 1st pair of legs (p^1), probably also in the maxillipeds, the articulations are still enveloped by a thin membranous sheath. In the 3 succeeding pairs of legs (p^2 — p^4), however, this sheath has been cast off, so as to allow the spines and setæ to project freely. The branchial apparatus is not yet functionally developed, the exopodal parts (br. exp.) being still discontinuous, whereas they will subsequently meet at the ends to form the ejecting tube projecting from the pseudo-rostral prominence. The distal portions of these parts in the present stage are seen projecting downwards from about the oral region as thin linguiform lappets. The telson (t) is conically tapered, and tipped with 2

slender spines; but no traces of the lateral spinules have as yet appeared, nor do the uropoda (urp) as yet exhibit any armature whatever. No trace of calcareous matter has as yet been deposited in the integuments, which of course are very thin and pellucid, admitting the inner organs to be traced with great distinctness through their walls. The stomach (st) has assumed its characteristic form and curvature, and all 3 liver-sacs (l) on each side have been formed; but the upper and lower sac are still very short, scarcely attaining half the length of the middle one. Behind the carapace dorsally, the heart (h) is easily observable, as also the renal organs (n) occurring to each side of it. The intestinal tube is still without any contents, and on this account is less conspicuous than in the post-embryonal stages.

When the young is ready to escape from the mother, it has assumed much the appearance of the adult animal, and the integuments have been partly indurated with calcareous deposits, so as to make them rather hard and intransparent. The only essential difference consists in the absence of the last pair of legs. On a closer examination, however, these limbs are found in process of development, but enclosed within a conspicuous ventral prominence of the last trunk segment. They will accordingly be set free by a subsequent exuviation.

Supplementary Notes.

Pages 10 & 12. *Cuma scorpioides* and *C. Edwardsii*.

Remarks. — There seems to be some diversity of opinion about the naming of these 2 Norwegian species of *Cuma*. Thus in his "History of Crustacea" (International Scientific Series) the Rev. Mr. Stebbing records *Cuma Edwardsii* Goodsir as a synonym of *Cuma scorpioides* (Montagu). If this is really correct—a question which only can be settled by a re-examination of the original specimen described by Montagu—the species recorded in the present account as *Cuma scorpioides* must have another specific name, and as *Bodotria arenosa* Goodsir is unquestionably the male of this species, it ought to be named *Cuma arenosa*, while the specific name proposed by Montagu must be transferred to the 2nd Norwegian species, the one here recorded as *Cuma Edwardsii* Goodsir.

Occurrence. — I found both these species last summer off the Jæderen coast, the one, *Cuma arenosa*, rather abundantly off Egersund in a depth of from 15 to 20 fathoms, coarse sandy bottom; of the other, *Cuma scorpioides*, only 2 specimens, male and female, were found at Sirevaag, somewhat farther north. These 2 specimens, unlike those previously observed, were of a dark reddish brown colour.¹⁾

Page 30. *Leucon Nacica*.

Remarks. -- I have been informed by the Rev. Mr. Stebbing, that the name of this species ought to be spelt as above, since no adjective „nasicus“ exists in the Latin language. (Cf. Scipio Nastica).

Page 40. *Eudorellopsis deformis*.

Distribution. — Firth of Forth, Aberdeen Bay, Firth of Clyde (Th. Scott).

¹⁾ The latter species has also been observed by Dr. Hoek off the Dutch coast.

Page 44. *Diastylis Rathkei*, var.

(Pl. LXX—LXXII.)

Remarks.—On page 45 I have mentioned that some forms of *Diastylis Rathkei* differ conspicuously from the type described by Krøyer, in their more spiny carapace, and apparently form a transition to the British species *D. Bradyi* Norman. These forms I propose to combine as a distinct variety, of which figures, both habitus and detail, are given in the last 3 plates. It will be seen, on comparing these figures with those given on Pl. XXXIII and XXXIV, which are from a typical specimen, that this variety exhibits several differences, not only in the form and armature of the carapace, but also in the structure of the several appendages. In my opinion, however, these differences are not great enough to warrant a specific distinction, and I therefore do not find it necessary to give any exhaustive diagnosis of this form. Meanwhile it may be of interest to call attention to some of the more conspicuous differences from the typical form. Whereas in the latter (see Pl. XXXIII) only 3 small spinules are found on each side below the frontal lobe, there is in the present variety a considerable number of such spinules, giving the anterior part of the carapace a rather scabrous appearance (see Pl. LXX). These spinules are even partly continued beyond the middle of the carapace along the most prominent part of the branchial regions. The spinules of the frontal lobe have a somewhat variable arrangement, being disposed in some specimens (see the 2 habitus-figures) in 2 or 3 transverse rows, whereas in other specimens (see the 2 figures of the carapace) they form 2 longitudinal rows, as in the typical form. As to the shape of the carapace, a rather conspicuous difference is observed in the development of the subrostral corners, which in the typical form are distinctly prominent, whereas in the present variety they are almost obsolete, causing the anterior part of the carapace, when viewed laterally, to appear more conically tapered. The mucroniform processes of the last pedigerous segment in this variety always point straight behind, whereas in the typical form they are slightly divergent. In the structure of the appendages the following differences may be noted. On the superior antennæ I have failed to detect any trace of the strong denticle found in the typical form at the end of the 1st peduncular joint. The 1st pair of legs appear somewhat more slender, with the outer joints more elongated, and this is also the case with the 2nd pair, the last joint of which in particular is conspicuously longer than in the typical form. The telson considerably exceeds in length the stem of the uropoda, and its lateral spinules are more slender and fewer in number than in the typical form. The outer

ramus of the uropoda is less robust and scarcely longer than the inner, the terminal joint of which has 3 lateral spinules, whereas only 2 are found in the typical form.

The figures given on the last plate of the adult male are from specimens kindly sent to me by Mr. Th. Scott, who collected them in the Firth of Forth. There cannot be any doubt that this is in reality, as suggested by the above-named distinguished zoologist, the male of *D. Rathkei*; and I think I am right in considering it to belong to the present variety, which seems to be that exclusively found off the British Isles. As seen from the figures, it is of a very slender form, and on the whole resembles the males of other species of the genus, having a well-marked serrated keel along the sides of the carapace, and the caudal segments partly spinulous. It is, however, easily proved to belong to the present species by the structure of the several appendages.

Occurrence. — This variety seems to be much more generally distributed off the Norwegian coast than the typical form, as it occurs from the Christiania Fjord to Vadsø, and in some places in great profusion.

Page 71. *Leptostylis villosa*.

Distribution. — Three well-marked female specimens of this form were sent to me from Mr. Th. Scott, who collected them in the Firth of Clyde.

Page 74. *Pseudocuma cercaria*.

Occurrence. — I found this form last summer in great abundance off the Jæderen coast, outside Sirevaag, in a depth of 6—10 fathoms, fine sandy bottom.

Page 76. *Pseudocuma similis*.

Occurrence. — This form, which had previously only been observed at Skudesnæs, occurred not unfrequently, together with the preceding species, outside Sirevaag.

Distribution. — According to a communication from Mr. Th. Scott, some specimens of this species were taken by him at the "seaweed limit" of the estuary of the Clyde.

Page 77. *Petalosarsia declivis*.

Distribution. — Firth of Forth, Moray Firth (Th. Scott).

Page 84. *Campylaspis rubicunda*.

Distribution. — Firth of Forth, Firth of Clyde, Moray Firth, Loch Fyne (Th. Scott).

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LIST OF PLATES.

The Plates, as far as possible, have been marked in accordance with those belonging to the first 2 Volumes (Amphipoda and Isopoda).

The following are the chief signs, with their significance:

♀ female; ♂ male; *C.* carapace; *O.* ocular tubercle; *a*¹. superior antennæ; *a*². inferior antennæ; *L.* anterior lip; *l.* posterior lip; *M.* mandibles; *m*¹. anterior maxillæ; *m*². posterior maxillæ; *mp*¹. 1st pair of maxillipeds; *br.* branchial apparatus; *exp.* exopodal part of same; *ep.* epipodal part of same; *mp*². 2nd pair of maxillipeds; *mp*³. 3rd pair of maxillipeds; *p*¹.—*p*⁵. legs of 1st to 5th pair; *plp.* pleopoda of male; *Urs.* Urosome; *t.* telson; *urp.* uropoda.

A detailed explanation of Pl. LXV—LXIX, illustrating the internal anatomy and development of Cumacea, is given below.

<p style="text-align: center;">Pl. I.</p> <p>Cuma arenosa, (Goodsir); female. (See supplementary notes).</p>	<p style="text-align: center;">Pl. IX.</p> <p>Lamprops fasciata, G. O. Sars; female and male.</p>
<p style="text-align: center;">Pl. II.</p> <p>Cuma arenosa; female (continued).</p>	<p style="text-align: center;">Pl. X.</p> <p>Lamprops fasciata; female and male (continued).</p>
<p style="text-align: center;">Pl. III.</p> <p>Cuma arenosa; adult male.</p>	<p style="text-align: center;">Pl. XI.</p> <p>Lamprops fuscata, G. O. Sars; female and male.</p>
<p style="text-align: center;">Pl. IV.</p> <p>Cuma scorpioides (Mont.): female and male. (See supplementary notes).</p>	<p style="text-align: center;">Pl. XII.</p> <p>Hemilamprops rosea (Norman); female and male.</p>
<p style="text-align: center;">Pl. V.</p> <p>Iphinoë trispinosa (Goodsir); female and male.</p>	<p style="text-align: center;">Pl. XIII.</p> <p>Hemilamprops rosea; female (continued).</p>
<p style="text-align: center;">Pl. VI.</p> <p>Iphinoë trispinosa; female (continued).</p>	<p style="text-align: center;">Pl. XIV.</p> <p>Hemilamprops rosea; female and male (continued).</p>
<p style="text-align: center;">Pl. VII.</p> <p>Cyclaspis longicaudata, G. O. Sars, female.</p>	<p style="text-align: center;">Pl. XV.</p> <p>Hemilamprops assimilis, G. O. Sars; female and male.</p>
<p style="text-align: center;">Pl. VIII.</p> <p>Cyclaspis longicaudata; female and male (continued).</p>	<p style="text-align: center;">Pl. XVI.</p> <p>Hemilamprops uniplicata, G. O. Sars; female and male.</p>

- Pl. XVII.
Hemilampros uniplicata; female and male
(continued).
- Pl. XVIII.
Hemilampros cristata, G. O. Sars; female
and male.
- Pl. XIX.
Platyaspis typica, G. O. Sars; female and male.
- Pl. XX.
Platyaspis typica; female and male (continued).
- Pl. XXI.
Leucon Nasica (Kröyer); female and male.
(See supplementary notes).
- Pl. XXII.
Leucon Nasica; female and male (continued)
- Pl. XXIII.
Leucon nasicoïdes, Lilljeborg; female and male.
- Pl. XXIV.
Leucon fulvus, G. O. Sars; female and male.
- Pl. XXV.
Leucon pallidus, G. O. Sars; female and male.
- Pl. XXVI.
Leucon acutirostris, G. O. Sars; female and
male.
- Pl. XXVII.
Eudorella emarginata (Kröyer); female and
male.
- Pl. XXVIII.
Eudorella emarginata; female and male (con-
tinued).
- Pl. XXIX.
Eudorella truncatula (Sp. Bate); female and
male.
- Pl. XXX.
Eudorella hirsuta, G. O. Sars; female and
young male.
- Pl. XXXI.
Eudorellopsis deformis (Kröyer); female and
male.
- Pl. XXXII.
Eudorellopsis deformis; female and male
(continued).
- Pl. XXXIII.
Diastylis Rathkei (Kröyer), typica; female
and young male.
- Pl. XXXIV.
Diastylis Rathkei; female (continued).
- Pl. XXXV.
Diastylis cornuta (Boeck); female.
- Pl. XXXVI.
Diastylis cornuta (continued); adult male.
- Pl. XXXVII.
Diastylis rugosa, G. O. Sars; female and male.
- Pl. XXXVIII.
Diastylis lucifera (Kröyer); female and male.
- Pl. XXXIX.
Diastylis rostrata (Goodsir); female and male.
- Pl. XL.
Diastylis tumida (Lilljeborg); female and male.
- Pl. XLI.
Diastylis Goodsiri (Bell); female.
- Pl. XLII.
Diastylis spinulosa, Heller; female and young
male.
- Pl. XLIII.
Diastylis echinata, Sp. Bate; female and male.
- Pl. XLIV.
Diastylis scorioides (Lepechin); female and
male.
- Pl. XLV.
Diastylis serrata, G. O. Sars; female and
male.
- Pl. XLVI.
Diastylis biplicata, G. O. Sars; female
and male.
- Pl. XLVII.
Diastylis resima (Kröyer); female and male.
- Pl. XLVIII.
Leptostylis longimana, G. O. Sars; female
and male.
- Pl. XLIX.
Leptostylis macrura, G. O. Sars; female and
male.
- Pl. L.
1. Leptostylis ampullacea (Lilljeborg); fe-
male.
2. Leptostylis villosa, G. O. Sars; female.
- Pl. LI.
Pseudocuma cercaria (v. Beneden); female.

Pl. LIII.

Pseudocuma cercaria (continued); adult male.

Pl. LIII.

Pseudocuma similis, G. O. Sars; female and male.

Pl. LIV.

Petalosarsia declivis, G. O. Sars; female and male.

Pl. LV.

Cumella pygmaea, G. O. Sars; female and male.

Pl. LVI.

Campylaspis rubicunda (Lilljeborg); female and male.

Pl. LVII.

Campylaspis rubicunda (continued); female and male.

Pl. LVIII.

Campylaspis glabra, G. O. Sars; female and male.

Pl. LIX.

Campylaspis sulcata, G. O. Sars; female and male.

Pl. LX.

Campylaspis costata, G. O. Sars; female and male.

Pl. LXI.

Campylaspis undata, G. O. Sars; female and male.

Pl. LXII.

Campylaspis horrida, G. O. Sars; female and male.

Pl. LXIII.

Campylaspis verrucosa, G. O. Sars; female and male.

Pl. LXIV.

Campylaspis affinis, G. O. Sars; female and male.

Pl. LXV.

Internal Anatomy of *Cumacea* (*Diastylis lucifera*).

Fig. 1. Anterior part of body together with the first 3 caudal segments of a young, not yet gravid, female, viewed from left side. Inner organs delineated within the body in their natural position. — *O* ocular tubercle; *M*, mandible; *br. exp.* exopodal part of bran-

chial apparatus; *sc.* scale-like terminal piece of same; *br. ep.* epipodal part of branchial apparatus; *st.* stomach; *l¹—l³*, the 3 liver-sacs on left side; *i* intestinal tube; *h.* heart; *n.* nephridium (renal organ); *C.gl.* cephalic ganglion; *gl.* ventral ganglionic chain; *ov.* left ovarian sac; *inc. pl.* incubatory plates in process of formation.

Fig. 2. Anterior part of intestinal tract, viewed from left side. — *oes.* oesophagus; *st.* stomach; *pr. v.* anterior triturating part of same; *l¹—l³* the 3 liver-sacs on left side; *i.* intestinal tube.

” 3. Anterior part of stomach, more highly magnified, exhibiting the triturating apparatus; lateral view.

” 4. Same part viewed from the ventral face.

” 5, 6, 7. Seta and pectiniform fillets of the triturating apparatus, highly magnified.

” 8. Extremity of a liver-sac.

” 9. Some of the secretory cells from same, highly magnified.

” 10. Schematic transverse section of body behind the middle of the carapace, exhibiting the internal organs in section. Lettering as in fig. 1.

” 11. Another transverse section of body through about the 2nd exposed segment. Lettering as above.

Pl. LXVI.

Inner Anatomy of *Cumacea* (continued).

Fig. 1. Anterior part of body together with the first 2 caudal segments of a female *Diastylis lucifera*, viewed from the dorsal face. Inner organs delineated within the body in their natural position. Lettering as in fig. 1 on the preceding plate.

” 2. Central nervous system of same species, viewed from the dorsal face.

” 3. Cephalic ganglion together with the oesophageal commissures, viewed from the dorsal face.

” 4. Two of the ventral ganglia with their connecting commissures; dorsal view.

” 5. Two ganglia, with their commissures, from the caudal part of the nervous chord.

” 6. Left renal organ.

” 7. One of the lobules of same, more highly magnified, and showing the finely granular contents.

” 8. Ocular tubercle of same species, exhibiting trace of its original duplicity; dorsal view.

” 9. Anterior part of the intestine, with the liver-sacs (*Diastylis*); ventral view.

- Fig. 10. Same part from *Cuma arenosa*.
 „ 11. Same part from *Lamprops fasciata* (dorsal view).
 „ 12. Same part from *Pseudocuma cercaria* (ventral view).
 „ 13. Same part from *Campylaspis rubicunda* (ventral view).

PL. LXVII.

Internal Anatomy of Cumacea (continued).

- Fig. 1. Anterior part of body together with the first 3 caudal segments of a young female specimen of *Leucon Nasica*, viewed from left side. Internal organs delineated within the body in their natural position. Lettering as in fig. 1 on the two preceding plates.
 „ 2. Left ovarian sac of the same individual, isolated and more highly magnified.
 „ 3. One of the ova contained in the sac isolated.
 „ 4. Ovarial sacs of a very young specimen of *Diastylis lucifera*, showing the small median connecting part.
 „ 5. Egg-cell from same, highly magnified.
 „ 6. Epithelial cell.
 „ 7. Anterior part of intestine with the liver-sacs from *Leucon Nasica*; ventral view.
 „ 8. Same part from a male specimen of *Leucon fulvus*.
 „ 9. Heart with pericardium from a male *Diastylodes biplicata*, as found by dissection of an alcoholic specimen; left side-view.

PL. LXVIII.

Internal Anatomy of Cumacea (continued).

- Fig. 1. Anterior part of body together with the first 3 caudal segments of an adult male specimen of *Leucon Nasica*, viewed from left side. — *t.* testes; remaining letters as in fig. 1 on the 3 preceding plates.
 „ 2. Testes of same species isolated, together with last pedigerous segment; ventral view.
 „ 3. Anterior part of one of the testes more highly magnified, exhibiting the coecal lateral lobes. From the lower ruptured end, the zoosperms are seen protruding.
 „ 4. A bundle of zoosperms still enveloped by a thin membranous sheath.
 „ 5. Another bundle, in which the envelope has been cast off.
 „ 6. A fully-developed zoosperm isolated.
 „ 7, 8. Front part of 2 other zoosperms from same species, highly magnified.

Fig. 9, 10, 11. Zoosperms from *Leucon fulvus*.

- „ 12. One of the testes from an adult male of *Diastylis lucifera*.
 „ 13. Anterior part of same, more highly magnified.
 „ 14, 15, 16. Zoosperms from the same species.
 „ 17—20. Not yet fully developed zoosperms from a young male of *Diastylis lucifera*.
 „ 21. Germinal cells of same specimen.
 „ 22. Zoosperm from *Hemilamprops rosea*.

PL. LXIX.

Development of Cumacea. *Diastylis lucifera*.

- Fig. 1. Ovum still enveloped by a thin filmy membrane, and exhibiting the coarsely granular central yolk-mass and the peripheral layer of clear cleavage-cells. The latter has considerably increased on one side, to form the ventral face of the developing embryo.
 „ 2, 3. Another ovum in a somewhat later stage, represented in 2 different positions, to show the cruciate arrangement of the central yolk-mass.
 „ 4. Early stage of the embryo, exhibiting the first intimations of the limbs, and still enveloped by the chorion; left side-view. — *a*¹. superior antennæ; *a*². inferior antennæ; *M.* mandibles; *L.* anterior lip; *m*¹. anterior maxillæ; *m*². posterior maxillæ; *mp*¹. 1st pair of maxillipeds; *mp*². 2nd pair of maxillipeds; *mp*³. 3rd pair of maxillipeds; *p*¹—*p*⁴. legs of 1st to 4th pair; *f.* dorsal cleft.
 „ 5. Embryo in a later stage, viewed from left side. The chorion has been cast off, whereby the 3 anterior pairs of limbs have been set free, the others being still enclosed in the larval skin. — *C.* inferior edge of the developing carapace; *urp.* uropoda; *l.* capsule imbedded in the yolk-mass and forming the first indication of the liver; remaining letters as in fig. 4.
 „ 6. A still more developed embryo, in which the larval skin has been cast off, thus causing all the limbs to be freely exposed; lateral view. — *O.* developing eyes; *R.* rostral plates of carapace; *br. cap.* exopodal part of the branchial apparatus; *t.* telson; remaining letters as in fig. 5.
 „ 7. Same embryo viewed from the dorsal face.
 „ 8. Embryo in the immediately succeeding stage, viewed from left side. The dorsal curvature of the body has changed to a pronounced ventral one,

and the several limbs are extended in front instead of being reflexed. — *V.* remnant of the yolk-mass; *h.* developing heart; remaining letters as in fig. 6.

- Fig. 9. Anterior extremity of same embryo, viewed dorsally, and exhibiting the 2 still separated eyes.
- * 10. Embryo in one of the last stages, and considerably less magnified than those mentioned above; lateral view. *n.*

renal organ; remaining letters as in fig. 8.

Pl. LXX.

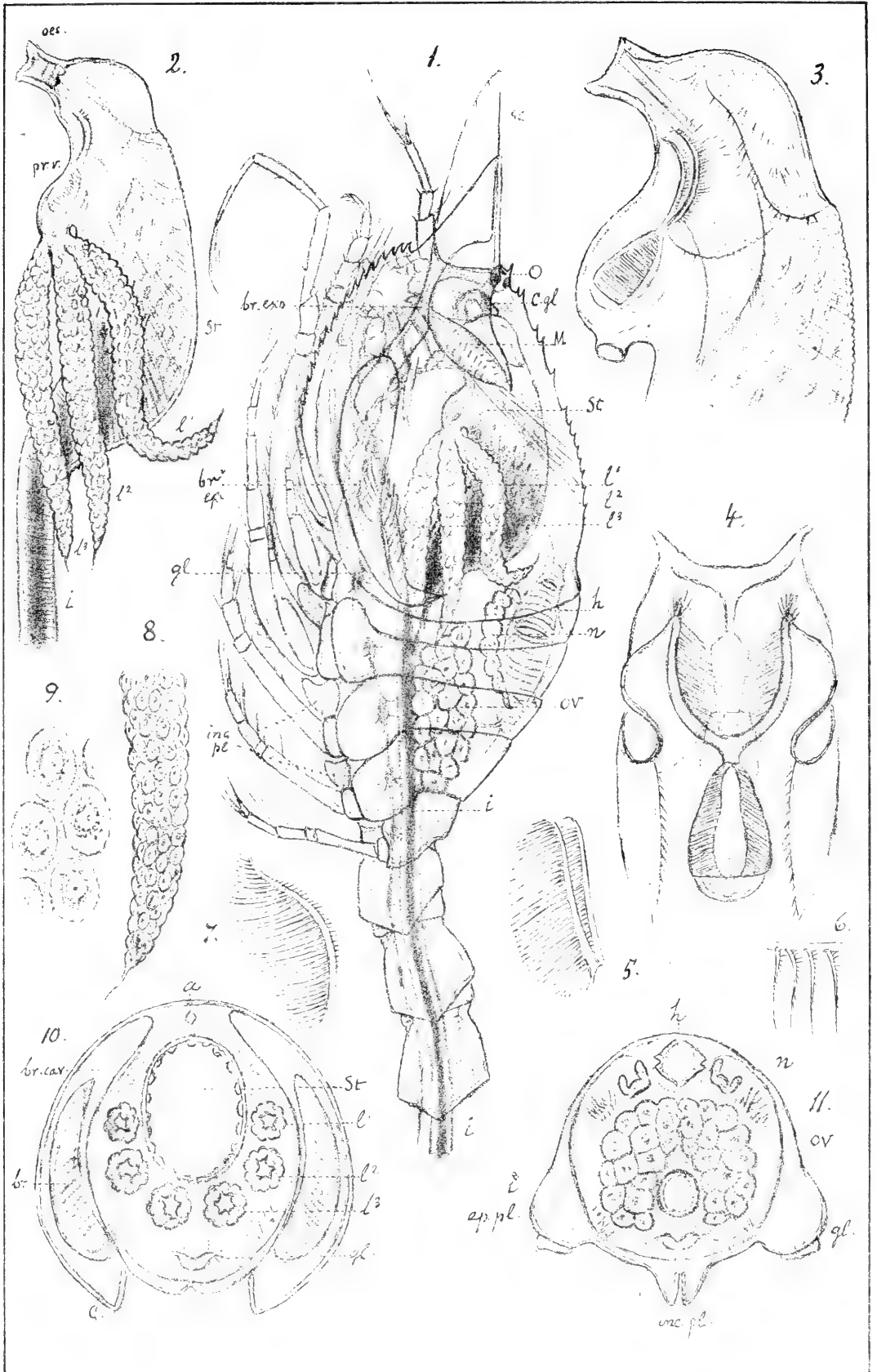
Diastylis Rathkei (Kröyer), *var.*; female.

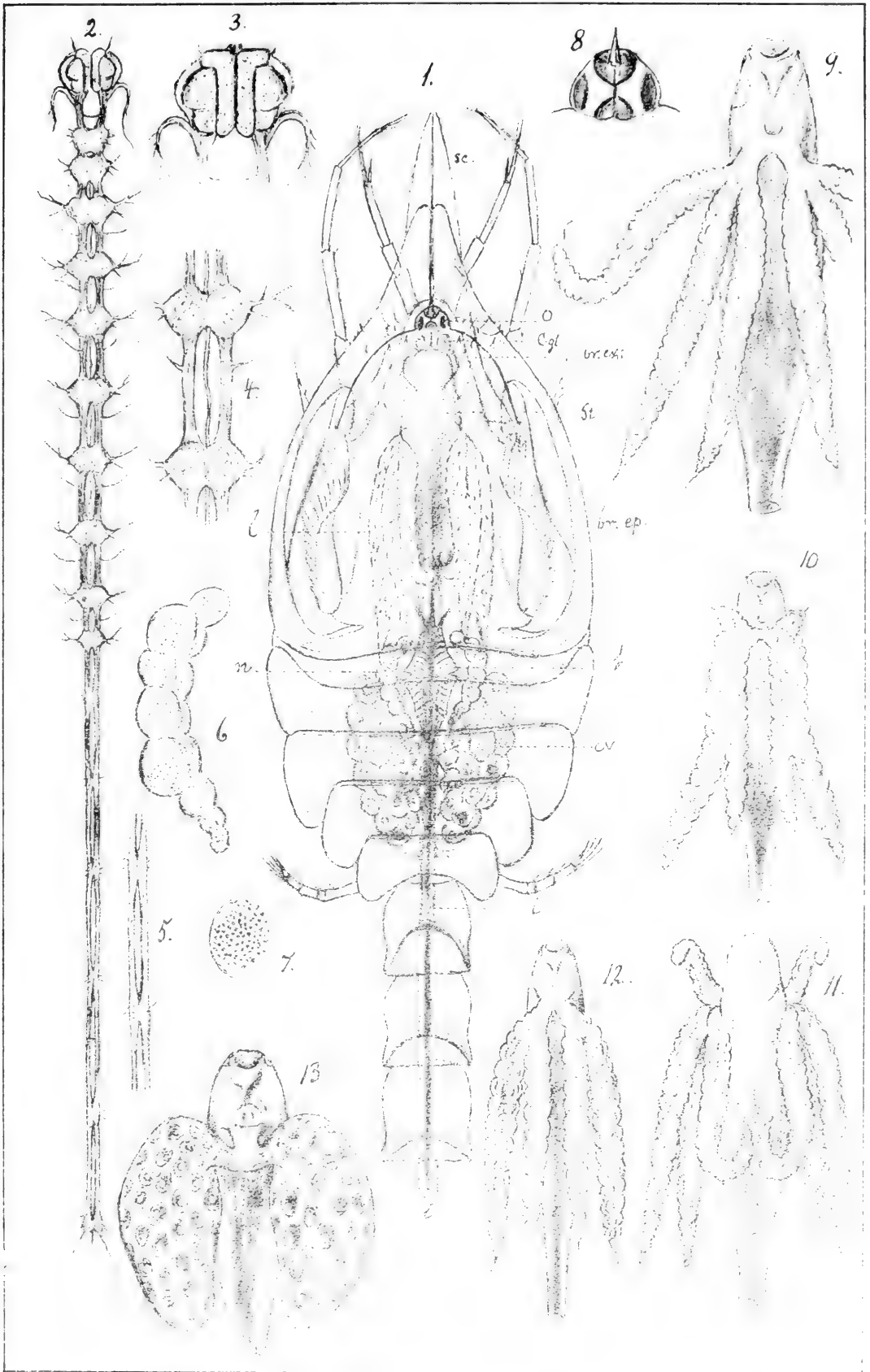
Pl. LXXI.

Diastylis Rathkei, *var.* (continued); female.

Pl. LXXII.

Diastylis Rathkei, *var.* (continued); adult male.

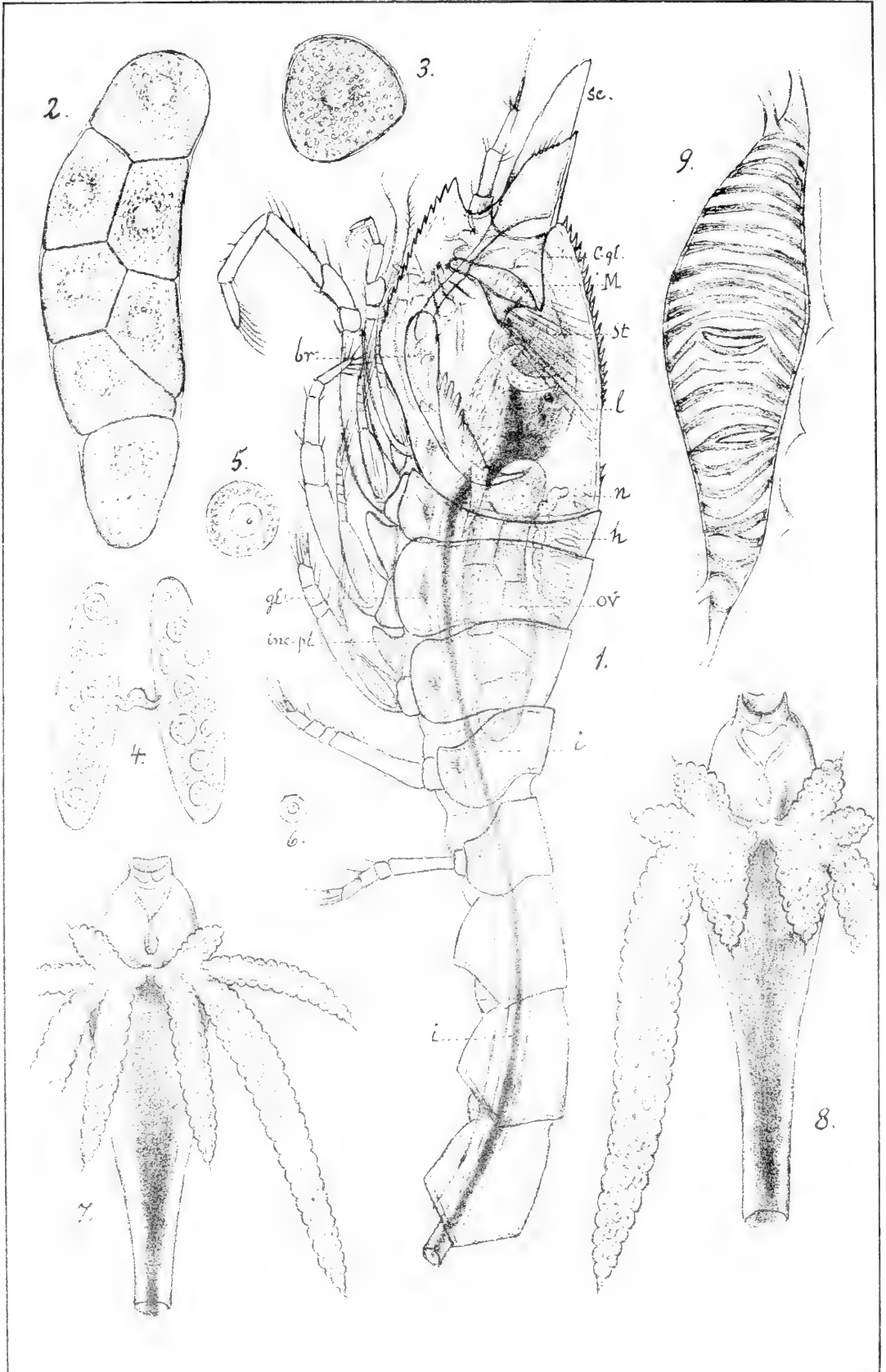


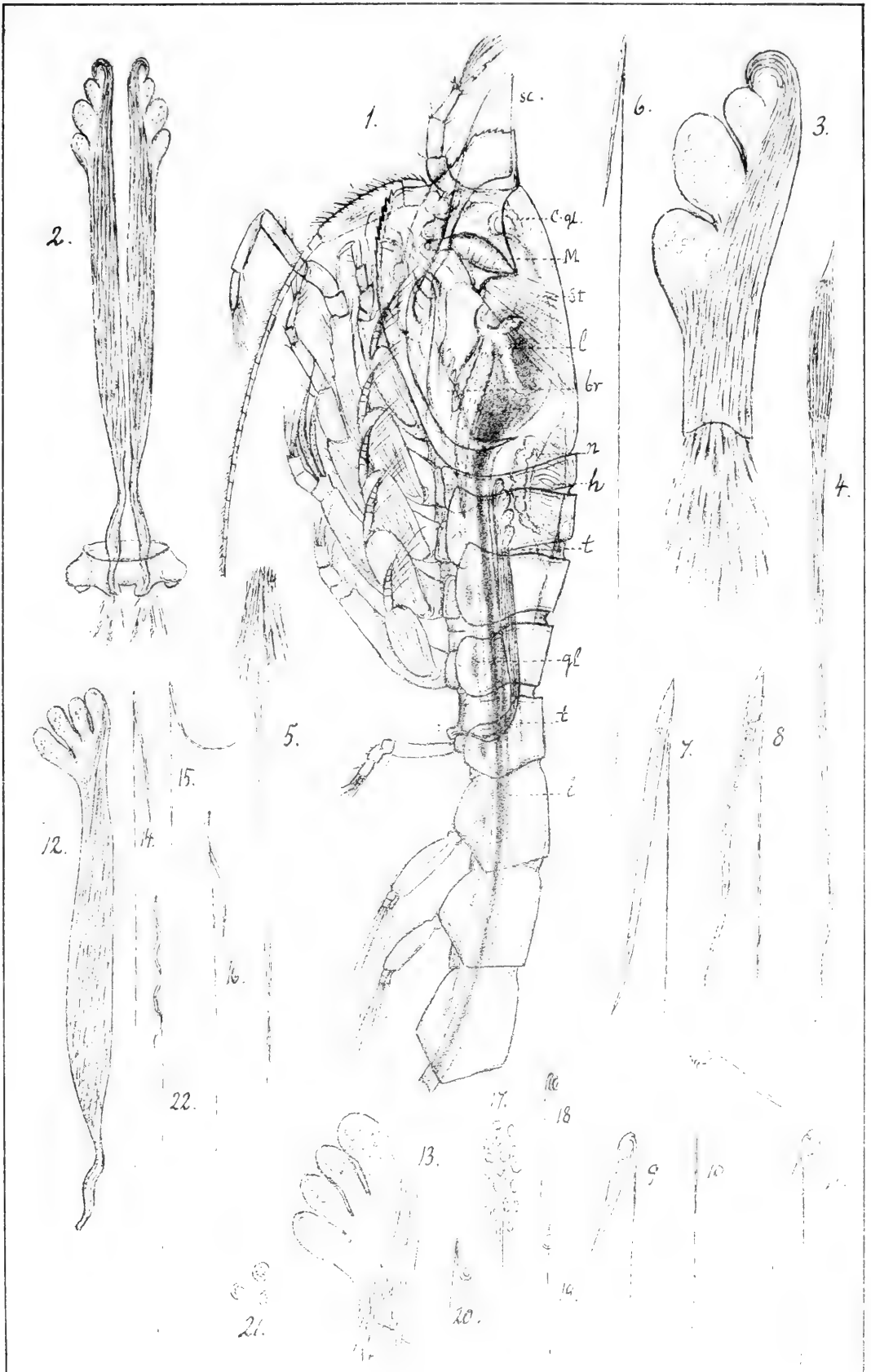


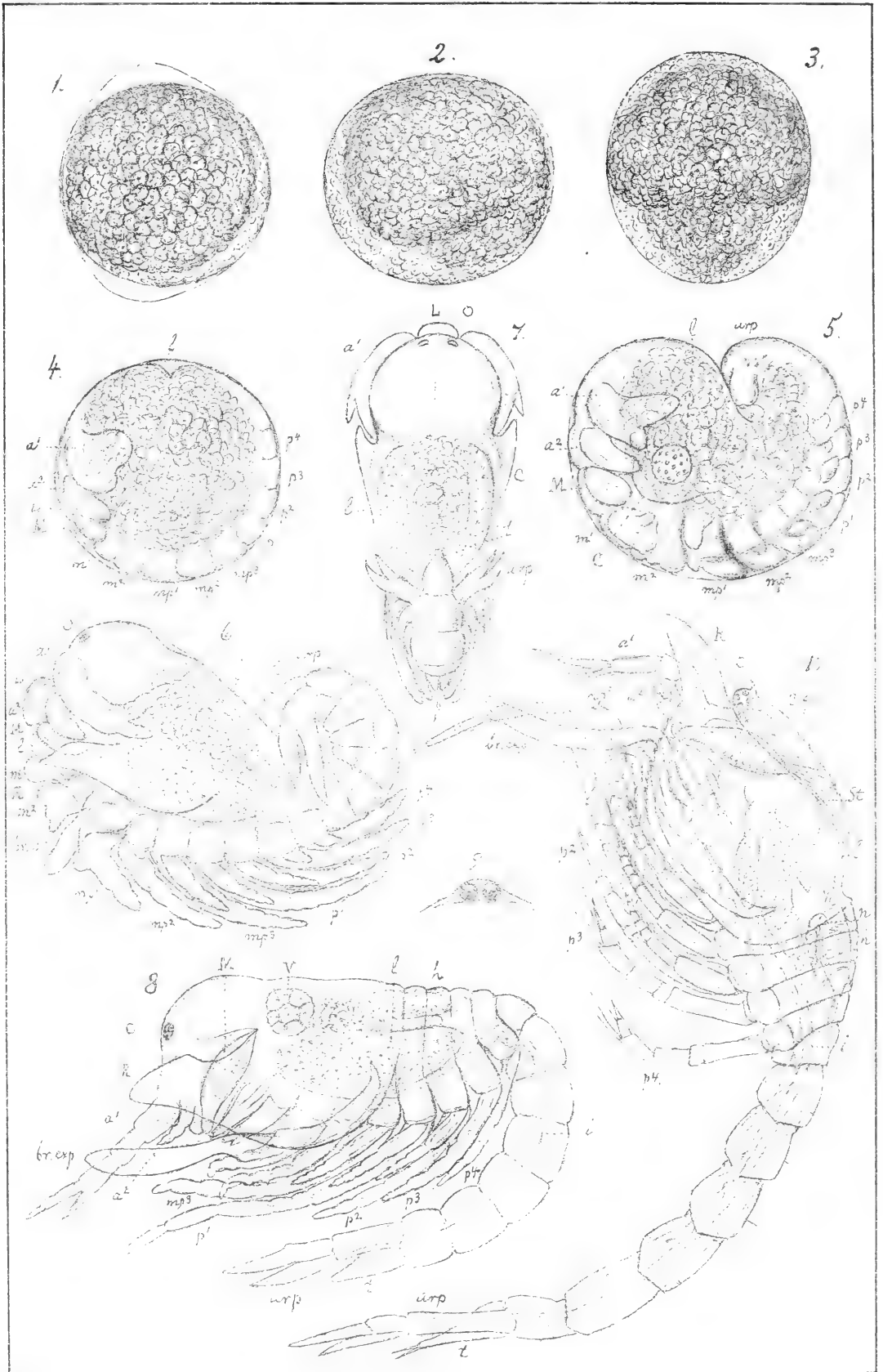
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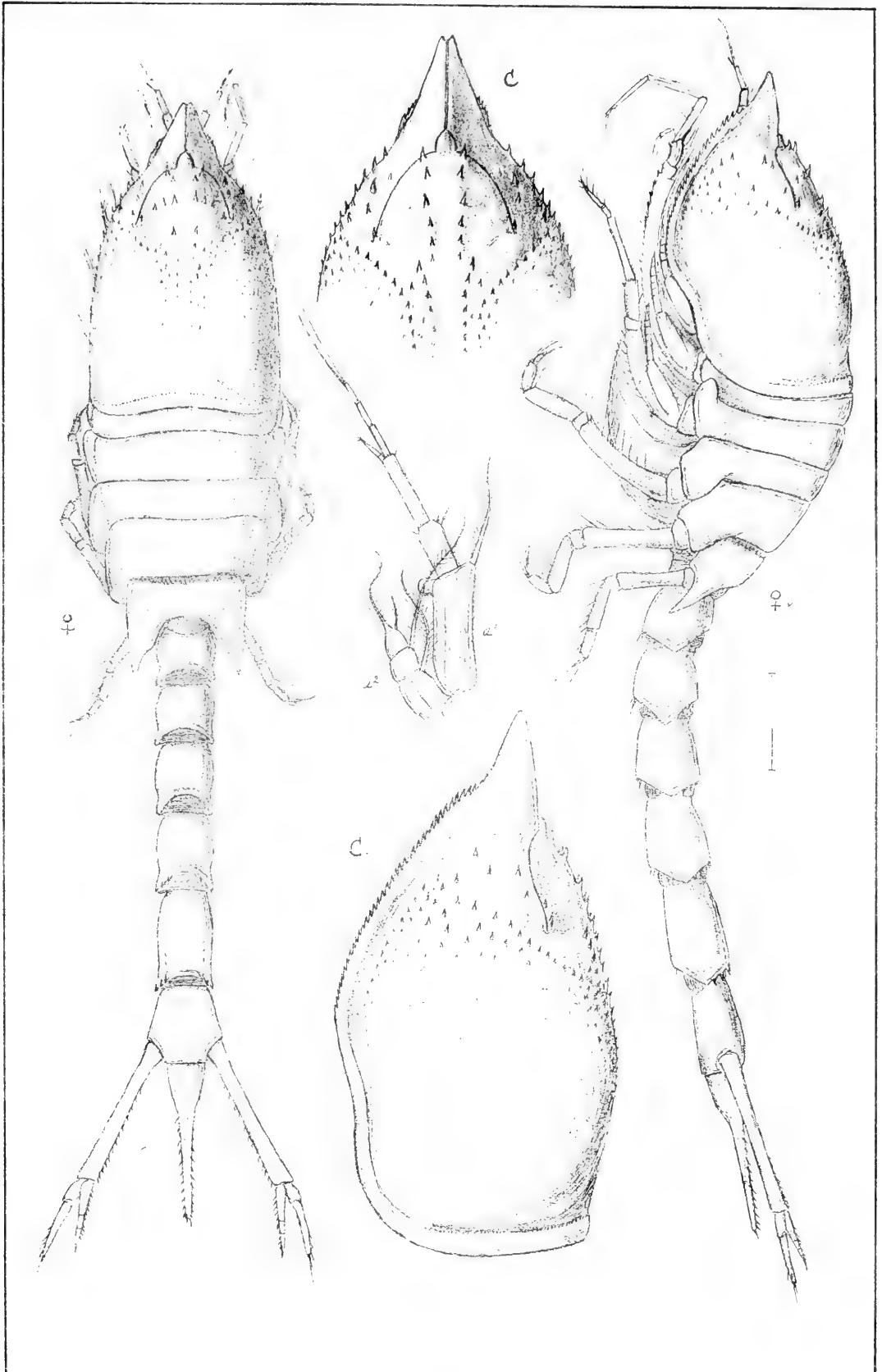
Diastylis - Cuma - Lamprops -
Pseudocuma - Campylaspis.

Act. Scand. Nat. Hist. Soc. 1895





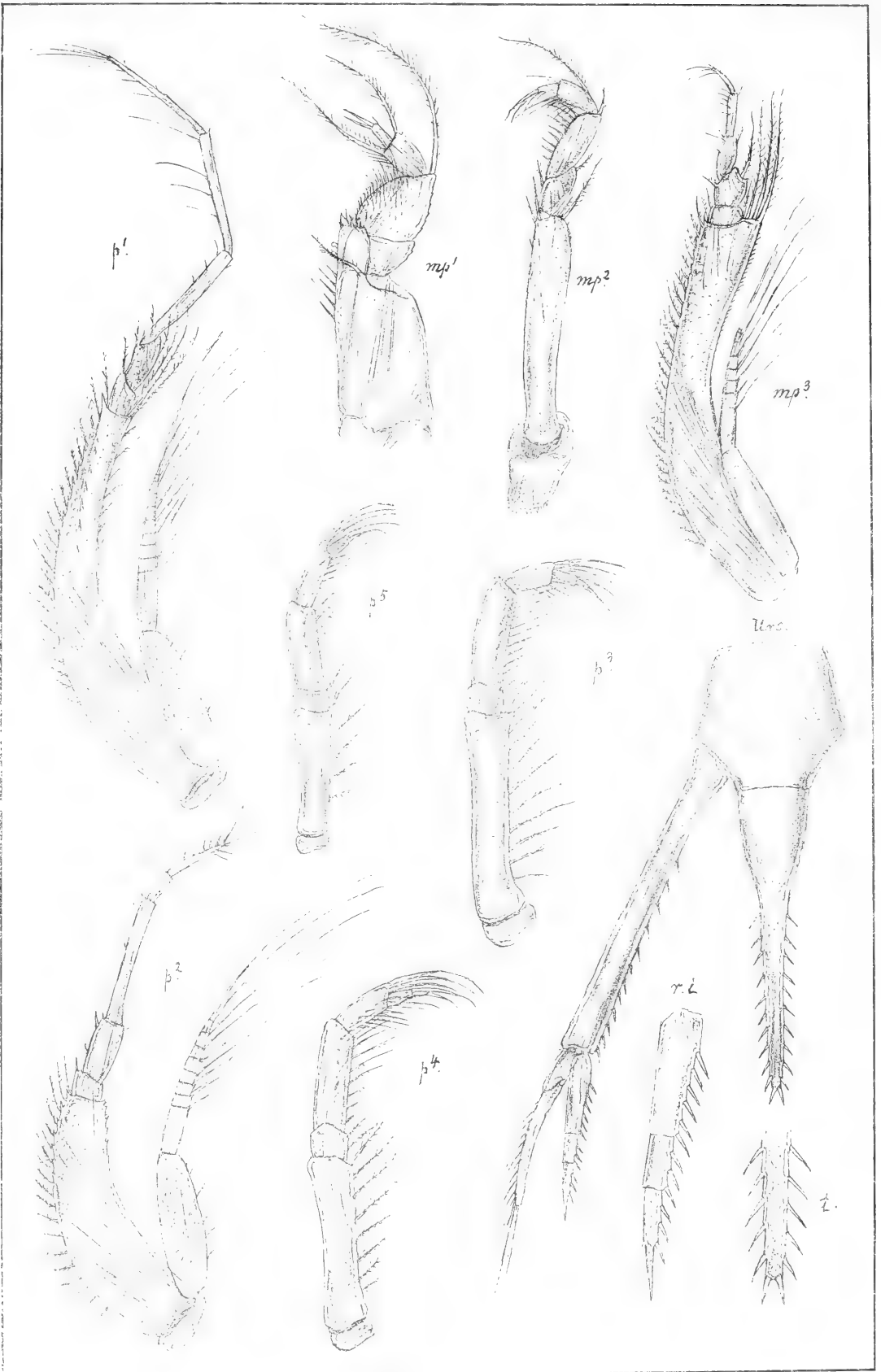




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Diastylis Rathkei, (Kröyer).
var.

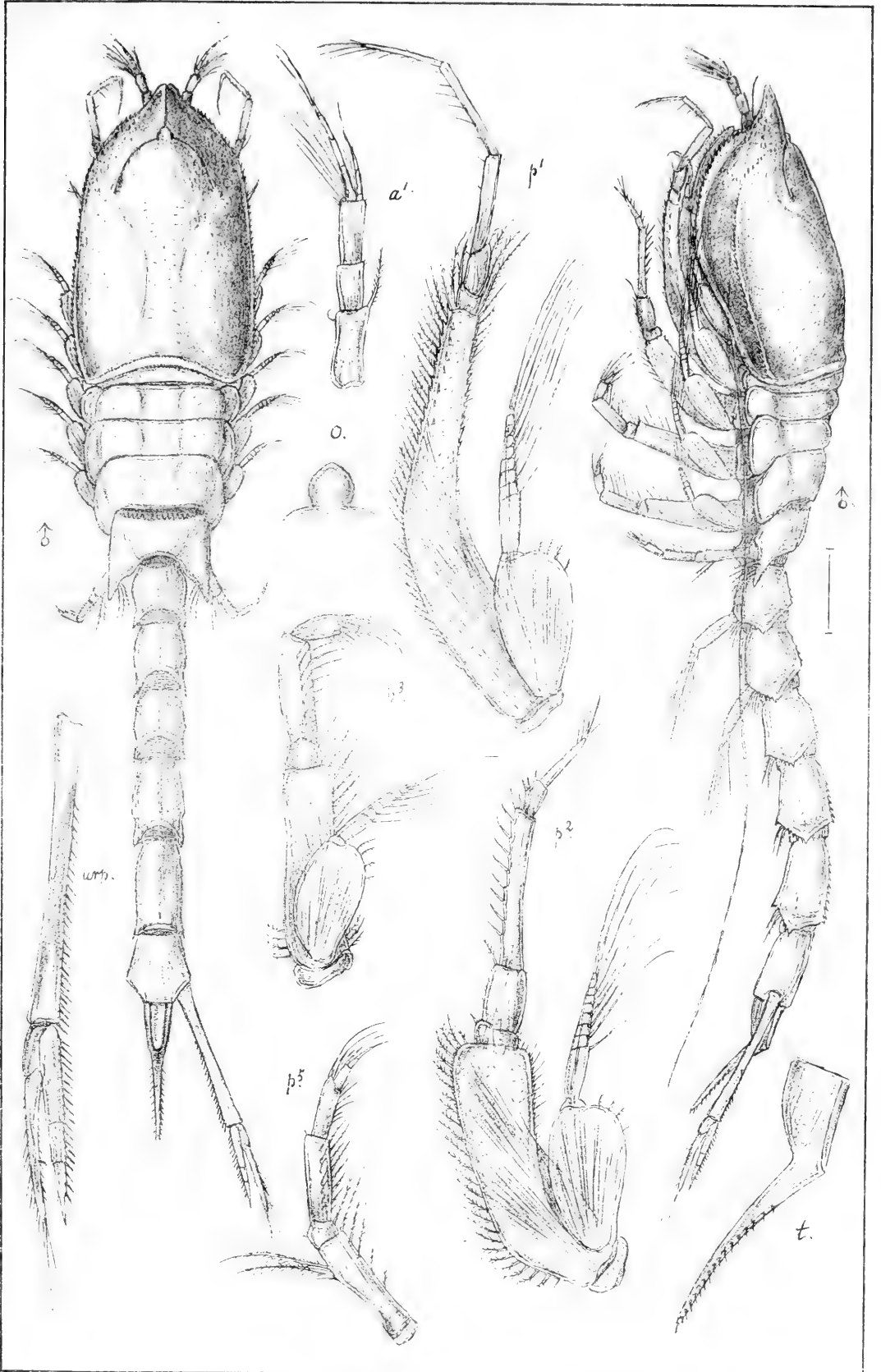
Trykt i den private Opmaaling, Chra



G. O. Sars autogr.

Diastylis Rathkei, (Kröyer). var.
(continued).

Trykt i den private Opmaaling, Chra.



G.O. Sars autogr.

Diastylis Rathkei, (Krøyer). var.
(adult male).

Trykt i den private Opmaaling, Chra

