

AN ACCOUNT
OF THE
CRUSTACEA
OF
NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY

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VOL. VIII

COPEPODA
MONSTRILLOIDA & NOTODELPHYOIDA

PARTS I & II

THAUMATOPSYLLIDÆ, MONSTRILLIDÆ,
NOTODELPHYIDÆ (part)

WITH 16 AUTOTYPIC PLATES



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INTRODUCTION.

In the present volume I propose to give an account of 2 anomalous groups of *Copepoda*, viz., the *Monstrilloida* and the *Notodelphyoida*, the systematic position of which has not been fully recognised by earlier authors. In the more recent classification of the Copepoda proposed by Giesbrecht, and now generally adopted by carcinologists, only the systematic rank of families is allotted to these groups, and they are both, together with several other heterogeneous families, comprised within the 2nd tribe of this suborder *Podoplea*, to which the name *Ampharthrandria* is given. I have otherwise shown, that the principles upon which Giesbrechts classification is founded do not at all hold good in every case, and this is also proved in regard to the Copepoda here in question. It may be that the name *Ampharthrandria* is applicable to the *Monstrilloida*; but this is by no means the case with the *Notodelphyoida*, this group comprising many forms with the anterior antennæ quite alike in the 2 sexes. Moreover, the genus *Thaumatopsyllus* among the *Monstrilloida* differs conspicuously even in the principal character by which the 2 suborders *Gymnoplea* and *Podoplea* are distinguished by Giesbrecht, viz., the mutual relation between the anterior and posterior divisions of the body. The many essential characters distinguishing the 2 groups here treated of, both from each other and from the other known Copepoda, have led me to the conclusion, that they ought to be raised to the rank of distinct divisions, to be again subdivided into real families. The relation of these divisions to other known groups of Copepoda is somewhat obscure, though in some instances a tendency towards the Cyclopoid type is unmistakable. On the other hand, by an extreme degradation of the whole body and its appendages, some forms belonging to the *Notodelphyoida* acquire an appearance, strongly recalling that of the *Lernæoida*. All the forms here in question are in some measure parasitic in habits. But the parasitism is of a very different kind in the

2 divisions. The *Monstrilloida* are, according to the interesting observations of Malaquin, in their juvenile state true endoparasites, living as simple, sac-like bodies in the blood-vessels of some invertebrate animals (Annelids), whereas in the adult state they are freely living pelagic animals provided with powerfully developed natatory appendages. The *Notodelphyoida*, on the other hand, are for whole their life confined to their hosts (simple and compound Accidians), all stages of growth being mostly found together in the branchial cavity of these Tunicata. Yet they do not seem, as a rule, to feed on the juices of their hosts, but more properly on the nourishing particles and small organisms introduced, together with the constantly renewed water, in the branchial cavity by the breathing process. Of course they cannot at all be regarded as true parasites, but more properly as commensals or messmates. Both divisions here treated of are well represented in the Fauna of Norway, and as there is some confusion in regard to the exact definition of the genera and species, and moreover the descriptions and figures given by earlier authors in many cases are very incomplete and partly erroneous, I think that a thorough revision of these 2 interesting groups, accompanied by good figures, cannot fail to be of interest.

MONSTRILLOIDA.

Remarks.—The most prominent morphological character distinguishing this group of Copepoda, is the total absence, in the adult state, of both the posterior antennæ and of any traces of oral appendages, as also of a functional alimentary canal. Of course the fully developed animal is quite incapable to feed in the ordinary manner, but may only subsist on the nourishing matter accumulated within the body-cavity during its juvenile parasitic existence, the adult stage being exclusively devoted to the propagation. The division *Monstrilloida* comprises as yet only a rather restricted number of forms, which all formerly were referred to a single genus, viz., *Monstrilla* of Dana, with which the genus *Thaumaleus* of Krøyer was considered to be identical. In recent times, it is true, a subdivision of the genus *Monstrilla* into 2 or 3 genera has been attempted, but these genera are so closely allied, that they at all events must be comprised within the same family. Yet an interesting new genus (*Thaumatopsyllus*), apparently referable to the *Monstrilloida*, has recently been added by the present author, and this genus is so very different from the other Monstrilloid genera, that it cannot by any means be included in the same family with them, but must be regarded as the type not only of a separate family, but even of a distinct section, for which I have proposed the name *Monstrilloida cyclopimorpha*. Of course the division *Monstrilloida* appears at present cleft into 2 well defined sections, the *M. cyclopimorpha* and the *M. genuina*; but each of these sections is as yet only represented by a single family.

Section 1.

Monstrilloida cyclopimorpha

Remarks.—The type of this section is the remarkable form described by the present author in another place under the name of *Thaumatopsyllus paradoxus*. The reception of this form within the division *Monstrilloida* appears to be warranted by the above-mentioned general morphological character: the total absence of both the posterior antennæ and of any oral appendages. Otherwise this form differs considerably from the Monstrilloid type.

Fam. Thaumatopsyllidæ.

Remarks.—As this family at present only comprises a single genus, it may be sufficient to give the characters of that genus.

Gen. *Thaumatopsyllus*, G. O. Sars, 1913.

Generic Characters.—Body of adult female cyclopid in shape, the anterior division being conspicuously dilated, the posterior slender and attenuated. Head consolidated with the 1st trunkal segment, and having the front produced below to a short and blunt rostral prominence. The 2 succeeding trunk-segments normally developed, the 2 posterior ones, however, abruptly much narrower and firmly connected with the tail, to form with it the posterior movable portion of the body. Tail proper composed in female of only 3 segments, the last extremely slender and narrow, rod-like. Caudal rami well

developed, with the normal number of setæ, Anterior antennæ composed of a limited number of well defined joints, and extended laterally. No traces of posterior antennæ and oral appendages observable, nor of any distinct oral tubule. Three pairs only of natatory legs present, the 2 posterior pairs of legs being quite rudimentary and of similar structure. Two ovisacs present in female.

Remarks.—In the above diagnosis I have attempted to give the most essential characters, by which the present genus distinguishes itself from the other known Monstrilloida. The mutual relation of the 2 chief divisions of the body is very peculiar, and does not agree either with that mentioned by Giesbrecht as characteristic to his suborder *Gymnoplea* or with that characterising the *Podoplea*, the movable articulation between the 2 divisions occurring in quite a different place, viz., at the junction between the penultimate and antepenultimate trunk-segments. This is indeed a quite unique character distinguishing this genus from any other form known to me. As anomalous characters may also here be named the presence of only 3 pairs of natatory legs, and the narrow rod-like shape of the last caudal segment. The genus comprises as yet only a single species, to be described below.

1. *Thaumatopsyllus paradoxus*, G. O. Sars.

(Pl. I.)

Thaumatopsyllus paradoxus, G. O. Sars, Arch. f. Mathem. og Naturvidenskab. Bd. XXXIII, No. 6, p. 5, w. plate.

Specific Characters.—*Female.* Body comparatively slender, with the anterior division somewhat depressed and oblong oval in outline. Cephalic segment very large and slightly contracted anteriorly, frontal part narrowly rounded. The 2 succeeding segments well developed, with the lateral parts closely contiguous and rounded behind. Penultimate trunk-segment scarcely more than half as broad as the preceding one; last segment still smaller. Tail exceedingly slender, almost attaining half the length of the body; genital segment slightly constricted in the middle; 2nd segment quite short and having the posterior edge somewhat produced dorsally; 3rd segment more than twice as long as the other 2 combined, and extremely narrow, rod-like, with the slightly dilated extremity transversely truncated. Caudal rami but slightly diverging and oblong quadrangular in form, being about 4 times as long as they are broad, and a little widening distally; seta of outer edge occurring about in the middle; apical setæ of moderate size and densely ciliated, the outermost one shorter than the other 3. Antennæ not nearly attaining the length of the cephalic

segment, and each composed of 9 joints clothed with scattered simple setæ; 3rd joint much the largest, the 6 outermost joints comparatively short and equal-sized. The 3 pairs of natatory legs normally developed and of essential same structure, with both rami 3-articulate and nearly of equal size. The last 2 pairs of legs very unlike the former, and reduced to simple small 3-articulate stems, with the middle joint very small, last rounded in shape and provided with 2 unequal apical spines. Ovisacs very large, rounded oval in form.

Body in the living animal highly transparent and nearly colourless, its anterior part being filled up with a number of clear oil-bubbles of unequal size, and partly of a light orange colour. Eye replaced by a comparatively large transverse patch of a light red pigment, in which, however, no trace of refracting elements could be detected.

Length of adult female 1.65 mm.

Male unknown.

Remarks.—The above-described form is easily recognisable from any of the other known Copepoda, both as regards its outward appearance and the structure of the several appendages. I am much inclined to believe, that its life-history will turn out to be a similar one to that stated by Malaquin for the *Monstrillidæ*, and that in the juvenile state this form leads a true parasitic existence within the body of some invertebrate animals.

Occurrence.—Three specimens only of this remarkable form, all of the female sex, have as yet come under my notice. One of them was taken, many years ago, in the Christiania Fjord, at Drøbak, the other 2 in the Trondhjem Fjord, at Selven. All 3 specimens were captured, together with other pelagic animals, by the aid of a plankton-net lowered to a depth of about 60 fathoms. The living animal was seen moving through the water in a similar jumping manner to that observed in most Cyclopoida. It was, however, by no means particularly agile in its movements.

Section 2.
Monstrilloida genuina.

Remarks.—In this section are comprised the typical Monstrilloida, the general characters of which coincide with those given below for the sole family as yet representing the section.

Fam. Monstrillidæ.

General Characters.—Body more or less slender and elongated, with the anterior division only slightly dilated and not sharply marked off from the posterior. Head and 1st trunkal segment completely coalesced, forming together a very large segment of a more or less cylindrical shape, and as a rule occupying rather more than half the body, its anterior extremity obtusely truncated, without any rostral prominence; ventral face of the segment in the greater extent of its length quite smooth, exhibiting no traces of either posterior antennæ or any oral appendages, being only provided in the median line with a small tubular process, from which a short canal leads to the inner substance of the body; the latter in female specimens retracted from the walls of the segment in a most peculiar manner, so as to form a rather narrow band-like chord passing through the axis of the segment. Exposed part of trunk composed of 4 well defined segments gradually diminishing in size behind. Tail poorly developed, with the number of segments more or less reduced, and exhibiting well marked sexual differences. Caudal rami, as a rule, short, but provided with strong plumose setæ, the number of which is somewhat variable in the

different genera. Eye, when present, exhibiting 3 highly refracting lenses, one ventral and 2 lateral, imbedded in a dark pigment. Anterior antennæ, unlike what is generally the case in Copepoda, extended straight forwards, and composed of a limited number of joints clothed with rather unequal setæ pointing in different directions, some of them being much elongated and finely ciliated, some others, attached to the terminal joint, exhibiting not seldom a peculiar dichotomous ramification; same antennæ in male distinctly hinged. Natatory legs present in the usual number, and very powerfully developed, with the basal part large and muscular and both rami 3-articulate. Last pair of legs in female represented on each side by a single more or less lamellar joint carrying a restricted number of plumose setæ; in male much reduced, or wholly absent. Alimentary canal quite obliterated. Ovaria, when fully developed, very massive, filling up the greater part of the body-cavity and extending anteriorly within the frontal part of the head; the ripe ova not included in any true ovisacs, but agglutinated to 2 slender juxtaposed spines or filaments issuing from the ventral face of the genital segment, these spines being in male replaced by a thickish, somewhat clavate appendage, into which the spermatophores are received before extrusion.

Remarks.—Of this family at first only 2 species were known, derived from 2 widely remote localities, the one recorded by Dana from the Sulu Sea as *Monstrilla viridis*, the other by Krøyer from the Norwegian coast as *Thaumaleus typicus*. These 2 species, though bearing very different names, are evidently nearly allied, and were also by most subsequent authors regarded as congeneric. In more recent times a considerable number of additional forms of the same remarkable type have been recorded from different parts of the oceans, and it appeared desirable to group these species according to some more conspicuous diversities found between them. Thereby the first step to a subdivision of the genus *Monstrilla* was intimated. Such a subdivision was indeed carried out in the year 1892 by Giesbrecht, who referred the Monstrillidæ at that time known to 2 nearly-allied genera, chiefly characterised by the segmentation of the tail and by the number of the caudal setæ. For the one of these genera he retained the old name *Monstrilla*, for the other he applied the name *Thaumaleus* proposed by Krøyer, and this arrangement has now generally been admitted by carcinologists. I am also of opinion that these 2 genera should be supported; but I am by no means prepared to consent with Giesbrecht in his application of the name *Thaumaleus* to the one of these genera. For it is quite certain, that the form recorded by Krøyer is not referable to Giesbrecht's genus, differing as it does,

just in one of the 2 principal characters by which that genus is distinguished from *Monstrilla*, viz., in the number of caudal setæ. Both according to the description given by Krøyer in "Naturhistorisk Tidsskrift" and to the figures in the Atlas to Gaimards voyage, the caudal rami in Krøyers species are each provided with 5 well-developed setæ, as in most species of the genus *Monstrilla*, whereas in Giesbrecht's genus the number of setæ is much reduced, only 3 such setæ occurring on each ramus (at last in female). In any case, if it should be found advisable to support the genus *Thaumaleus* of Krøyer, it must be confined to the species recorded by that author. Fortunately we have another generic name to replace that given by Giesbrecht to his genus, viz., *Cymbasoma*, proposed as early as the year 1888 by I. C. Thompson for a species (*rigidum*), which evidently is referable to Giesbrecht's genus. The genus *Hæmocera* of Malaquin I regard as synonymous with that genus. In addition to the 2 genera *Monstrilla* and *Cymbasoma*, I have found it advisable to establish another genus, *Monstrillopsis*, to include the anomalous species described by Scott under the name of *Monstrilla dubia*. The family Monstrillidæ thus at present comprises 3 genera, all of which are represented in the fauna of Norway.

Though I have not myself as yet had any opportunity to study the peculiar life-history of the Monstrillidæ, I think that a short resumé of the interesting investigations made in this respect by the French naturalist Malaquin¹⁾ may here be given. According to that distinguished author, the young live the eggs as small Nauplii, without mouth or alimentary canal, but provided in front with the usual 2 pairs of limbs (anterior and posterior antennæ) and behind them on each side with a hook-like appendage (mandibles). The Nauplii soon attach themselves to some polychæte Annelid and penetrate through the body-wall of the same, then entering the vascular system. By this process they lose completely all their appendages, and become converted to simple ovoid bodies merely consisting of an assemblage of indifferent embryonic cells surrounded by a thin cuticle. From the one end of these bodies 2 soft horn-like processes grow out, gradually increasing in length, and at last assuming the form of slender thread-like appendages. It is supposed that through these appendages the absorption of the blood-serum of the host is performed, and according to their position they may answer to the posterior antennæ. During the rapid growth of these endo-parasitic larvæ a remarkable differentiation take place in their interior, resulting in the formation of the characteristic and rather

1). See: Arch. Zool. Exp. (3), Vol. 9, 1901.

complicated body of a true Monstrillid. In the last larval stage the enclosed Monstrillid is very distinctly traced through the thin outer cuticle of the larva, filling up nearly the whole inner cavity, and exhibiting all the definitive appendages, as also distinct traces of the generative organs, at least the female ones. At this time the larva is ready to force its way out of the body of the host, and this is apparently accomplished by a burrowing action of the hind acutely produced extremity, which is surrounded with several rows of small hooklike spinules. After the escape of the larva its thin outer cuticle soon burst, and the enclosed Monstrillid is thus allowed to emerge, unfolding its several appendages. Its movements are at first rather slow, but very soon, by a single moult, it acquires its full development, moving quickly about, to commence its free pelagic existence.

Gen. 2. **Monstrilla**, Dana, 1848.

Syn: ? *Thaumaleus*, Kröyer (not Giesbrecht).

Generic Characters.—Body as a rule very slender and elongated, especially in female, with the cephalic segment in most cases occupying rather more than half its length and more or less cylindrical in shape; exposed part of trunk gradually narrowed behind, with the lateral parts of the segments rounded off. Tail composed in female of 3, in male of 4 well defined segments, the last one rather small and obtusely truncated behind.* Caudal rami sublamellar, each provided in female with 5 or 6 setæ, one of which is generally shorter than the others and attached more dorsally; those in male of same appearance as in female, but lacking one of the setæ. Eye in most of the species imperfectly developed. Oral tubule generally far remote from the frontal part of the head. Antennæ more or less elongated, with the joints generally imperfectly defined in female. Natatory legs with the basal part very massiv, rami comparatively short, both clothed inside and at the end with long plumose setæ; outer ramus somewhat longer than the inner and only provided with 2 small spines outside, the one attached to the 1st joint, the other to the end of the last joint. Last pair of legs in female sublamellar and somewhat extended laterally, inner edge more or less expanded, extremity slightly exserted and provided with 3 (in some cases only 2) plumose setæ; those in male much reduced in size, knob-like, and tipped with one or two slender setæ.

Remarks.—The present genus was established as early as in the year 1848 by Dana, and may be regarded as the type not only of the family Monstrillidæ, but also of the whole division here treated of. It is chiefly distin-

guished from the other 2 genera comprised within the present family by the more complete segmentation of the tail and the increased number of caudal setæ. Another character by which the species of this genus may be readily recognised, is the position of the oral tubule, which is more or less far remote from the frontal part of the head, whereas in the other 2 genera it generally occurs in close approximation to that part.

Seven Norwegian species referable to this genus will be described in the sequel, one of them being, however, somewhat doubtful and only observed in the male sex.

2. *Monstrilla longicornis*, Thompson.

(Pl. II & III).

Monstrilla longicornis, I. C. Thompson, Trans. Biol. Soc. Liverpool, Vol IV, p. 119, Pl. IV, figs. 1, 2, 4 (♂).

Syn: *Monstrilla intermedia*, Aurivillius.

Specific Characters.—*Female.* Body moderately slender, with rather coarse integuments, which exhibit everywhere a finely granular or dotted surface. Cephalic segment occupying about half the length of the body, and almost of equal width throughout, though, seen dorsally, exhibiting somewhat behind the middle a slight but easily observable dilatation, frontal part bluntly truncated. Tail about equalling half the length of the exposed part of the trunk; genital segment comparatively large, being fully as long as the remaining part of the tail, and oblong quadrangular in shape, with a well marked transverse suture in the middle of the dorsal face; ovigerous spines about twice the length of the tail. Caudal rami about equalling in length the last 2 segments combined, and only slightly divergent, each provided with 5 strong plumose setæ of nearly equal size, the outermost one attached to a well-marked ledge of the outer edge, the others to the somewhat obliquely rounded apex. Eye imperfectly developed, without any trace of refracting elements, and only replaced by a diffuse yellowish pigment. Antennæ rather slender and elongated, though scarcely exceeding in length the cephalic segment, and each apparently composed of 5 joints, of which, however, only the 1st is distinctly defined, the others being confluent and only indicated by slight constrictions of the antenna; most of the setæ attached around the middle of the fusiform terminal joint reachly ramified. Oral tubule well marked and occurring somewhat behind the middle of the cephalic segment. Natatory legs all of the very same structure and also of about equal size; 2nd basal segment not very sharply defined from the 1st, and armed inside with 2 small juxtaposed denticles; terminal joint of outer

ramus rather produced, being fully twice as long as the middle one, and having the outer edge divided into 4 very distinctly marked crenulations. Last pair of legs rather broad at the base, but having the outer part abruptly narrowed and provided at the obtusely rounded extremity with 3 ciliated setæ, the innermost of which is much smaller than the other 2; inner expansion almost rectangular and carrying a single, but well developed seta.

Male considerably smaller than female and of somewhat shorter and stouter form of the body, but exhibiting a very similar shape of the cephalic segment. Tail comparatively more slender than in female, and composed of 4 well defined segments of nearly equal length, the 1st, as usual, produced below to a club-like copulative appendage terminating in 2 short diverging rami, each armed at the end with a short spine. Caudal rami of a similar shape to that in female, but with one of the apical setæ absent. Antennæ more strongly built than in female and having the joints more distinctly defined, being moreover conspicuously hinged, the hinge occurring between the last 2 joints. Natatory legs of exactly same structure as in female. Last pair of legs, however, much reduced in size, forming 2 small knob-like prominences issuing from a common base, each prominence tipped by 2 (in some cases only 1) slender setæ.

Body in both sexes of a yellowish grey colour, and on the whole less transparent than in most other species.

Length of adult female 3.50 mm., of male 2.30 mm.

Remarks.—This species was established in the year 1890 by J. C. Thompson, and was only based on a solitary male specimen taken by him off the Puffin Islands. Subsequently, however, Th. Scott recorded this form from many other localities, and has given in the report of the Fishery Board for Scotland (1904) good descriptions and figures of both sexes. He is of opinion that Giesbrecht's species, *M. longiremis*, is identical with that observed by him; but this is certainly not the case, as will be shown further on. The present species may be easily distinguished from its nearest allies by the somewhat robust body and the rather coarse and distinctly granular integuments. Two other characters, both derived from the structure of the natatory legs, may also here be named, viz., the presence inside the 2nd basal segment of 2 well defined denticles, and the very conspicuous crenulation of the outer edge on the terminal joint of the outer ramus. These characters are pretty constant and found quite alike in both sexes. The form recorded by Aurivillius under the name of *M. intermedia* is identical with the present species.

Occurrence.—I have met with this form occasionally in several places, both on the south and west coast of Norway, among other pelagic animals

taken by the aid of the tow-net near the surface of the sea. The movements of the animal are very rapid, and are performed in abrupt bounds, whereby the body is kept in a more or less erect position. Male specimens seem to occur in nearly same number as the females.

Distribution. British Isles (Thompson, Scott), Skagerak (Aurivillius).

3. *Monstrilla longiremis*, Giesbrecht.

(Pl. IV & V)

Monstrilla longiremis, Giesbrecht, Pelagische Copepoden des Golfes von Neapel, p. 589, Pl. 46, figs. 10, 14, 22, 37, 41.

Specific Characters.—Female. Body considerably more slender than in the preceding species, with thinner and scarcely at all granular integuments. Cephalic segment occupying rather more than half the length of the body, and slightly narrowed in its anterior part, with no distinct dilatation in the middle. Tail agreeing with that in *M. longicornis*, as regards its relativ size and its segmentation, but having the ovigerous spines considerably more elongate. Caudal rami comparatively narrower than in that species and remarkably divergent; number of marginal setæ, as in *M. longicornis*, 5 on each ramus, the innermost but one conspicuously shorter than the others. Eye inconspicuous. Antennæ exceedingly slender and elongated, considerably exceeding in length the cephalic segment, and, as in the preceding species, having all the joints, except the 1st, confluent. Oral tubule rather small, and occurring about in the middle of the cephalic segment. Natatory legs resembling in structure those in *M. longicornis*, but differing in the presence of only a single denticle inside the 2nd basal segment, and in the total absence of any crenulations on the outer edge of the terminal joint of the outer ramus. Last pair of legs comparatively narrower, with the inner expansion less prominent and evenly rounded off; number of marginal setæ as in *M. longicornis*. Ova attached to the genital spines very numerous, and in some cases accumulated to form an oblong oval mass extending far beyond the limits of the body.

Male of rather small size, as compared with the female, but exhibiting a much similar slender and narrow form of the body. Cephalic segment nearly perfectly cylindrical in shape and exceeding somewhat in length the remaining part of the body. Tail, as in the male of *M. longicornis*, distinctly 4-articulate, with the copulative appendage of a very similar structure. Caudal rami agreeing in shape with those in female and spread out in the same remarkable manner, each of them, however, only provided with 4 setæ. Antennæ much more slender than in the male of *M. longicornis*, with the 2nd joint of

unusual length, otherwise built in a much similar manner. Natatory legs exactly as in female. Last pair of legs, however, very small, knob-like, each only tipped with a single slender seta.

Body in both sexes rather pellucid with only a very slight yellow tinge, and provided in some places with a few small pigmentary patches of a darker colour.

Length of adult female generally about 3 mm., though in some instances reaching 3.70 mm.; that of male scarcely attaining 2 mm.

Remarks.—The above-described form is unquestionably the same as that recorded by Giesbrecht from the Mediterranean, the identity of both being at once seen by a comparison of the figures here given with those in Giesbrecht's work. It is true that the present form in several respects shows a near relationship to *M. longicornis*; but I think that the above given descriptions of these 2 forms will prove them to be in reality specifically distinct.

Occurrence.—Several specimens of this form have been taken by me at different times and in different places on the Norwegian coast, from the Christiania Fjord and northwards to Kvalø. Only a single male has, however, as yet come under my notice, all the other specimens were of the female sex.

Distribution.—Mediterranean (Giesbrecht).

4. *Monstrilla clavata*, G. O. Sars, n. sp.

(Pl. VI)

Specific Characters.—*Female.* Body rather stout and clumsy, being considerably dilated in its anterior part and viewed laterally, of a pronouncedly clavate shape. Cephalic segment very large, occupying rather more than half the length of the body, and having its greatest width about in the middle, dorsal face remarkably vaulted in front. Tail about half the length of the exposed part of the trunk, and on the whole resembling in structure that in the 2 preceding species; ovigerous spines rather produced, being fully 3 times as long as the tail. Caudal rami exceeding somewhat in length the last 2 segments combined, and only slightly divergent, each, as in the 2 preceding species, provided with 5 setæ, the innermost but one being, however, considerably shorter than the others. Eye inconspicuous. Antennæ not nearly attaining the length of the cephalic segment, otherwise built in much the same manner as in the 2 preceding species. Oral tubule rather prominent and occurring somewhat behind the middle of the cephalic segment. Natatory legs, as in *M. longiremis*, armed inside the 2nd basal segment with a single well-marked denticle, terminal joint of outer ramus with a slight indication of a crenulation

of the outer edge. Last pair of legs very similar in shape to those in *M. longicornis*, the inner expansion being rather prominent.

Body in the living animal whitish pellucid, and ornamented with irregular patches of a light reddish brown or chestnut-coloured pigment.

Length of adult female 4.50 mm.

Male unknown.

Remarks.—This is much the largest of the species observed by me, and I therefore at first believed it to be the *M. grandis* of Giesbrecht. On a closer examination I have, however, found it to differ in some respects very essentially from that species, being in reality much more nearly related to the 2 preceding species, though easily distinguishable from them by the rather different shape of the body.

Occurrence.—A solitary female specimen of this form was taken, many years ago, at Hvalør, outside the Christiania Fjord.

5. *Monstrilla leucopis*, G. O. Sars, n. sp.

(Pl. VII)

Specific Characters.—*Female.* Body exceedingly slender and elongated, resembling somewhat in shape that of *M. longiremis*. Cephalic segment considerably exceeding half the length of the body, and of a narrow cylindrical form. Tail comparatively short, scarcely attaining half the length of the exposed part of the trunk; genital segment rather dilated at the base, and without any trace of a dorsal suture; ovigerous spines of moderate length. Caudal rami rather large, exceeding in length the last 2 segments combined, and only slightly divergent, inner edge perfectly straight, outer considerably protuberant in front of the middle; each ramus provided with 5 setæ, 3 of which issue from the narrowly rounded apex, the other 2 from the outer edge, the latter of very unequal size, the proximal one being normally developed, whereas the distal one is greatly reduced, and only slightly exceeds in length the corresponding ramus. Eye inconspicuous, and replaced by an opaque whitish substance apparently answering to the ocular pigment. Antennæ rather slender, though not nearly attaining the length of the cephalic segment, and having their 5 joints more distinctly defined than in the preceding species, none of the setæ attached to the terminal joint ramified. Oral tubule rather small, and occurring somewhat in front of the middle of the cephalic segment. Natatory legs without any denticle inside the 2nd basal segment, outer ramus rather produced and having the outer edge of the terminal joint perfectly

smooth. Last pair of legs gradually narrowed distally, and only provided with 2 apical setæ, inner edge scarcely expanded.

Male much smaller than female, but exhibiting a very similar slender form of the body. Tail, as usual, composed of 4 well defined segments, the 1st of which is the largest, and is produced below to a rather large and prominent copulative appendage of an oblong oval form and armed on each side with a straight rod-like spine. Caudal rami of the very same shape as in the female, and having the outermost but one of the setæ reduced in a similar manner, differing, however, as in the males of the preceding species, in the absence of one of the apical setæ. Anterior antennæ hinged in the usual manner. Last pair of legs reduced to 2 very small knob-like prominences, each tipped with a single slender seta.

Body (in female) highly transparent and ornamented in some places with pigmentary patches of a light reddish colour. Length of adult female reaching to 3.30 mm.; that of male scarcely exceeding 1.60 mm.

Remarks.—I have been in some doubt, if not the above-described form should be the same as that recorded by Scott under the name of *M. anglica* Lubbock. Indeed, in the structure of the last pair of legs and the peculiar reduction of the outermost but one of the caudal setæ, both these forms seem to agree pretty well. On the other hand, is the general shape of the body, to judge from the figure given by Scott, rather unlike, and another very essential difference is found as regards the number of the caudal setæ, which, both according to the description and the figure given by Scott, is stated to be 6 on each ramus in the form observed by him. In any case the specific name *anglica* cannot be applied either to the present form, or to that observed by Scott, as it seems evident that Lubbock's species is different from both of them. I have retained for the species here treated of the name assigned to it long ago in my notes.

Occurrence.—Some few specimens of this form, among them a single male, were collected, many years ago, at Kvalø on the Nordland coast.

6. *Monstrilla gracilicauda*, Giesbrecht.

(Pl. VIII)

Monstrilla gracilicauda, Giesbrecht. Pelagische Copepoden des Golfes von Neapel, p. 587, Pl. 46, figs. 9, 16, 18, 29, 32, 43.

Specific Characters.—*Female.* Body moderately slender, with the anterior division slightly dilated in the middle. Cephalic segment about occupying half

the length of the body, and, viewed dorsally, exhibiting a very slight dilatation in front of the middle, frontal edge somewhat produced between the insertion of the antennæ. Tail exceeding half the length of the exposed part of the trunk; genital segment rather large, being considerably longer than the remaining part of the tail, and gradually narrowed behind, dorsal face with a very slight transverse suture in the middle; ovigerous spines unusually short. Caudal rami comparatively small and somewhat divergent, each provided with 6 setæ, one of which, however, is very short and attached somewhat dorsally. Eye easily observable in the living animal, though of a somewhat incomplete structure, lateral lenses small and rather remote from each other, being connected by a narrow stripe of dark pigment, ventral lens apparently imperfectly developed. Antennæ rather shorter than in the species described in the preceding pages, not even attaining half the length of the cephalic segment, and only composed of 4 joints, the last of which is about as long as the other 3 combined and somewhat fusiform in shape, with none of the setæ ramified. Oral tubule occurring unusually far in front, at about the end of the first $\frac{1}{3}$ of the cephalic segment. Natatory legs without any denticle inside the 2nd basal segment, outer ramus considerably longer than the inner and having the terminal joint well developed, with the outer edge perfectly smooth. Last pair of legs somewhat clavate in outline, the inner edge forming a rounded expansion immediately inside the extremity, apical setæ 3 in number and of nearly equal size.

Body in the living animal rather transparent and in some places tinged with a light yellow pigment.

Length of adult female reaching to 3.55 mm.

Male unknown.

Remarks.—The present species is easily distinguished from those described in the preceding pages by the comparatively shorter antennæ, the position of the oral tubule, and the shape of the last pair of legs. The tail, moreover, appears more elongate and the genital segment of larger size than in those species.

Occurrence.—Some few specimens of this form, all of the female sex, were collected, many years ago, in 2 different places on the Nordland coast, viz., Valdersund and Kvalø.

Distribution.—Mediterranean (Giesbrecht) Scottish coast (Scott).

7. *Monstrilla helgolandica*, Claus.

(Pl. IX)

Monstrilla helgolandica, Claus. Die freilebenden Copepoden, p. 165, Pl. 12, fig. 9.

Specific Characters.—*Female.* Body comparatively short and stout, and somewhat dilated in its anterior part. Cephalic segment about occupying half the length of the body and, viewed dorsally, exhibiting a somewhat fusiform shape, with the greatest width a little in front of the middle and almost attaining half the length. Tail of a similar shape to that in *M. gracilicauda*, the genital segment being rather large and gradually narrowed behind; ovigerous spines of moderate length. Caudal rami considerably divergent, and narrow oblong in shape, each provided with 6 setæ of somewhat unequal length, one of them, attached somewhat dorsally, being very small, that next to it on the outer side somewhat shorter than the 4 remaining ones, all the setæ issuing from the outermost rounded part of the ramus. Eye easily observable, and having all 3 lenses distinctly developed. Antennæ scarcely attaining half the length of the cephalic segment, and, as in *M. gracilicauda*, only composed of 4 joints. Oral tubule well marked, and occurring about in the middle of the cephalic segment. Natatory legs without any denticle inside the 2nd basal segment, outer ramus less elongate than in the other species, with the terminal joint of smaller size. Last pair of legs rather unlike those in the other known species, each forming a narrow cylindrical stem, angularly bent in the middle and tipped with 2 subequal setæ.

Body very transparent in its anterior part, but behind tinged with a dark brownish pigment.

Length of adult female scarcely exceeding 1.40 mm.

Male unknown.

Remarks.—This is a very small-sized species, and may moreover be easily recognised by the unusual short and stout form of the body, as also by the structure of the caudal rami and that of the last pair of legs. The form recorded by Bourne as *M. helgolandica* is quite certainly not that species, but more properly referable to *M. longiremis* Giesbrecht.

Occurrence.—Two female specimens only of this form have as yet come under my notice. They were taken, many years ago, at Christiansund, west coast of Norway.

Distribution.—Helgoland (Claus), Skagerak (Timm).

8. *Monstrilla serricornis*, G. O. Sars, n. sp.

(Pl. X, fig. 1).

Specific Characters.—*Male.* Body comparatively short and stout, and, seen laterally exhibiting a somewhat clavate shape. Cephalic segment shorter than usual, only slightly exceeding in length the exposed part of the trunk and, seen dorsally, nearly of equal width throughout, its ventral face forming anteriorly a rather prominent gibbous convexity, but without any distinctly marked oral tubule. Tail rather narrow, and composed of 4 well defined segments, the 1st of which is produced below to a sub-clavate copulative appendage provided at the end on each side with a short auriculiform lobe. Caudal rami comparatively small and somewhat divergent, each having the form of a rounded oval lamella edged with 5 subequal setæ. Eye inconspicuous. Antennæ about equalling in length $\frac{2}{3}$ of the cephalic segment, and rather strongly built, being composed of 5 well defined joints, the last of which is, as usual, very movably articulated to the preceding one, and somewhat knife-shaped, with the inner sharpened edge divided at the extremity into 5 small recurved denticles. Natatory legs of the usual structure. 5th pair of legs wholly absent. Colour not yet ascertained. Length of the body 1.75 mm.

Female unknown

Remarks.—It is only provisionally that I refer the above-described remarkable form to the genus *Monstrilla*, from which it in some respects seems to differ rather conspicuously. As, however, only the one sex as yet has been observed, its true relationship cannot at present be fully made out. The peculiar armature of the antennæ may suffice to distinguish at once this form from any of the hitherto known *Monstrillidæ*.

Occurrence.—Two specimens only of the present form have as yet come under my notice, both of the male sex and exactly agreeing with each other. The one was taken at Bukken, outside the Stavanger Fjord, the other at Kvalø, on the Nordland coast.

Gen. 3. *Cymbasoma*, Thompson, 1888.

Syn: *Thamaleus*, Giesbrecht (not Kröyer).

„ *Hæmocera*, Malaquin.

Generic Characters.—General form of the body resembling that in *Monstrilla*. Tail however having the number of segments reduced in both sexes, only 2 segments being present in female and 3 in male. Caudal rami com-

paratively short and more or less pronouncedly club-shaped, each ramus provided in female with only 3 distinctly developed setæ, whereas in male, contrary to what is the case in *Monstrilla*, their number is generally increased by one additional seta. Eye as a rule well developed. Antennæ rather short in female and only composed of 4 joints, in male much more elongate, and distinctly 5-articulate, with a well-marked hinge between the last 2 joints. Oral tubule generally occurring far in front, in close approximation to the frontal part of the head. Natatory legs built in the usual manner. Last pair of legs in female comparatively short, but provided inside with a well defined lobe; in male wholly absent.

Remarks.—This genus was proposed in the year 1888 by J. C. Thompson, to include a peculiar Copepod (*C. rigidum*), of which at first only a single female specimen was found. As, on a closer examination of several other specimens taken by the same author partly in the Mediterranean, partly on the British coast, the near relationship of this form to the species at that time referred to the genus *Monstrilla* of Dana was recognised, the generic name *Cymbasoma* was subsequently withdrawn in favour of that of *Monstrilla*. By the subdivision of the latter genus into 2 nearly-allied genera carried out by Giesbrecht, it was, however, of course required to decide to which of these 2 genera the species of Thompson should be referred, and in this regard no doubt can arise. It is quite certainly a true member of the genus to which Giesbrecht had applied the name *Thaumaleus*. Since, however, as stated above, the application of this name to the present genus is quite inadmissibel, I have felt justified to restore the generic name proposed by Thompson.

The genus here treated of is chiefly distinguished from *Monstrilla* by the reduced number of segments in the tail, and, by the likewise reduced number of caudal setæ. Moreover the position of the oral tubule and the total absence in the male of the 5th pair of legs may be named as characters distinguishing the present genus. Three well defined species will be described in the succeeding pages.

9. *Cymbasoma rigidum*, Thompson.

(Pl. X, fig. 2, Pl. XI).

Cymbasoma rigida, J. C. Thompson, Linn. Soc. Journ. Zool., Vol., XX, p. 154, Pl. XIII, figs. 1—4.

- Syn: *Monstrilla rigida*, Bourne.
 „ *Thaumaleus rigidus*, Scott.
 „ *Thaumaleus Claparèdi*, Giesbrecht.
 „ *Thaumaleus germanicus*, Timm.
 „ *Hamocera Dauw*, Malaquin.

Specific Characters.—*Female.* Body moderately slender, and generally extended in a manner to give it a somewhat rigid appearance. Cephalic segment fully as long as the remaining part of the body and, viewed dorsally, somewhat dilated in the middle, ventral face evenly convex throughout. Tail scarcely exceeding half the length of the exposed part of the trunk; genital segment of moderate size and evenly narrowed behind, ovigerous spines nearly 3 times as long as the tail; distal segment somewhat flattened and gradually widening behind, exhibiting in front of the middle, on each side, a slight notch, as an attempt to a subdivision, the notch not being, however, continued in any defining suture. Caudal rami only slightly longer than they are broad, and not much divergent, with the inner edge somewhat concaved, the outer gibbously produced, each ramus provided with 3 strong subequal setæ, the outermost of which is attached to a rather prominent ledge; a very small appendicular bristle is moreover generally found attached near the inner corner to the ventral face. Eye well developed, with all 3 lenses distinct. Antennæ rather short, scarcely attaining $\frac{1}{3}$ of the length of the cephalic segment, terminal joint somewhat shorter than the other 3 combined, with none of the setæ ramified. Oral tubule rather small, and occurring at about the end of the first $\frac{1}{4}$ of the cephalic segment. Natatory legs with the outer ramus only slightly longer than the inner, its terminal joint not much produced. Last pair of legs with 3 apical setæ, the innermost of which is much smaller than the other 2, inner edge produced to a narrow linguiform lobe curving outwards along the terminal part of the leg, and in most cases extending as far as the latter. Ova attached to the genital filaments very numerous and in some cases accumulated to form an elongate almost cylindrical mass extending far beyond the limits of the body.

Male, as usual, smaller than female and of a shorter and more robust form of the body, with the cephalic segment somewhat clavate in outline. Tail rather narrow and composed of 3 segments, the last exhibiting on each

side a quite similar notch to that observed in female; copulative appendage divided at the end into 2 comparatively large diverging lobes of a somewhat sausage-shaped form. Caudal rami more pronouncedly clavate than in female, each provided with 4 slender subequal setæ attached to the obtusely truncated and distinctly thickened extremity, one of them apparently answering to the small appendicular bristle found in the female. Antennæ much more elongate than in female and distinctly 5-articulate, last joint very movably articulated to the preceding one, and terminating in a slender, slightly curved spine. Natatory legs of exactly same structure as in female. Of a 5th pair of legs not the slightest trace is to be detected.

Body of female, as usual, very transparent in its anterior part, but otherwise exhibiting a light yellowish-grey colour, and tinged in some places with a darker brownish pigment.

Length of adult female reaching to 2.50 mm., of male to 1.75 mm.

Remarks.—That the present form is identical with that recorded by I. C. Thompson under the name of *Cymbasoma rigidum* and subsequently more fully described by Scott as *Thaumaleus rigidus*, appears to me to be beyond any doubt, and I am also of opinion, that several other forms, described under different names, should be referred to that species. Indeed, I have been unable to find any reliable character to distinguish the several forms enumerated above as synonymes, and I am thus led to the conclusion, that they all should be combined into the very same species, for which of course the earliest name ought to be retained.

Occurrence.—Several specimens of this form have been taken by me at different times and in different places, both on the south and west coast of Norway. Most of the specimens collected were of the female sex; but I have also come across a few male specimens, one of which has been subjected to a closer examination and is figured on Pl. X.

Distribution.—Atlantic Ocean off Teneriffe (Thompson). Mediterranean (Giesbrecht), coast of Normandie (Claparède), British Isles (Thompson, Scott), Eastern part of North Sea (Timm).

10. *Cymbasoma Thompsoni*, (Giesbrecht).

(Pl. XII)

Thaumaleus Thompsoni, Giesbrecht, Pelagische Copepoden des Golfes von Neapel, p. 584, Pl. 46, figs. 7, 27, 31, 36, 40.

Syn. *Monstrilla* Danæ, Moebius (non Claparède)

Specific Characters.—Female. Body comparatively more slender than in the preceding species, with the cephalic segment narrower and considerably exceeding in length the remaining part. Tail very short, scarcely longer than the last 2 trunkal segments combined; genital segment unusually tumid, seen dorsally almost circular in outline, ventral face strongly protuberant, ovigerous spines of moderate length; distal segment without any traces of lateral notches. Caudal rami rather small, each provided with 3 subequal setæ; no appedicular bristle present. Eye apparently well developed. Antennæ scarcely attaining $\frac{1}{3}$ of the length of the cephalic segment, and of a structure very similar to that in the preceding species. Oral tubule somewhat more approximate to the frontal part of the head. Natatory legs with the outer ramus considerably longer than the inner, and the terminal joint more produced than in the preceding species. Last pair of legs resembling in structure those in *C. rigidum*, though having the innermost of the apical setæ rather smaller and the lobe of the inner edge less prominent.

Male comparatively more slender than that of the preceding species, and having the cephalic segment shorter and less pronouncedly clavate in shape. Tail composed of 3 well defined segments, the last of which, as in female, does not exhibit any traces of lateral notches. Caudal rami of the very same structure as in the female, each ramus being only provided with 3 setæ. Antennæ very strongly built, with the joints rather expanded, the last one very mobile and somewhat thickened at the extremity, which is armed with 2 small denticles. No traces of a 5th pair of legs present. Copulative appendage comparatively smaller than in the preceding species, with the terminal lobes less produced.

Colour: of the living animal not yet ascertained.

Length of adult female 1.20 mm., of male 0.80 mm.

Remarks.—The present species was described by Giesbrecht from some specimens taken in the Baltic, east of Langeland, and sent to him from Moebius, who had previously recorded this form under the name of *Monstrilla Danæ*, Claparède. It may easily be distinguished from the preceding species by its much inferior size, and more particularly by the rather different shape

of the tail. The form described by Scott as *Thaumaleus Thompsoni* is quite certainly different from Giesbrecht's species.

Occurrence.—Three specimens only of this species, 2 females and 1 male, have as yet come under my notice. They were taken in as many different localities, viz., Christiansund, Skutesnæs and Risør.

Distribution.—Western part of the Baltic (Moebius).

11. *Cymbasoma longispinosum* (Bourne).

(Pl. XIII)

Monstrilla longispinosa, Bourne, Quart. Journ. Micr. Science, (2), Vol. 30, p. 575, Pl. 37, figs. 1–4, 10.

Syn.: *Thaumaleus longispinosus*, Giesbrecht.

Specific Characters.—*Female*. Body rather slender, with the cephalic segment only very slightly dilated in the middle, and considerably exceeding half the length of the body. Tail very short, not even attaining the length of the 2 preceding segments combined; genital segment about the size of the last trunkal segment and, seen from above, of a very similar subquadrate form its ventral face considerably protuberant; ovigerous spines of quite an extraordinary length, attaining in some instances nearly the double length of the body, and confluent at the base for some distance; distal segment much narrower than the proximal one, being conspicuously constricted at the base, and without any trace of a subdivision. Caudal rami very small, scarcely longer than they are broad, and each only provided with 3 thickish setæ of equal length. Eye well developed, at least in female. Antennæ comparatively short and stout, scarcely exceeding in length $\frac{1}{4}$ of the cephalic segment and, as in the other species of the present genus, only composed of 4 joints, the last of which is about the length of the other 3 combined and gradually narrowed distally, some of its setæ distinctly ramified. Oral tubule occurring far in front, at only at short distance from the frontal part of the head. Natatory legs with the terminal joint of the outer ramus unusually short, scarcely longer than the middle one, and of a rounded form. Last pair of legs provided at the obtusely truncated extremity with 3 plumose setæ, the innermost of which is a little shorter than the other 2; inner lobe well defined, triangular, and extending at right angle to the axis of the leg.

Male somewhat smaller than female and less slender of form, with the cephalic segment comparatively shorter and nearly of equal width throughout. Tail exceeding somewhat half the length of the exposed part of the trunk, and composed of 3 well defined segments, the middle of which is the smallest;

copulative appendage divided at the end into 2 comparatively short diverging lobes. Caudal rami of a similar shape to those in the female, but each provided with 4, instead of 3, setæ of nearly equal length. Antennæ comparatively much larger than in female, and each composed of 5 well defined joints, the 3 middle ones lamellarly expanded inside and armed with several short spines in addition to the setæ, last joint comparatively small, but very movably articulated to the preceding one. Natatory legs agreeing exactly in structure with those in female. 5th pair of legs wholly absent.

Body, as usual, much more transparent in female than in male, being in the latter, according to Giesbrecht, everywhere of a dark fuscous colour.

Length of adult female 2.60—3.16 mm., of male 2.30 mm.

Remarks.—The present form is chiefly characterised by the extraordinary length of the ovigerous spines in the female and their peculiar coalescence at the base. In its general appearance it bears a very close resemblance to the form recorded by Claparède under the name of *Monstrilla dance*, and, were it not that no mention has been made by that author on the above-named distinguishing character, I should indeed have been much inclined to regard these 2 forms as identical.

Occurrence.—The present species, it is true, has not yet been observed off the Norwegian coast; but I regard it as very probable that on further investigations it will be found to occur in some place or other on the south and west coast. As I have had an opportunity of examining this form, I find it advisable to give here a detailed description of it, for comparison with the other 2 species. The figures given on Pl. XIII have been drawn from specimens collected during one of the Monaco-Expeditions in the Mediterranean off Sardinia.

Distribution.—British Channel (Bourne), Mediterranean at Naples (Giesbrecht).

Gen. 4. **Monstrillopsis**, G. O. Sars, n.

Generic Characters.—Body of very different appearance in the 2 sexes, being exceedingly slender in female, much shorter and stouter in male. Tail composed in female of 3 well defined segments, the middle of which is the smallest, in male distinctly 4-articulate. Caudal rami in both sexes of the very same structure, being unusually produced, and each provided with 4 well

developed setæ, 2 apical and 2 lateral. Eye very fully developed, especially in male. Antennæ in female 4-articulate, in male much larger and distinctly 5-articulate, with the usual hinge between the last 2 joints. Oral tubule occurring far in front. Natatory legs built in the usual manner. Last pair of legs, however, in female of rather a peculiar structure, being somewhat fusi-form in shape, and each produced into 2 smooth conical lappets, the outer of which is the more prominent; setæ of these legs not, as usual, attached to the terminal edge of the leg, but arranged in a line crossing the base of the outer lappet. Male without any trace of these legs, but having the copulative appendage normally developed.

Remarks.—This new genus is established to include the anomalous form recorded by Scott under the name of *Monstrilla dubia*. Indeed, I have found it impossible to place this species either in the genus *Monstrilla* or in that of *Cymbasoma*, as it in some respects seems to combine characters of both these genera, in other respects to differ conspicuously from either of them.

12. *Monstrillopsis dubia*, (Scott).

Pl. XIV.

Monstrilla dubia, T. Scott, Twenty-second Ann. Rap. of the Fishery Board for Scotland, Part III, p. 247, Pl. XIII, fig. 14, Pl. XIV, figs. 16—18

Specific Characters.—*Female.* Body exceedingly slender and narrow, with the anterior division not at all dilated. Cephalic segment exceeding the remaining part of the body by $\frac{1}{3}$ of its length, and narrow cylindrical in form, being almost of equal width throughout. Tail about equalling half the length of the exposed part of the trunk; genital segment a little longer than the other 2 segments combined and slightly dilated at the base, with the ventral face somewhat protuberant; ovigerous spines of moderate length; anal segment somewhat flattened and sharply defined from the rather small middle segment. Caudal rami rather produced, exceeding somewhat in length the 2 preceding segments combined, and slightly divergent, each ramus provided with 4 setæ, one about in the middle of the outer edge, 2 at the apex, and one inside at some distance from the end. Eye very conspicuous in the living animal, with dark pigment and all 3 lenses well developed. Antennæ exceeding somewhat in length $\frac{1}{3}$ of the cephalic segment, and composed of 4 well defined joints, the last of which is fully as long as the other 3 combined; none of the setæ ramified. Oral tubule well marked, and occurring near the frontal part of the head. Natatory legs with the outer ramus con-

siderably longer than the inner, and having the terminal joint well developed. Last pair of legs rather narrow at the base, but considerably widening towards the end, which is produced to a conical lappet, across the base of which 3 slender setæ are attached; inner edge of the leg produced to a similar lappet, which, however, is quite smooth.

Male very unlike the female and of much smaller size, with the body much shorter and stouter. Cephalic segment somewhat club-shaped, and scarcely exceeding half the length of the body. Tail very narrow and composed of 4 well defined segments, the 1st of which is produced below to a rather large copulative appendage divided at the end into 2 diverging sub-cylindrical rami. Caudal rami of much the same appearance as in female, with the same number of setæ. Eye still more largely developed than in female, with the ventral lens rather prominent and highly refractive. Antennæ considerably exceeding half the length of the cephalic segment and distinctly 5-articulate, with the last very mobile joint abruptly attenuated distally.

Body in the living animal rather pellucid, with a pale yellow hue, and in some places dotted with a chestnut-coloured pigment.

Length of adult female 3.80 mm., of male 2.10 mm.

Remarks.—This form was described in the year 1904 by Scott from some female specimens taken in 2 different places of the Scottish coast. The resemblance of this form to *Monstrilla Danæ* Claparède, vindicated by Scott in a note to his description, I find to be a very slight one. In fact the present form is easily distinguishable both from this and from any other of the Monstrillidæ.

Occurrence.—Two specimens only of this remarkable form, a female and a male, have as yet come under my notice. They were captured, many years ago, at Bejan, outside the Trondhjem Fjord, and coloured drawings of both, when still alive, were immediately executed.

Distribution.—Scottish coast (Scott).

NOTODELPHYOIDA.

Remarks.—This division comprises a number of Copepoda, which partly differ considerably from each other and according to their organisation, represent several distinct types. Yet, all these forms agree as to habits, in so far that they live as parasites, or more properly as commensales, within Ascidiæ of different kinds. They were all by earlier authors comprised within a single family, the *Ascidicolidæ*, and this family was by Giesbrecht, together with the *Monstrillidæ* and several other heterogeneous groups, included in the 2nd tribe of his suborder *Podoplea*, for which the name *Ampharthrandria* was proposed. I have already mentioned, that the latter name is quite inapplicable for the present group of Copepoda, which comprises both forms with the anterior antennæ in the male transformed to prehensile organs, and such in which these antennæ are quite alike in the 2 sexes. According to the classification proposed by Giesbrecht, these latter forms should of course be transferred to his 1st tribe, the *Isokerandria*; but such a transfer appears quite unreasonable, since there are forms, otherwise closely related and even referred to one and the same genus, in which the above-named difference, as to the structure of the anterior antennæ, is found. Thus in the male of *Doropygus longicauda* Aurivillius, as will be shown farther on, these antennæ are very distinctly hinged, whereas in the other species referred to that genus they are quite alike in the 2 sexes. It is thereby clearly proved that the above-named character, upon which Giesbrecht laid so much stress, is of far inferior systematic value than opined by that author, and that it in reality must be considered unwise as the basis for a more general classification of the Copepoda. There are many other much more important diversities to be found on a comparison of the several forms comprised within the present group, and these diversities are in fact of such an essential quality as to make it inadmissible to include all these forms within a single family. This was also recognised by Thorell, who referred the forms observed by him to 3 different families, viz., *Notodelphyidæ*, *Ascidicolidæ* and *Buproridæ*. The 1st of these families has subsequently been subdivided by Prof. Brady into 2 nearly-allied

families: *Notodelphyidæ* (proper) and *Doropygidæ*, and 2 other very distinct families, *Botryllophilidæ* and *Enterocolidæ*, are here added. The present division thus comprises at least 6 families, and I regard it as very probable, that their number will still be augmented, on a closer investigation of the many peculiar forms found by Hesse within compound Accidians, but rather imperfectly described by that author.

Fam. 1. Notodelphyidæ.

General Characters.—Body in both sexes cyclopoid in shape and more or less straight, with the anterior division somewhat depressed, the posterior much narrower and cylindric in form. Exposed part of trunk composed in male of the usual number of segments, whereas in female the last 2 segments are confluent, forming together a large median piece somewhat broader in front than behind in young specimens, but in the adult female greatly expanded behind, to form dorsally a very voluminous, somewhat flattened bag or incubatory pouch, into which the ripe ova are received. Tail composed in both sexes of 5 segments not very different in size. Caudal rami well developed and provided at the end with strong ciliated setæ present in the usual number. Eye of the structure generally met with in the Copepoda. Anterior antennæ of moderate size, and extended laterally, being composed of numerous short joints densely clothed with setæ; those in male distinctly hinged. Posterior antennæ much smaller than the anterior, but distinctly prehensile, each terminating in a strong mobile claw. Oral parts, as a rule, well developed, and built on a somewhat similar type to that in the family *Cyclopinidæ*. The 4 anterior pairs of legs likewise cyclopoid in structure, and adapted for swimming; 5th pair of legs extremely small and rudimentary, biarticulate.

Remarks.—This family is here taken in a much more restricted sense than done by Thorell, who included into it also his 2 genera *Doropygus* and *Botachus*. In the restriction here adopted, the family only comprises 2 genera, viz., *Notodelphys* Allman and *Agnathaner* Canu.

Gen. 1. **Notodelphys**, Allman, 1847.

Generic Characters.—Body more or less elongated, and in female conspicuously dilated in the middle on account of the greatly expanded matrical part; integuments rather soft and flexible. Cephalic segment not very large, and produced in front to an obtuse deflexed rostral prominence. The 2 succeeding segments in both sexes well defined and separated by deep lateral incisions. Incubatory pouch in female broad, flattened, more or less advancing over the base of the tail. The latter perfectly cylindrical in form, with the 1st segment in female scarcely larger than the succeeding ones, in male somewhat swollen and generally containing 2 oval spermatophores. Caudal rami, as a rule, finely ciliated on both edges, and each carrying at the tip 4 well developed and somewhat diverging plumose setæ, being moreover provided with 2 small bristles, the one attached to the outer edge, the other to the dorsal face, near the inner corner. Eye comparatively small, but easily observable in the living animal, being provided with 2 lateral lenses imbedded in a bright red pigment. Anterior antennæ in female gradually tapered distally, and generally composed of 15 joints clothed with comparatively short, but distinctly ciliated setæ; those in male having the number of joints somewhat reduced, and exhibiting between the penultimate and antipenultimate joints a well marked hinge. Posterior antennæ only composed of 3 distinctly defined joints, the first 2, representing the basal part, somewhat compressed and separated by an oblique suture, at the end of which outside 2 juxtaposed plumose setæ are attached; terminal joint very movably articulated to the basal part, and linear in form; apical claw accompanied by a number of short curved setæ. Anterior lip projecting at the end into 2 triangular lappets. Mandibles with the masticatory part lamellarly expanded and divided at the end into several unequal teeth; palp well developed, biramous. Maxillæ with all their constituent parts distinctly defined. Anterior maxillipeds with the 1st basal joint very large and massive, exhibiting inside 3 or 4 short setiferous lobes; 2nd basal joint much narrower, and armed at the end inside with a strong claw-like spine accompanied by a slender seta; terminal part thin, 3-articulate. Posterior maxillipeds much smaller than the anterior ones, and 3-articulate, 1st joint much the largest and provided inside with several short plumose setæ arranged in 2 groups, each of the other 2 joints armed with a slender incurved spine, that of the terminal joint accompanied by 2 small setæ. Natatory legs with the basal part broad and flattened, rami in all the pairs

distinctly 3-articulate and armed in the usual manner, those of 1st pair somewhat unequal, in the other pairs of about equal size. Last pair of legs extremely small, and in female quite concealed beneath the dilated matrical part of the body; proximal joint short and broad, and produced outside to a digitiform process tipped with a small bristle; distal joint more or less scale-like, with a small apical bristle and a short spine inside.

Remarks.—This genus was established as early as in the year 1847 by Allman, and may be regarded as the type, not only of the present family, but of the whole division *Notodelphyoida*. It comprises the most perfectly organised forms of that division, and exhibits some unmistakable relations to certain gnathostomous Cyclopoida, in particular the *Cyclopinidæ*. Indeed, the forms included in the present genus may be regarded as Cyclopoids, which by a close adaptation to the particular conditions of life as commensales of Ascidians, have acquired some extraneous characters apparently distinguishing them very essentially from their original ancestors. The genus was in the year 1859 subjected by Thorell to a careful investigation, and its general characters were made out by him in a very satisfactory manner. Thorell distinguished within the genus no less than 7 different species, all of which I have had an opportunity of examining from material collected off the Norwegian coast. These species are very closely related to each others, and as the distinctive characters given by Thorell in the short diagnoses in Latin, preceding the description of each species, appeared to be of a rather trifling kind, the validity of most of them has been questioned by recent authors. On a careful examination I have, however, come to the conclusion, that they all ought to be supported, though their distinction indeed is attended with no small difficulties, at least in the case of preserved specimens. I hope that the descriptions given below, in connection with the figures on the accompanying plates, may render the species more easily recognisable than this has been possible by consulting the work of Thorell.

1. *Notodelphys Allmani*, Thorell.

(Pl. XV & XVI)

Notodelphys Allmani, Thorell. Bidrag til k nneheten om Krustaceer som lefva i Arter af sl gtet Ascidia, p. 31, Pl. I, Pl. II, 1.

Syn: *Notodelphys mediterranea*, Buchholtz.

Specific Characters.—*Female.* Body moderately slender, with the anterior division pronouncedly depressed, and nearly twice as long as the posterior. Cephalic segment scarcely longer than the 2 succeeding segments combined,

and gradually narrowed anteriorly, terminating in an obtuse point. Incubatory pouch, when fully developed, very broad, rounded quadrate in outline, with the posterior edge slightly concave in the middle. Caudal rami rather slender, sublinear in form, and more or less divergent, attaining nearly twice the length of the anal segment, and more than 4 times as long as they are broad, both edges distinctly ciliated; apical setæ of moderate length and rather divergent; bristle of outer edge occurring at a distance from the end equalling about $\frac{1}{3}$ of the length of the ramus. Anterior antennæ nearly as long as the cephalic segment and rather thick at the base, but rapidly tapered distally, 3rd joint the largest, the 3 succeeding joints gradually diminishing in size, remaining joints very small; setæ attached to the anterior face of these antennæ rather coarse and very distinctly ciliated. Posterior antennæ moderately slender, with the terminal joint about the length of the other 2 combined. 1st pair of legs, as in the other species, differing from the succeeding ones by the presence, at the inner corner of the 2nd basal segment, of a short deflexed spine; rami moreover rather unequal, the outer one being considerably shorter than the inner and bent outwards in a peculiar manner, its 1st joint comparatively large and having the outer edge finely denticulate. Last pair of legs with the proximal joint rather broad and finely denticulate at the inner rounded corner, digitiform process considerably produced; distal joint small, scale-like and conspicuously contracted at the base, spine of inner edge accompanied proximally with a few small denticles.

Male of much smaller size than female, with the body gradually attenuated behind. Cephalic segment comparatively larger, exceeding in length the 3 succeeding segments combined. Last trunkal segment scarcely broader than the genital segment. Anterior antennæ of coarser structure than in female and only composed of 11 joints very unlike in size, the outer 2 rather elongate and forming together a very mobile piece, which admits to be impinged against the preceding part of the antenna. Posterior antennæ, oral parts, and legs of same structure as in female. Genital lobes contiguous at the base inside, and subtriangular in form, their extremity somewhat truncated and provided at the outer corner with a small bristle, at the inner with 2 unequal juxtaposed spines.

Body in the living animal semipellucid, with a light yellowish gray hue; ovarial tubes in female pale greenish, the ripe ova included within the incubatory pouch being of a somewhat darker green colour.

Length of adult female attaining 4.50 mm; of male 1.90 mm.

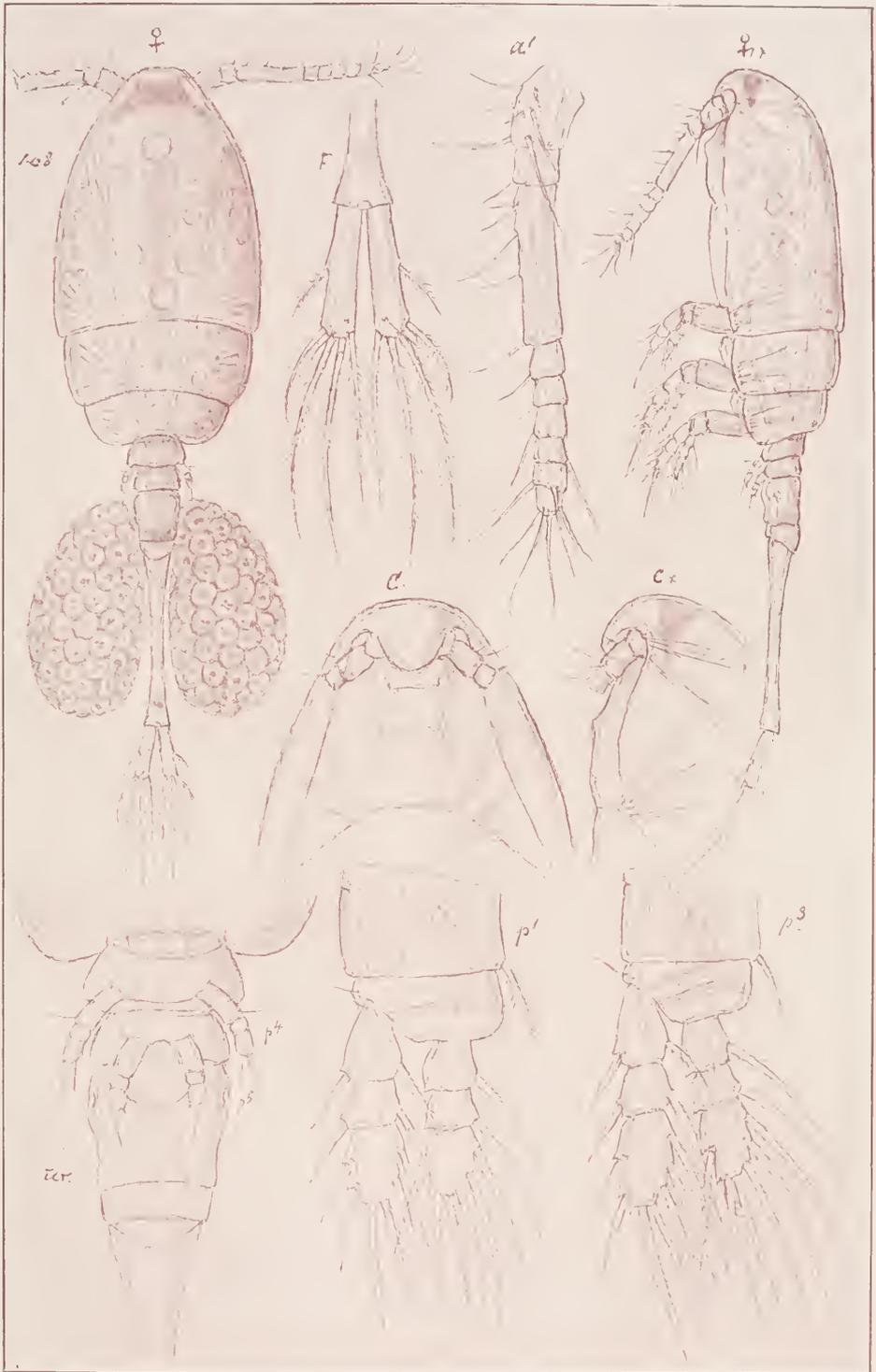
Remarks.—This is the largest and also the most common of the species,

Copepoda

Thamatopsyllidæ

Monstrilloida

Pl. I



G. O. Sars del.

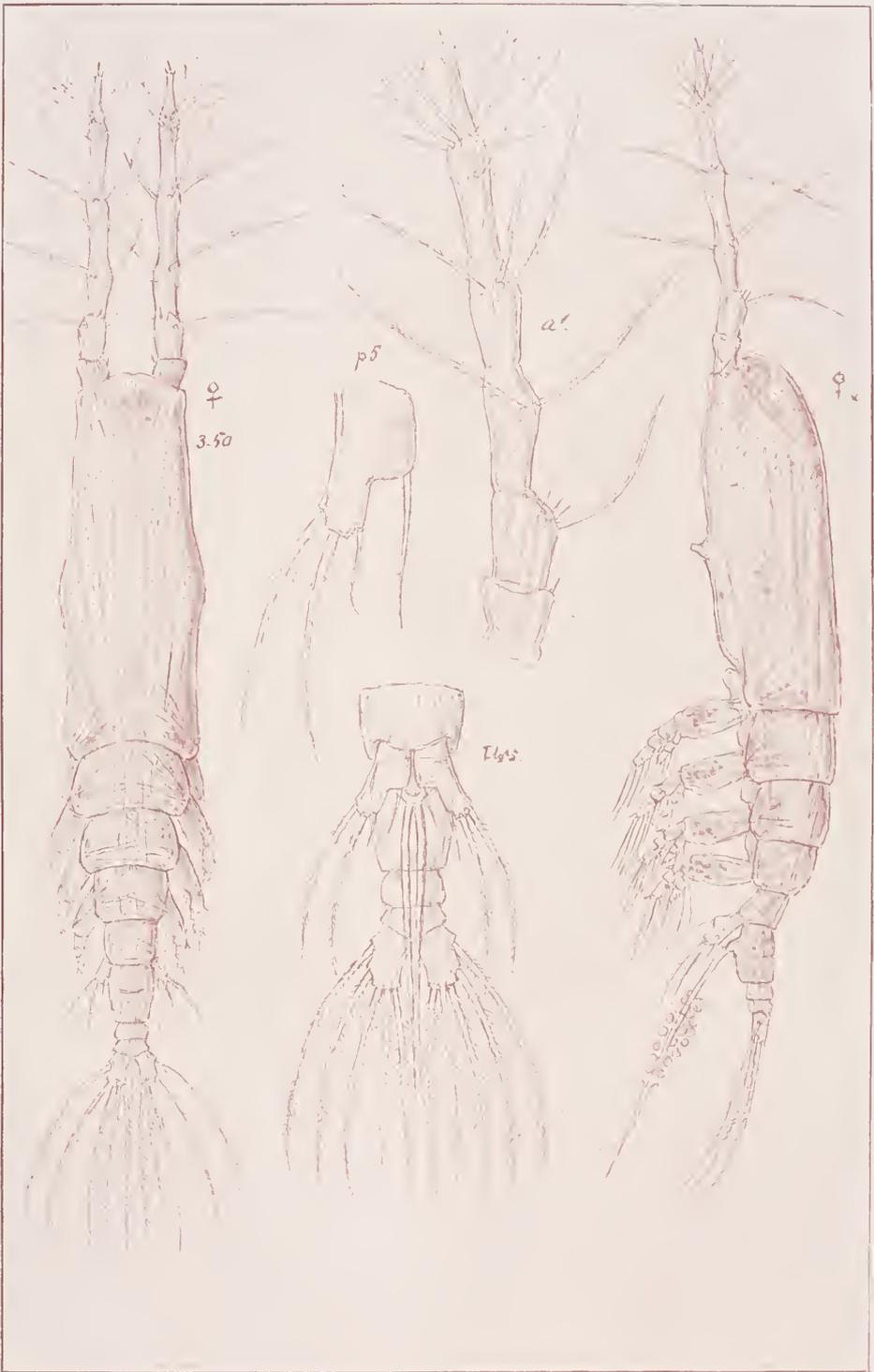
Thaumtopsyllus paradoxus, G. O. Sars

Copepoda

Monstrillidæ

Monstrilloida

Pl. II



G. O. Sars del.

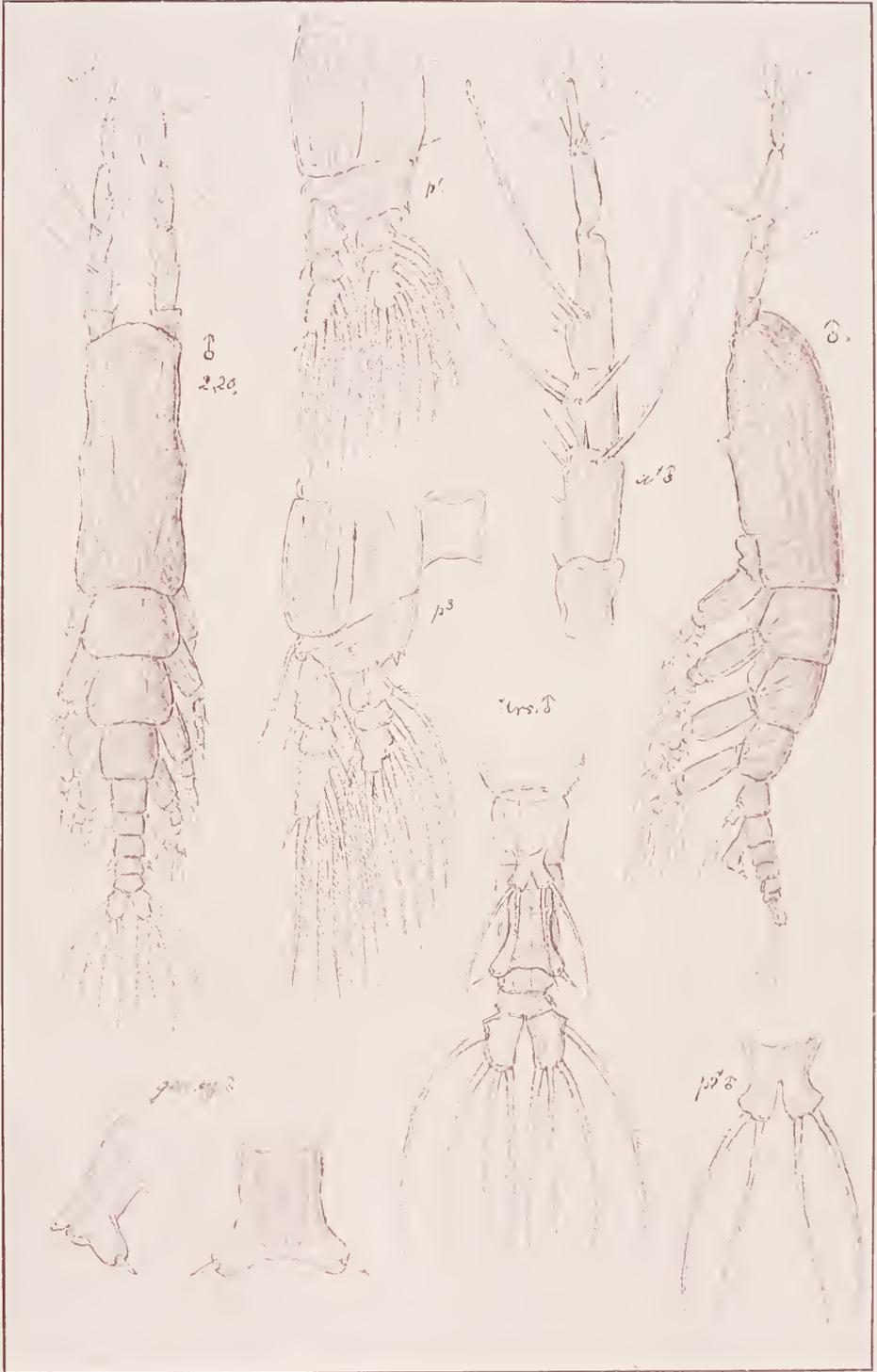
Monstrilla longicornis, Thomps.

Copepoda

Monstrillidæ

Monstrilloida

Pl. III



G. O. Sars del.

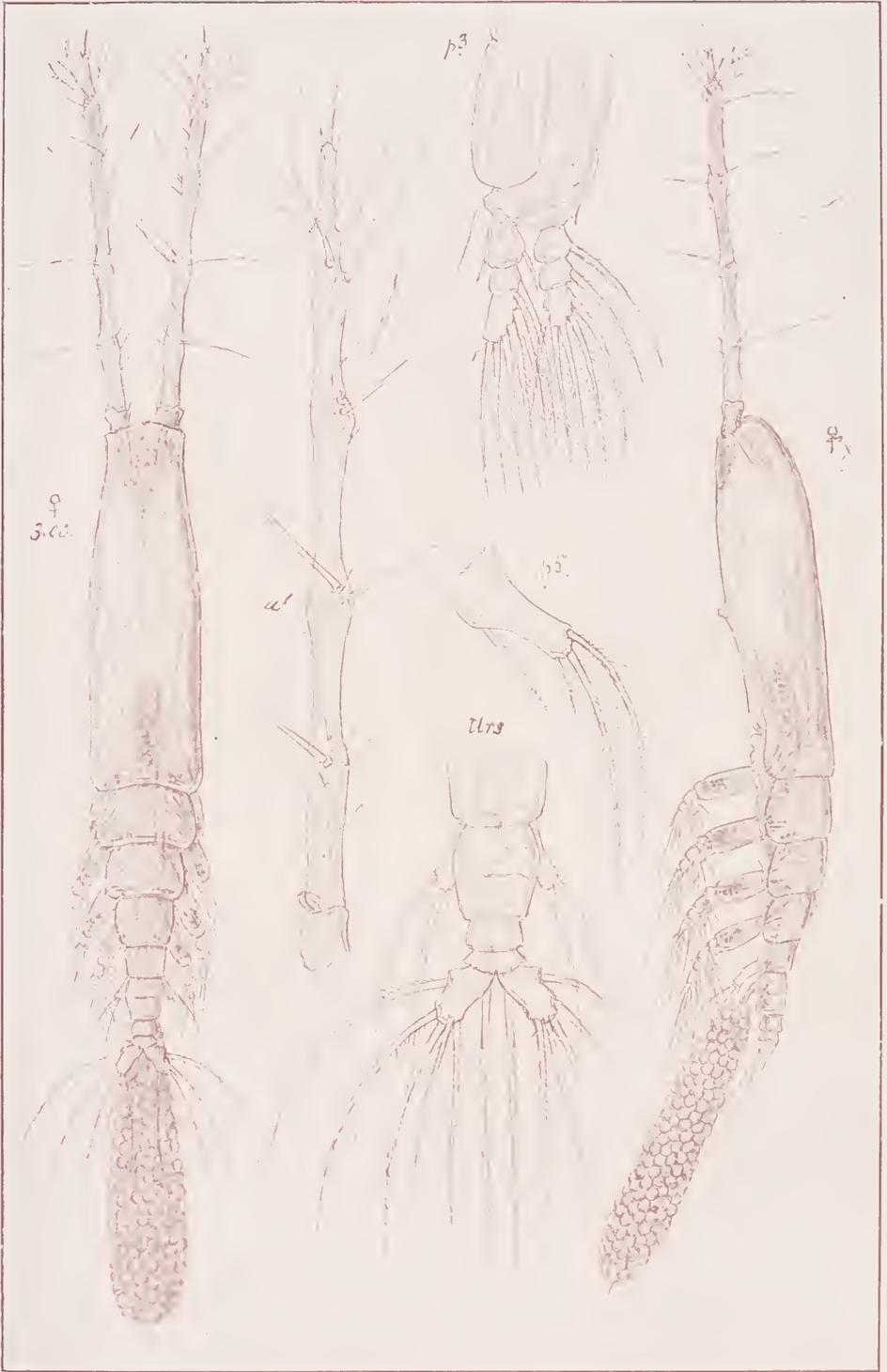
Monstrilla longicornis, Thomps.
(continued)

Copepoda

Monstrillidæ

Monstrilloida

Pl. IV



G. O. Sars del.

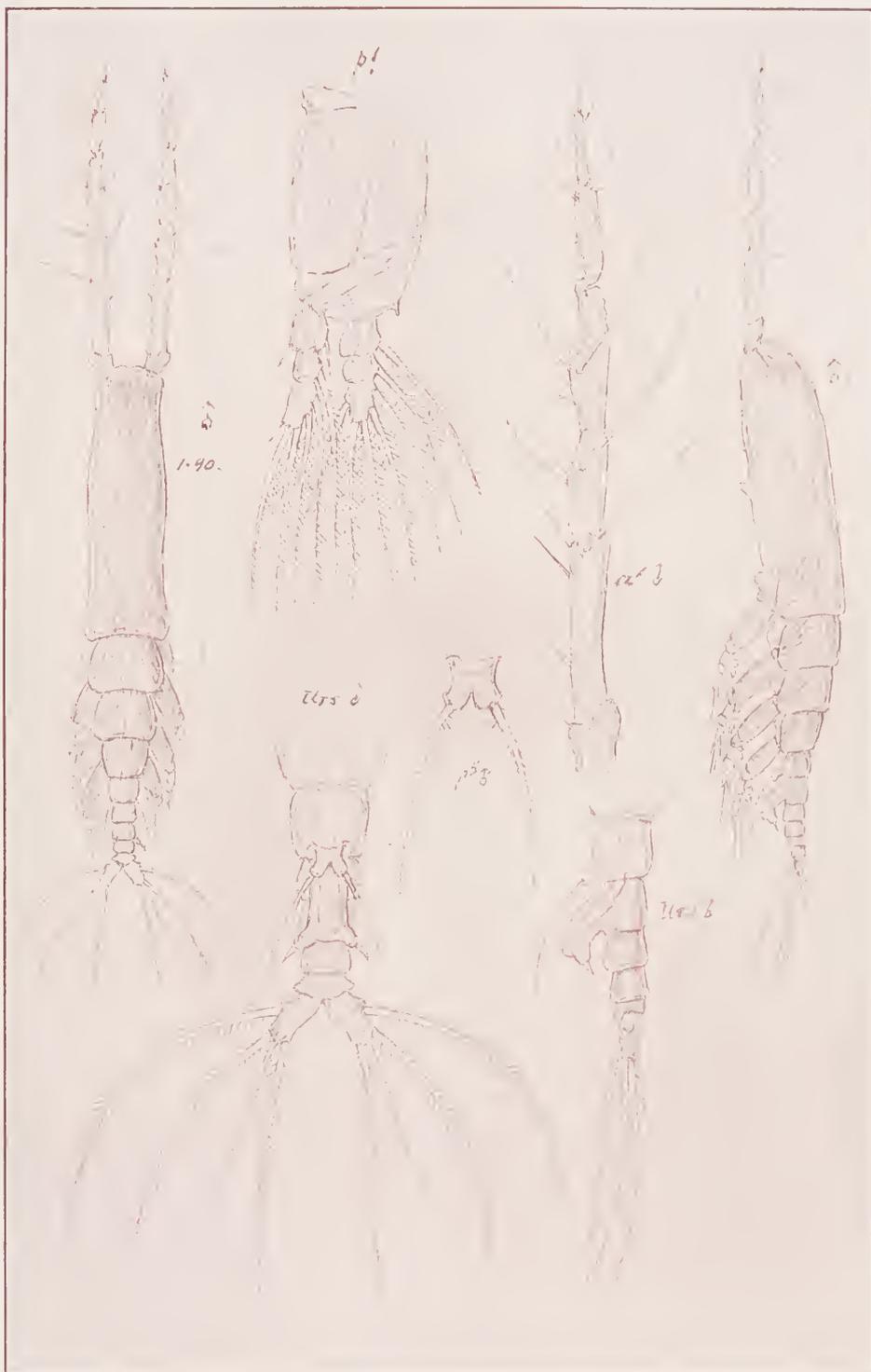
Monstrilla longiremis, Giesbr.

Copepoda

Monstrillidæ

Monstrilloida

Pl. V



G. O. Sars del.

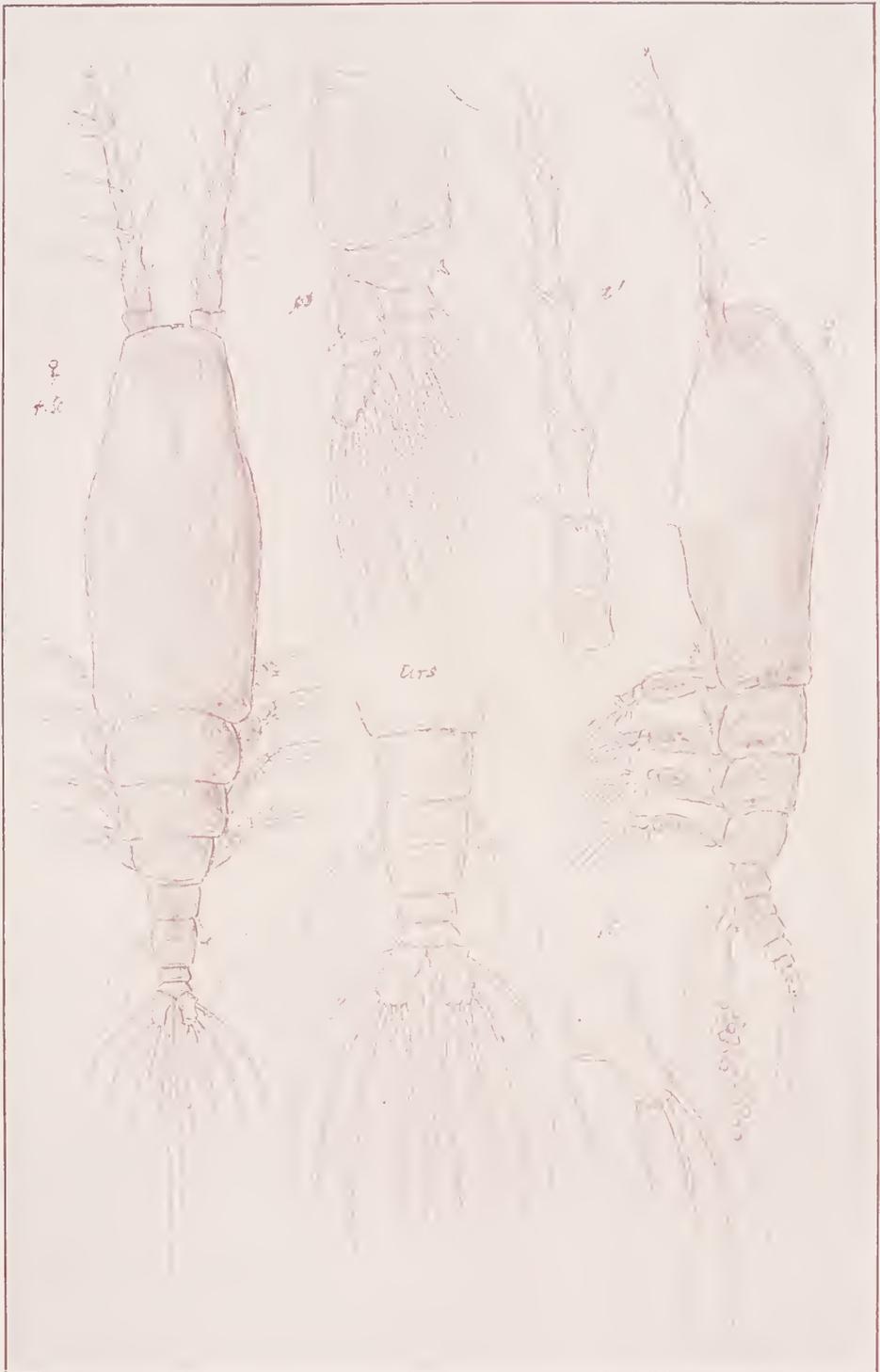
Monstrilla longiremis, Giesbr.
(male)

Copepoda

Monstrillidæ

Monstrilloida

Pl. VI



G. O. Sars del.

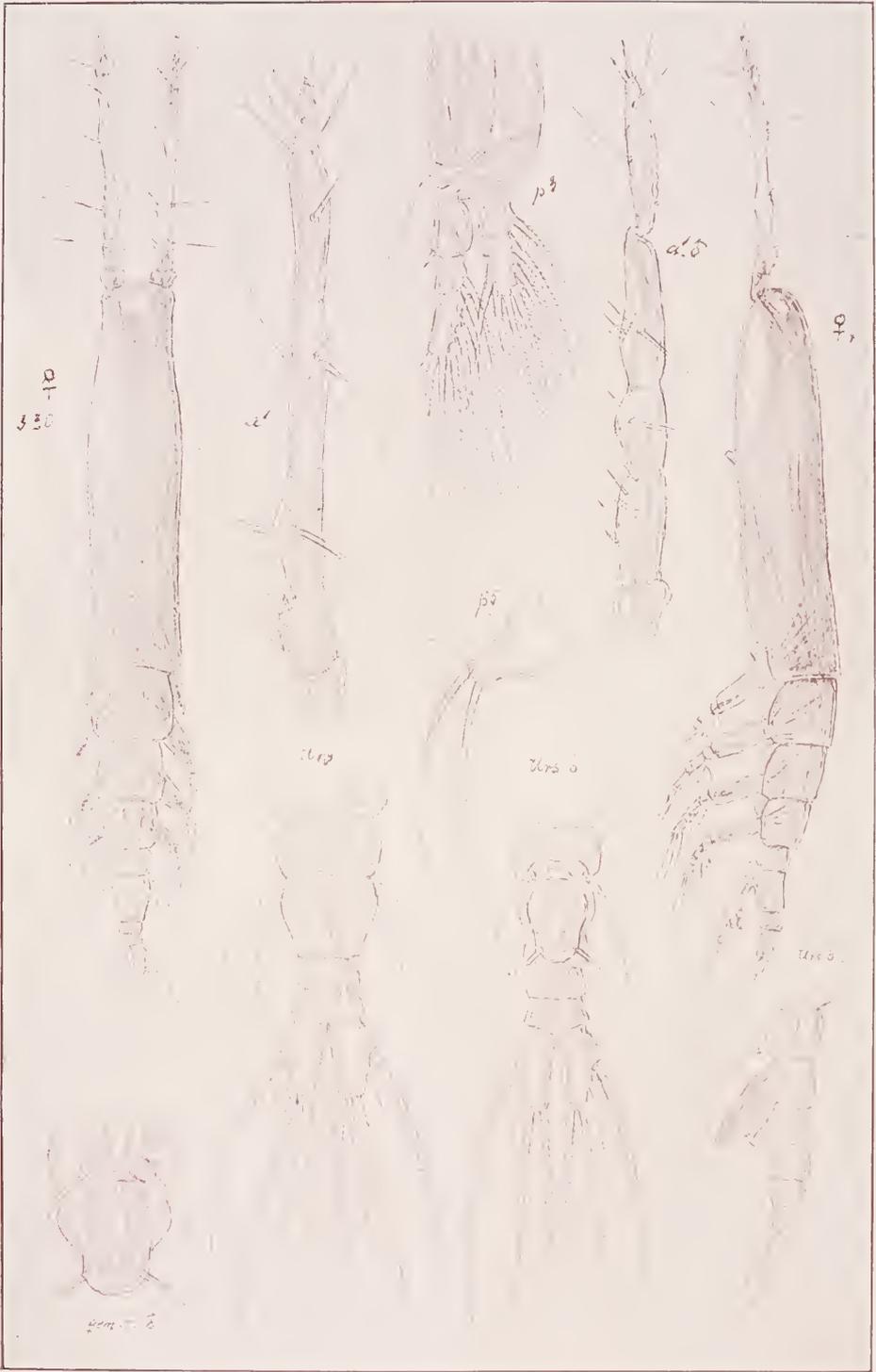
Monstrilla clavata, G. O. Sars

Copepoda

Monstrillidæ

Monstrilloida

Pl. VII



G. O. Sars del.

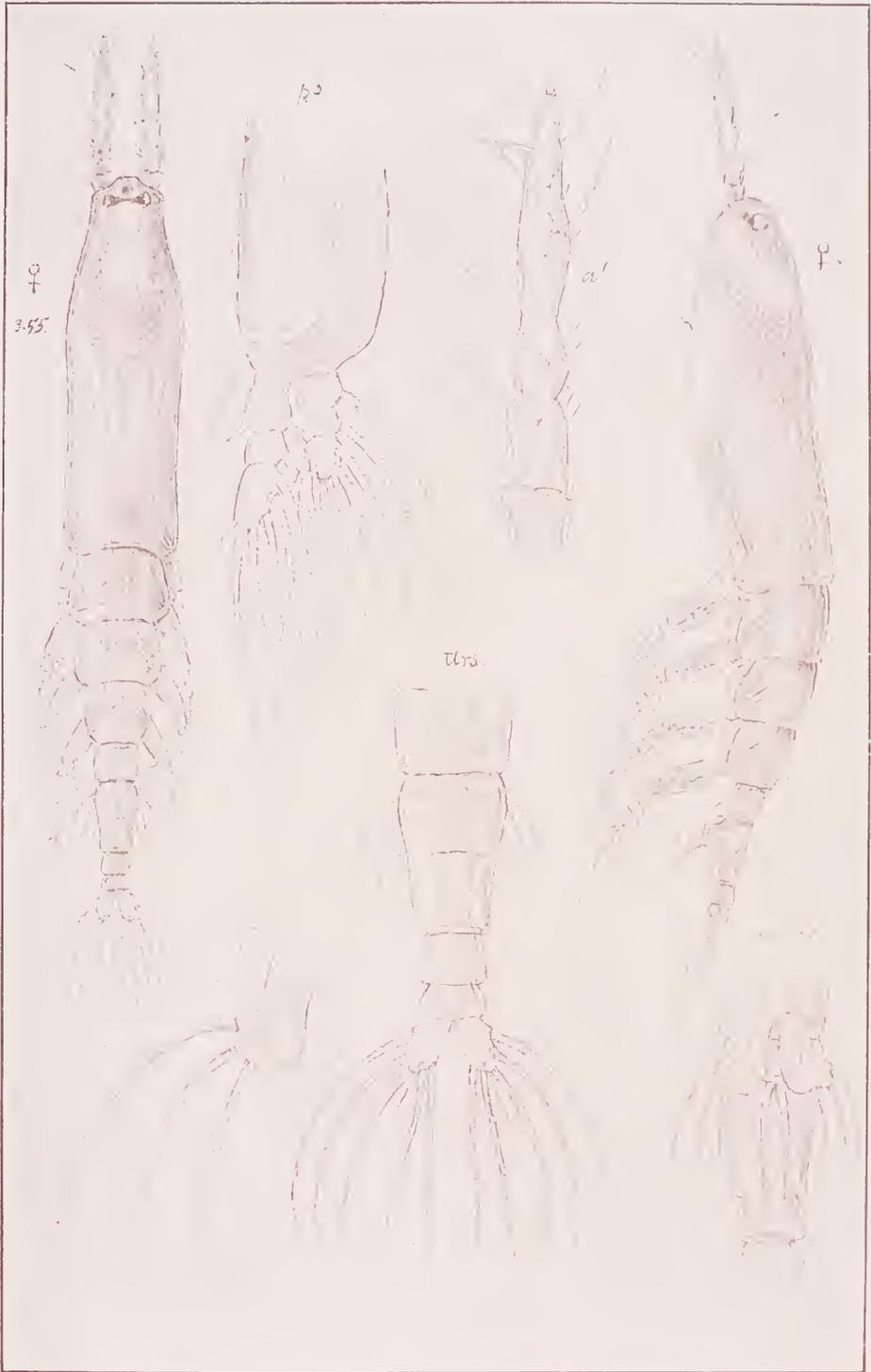
Monstrilla leucopis, G. O. Sars

Copepoda

Monstrillidæ

Monstrilloida

Pl. VIII



G. O. Sars del.

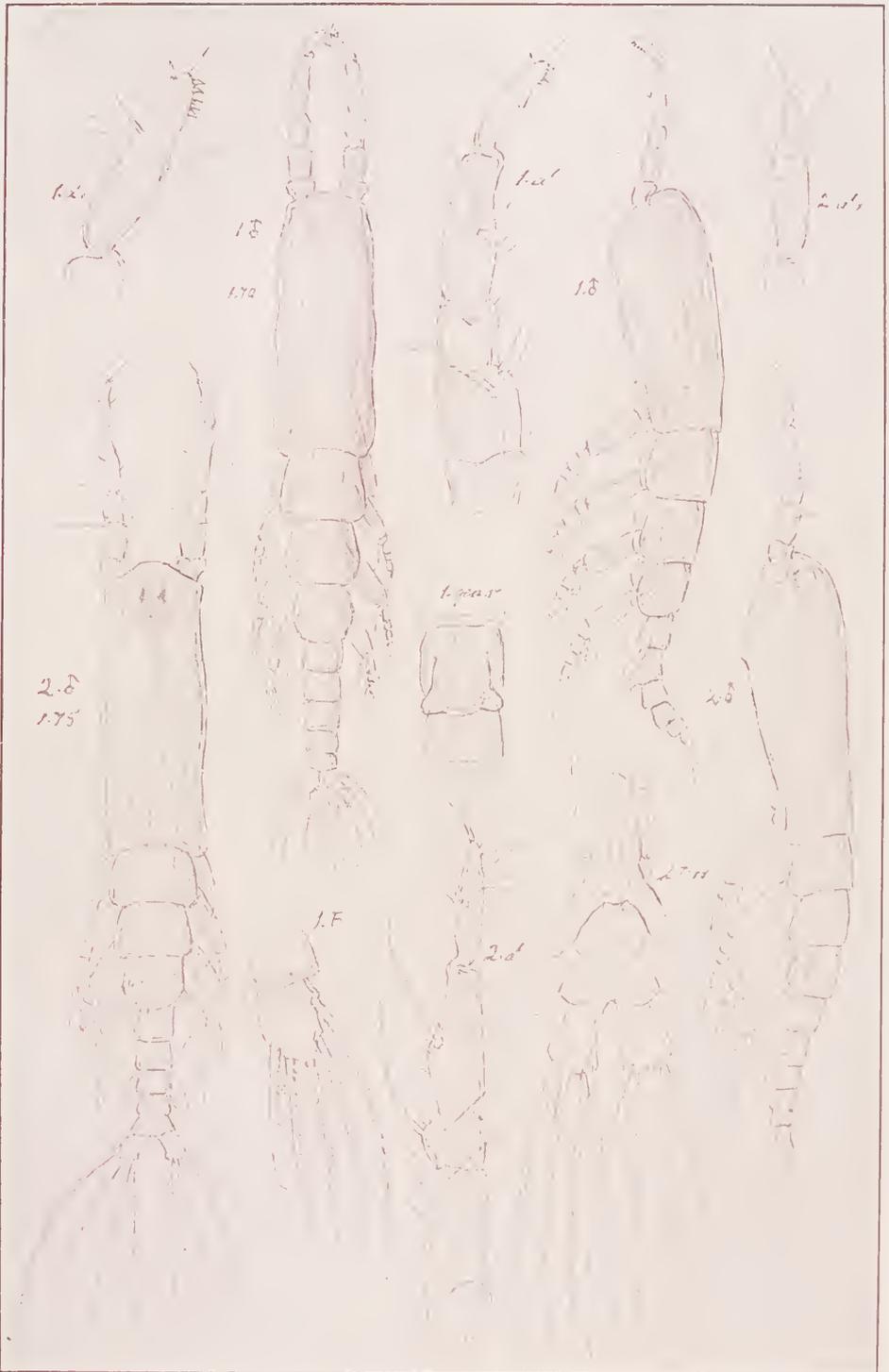
Monstrilla gracilicauda, Giesbr.

Copepoda

Monstrillidæ

Monstrilloida

Pl. X



G. O. Sars del.

1. *Monstrilla serricornis*, G. O. Sars. ♂
2. *Cymbasoma rigidum*, Thomps. ♂

Copepoda

Monstrillidæ

Monstrilloida

Pl. XI



G. O. Sars del.

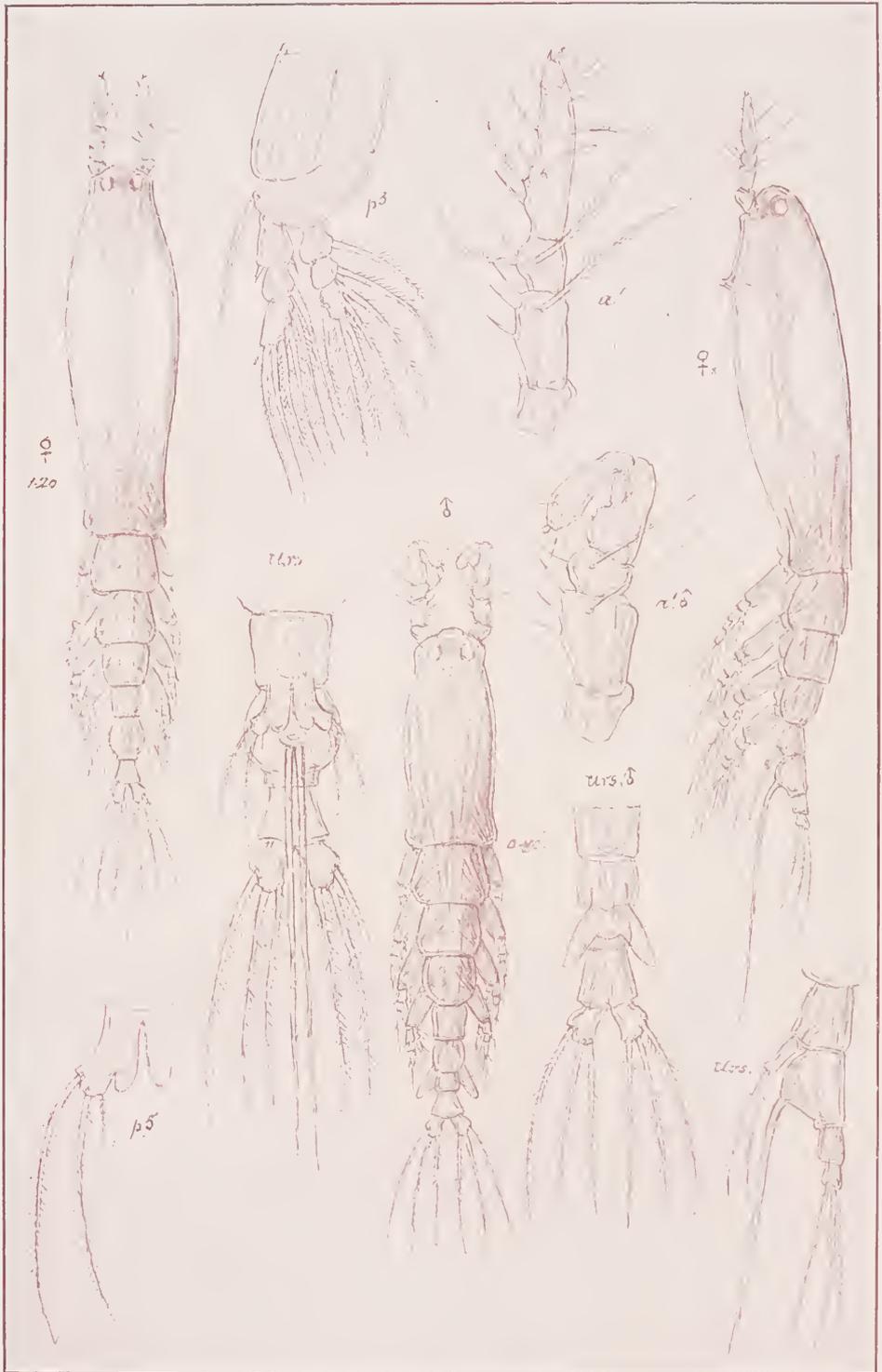
Cymbasoma rigidum, Thomps.

Copepoda

Monstrillidæ

Monstrilloida

Pl. XII



G. O. Sars del.

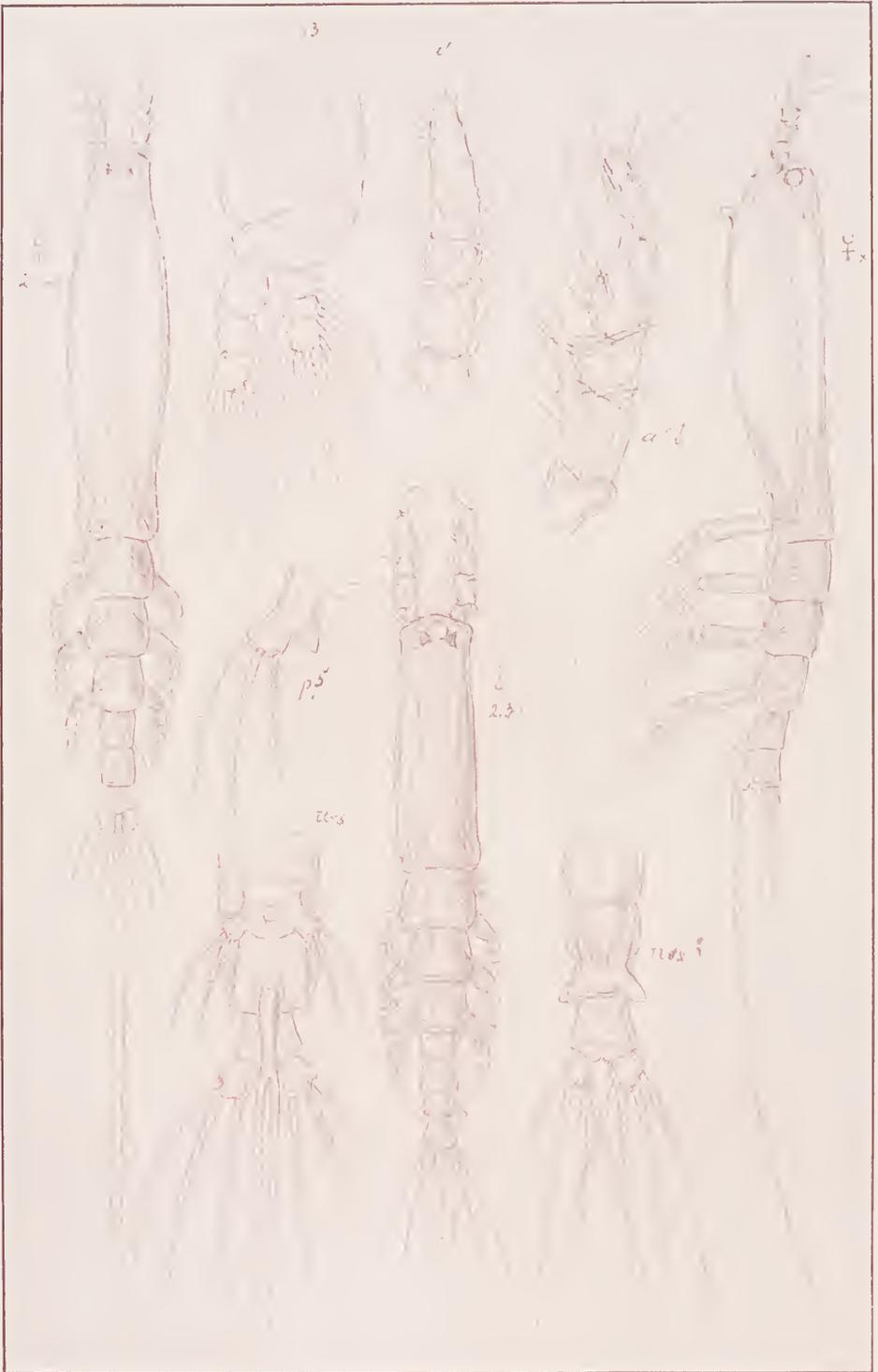
Cymbasoma Thompsoni, (Giesbrecht)

Copepoda

Monstrillidæ

Monstrilloida

Pl. XIII



G. O. Sars del.

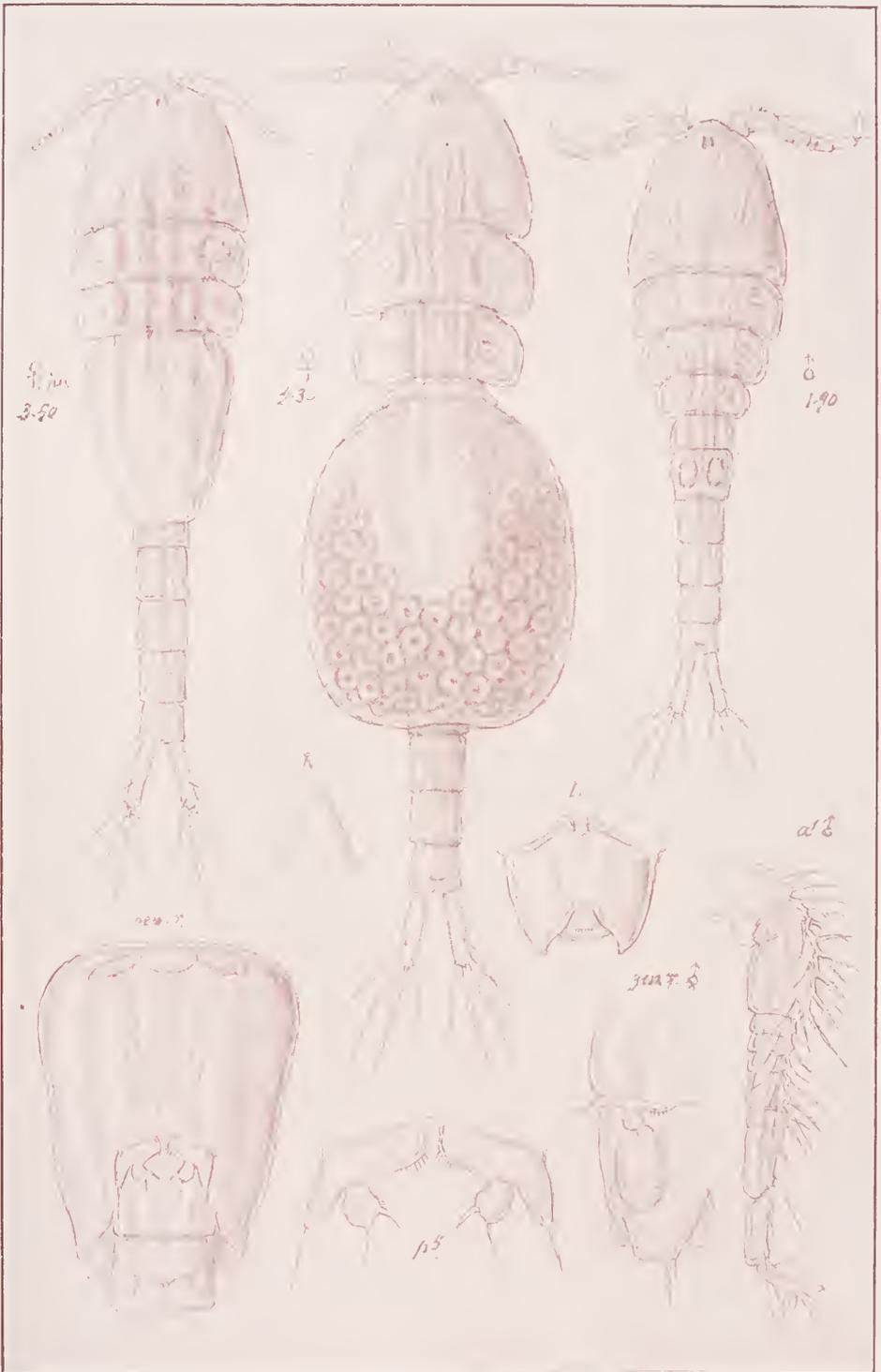
Cymbasoma longispinum, (Bourne)

Copepoda

Notodelphyidæ

Notodelphyoida

Pl. XV



G. O. Sars del.

Notodelphys Allmani, Thorell

