AN ACCOUNT

OF THE

CRUSTACEA

OF

NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY

G. O. SARS

VOL. VI

COPEPODA

CYCLOPOIDA

PARTS XI & XII

CLAUSIDIIDÆ, LICHOMOLGIDÆ (part)

WITH 16 AUTOTYPIC PLATES

BERGEN
PUBLISHED BY THE BERGEN MUSEUM

SOLD BY
ALB. CAMMERMEYERS'S FORLAG, CHRISTIANIA
1917

oblong oval in form, and, in addition to the apical bristles, provided with 2 finely ciliated setæ on the inner edge.

Body in female of a clear yellowish grey colour, with translucent olive-green ovarial cells and likewise greenish ovisacs; that of male highly pellucid, exhibiting within the anterior part scattered reddish-orange oil-bubbles; eye much larger than in female, and bright red.

Length of adult female amounting to 1.10 mm., of male to 0.90 mm.

Remarks.—The female sex of this peculiar Copepod has long been known; but it is only in recent times that the existence of the male sex has been satisfactorily ascertained. True, a male specimen was observed by Claus as early as the year 1889; but its relation to *Cancerilla tubulata* of Dalyell was not recognised by that author, who did not hesitate to establish for it, not only a new species, but even a new genus. There cannot in my opinion be any doubt, that Giesbrecht was quite right in considering *Caligidium vagabundum* of Claus to be the adult male of *Cancerilla tubulata,* and that the description and figure given by Canu of the supposed male *Cancerilla* only refer to a quite immature specimen. The remarkable sexual dimorphism occurring in the present form may be easily explained from the sedentary habits of the female, causing in the latter a considerable reduction of the sensory and locomotory apparatus, and at the same time affecting the general form of the body.

Occurrence.—I have met with the female of this curious form occasionally, off both the south and west coasts of Norway, and always attached in the very same manner ventrally to the base of one of the arms of the common brittle-star, *Amphiura squamata.* Its attachment is effected by the strongly hooked posterior antennæ, and is so firm that it is very difficult to detach it without breaking off those appendages. It is indeed very probable that the animal remains attached in the place it has chosen for the rest of its life, being quite unable to move about in the water. The adult male I have taken free in the sea in 3 different localities of the Norwegian coast, viz., at Risor and Korshavn, on the south coast, and at Magero, outside the Trondhjem Fjord, only a single specimen being found in each locality.

Distribution.—British Isles (Dalyell), coast of France (Canu), Mediterranean, at Trieste (Claus) and Naples (Giesbrecht).

Section 3. Poecilostoma.

General Characters.—Anterior antennæ in male not hinged. Posterior antennæ without any outer ramus, and generally adapted for prehension. Oral parts not adapted either for mastication or for suction. Mandibles wanting. Maxillæ with the terminal part variously modified for conveying food to the mouth, and provided outside with a flap-shaped setiferous palp or exopodite. Anterior maxillipeds never prehensile. Posterior maxillipeds transformed in male to powerful grasping organs. Natatory legs, as a rule, well developed. Last pair of legs, when present, extended laterally, uni-or biarticulate.

Remarks.—The Cyclopoids comprised within this section differ materially from those included in the 2 preceding sections by the structure of the mouth-organs, which are not adapted either for mastication or for suction, but more properly for licking up finely dissipated nourishing particles from the surface of various organisms or from the wall of their inner (branchial) cavities. In accordance therewith the chief masticating organs, the mandibles, are entirely wanting, and the number of oral appendages of course reduced to 3 pairs only, viz., the maxillæ and the 2 pairs of maxillipeds. I am well aware that the above interpretation of the mouth-organs, which agrees, as will be seen, with that originally set forth by Thorell, is quite at variance with the view generally adopted by recent carcinologists on the authority of Claus, according to which the usual number of oral limbs should be present, the foremost of them representing the true mandibles. There are, however, several serious objections to be urged against the correctness of this altered view of the oral apparatus. Indeed, on a careful examination of the mouth-organs in various types of the present section, I am led to the conclusion that the view insisted on by Claus and accepted by most recent authors cannot be maintained, and that we must recur to the interpretation originally given by Thorell as the only one acceptable.

As to the number of oral limbs, only 3 pairs are in reality distinguishable, as stated by Thorell. The assumption of the presence of a 4th pair between the 2 anterior ones rests entirely on a miscomprehension, a part of the foremost pair having been erroneously taken for an independent limb. This part, generally described as a maxilla, is always found firmly attached to the outer side of the foremost pair of limbs, and represents in reality, as opined by Thorell, the palp or exopodite of those limbs. Though in a few cases this exopodite may assume a somewhat maxilla-like appearance, it presents

itself in the great majority of forms as an insignificant appendage turned backwards, or from the mouth, and attached in much the same manner as in other Copepoda. That this foremost pair of oral limbs, together with their palpiform appendage, cannot be regarded as the mandibles, but must represent, as justly opined by Thorell, the true maxillæ, is evident not only from their place far behind the antennal area, but also from their relation to the oral aperture. The exact position of the latter is not always easy to determine, because it is more or less completely covered by a lamellar anterior lip; on a closer examination, however, it will invariably be found that the said limbs are not placed, like the mandibles, at the sides of that aperture, but decidedly behind it, turning their extremities more or less forwards, precisely as do the maxillæ in other Copepoda. The armature also of these limbs is very different from that generally met with in the mandibles, and in some cases at least (Clausidiidæ) exhibits an unmistakable resemblance to that found in some of the gnathostomous Cyclopoida, for instance in those belonging to the family *Cyclopidæ*. It will finally be noticed that whereas the mandibles in several cases are quite destitute of palps, these appendages are almost invariably found in the maxillæ. Thorell describes all the oral limbs as maxillæ (m^1—m^3); but, according to the usual terminology, the 2 posterior pairs should more properly be named maxillipeds.

About the parasitic nature of the Copepods belonging to the present section there cannot be any doubt; but in many instances the hosts infested by them have not yet been ascertained. The parasitism is in every case, like that of most of the siphonostomous Cyclopoida, rather incomplete or merely temporary, the animals being able easily to change their place and to move freely through the water. Somewhat more sedentary are of course the habits of such forms as live in the branchial cavity of Ascidians or within the valves of different Mussels; though these forms also may at times be able to leave their hosts. Only a few forms are stated to be true fish-parasites, viz., the species of the genera *Bomolochus, Ergasilus* and *Thersitina;* but by far the greater number seem to be confined to invertebrate animals belonging to many different groups e. g. Echinoderms, Worms, Mollusca, Tunicata. A number of forms belonging to this section lead a true pelagic life, being constantly found in the open sea, and probably at times infesting some of the larger pelagic animals. This is the case with all the known forms belonging to the 3 families *Oncæidæ, Corycæidæ* and *Sapphirinidæ.*[1])

[1]) The parasitism of some species of *Sapphirina* on Salpæ has long been known.

The poecilostomous Cyclopoida which up to the present are stated to belong to the Fauna of Norway, may be referred to 6 well-defined families, to be treated of in the succeeding pages.

Fam. 10. Clausidiidæ.

Characters.—Anterior division of body more or less expanded, having the first trunk-segment wholly consolidated with the cephalon. Tail composed of the usual number of segments. Anterior antennæ 6—7-articulate. Posterior antennæ scarcely prehensile, being clothed at the tip with long curved setæ. Anterior lip short and broad, lamellar, with the terminal edge entire and fringed with fine spinules. Maxillæ with the terminal part only slightly curved and armed at the tip with 2 stout claw-like spines distinctly articulated at the base, and accompanied inside by one or two coarse ciliated setæ; palp generally well developed, incurved. Anterior maxillipeds short and stout, biarticulate; 1st joint very massive, 2nd small and terminating in 2 claw-like spines accompanied by one or 2 ciliated setæ. Posterior maxillipeds more slender and 3-articulate, being generally clothed with rather long setæ; those in male very powerfully developed. Ventral face forming between the oral parts in front 2 juxtaposed hairy lappets (lateral lips). Natatory legs, as a rule, of normal structure, though the 1st pair in some cases (Clausidium) may be peculiarly modified. Last pair of legs uni- or bi-articulate, distal joint more or less lamellar.

Remarks.—The present family was established by E. Canu, to comprise the genus *Hersilia* Philippi and allied forms. As however the generic name *Hersilia* has been preoccupied, it must be replaced by the name *Clausidium* proposed by Kossman, and the family accordingly be named *Clausidiidæ* instead of *Hersiliidæ*. It is chiefly characterised, as compared with the other families, by the non-prehensile posterior antennæ, the form of the anterior lip, the peculiar armature of the maxillæ, and partly also by the structure of the maxillipeds. To the Norwegian Fauna belong 2 well-defined genera referable to this family, each represented by only a single species.

Gen. 36. **Hemicyclops,** Boeck, 1873.

Syn: *Hersiliodes,* Canu (part).
„ *Platycheiron,* Scott.

Generic Characters.—Body cyclopoid in shape, with the anterior division sharply marked off from the posterior, and more or less flattened. Tail comparatively slender, with the caudal rami not much produced. Anterior antennæ of moderate length and composed of 7 joints, none of which are expanded in front. Posterior antennæ with the terminal joint very short. Maxillæ provided with 2 setæ inside the apical spines; palp produced inside at the end to a well-defined small setiferous lobule. Anterior maxillipeds with several ciliated setæ in addition to the 2 apical spines. Posterior maxillipeds in female moderately strong, but scarcely prehensile, being clothed with rather long, partly spiniform setæ; those in male powerfully developed, with the propodos very broad and flattened and coarsely denticulated inside. Natatory legs all of normal structure, with both rami 3-articulate. Last pair of legs biarticulate; distal joint broad, lamellar, and edged with 3 spines and a delicate apical bristle.

Remarks.—This genus was established as early as the year 1873 by Boeck, to include a peculiar Copepod found by the present author in the upper part of the Christiania Fjord. Its true relationship to the other Cyclopoida was however not recognised by Boeck, who placed the genus near *Cyclops* within the group of gnathostomous Copepoda. The genus *Hersiliodes* of Canu agrees in most characters with that here under question; but of the 3 species recorded by him only the two, viz., *H. Thompsoni* and *H. puffini* can with full certainty be adduced to Boeck's genus; the 3rd species *H. Pelseneeri*[1]) seems to me to be so different from the other 2, both as to the general form of the body an to the structure of some of the appendages, that it hardly can be combined with them in the same genus. If the generic name *Hersiliodes* is to be retained, it must of course be restricted to that species. Of the various species described by T. Scott, and provisionally referred to the genus *Lichomolgus* Thorell, there are two which unquestionably belong to the present genus, viz., *L. littoralis* and *L. aberdonensis,* the first of them being apparently identical with the Norwegian species here described. Scott himself was well aware of the considerable differences which these two species exhibit, as compared with the typical Lichomolgi, and in a supplementary note[2]) suggested

[1]) According to Giesbrecht, this species is identical with the form described at an earlier date by Grube as *Antaria latericia.*

[2]) Annals of Scottish Nat. Hist. 1892, p. 153.

the desirability of transferring them to a particular genus or subgenus, for which he proposed the name *Platycheiron,* referring to the broad and flattened form of the propodos in the male posterior maxillipeds. This name cannot however be accepted, as it is of much more recent date than that proposed by Boeck.

77. Hemicyclops purpureus, Boeck.

(Pl. LXXXI).

Hemicyclops purpureus, Boeck, Nye Slægter og Arter av Saltvandscopepoder, Chr. Vid. Selsk. Forhandl. f. 1872, p. 42.

Syn: *Lichomolgus littoralis,* Scott.

Specific Characters.—Female. Body moderately slender, with the anterior division rather broad, oval in outline, and pronouncedly applanated. Cephalic segment fully as long as the 4 succeeding segments combined and narrowly rounded in front; rostral prominence incurved and obtuse at the tip. Epimeral plates of the 3 succeeding segments expanded laterally and closely imbricate; those of the 4th segment scarcely smaller than the others. Last trunk-segment abruptly much smaller than the preceding ones, and not much broader than the genital segment. Tail rather slender, equalling in length about $^2/_3$ of the anterior division, and sub-cylindric in form; genital segment about as long as the 3 succeeding segments combined, and only very slightly dilated in front; anal segment rather small. Caudal rami comparatively short, though a little longer than they are broad at the base, and slightly narrowed distally; seta of outer edge small and attached near the end; apical setæ rather unequal, the inner mediate one being, as usual, the longest, and almost attaining the length of the tail, seta of outer corner scarcely half as long as that of the inner. Anterior antennæ about equal in length to the cephalic segment, and gradually attenuated distally, being somewhat abruptly bent at the base, 2nd and 4th joints the longest. Posterior antennæ well developed, penultimate joint almost as long as the preceding one and ciliated along the anterior edge, distal corner scarcely produced and provided with a strong curved seta and 2 bristles, one of which is ciliated; terminal joint much shorter than the penultimate one and almost quadrangular in form, carrying on the tip 4 strong curved setæ accompanied by a few short bristles. Anterior maxillipeds with 2 coarse setæ at the end of the proximal joint inside and 2 others on the distal joint, apical spines very strong, claw-like, the outer one armed in the middle with a well-marked denticle. Posterior maxillipeds rather fully developed, with the middle joint angularly produced inside, and, like the

preceding joint, carrying 2 ciliated setæ; terminal joint small, with 2 remarkably incurved setæ accompanied by a number of thin bristles. Natatory legs with the inner ramus considerably longer than the outer. Last pair of legs with the proximal joint well defined and carrying outside the usual bristle; distal joint broadly ovate, or almost spatulate in form, and densely ciliated on both edges, marginal spines rather strong and attached to distinct ledges; apical bristle thin and slender. Ovisacs of moderate size, narrow fusiform in shape, and considerably divergent.

Body of a clear whitish hue, with the ovarial tubes and the ovisacs bright red.

Length of adult female 1.15 mm.

Remarks.—This form, as above mentioned, was briefly characterised by Boeck as early as the year 1873, and is the type of the present genus. I have little doubt that the *Lichomolgus littoralis* of Scott, originally described from a solitary male specimen, is the very same species, and this is indeed still more confirmed by the figure subsequently given by the same author of an adult female specimen. It is an easily recognisable form, and in the living state highly distinguished by the bright red colour of the ovarial tubes and the ovisacs, a character which has given rise to the specific name proposed by Boeck.

Occurrence.—Only very few specimens of this pretty form have hitherto come under my notice, all of the female sex. One of these specimens, that from which Boeck's description was made, was taken many years ago in the upper part of the Christiania Fjord from a depth of about 20 fathoms; the other specimens were procured in the middle part of the Fjord, at Moss, and in about the same depth.

Distribution.—Scottish coast (Scott).

Gen. 37. **Hippomolgus,** G. O. Sars, n.

Generic Characters.—Body less pronouncedly cyclopoid in shape, the anterior division being only slightly dilated and not very sharply marked off from the posterior. Caudal rami much produced. Anterior antennæ short and robust, 6-articulate. Posterior antennæ comparatively feeble in structure. Maxillæ armed in a much similar manner to those in *Hemicyclops,* palp however of somewhat simpler structure, with the sub-apical lobule very small and pro-

vided with only 2 unequal setæ. Maxillipeds also less fully developed, with the setæ rather reduced both in size and number. Natatory legs very coarsely developed, with some of the setæ transformed in to slender spines; 1st pair not peculiarly modified. Last pair of legs uniarticulate, the proximal joint being wholly coalesced with the corresponding segment; distal joint comparatively narrow, but armed in a manner similar to that in *Hemicyplops*.

Remarks.—This is a very distinct genus, differing in several points rather markedly from the other known *Clausidiidæ*. It ought however evidently to be referred to that family, as the oral parts are built on much the same type. It comprises as yet only a single species, to be described below.

78. Hippomolgus furcifer, G. O. Sars, n. sp.

(Pl. LXXXII).

Specific Characters.—Female. Body moderately slender, with the anterior division oblong oval in outline and scarcely applanated. Cephalic segment occupying about half the length of the anterior division, and gradually narrowed anteriorly; rostral prominence small, but well defined. The 3 succeeding segments gradually diminishing in width, and having the epimeral plates only slightly expanded. Last trunk-segment well developed, and almost at broad as the preceding segment. Tail exceeding in length $^2/_3$ of the anterior division, and rapidly tapering behind; genital segment rather massive, and exhibiting on each side, close to the base, a small dentiform prominence; anal segment attaining the length of the 2 preceding segments combined. Caudal rami exceedingly slender and narrow, being more than twice as long as the anal segment and slightly divergent, outer edge provided close to the base with a small bristle, and at about the middle with another somewhat larger bristle, the 2 middle apical setæ well developed, the other 2 however very small. Eye apparently wholly absent. Anterior antennæ unusually short and robust, being scarcely half as long as the cephalic segment, and clothed with numerous diverging setæ, some of which are short and curved, almost spiniform and coarsely spinulose, others very long and slender; 1st joint rather broad and produced in front to a short dentiform projection, behind to a strong mucroniform spine; the 4 succeeding joints gradually diminishing in size and lamellarly expanded in front; terminal joint simple, cylindric and provided at the tip, in addition to the setæ, with a strongly developed slender æsthetask; a similar æsthetask being moreover attached to each of the 2 preceding joints. Posterior antennæ comparatively feeble, though built

on the same type as in the other *Clausidiidæ*, penultimate joint scarcely half as long as the preceding one, and provided with 3 curved setæ accompanied by a thin bristle; last joint considerably longer and carrying on the tip 6 very long and curved setæ. Anterior lip and maxillæ not much differing in their structure from those parts in other *Clausidiidæ*. Lateral lips only slightly indicated. Anterior maxillipeds with no setæ on the proximal joint; apical spines comparatively slender and nearly straight, being only accompanied by a single seta. Posterior maxillipeds rather feeble in structure, and provided with only a few comparatively short setæ; terminal joint very small, with only 2 minute spines on the tip. Natatory legs with the rami nearly equal in size; spines of outer ramus much elongated, especially in the 1st pair. Last pair of legs with the free joint narrow oblong in shape, and produced at the inner distal corner to a recurved dentiform projection, marginal spines moderately strong, 2 of them being attached to the end of the joint, the 3rd to a distinct ledge at about the middle of the outer edge; apical bristle rather slender. Ovisacs of moderate size, oblong oval in form, and scarcely at all divergent.

Colour whitish grey.

Length of adult female 1.40 mm.

Male unknown.

Remarks.—The present form is easily recognisable from any of the other known *Clausidiidæ*, both by the general appearance of the body and by the structure of the several appendages. The anterior antennæ in particular are highly distinguished by their short and stout form and the coarse setæ clothing them.

Occurrence.—Only 3 female specimens of this remarkable form have hitherto come under my notice. Two of them were taken in the outer part of the Stavanger Fjord, at Bukken, from a depth of about 60 fathoms, muddy bottom. The 3rd specimen was found at Risør, south coast of Norway, in about the same depth.

Fam. 11. Lichomolgidæ.

Characters.—Body more or less pronouncedly cyclopoid in shape, the anterior division being generally considerably dilated and sharply marked off from the slender posterior one. Anterior antennæ slender, and composed of

7 joints, the 2nd of which is invariably the longest. Posterior antennæ more or less pronouncedly prehensile, being armed at the tip with a varying number of curved claws. Oral area far remote from the antennal one, and occupying about the centre of the ventral face of the cephalic segment. Anterior lip deeply cleft in the middle or bilobate, edges of the lobes smooth. Lateral lips absent. Maxillæ terminating in a lamellar falciform lappet curving anteriorly and exserted to a thin flexible point; palp in most cases of inconsiderable size. Anterior maxillipeds with the proximal joint naked, distal joint provided inside with a slender spine, its end being, as a rule, exserted to a thin setiform lash abruptly bent at the base and turned anteriorly, with the outer edge finely spinulose. Posterior maxillipeds more or less imperfectly developed in female, but transformed in male to strong grasping organs. Natatory legs, as a rule, of normal structure, though the inner ramus of the 4th pair may in some cases be more or less reduced. Last pair of legs, as a rule, represented on each side by a single joint extended laterally.

Remarks.—The type of the present family is the genus *Lichomolgus* of Thorell, with which in recent times a number of more or less nearly allied genera have been associated, to form a quite natural group. From the *Clausidiidæ* this family is pretty well distinguished by the generally pronouncedly prehensile character of the posterior antennæ, as also by the rather different structure of the oral parts. In these respects it agrees much more closely with another family, viz., the *Sapphirinidæ,* and indeed, for this reason, Thorell referred his genus *Lichomolgus* to that family. The external appearance of the body is however very unlike that met with in the said family, being perfectly cyclopoid. Nor are there any traces of the peculiar ocular lenses so characteristic of the *Sapphirinidæ*. The present family is well represented in the Fauna of Norway, several genera and species having been observed, to be described in the succeeding pages.

Gen. 38. **Lichomolgus,** Thorell, 1860.

Generic Characters.—Anterior division of body rather dilated and pronouncedly applanated, with the 1st trunk-segment in most cases defined from the cephalon by a well-marked suture dorsally. Tail slender and composed of the usual number of segments; the genital one in male greatly inflated. Integuments, as a rule, very thin and soft. Anterior antennæ slender and

narrow, 7-articulate. Posterior antennæ pronouncedly prehensile, being armed at the tip with 2 or 3 curved claws. Maxillæ with the terminal lappet much produced and densely hairy on both edges; palp forming a small bi—or tri—setose lobe turning backwards. Anterior maxillipeds with the apical lash long and slender. Posterior maxillipeds in female short and stout, 3-articulate, and almost naked, last joint conically produced; those in male well developed, subcheliform, dactylus very slender and more or less strongly curved in the middle. Natatory legs with the rami comparatively broad and nearly equal-sized in the 3 anterior pairs; inner ramus of 4th pair however somewhat reduced in size, and composed of only 2 joints, the distal one provided with 2 unequal spines on the tip. Last pair of legs with the free joint comparatively small, bisetose. Ovisacs in female very large.

Remarks.—This genus was established by Thorell as early as the year 1860, to include 4 species found by him in the branchial cavity of various Ascidians. I have been enabled to identify all these species, and they will be here described and figured in detail, together with 4 additional forms, making in all no less than 8 different species belonging to the Norwegian Fauna. In spite of this considerable number of species, the genus is here taken in a much more restricted sense than is done by most other authors, who refer to it forms which in my opinion evidently are not congeneric. Some of these aberrant forms have certainly been separated by Claus and Canu as types of nearly-allied genera; but I think that this generic separation must be carried still further. The peculiar rudimentary condition of the caudal setæ observed in the species described by Thorell cannot however properly be regarded as a character of generic value, but is evidently due to the sedentary habits of these forms within the branchial cavity of Ascidians. In 3 of the species described below, these setæ, as shown by the figures, are quite normally developed; and it is very likely that the said species do not at all have their abode within Ascidians, but are true ecto-parasites, as has indeed been proved as regards at least one of them *(L. agilis)*.

79. Lichomolgus albens, Thorell.

(Pl. LXXXIII).

Lichomolgus albens, Thorell, Bidrag til Kännedomen om Krustaceer som lefva i Arter af slägtet Ascidia, p. 69, Pl. X, XI, XII: 15.

Specific Characters.—Female. Body moderately slender, with the anterior division rather dilated in front and pronouncedly applanated. Cephalic segment broadly expanded, and exhibiting in its posterior part dorsally a

well-marked transverse suture, indicating the boundary between the 1st trunk-segment and the cephalon. The 3 succeeding segments gradually diminishing in size, with the epimeral plates rounded off and, as a rule, discontiguous, being separated by well-marked lateral incisions. Last trunk-segment very small, not nearly as broad as the genital segment. Tail somewhat exceeding half the length of the anterior division; genital segment fully as long as the 3 succeeding segments combined, and having its anterior part considerably dilated and rather sharply marked off from the posterior; anal segment not attaining the length of the 2 preceding segments combined, and scarcely longer than it is broad. Caudal rami of moderate length and sublinear in form, equalling in length about the last 2 segments combined, and scarcely at all divergent; seta of outer edge well marked and attached near the middle; apical setæ much reduced in size, the 2 middle ones terminating in a very delicate smooth filament obtuse at the tip. Anterior antennæ rather slender, about equal in length to the cephalon, and clothed with scattered curved setæ of moderate length; 1st joint considerably dilated; 2nd joint about the length of the 2 succeeding joints combined; 4th joint longer than the 5th, which equals the 6th in length; last joint very small. Posterior antennæ moderately strong, with the 2nd joint longer than the outer 2 combined; penultimate joint short and very oblique, with 3 small bristles in front; terminal joint slightly dilated in the middle and armed on the tip with 2 somewhat unequal claws, the outer one shorter, but stronger, than the inner. Maxillæ with the terminal lappet very slender and finely ciliated on both edges, palp rather small, bisetose, with a slight notch inside the tip. Anterior maxillipeds with the proximal spinule of the apical lash much coarser than the others. Natatory legs with the rami rather broad; terminal joint of the outer one carrying outside in the 2 anterior pairs 3, in the 2 posterior pairs 2 spines, those in the 1st pair coarsely denticulate in front; terminal joint of inner ramus with only a single spine in the 1st pair and 3 spines in the 2 succeeding pairs; inner ramus of 4th pair somewhat longer than the first 2 joints of the outer combined; distal joint attenuated, with the apical spines rather slender. Last pair of legs extremely small, being represented on each side by a minute sub-cylindric joint with 2 slightly unequal bristles on the tip. Ovisacs very large, extending far beyond the end of the tail, and oblong, or nearly cylindric in form.

Male of much smaller size than female, and having the anterior division of the body less dilated. Tail, as usual, composed of 5 well-defined segments, the foremost of which (the genital segment) is very large and tumid for the reception of the 2 spermatophores. Posterior maxillipeds powerfully developed,

with the dactylus very long and abruptly curved in the middle, tip minutely hamate.

Body in both sexes semipellucid, of a whitish hue; ovarial tubes and ovisacs in female of an opaque pure white colour; eye bright red.

Length of adult female amounting to 1.50 mm.; that of male scarcely attaining 1 mm.

Remarks.—This form has been very carefully described and figured by Thorell in his above-mentioned paper, and, as it is that species which is placed at the head, it ought to be regarded as the type of the present genus.

Occurrence.—I have taken this form from the branchial cavity of various Ascidians captured on the south and west coasts of Norway, most frequently perhaps from that of *Corella paralellogramma*. It is generally found attached between the lamellæ of the branchial sac; but it may easily change its place. When detached, it swims about in the usual cyclopoid manner, though by no means very rapidly. Owing to its pale semipellucid body, it is not easy to detect, except when loaded with the large ovisacs, the opaque white colour of which at once strikes the eye.

Distribution.—Bohuslän (Thorell), British Isles (Scott), ? coast of France (Canu), Mediterranean (Della Valle).

80. Lichomolgus forficula, Thorell.

(Pl. LXXXIV).

Lichomolgus forficula, Thorell, l. c. p. 73, Pl. XII, XIII: 19.

Specific Characters.—Female. Body comparatively more slender than in the type species, with the anterior division more regularly oval in outline, the greatest width occurring at about the middle, 1st trunk-segment very distinctly defined from the cephalon; last segment small, though scarcely narrower than the genital segment. Tail very slender, even exceeding in length the anterior division; genital segment slightly dilated in front of the middle, with the anterior part not sharply marked off from the posterior; anal segment very long and narrow, attaining half the length of the preceding part of the tail, and more than twice as long as it is broad. Caudal rami exceedingly slender and elongated, considerably exceeding half the length of the remainder of the tail, and somewhat bent in front of the middle, carrying at this place dorsally 2 juxtaposed delicate bristles, one of them apparently answering to the seta of the outer edge in *L. albens;* distal part of the rami very narrow and attenuated, curving generally slightly outwards; apical setæ, as in *L. albens,*

much reduced in size. Anterior antennæ comparatively shorter than in that species, scarcely attaining the length of the cephalon, but having some of the setæ rather longer; 1st joint less broad; 2nd somewhat longer than the 2 succeeding joints combined, and slightly curved; 4th joint about the length of the 5th, which equals in length the 2 outer joints combined. Posterior antennæ shorter and stouter than in *L. albens*, with the 2nd joint rather thick and not attaining the length of the 2 outer joints combined; apical claws 2 in number, both rather strong, the outer one being much the longer. Maxillæ with the terminal lappet abruptly bent at the base and edged with rather long cilia, especially at the basal curvature; palp with a small additional seta inside the other 2. Anterior maxillipeds with none of the spinules of the apical lash particularly strong. Natatory legs on the whole resembling in structure those in the type species; spines of outer ramus in 1st pair however broadly marginate, dagger-shaped. Inner ramus of 4th pair of legs scarcely longer than the first 2 joints of the outer combined; distal joint oblong oval in form, with the inner edge evenly curved, apical spines comparatively short, the outer one scarcely half as long as the inner. Last pair of legs with the free joint small, though a little more produced than in *L. albens*, and slightly curved. Ovisacs oblong oval in form and extending scarcely as far as the caudal rami.

Male exhibiting the usual sexual differences from the female.

Colour whitish, pellucid.

Length of adult female amounting to 1.40 mm.; that of male to about 1 mm.

Remarks.—This form is at once recognised by the very slender tail, the elongate anal segment, and the peculiar structure ot the caudal rami. It also differs conspicuously from *L. albens* in some of the structural details, and more particularly in the form and armature of the posterior antennæ.

Occurrence.—I have taken this form not unfrequently from the branchial cavity of *Ascidia mentula* and *canina* captured in different places on the south and west coasts of Norway. Thorell obtained it only from the last-named Ascidian.

Distribution.—Bohuslän (Thorell), British Isles (Brady).

81. Lichomolgus marginatus, Thorell.

(Pl. LXXXV).

Lichomolgus marginatus, Thorell, l. c., p. 71, Pl. XII: 18.

Specific Characters.—Female. General form of body somewhat resembling that of *L. albens,* the cephalic segment being considerably expanded and much broader than the succeeding ones. No trace however of any subdivision of this segment is to be detected. Tail rather slender, though not fully attaining the length of the anterior division; genital segment sub-fusiform in shape, being slightly dilated in the middle, with no sharp demarcation between the anterior and posterior parts; anal segment somewhat exceeding in length the 2 preceding segments combined, and considerably longer than it is broad. Caudal rami slender and narrow, attaining about half the length of the remainder of the tail, and only slightly divergent, tapering gradually to an obtuse point, each of them having in front of the middle a very delicate bristle arising from the dorsal face; apical setæ extremely small and rudimentary, almost obsolete. Anterior antennæ of moderate length, and on the whole agreeing in structure with those in *L. forficula.* Posterior antennæ also rather similar, though somewhat more elongated; apical claws longer and thinner, the anterior one, as in that species, fully twice as long as the posterior. Maxillæ with the terminal lappet less abruptly bent at the base, and having the marginal cilia shorter and more densely crowded; palp very small with only 2 setæ on the tip. Maxillipeds scarcely differing in structure from those in *L. forficula.* Natatory legs also very similar; distal joint of inner ramus in 4th pair, however, somewhat less broad. Last pair of legs with the free joint rounded oval in form. Ovisacs large, though extending only slightly beyond the caudal rami.

Body of the usual whitish colour.

Length of adult female 1.30 mm.

Remarks.—The present species somewhat resembles in the general form of the body *L. albens,* from which it is however at once distinguished by the absence of any dorsal suture on the cephalic segment, as also by the form of the genital segment (in female) and of the caudal rami. In the structural details it evidently comes nearer to *L. forficula* than to *L. albens,* as shown by the figures given on the accompanying plate.

Occurrence.—Only a few female specimens of this form have as yet come under my notice. They were selected from a number of specimens of *L. forficula,* collected at different times and in different localities. I cannot,

of course, state from which form of Ascidians these specimens were derived. Thorell, who is the only author by whom this species has hitherto been observed, obtained it from the branchial cavity of *Ascidia venosa,* and more rarely from that of *A. canina.*

Distribution.—Bohuslän (Thorell).

82. Lichomolgus furcillatus, Thorell.

(Pl. LXXXVI).

Lichomolgus furcillatus, Thorell, l. c., p. 74, Pl. XIII: 20.

Specific Characters.—Female. Body comparatively less slender than in the 3 preceding species, with the anterior division sub-pyriform in outline. Cephalic segment moderately expanded, and exhibiting behind a well-marked transverse suture. Tail scarcely exceeding half the length of the anterior division; genital segment comparatively large and somewhat dilated in the middle, with the anterior and posterior parts well marked off from each other laterally; anal segment rather small, broader than it is long. Caudal rami not much produced, scarcely exceeding in length the last 2 segments combined, and of nearly equal width throughout; seta of outer edge well marked and attached at about the middle; apical setæ less rudimentary than in the preceding species, though scarcely ciliated, the inner mediate one almost as long as the corresponding ramus; dorsal bristle well marked and attached near the end. Anterior antennæ about the length of the cephalon, and of the usual appearance. Posterior antennæ resembling in structure those in *L. albens,* except that the proximal bristle of the penultimate joint is replaced by a strong spine. Oral parts on the whole normal. Natatory legs likewise built on the very same type as in the preceding species. Inner ramus of 4th pair of legs somewhat longer than the first 2 joints of the outer combined; distal joint, as in *L. albens,* attenuated in its outer part, and having the inner apical spine rather long. Last pair of legs with the free joint comparatively larger than in the preceding species, and exhibiting a well-marked notch in the middle of the outer edge; both apical setæ spiniform, the posterior one the longer. Ovisacs rather large, extending far beyond the end of the tail.

Male with the posterior maxillipeds very powerfully developed, inner edge of the propodos produced in the middle to a small papilliform prominence; dactylus long and slender, being abruptly curved at some distance from the base.

Colour whitish.

Length of adult female 1.30 mm.

Remarks.—I cannot doubt that the above-described form is that recorded by Thorell as *L. furcillatus,* though the figure he gives of the female looks somewhat different from that here reproduced. On the other hand the form described (though rather imperfectly) by Brady under that name is certainly very different, and would seem, judging from the figure given of the posterior part of the body in a female specimen, to be more properly referable to the genus *Macrocheiron,* to be treated of farther on. Though nearly related to the 3 preceding species, the present one may be easily distinguished by the comparatively much shorter caudal rami and the form of the genital and anal segments. The free joint of the last pair of legs also differs conspicuously both in shape and armature.

Occurrence.—I have only met with this form in a single locality situated in the upper part of the Christiania Fjord. All the specimens were taken from the branchial cavity of *Styela intestinalis.* Thorell obtained his specimens from the same Ascidian.

Distribution.—Bohuslän (Thorell), ? Scottish coast (Scott).

83. Lichomolgus Canui, G. O. Sars, n. sp.

(Pl. LXXXVII).

Syn: *Lichomolgus albens,* Canu (not Thorell).

Specific Characters.—Female. Body of shorter and stouter form than in any of the preceding species, with the anterior division oblong oval in outline. Cephalic segment not much expanded, being scarcely broader than the succeeding segment, and exhibiting behind a well-marked transverse suture. Tail about equalling in length the cephalic segment, and of a somewhat robust appearance; genital segment rather large and massive, being considerably tumified, with the anterior part slightly marked off from the posterior; anal segment scarcely larger than the preceding one. Caudal rami about twice as long as the anal segment, and somewhat divergent, being of almost equal width throughout; seta of outer edge attached a little beyond the middle; apical setæ somewhat resembling those in *L. furcillata,* being less rudimentary than in the type species. Anterior antennæ about the length of the cephalon, and somewhat less slender than in *L. albens.* Posterior antennæ resembling in structure those in the said species, but having the apical claws comparatively longer. Oral parts scarcely differing in structure from those in *L. albens.* Natatory legs also rather similar; distal joint of inner ramus in 4th pair how-

ever less attenuated in its outer part. Last pair of legs with the free joint comparatively broader than in *L. albens,* its posterior edge forming a conspicuous bulge; apical setæ more unequal, the inner one rather short and spiniform. Ovisacs oblong oval in form and somewhat divergent, extending only slightly beyond the end of the tail.

Colour whitish.

Length of adult female about 1 mm.

Remarks.—The above-described species agrees pretty well with the description and figures given by Canu of the form regarded by him as *L. albens* Thorell. That however this identification is erroneous, is at once proved by the figure he gives of the female, which is very unlike that given by Thorell, whereas it agrees much better with the species here described. The present form, it is true, is nearly allied to *L. albens*, but is evidently specifically distinct, as it differs not only in the general form of the body, but also in some of the structural details. It is also rather inferior in size.

Occurrence.—I have only recently become acquainted with this species, 2 or 3 female specimens of which were picked out from a number of *L. albens* collected in different localities and from various Ascidians. It is of course impossible for me to state from which form of Ascidian the said specimens were derived, or at which locality they occurred. Canu states its occurrence in 3 different Ascidians from the French coast, viz., *Styela intestinalis, Molgula socialis* and *Cynthia lurida.* In none of these Ascidians has the true *L. albens* as yet been found.

Distribution.—Coast of France (Canu).

84. Lichomolgus Poucheti, Canu.

(Pl. LXXXVIII).

Lichomolgus Poucheti, Canu, Copépodes du Boulonnais, p. 231, Pl. XXIII, figs. 5—12.

Specific Characters.—Female. Body somewhat resembling in shape that in *L. Canui,* though having the anterior division comparatively broader and regularly oblong oval or elliptical in outline. Cephalic segment large, though not much expanded, and narrowly rounded in front, exhibiting behind dorsally a well-marked transverse suture. Tail comparatively short, only slightly exceeding half the length of the anterior division; genital segment not attaining the length of the 3 succeeding segments combined, and rather tumid in its anterior part, the greatest width equalling the length; anal segment about as long as the 2 preceding segments combined. Caudal rami not much produced,

scarcely exceeding in length the anal segment, and slightly divergent; seta of outer edge attached about in the middle; apical setæ normally developed and finely ciliated, the inner mediate one about the length of the tail without the caudal rami; seta of inner corner considerably longer than that of the outer. Anterior antennæ moderately slender, about equalling in length the cephalon, and of the usual structure. Posterior antennæ with the 2nd joint scarcely as long as the outer 2 combined; penultimate joint with the distal bristle transformed into a claw-like spine; apical claws not particularly strong and 4 in number, increasing successively in length inwards, the innermost one rather slender, almost setiform. Maxillæ with the terminal lappet rather slender and edged inside with a finely striated lamella, at the base of which a small denticle is attached; palp comparatively larger than in most other species and projecting at the end, inside the apical setæ, to an angular corner, in front of which a very small additional seta is attached. Anterior maxillipeds with the proximal spinules of the apical lash much coarser than the others. Natatory legs with the spines attached outside the outer ramus rather small, 3 such spines occurring on the terminal joint, except in the 4th pair; inner ramus of this pair scarcely as long as the first 2 joints of the outer combined, and having the distal joint considerably narrowed in its outer part; apical spines very unequal in length. Last pair of legs with the free joint short cylindric in form; inner apical seta spiniform and much shorter than the outer. Ovisacs large, narrow oblong, or almost cylindric in form, and extending far beyond the end of the tail.

Body pellucid, with a slight yellow or orange tinge.

Length of adult female 0.90 mm.

Male unknown.

Remarks. I cannot doubt that the above-described form is identical with the species recorded by Canu as *L. Poucheti,* though some small differences may be found, on comparing the figures here given with those reproduced by Canu. It differs from all the 5 preceding species in the perfectly normal development of the caudal setæ, indicating its freer existence as a true ectoparasite.

Occurrence.—Only 2 female specimens of this form have as yet come under my notice. The one of them was taken many years ago off the west coast of Norway, at Skjerjehavn, the other at Risör on the south coast. Both specimens were found in the free condition among dredged material procured from moderate depths. Canu found this form as a semi-parasite on the sur-

face of large colonies of *Morchallium argus* M. Edw. and *Fragarium areolatum* Giard.

Distribution.—Coast of France (Canu).

85. Lichomolgus tenuifurcatus, G. O. Sars, n. sp.

(Pl. LXXXIX).

Specific Characters.—Female. Body a little more slender than in the last-described species, with the anterior division broadly oval in outline and pronouncedly depressed. Cephalic segments rather broad behind, but gradually narrowed in front, and exhibiting dorsally a well-marked transverse suture, as a boundary between the cephalon and the 1st trunk-segment, this boundary being also indicated by a slight instriction of the lateral edges. Tail rather slender, considerably exceeding half the length of the anterior division; genital segment fully as long as the 3 remaining segments combined, and rather tumid in its anterior part; anal segment about the length of the 2 preceding segments combined. Caudal rami considerably produced, being more than twice as long as the anal segment and slightly divergent, their distal part conspicuously narrowed; seta of outer edge atttached somewhat beyond the middle; apical setæ normally developed, the inner mediate one more than twice as long as the outer, and having its distal part somewhat bent outwards; seta of inner corner only slightly longer than that of the outer. Integuments rather thin and soft. Anterior antennæ scarcely as long as the cephalon, and built in the usual manner, last joint very small. Posterior antennæ resembling in structure those in *L. Poucheti,* having a claw-like spine at the end of the penultimate joint, and 4 apical claws, the innermost long and narrow. Oral parts and legs likewise rather similar. Ovisacs very large, oblong in form, and extending far beyond the end of the tail.

Body of a dark grey colour, with a slight yellow tinge, and the ovarial tubes more opaque.

Length of adult female 1.40 mm.

Male unknown.

Remarks.—The present new species is nearly related to *L. Poucheti,* as regards its structural details, but is of considerably larger size, and moreover at once distinguished by the much more produced and narrower caudal rami, a character which indeed has given rise to the specific name here proposed.

Occurrence.—Some few female specimens of this form were taken many years ago on the west coast of Norway, at Eggesbønæs, and last summer I

obtained 2 additional specimens, the one ovigerous, at Risör on the south coast. All the specimens were found in the free condition among dredged material procured from moderate depths. Although the integuments are of a rather thin and soft consistency, somewhat similar to that found in the species which live in Ascidians, I have little doubt that the present form, like *L. Poucheti,* is in reality ectoparasitic in habits, since the caudal setæ do not, as in those species, exhibit any obliteration, but are quite normally developed. It remains to be ascertained, however, what animals are at times infested by the present species.

86. Lichomolgus agilis, (Leydig).

(Pl. XC).

Doridicola agilis, Leydig, Zeitschr. f. wissensch. Zoologie, Vol. IV, p. 377, Pl. XIV.

Syn: *Eolidicola tenax,* M. Sars.
„ *Lichomolgus doridicola,* Claus.
„ „ *chromodoridis,* Della Valle.
„ „ *concinnus,* Scott.

Specific Characters.—Female. Body comparatively short and stout, with the anterior division very much dilated, and rounded oval in outline. Cephalic segment large and evenly rounded in front, exhibiting behind a well marked transverse suture. Tail scarcely attaining half the length of the anterior division; genital segment considerably dilated in its anterior part, and about the length of the 3 succeeding segments combined; anal segment scarcely larger than the preceding one. Caudal rami quite short, not even attaining the length of the anal segment and scarcely longer than they are broad; seta of outer edge attached near the end; apical setæ well developed, the inner mediate one being fully as long as the tail; seta of inner corner about twice the length of that of the outer. Anterior antennæ very slender, exceeding in length the cephalon, and having the outer 4 joints remarkably long and narrow. Posterior antennæ exceedingly powerful, 2nd joint large and muscular, exceeding a little in length the outer 2 joints combined; penultimate joint, as usual, short and oblique, with the middle bristle transformed into a claw-like spine; apical claws 2 in number, the interior one very strong and curved. Maxillæ with the terminal lappet rather produced, and forming at the base a slight expansion edged with small denticles; palp comparatively small, trisetose. Anterior maxillipeds with the apical lash less abruptly bent at the base than usual, and edged with rather slender spinules rapidly diminishing in size distally. Posterior maxillipeds with the dactylar joint short and provided outside with a well-

marked ciliated spine. Natatory legs built on the very same type as in the 2 preceding species; inner ramus of 4th pair somewhat longer than the first 2 joints of the outer combined; distal joint narrowed in its outer part, with the apical spines of moderate length. Last pair of legs with the free joint more produced than in the other species and having the apical setæ of nearly equal length, none of them spiniform. Ovisacs large, oblong in form, and extending far beyond the end of the tail.

Male, as usual, smaller than female, and having the anterior division of the body somewhat less broad, being moreover easily recognised by the greatly inflated genital segment. Posterior maxillipeds powerfully developed, with a dense row of delicate spinules along the inner edge of the propodos; dactylus slender and abruptly curved in the middle.

Body in both sexes semipellucid, with a violaceous or in some cases orange tinge.

Length of adult female about 1.20 mm., of male 0.90 mm.

Remarks.—This form was described as early as the year 1853 by Leydig under the name of *Doridicola agilis*. It has subsequently been observed by several authors, and recorded under different names. In the year 1862 my late father described it as a new form under the name *Eolidicola tenax*, being unaware of Leydig's paper, and Claus, who found that Leydig's species ought to be referred to Thorell's genus *Lichomolgus*, recorded it as *L. doridicola*. The specific name *agilis*, originally given to this form by Leydig, must however be retained, and this has also been done by Canu. The *L. concinnus* of Scott is unquestionably identical with the present species.

It is a very distinct and easily recognisable form, being especially distinguished by the very broad anterior division of the body, the comparatively short tail, and the unusually powerful posterior antennæ.

Occurrence.—I have met with this form in several places, both on the south and west coasts of Norway, and in most cases I have been enabled to prove its parasitism on various nudibranchiate Mollusca, for instance *Doris, Eolis, Polycera*. By other authors it has also been found on species belonging to the genera *Doto* and *Antiopa*.

Distribution.—Bohuslän (Aurivillius), British Isles (Scott), coast of France (Canu), Mediterranean (Claus).

Gen. 39. **Macrocheiron,** Brady, 1872.

Generic Characters.—Anterior division of body less pronouncedly depressed than in *Lichomolgus*; cephalic segment without any distinctly defined transverse suture dorsally. Tail slender, with the apical setæ normally developed. Anterior antennæ, as in *Lichomolgus,* 7-articulate. Posterior antennæ differing somewhat in structure in the various species, being generally provided with 2 apical claws, the inner of which, however, may be setiform. Maxillæ with the terminal lappet conspicuously expanded at the base, and the apical lash more or less sharply marked off; palp with 3 or 4 small setæ on the end. Anterior maxillipeds with the apical lash less slender and less abruptly bent at the base than in *Lichomolgus.* Posterior maxillipeds in female comparatively small, in male very powerfully developed, with the dactylus slender falciform. Natatory legs with the inner ramus in the 3 anterior pairs well developed and longer than the outer, in the 4th pair, however, much reduced in size and composed of only 2 joints, which in some cases may be wholly confluent. Last pair of legs with the free joint very long and slender, curving backwards, and provided at the end inside with a slender spine, outside with a much shorter simple bristle. Ovisacs much smaller than in *Lichomolgus.*

Remarks.—This genus was proposed in the year 1872 by Brady, to include a species (*M. fucicolum*) found by him on the coast of Northumberland. The genus was subsequently withdrawn by the same author, and the species upon which it was founded referred to the genus *Lichomolgus* of Thorell. I think however that there are reasons for restoring the genus in question, as it exhibits several well-marked distinguishing characters indicated in the above diagnosis. Two well-defined Norwegian species referable to this genus will be described in the sequel, and I have also had an opportunity of examining a 3rd species obtained during the Monaco-Expedition from the Sargasso Sea. Moreover several of the exotic species described by A. Scott and referred by him some to the genus *Lichomolgus* and some to the genus *Pseudanthessius,* may more properly be included in the present genus.

87. Macrocheiron fucicolum, Brady.

(Pl. XCI).

Macrocheiron fucicolum, Brady, Nat. Hist. Trans. Northumberland and Durham, Vol. IV, p. 434, Pl. XVIII, figs. 9—18.

Syn: *Lichomolgus fucicolus,* Brady.

Specific Characters.—Female. Body moderately slender, with the anterior division not much dilated, being regularly oblong oval in outline, and

rather strongly vaulted dorsally. Cephalic segment about twice as long as the 3 succeeding segments combined, and scarcely exhibiting the slightest trace of a dorsal suture; rostral prominence well defined and pointed at the end. Tail only slightly exceeding half the length of the anterior division; genital segment rather large, occupying almost half the length of the tail, and conspicuously dilated in front of the middle; anal segment scarcely as long as the preceding one. Caudal rami not much produced, though somewhat longer than the anal segment, and only very slightly divergent; seta of outer edge attached at a short distance from the end; apical setæ not much produced, the inner mediate one only slightly exceeding half the length of the tail. Anterior antennæ moderately slender and clothed with scattered comparativeiy short setæ; 2nd joint, as usual, the longest, though scarcely attaining the length of the 2 succeeding joints combined; last joint fully as long as the penultimate one. Posterior antennæ unusually short and stout, and apparently composed of only 3 joints, the outer 2 being wholly confluent; 1st and 2nd joints very massive and of about equal size, each having outside a well-marked seta; distal part of the antenna (the combined 2 outer joints) rather narrower than the proximal part, but of about the same length, and provided outside with a denticulated spine and 2 unequal setæ, at the tip with several curved setæ, one of which is somewhat stronger than the others and may represent the inner claw, the outer claw being exceedingly strong, knife-shaped and irregularly denticulate along the outer sharpened edge. Maxillary palp comparatively small but provided with 4 setæ. Anterior maxillipeds with the distal joint larger than usual; apical lash comparatively short and having the margin coarsely dentate at the base. Posterior maxillipeds rather feeble, but exhibiting a very conspicuous armature, 2 rather strong, almost claw-like spines being attached to the inner edge of the propodal joint and a similar, though smaller spine inside the dactylar joint. Natatory legs with the rami comparatively slender and having the spines narrow dagger-like; terminal joint of inner ramus in 1st pair obliquely oval in form, with the spine of the outer edge attached close to the apex. Inner ramus of 4th pair rather small, not nearly attaining the length of the first 2 joints of the outer combined, and biarticulate, proximal joint without any seta inside, distal joint slightly attenuated, with the apical spines very unequal in length. Last pair of legs with the free joint very long and narrow, slightly curved and quite smooth outside. Ovisacs oval in form and slightly divergent, extending scarcely beyond the tail.

Male, as usual, of smaller size than female, and moreover easily recognisable by the greatly inflated genital segment. Posterior maxillipeds very

powerfully developed, with the propodos large and fringed inside with a dense row of delicate spinules; dactylus slender falciform and abruptly bent at the base.

Body in female semipellucid, with a more or less distinct yellowish brown tinge, and the segments partly edged behind with a light rosy pigment; ovarial tubes and ovisacs dark green.

Length of adult female amounting to 1.20 mm., of male to 0.90 mm.

Remarks. This form was recorded as early as the year 1872 by Brady under the above name, and was subsequently redescribed by the same author in his well-known Monograph as a species of the genus *Lichomolgus*. It is an easily recognisable form, differing from most other Lichomolgidæ, both as to the general appearance and to the structure of some of the appendages, for instance the posterior antennæ.

Occurrence. I have taken this form in many places, both on the west and south coasts of Norway, as also in the upper part of the Christiania Fjord. It is generally found in moderate depths among algæ and other marine growths, and always in the free condition. Indeed, it is not improbable that, as suggested by Brady, it derives its food to a great extent from the juices of the algæ or from small particles licked up from the surface of their fronds.

Distribution—British Isles (Brady).

88. Macrocheiron hirsutipes (Scott).

(Pl. XCII).

Lichomolgus hirsutipes, Scott, Eleventh Ann. Rep. of the Fishery Board for Scotland, Part III, p. 206, Pl. IV, figs. 1—12.

Specific Characters.—Female. Body a little more slender than in the preceding species, though having the anterior division comparatively broader and less vaulted. Cephalic segment large, fully twice as long as the 3 succeeding segments combined, and exhibiting a very slight indication of a transverse suture behind. Last trunk-segment very narrow and sharply marked off form the preceding one. Tail rather slender, considerably exceeding half the length of the anterior division; genital segment comparatively large and dilated in front of the middle, with the posterior cylindric part sharply marked off from the anterior; anal segment a little larger than the preceding one. Caudal rami resembling in structure those in the type species. Anterior antennæ also rather similar, though somewhat more elongated, with the penultimate joint longer than the terminal one. Posterior antennæ rather unlike those in the

type species, being much more slender, and having all 4 joints well defined; 2nd joint considerably longer than the 1st, and about equal in length to the last 2 combined; penultimate joint, as usual, quite short and provided at the outer distal corner with a slender spine and 2 unequal setæ; terminal joint narrow cylindric in form, and armed at the tip with 2 simple subequal claws accompanied by a number of small setæ. Maxillar palp with only 3 setæ. Anterior maxillipeds with the distal joint less robust than in the type species. Posterior maxillipeds comparatively thicker, with only 2 simple unequal setæ inside the propodal joint. Natatory legs on the whole resembling in structure those in the type species; inner ramus of 4th pair, however, comparatively larger, exceeding in length the first 2 joints of the outer combined, and having a well-marked, though rather short seta inside the proximal joint. Last pair of legs with the free joint considerably produced and strongly curved, its outer face densely hairy.

Body semipellucid with a slight yellow or orange tinge.

Length of adult female 1.30 mm.

Remarks.—The present form, described by Scott as a species of the genus *Lichomolgus,* is unquestionably congeneric with the preceding species, though differing conspicuously in the structure of the posterior antennæ. The specific name given to it refers to the peculiar hairy coating, in the female, of the free joint of the last pair of legs.

Occurrence.—Only 3 female specimens of this form have hitherto come under my notice. One of them was taken many years ago on the west coast of Norway, at Eggesbønæs, the other 2 at Risør, on the south coast. All 3 specimens were found in the free condition among dredged material taken up from moderate depths.

Distribution.—Scottish coast (Scott), Novaja Zemlja (Scott).

Gen. 40. **Pseudanthessius,** Claus, 1889.

Generic Characters.—Body of rather varying form in the different species, with the anterior division more or less expanded and well marked off from the posterior. Cephalic segment with only slight traces of a subdivision. Anterior antennæ of normal structure, 7-articulate. Posterior antennæ distinctly 4-articulate, with 3 apical claws, which in some cases are short, in other cases very slender, almost setiform. Maxillæ with the terminal lappet blade-like,

gradually attenuated towards the end; palp tri-setose. Maxillipeds of normal structure. Inner ramus of 4th pair of legs uniarticulate. Last pair of legs quite rudimentary, each being replaced by a simple spine accompanied by 2 small bristles.

Remarks.—This genus, established by Claus, is chiefly characterised by the rudimentary condition of the last pair of legs. Another character on which still more stress has been laid by recent authors, is the reduction of the inner ramus of the 4th pair of legs to a single joint. This character is, however, not peculiar to the genus *Pseudanthessius,* but is also found in some species of the genus *Macrocheiron.* Thus in the species mentioned above from the Sargasso Sea, which in all other respects is closely allied to *M. fusicolum,* the 2 joints of this ramus are wholly coalesced; and the same is also the case with some of the Ceylon species described by A. Scott and, on account of that character, erroneously referred to the genus *Pseudanthessius,* though from the structure of the last pair of legs and other characters they must evidently be included in the genus *Macrocheiron,* as here defined. 4 Norwegian species referable to the present genus will be described below.

89. Pseudanthessius gracilis, Claus.

(Pl. XCIII).

Pseudanthessius gracilis, Claus, Arbeiten d. zool. Inst. Wien, Vol. VIII, p. 344, Pl. IV, figs. 1—7.

Specific Characters.—Female. Body rather slender, with the anterior division moderately dilated and oblong oval in outline, greatest width in front of the middle. Cephalic segment large, fully twice as long as the 3 succeeding segments combined, and narrowly rounded in front. Last trunk-segment slightly produced on each side. Tail very slender, somewhat exceeding half the length of the anterior division; genital segment scarcely longer than the 3 succeeding segments combined, and gradually widening posteriorly for about $^2/_3$ of its length, then abruptly contracted, the hind third part being cylindric in form and scarcely broader than the succeeding segment; anal segment nearly twice as long as the preceding one. Caudal rami very slender and narrow, equalling in length about half the remaining part of the tail, and scarcely at all divergent; seta of outer edge attached near the middle; apical setæ rather unequal in length, the 2 middle ones being much longer than the other 2. Anterior antennæ comparatively slender and clothed with moderately long setæ; 2nd joint, as usual, the longest; terminal joint scarcely more than half as long as the penultimate one. Posterior antennæ moderately strong, with the 2nd joint

the largest, and considerably exceeding in length the outer 2 combined; apical claws rather slender and of nearly equal length, though successively coarser inwards. Maxillæ with the terminal lappet evenly attenuated and almost quite smooth. Anterior maxillipeds with the apical lash coarsely denticulated in its proximal part; lateral spine of distal joint attached near the base of the joint and accompanied by a short seta. Posterior maxillipeds rather coarse, with the 1st joint fully as long as the other 2 combined; propodal joint armed with a strong ciliated spine inside in the middle; dactylar joint claw-like, with a well-marked spine outside the base. The 3 anterior pairs of natatory legs normally developed, with the rami slightly unequal in length, the inner one being the longer; all spines coarsely denticulate. 4th pair of legs with the outer ramus more slender than in the preceding pairs, and wanting one of the spines on the terminal joint; inner ramus shorter than the first 2 joints of the outer combined, and exhibiting outside in the middle a well-marked notch; apical spines narrow dagger-shaped and rather unequal in length, the inner one being nearly twice as long as the outer. Last pair of legs, as in the other species of the present genus, replaced on each side by a spine inserted directly on the corresponding segment and accompanied by 2 small setæ, the spine in the present species being rather slender and exhibiting at the base a slight dilatation. Ovisacs not very large, fusiform in shape, and considerably divergent.

Colour yellowish brown.

Length of adult female amounting to 1.30 mm.

Male unknown.

Remarks.—This is the species upon which Claus founded his genus *Pseudanthessius,* and it ought accordingly to be regarded as the type of the present genus. In the slender form of the tail and the narrowly-produced caudal rami, this species bears much resemblance to the form recorded by Brady as *Lichomolgus Thorelli,* and indeed I at first believed the two to be identical. T. Scott, however, regards them as distinct, and the detail-figures given by Brady exhibit in reality some points of difference, especially as regards the form of the genital segment and the relative size of the inner ramus of the 4th pair of legs. A redescription of Brady's species would however be very desirable.

Occurrence.—I have met with this form occasionally in several places, both on the south and west coasts of Norway. All the specimens were of the female sex, and were found in the free condition among dredged material taken up from moderate depths.

Distribution.—British Isles (Scott), Mediterranean (Claus), Ceylon (A. Scott).

90. Pseudanthessius liber, (Brady).

(Pl. XCIV).

Lichomolgus liber, Brady, Monogr. of British Copepoda, Vol. III, p. 44, Pl. LXXXVI, figs. 1—13.

Specific Characters.—Female. Body comparatively robust, with the anterior division considerably tumefied and rounded oval in outline, greatest width about in the middle. Cephalic segment very large, with a slight indication of a transverse suture behind the middle. Last trunk-segment, as usual, very sharply marked off from the preceding one and rather narrow. Tail comparatively short, scarcely attaining half the length of the anterior division; genital segment about as long as the 3 succeeding segments combined and slightly dilated in its anterior part; anal segment about the length of the preceding segment. Caudal rami rather short, scarcely longer than the anal segment, and slightly divergent; seta of outer edge attached near the end; apical setæ less unequal than in the type species, those of the outer and inner corner being well developed, though somewhat shorter than the 2 middle ones. Anterior antennæ not much elongated and only slightly attenuated, being clothed with comparatively short and thick setæ; the outer 2 joints rather small, and combined about the length of the antepenultimate one. Posterior antennæ scarcely shorter than the anterior ones and comparatively strongly built, the first 2 joints rather thick and massive, subequal in size, and combined occupying about half the length of the antenna; last joint cylindric in form, and provided at the end with several setæ in addition to the claws; the latter rather short, but somewhat unequal in size, one of them being much stronger than the other 2. Maxillæ with the terminal lappet rather produced, and fringed along the posterior edge with delicate spinules; palp with a very small seta inside, in addition to the 3 apical ones. Anterior maxillipeds with the apical lash less abruptly bent at the base than in the type species, and less coarsely denticulate at the edge. Posterior maxillipeds comparatively smaller, with only a simple seta inside the propodal joint; dactylar joint conically produced. 1st pair of natatory legs with the proximal joint of the basal part remarkably expanded outside, 1st joint of outer ramus much broader than the other 2, and having the spine of the outer edge rather produced. Inner ramus of this and the 2 succeeding pairs somewhat longer than the outer; that of 4th pair, however, scarcely as long as the first 2 joints of the outer combined, and forming a single oblong fusiform joint without any notch outside, apical spines rather unequal, the inner one being much

the longer. Last pair of legs exhibiting a rudimentary condition similar to those in the preceding species, the spine being however less slender, almost knife-shaped, and pointing backwards. Ovisacs of moderate size, oblong oval in form, and closely applied to the sides of the tail.

Male much smaller than female, and exhibiting the usual sexual differences. Dactylus of the posterior maxillipeds very slender and abruptly curved in the middle, terminating in a small knob-like dilatation.

Body in both sexes of a whitish grey colour, with a more or less distinct violaceous tinge.

Length of adult female amounting to 1.30 mm., of male to 0.90 mm.

Remarks.—This form was announced as early as the year 1875 by Brady and Robertson, and was subsequently more fully described and figured by the former author in this well-known Monograph as a species of the genus *Lichomolgus*. Canu was the first to recognise the true systematic position of this form within the genus *Pseudanthessius* of Claus. From the type of this genus, *P. gracilis,* it is at once distinguished by the short, compact shape of the body, in which respect it exhibits a perplexing similarity to an otherwise very different form, viz., *Echinocheres violaceus* belonging to the siphonostomous Cyclopoida (compare the figure here given with that of the latter form on Pl. LVIII).

Occurrence.—I have met with the present form in several places, both on the west and south coasts of Norway, as also in the upper part of the Christiania Fjord. It is not unfrequently found in the free condition among dredged material, and this indeed induced Brady to give it the rather inappropriate specific name liber. I have however, in several instances been enabled to ascertain its parasitic nature, having found it not unfrequently in considerable numbers clinging to the surface of various Echinids, for instance *Echinus sphæra* and *Strongylocentrotus dröbakiensis.*

Distribution.—British Isles (Brady), Ceylon (A. Scott).

91. Pseudanthessius assimilis, G. O. Sars, n. sp.
(Pl. XCV).

Specific Characters.—Female. Very like the preceding species, but of much larger size, and having the anterior division broader in front than behind. Tail considerably exceeding half the length of the anterior division; genital segment comparatively large, and of a similar form to that in *P. liber;* anal segment, however, much (nearly twice) larger than the preceding segment.

Caudal rami also considerably more produced, being fully 3 times as long as they are broad, and scarcely at all divergent; seta of outer edge rather slender, and attached at a short distance from the end; apical setæ well developed and not very unequal. Anterior antennæ, as in *P. liber*, rather robust, and clothed with comparatively short and thick curved setæ. Posterior antennæ built on the very same type as in that species, though having the distal part comparatively more slender. Oral parts and legs almost exactly as in *P. liber*. Ovisacs comparatively large, extending considerably beyond the end of the tail.

Male with the genital segment greatly inflated and terminating on each side in an acuminate lappet. Posterior maxillipeds transformed in an altogether similar manner to that in the male of *P. liber*.

Body in both sexes of whitish colour, with a slight rosy or orange tinge.

Length of adult female amounting to 1.85 mm., of male to 1.35 mm.

Remarks.—The above-described form is closely allied to *P. liber*, and indeed at first I regarded it as only a variety of that species. On a closer examination, however, I have found that it differs in some points so decidedly as to be more properly considered specifically distinct. It is also of much larger size, as is seen from the habitus-figures of both, which are drawn on the very same scale.

Occurrence.—I have met with this form in 2 rather remote places on the Norwegian coast, viz., in the outer part of the Romsdal Fjord, at some distance from Molde, and in the inner part of Hardanger Fjord, at Sunde. In both places it was found in considerable numbers clinging to the surface of the beautiful deep-water Echinid, *Echinus elegans*, taken up from the great depth of 150—200 fathoms.

92. Pseudanthessius Sauvagei, Canu.

(Pl. XCVI).

Pseudanthessius Sauvagei, Canu, Copépodes de Boulonnais, p. 243, Pl. XXV.

Specific Characters. Female. Body comparatively short and stout, with the anterior division sub-compressed, being greatly vaulted above and, viewed dorsally, narrow oblong in outline, the greatest width scarcely exceeding half the length. Cephalic segment occupying almost $^2/_3$ of the length of the anterior division, and exhibiting scarcely any trace of a subdivision. Last trunk-segment very small. Tail not attaining half the length of the anterior division, and almost perfectly cylindrical in form; genital segment scarcely at all dilated, but rather long, occupying about half the length of the tail; anal

segment of about the same size as the preceding one. Caudal rami comparatively short, but rather broad and transversely truncated at the end, being scarcely at all divergent; seta of outer edge attached near the end; apical setæ well developed and not very unequal in length. Anterior antennæ scarcely exceeding half the length of the cephalic segment, and distinguished by the great length of some of the setæ clothing them; 2nd joint comparatively shorter and thicker than in the other species; last joint very small. Posterior antennæ rather feeble in structure, though not much shorter than the anterior; 2nd joint not attaining the length of the outer 2 combined, and finely ciliated on the inner edge; apical claws very slender and not much stronger than the accompanying setæ, the outermost being the longest. Maxillæ agreeing in structure with those in the type species. Anterior maxillipeds also rather similar. Posterior maxillipeds however less strong, with the propodal joint the longest and somewhat curved at the base, carrying inside beyond the middle a very long recurved plumose seta; dactylar joint conical in form. The 3 anterior pairs of natatory legs with the rami rather coarse and of about equal length. 4th pair with the outer ramus much more slender than in the preceding pairs and, as usual, wanting one of the spines on the terminal joint; inner ramus somewhat exceeding the length of the first 2 joints of the outer combined, and rather broader, with a small, but distinct notch outside a little in front of the middle; apical spines rather thin and nearly equal-sized, or the outer one a little longer than the inner. Last pair of legs, as in the other species, replaced on each side by a rather strong posteriorly-pointing spine and 2 small setæ.

Colour not yet ascertained.

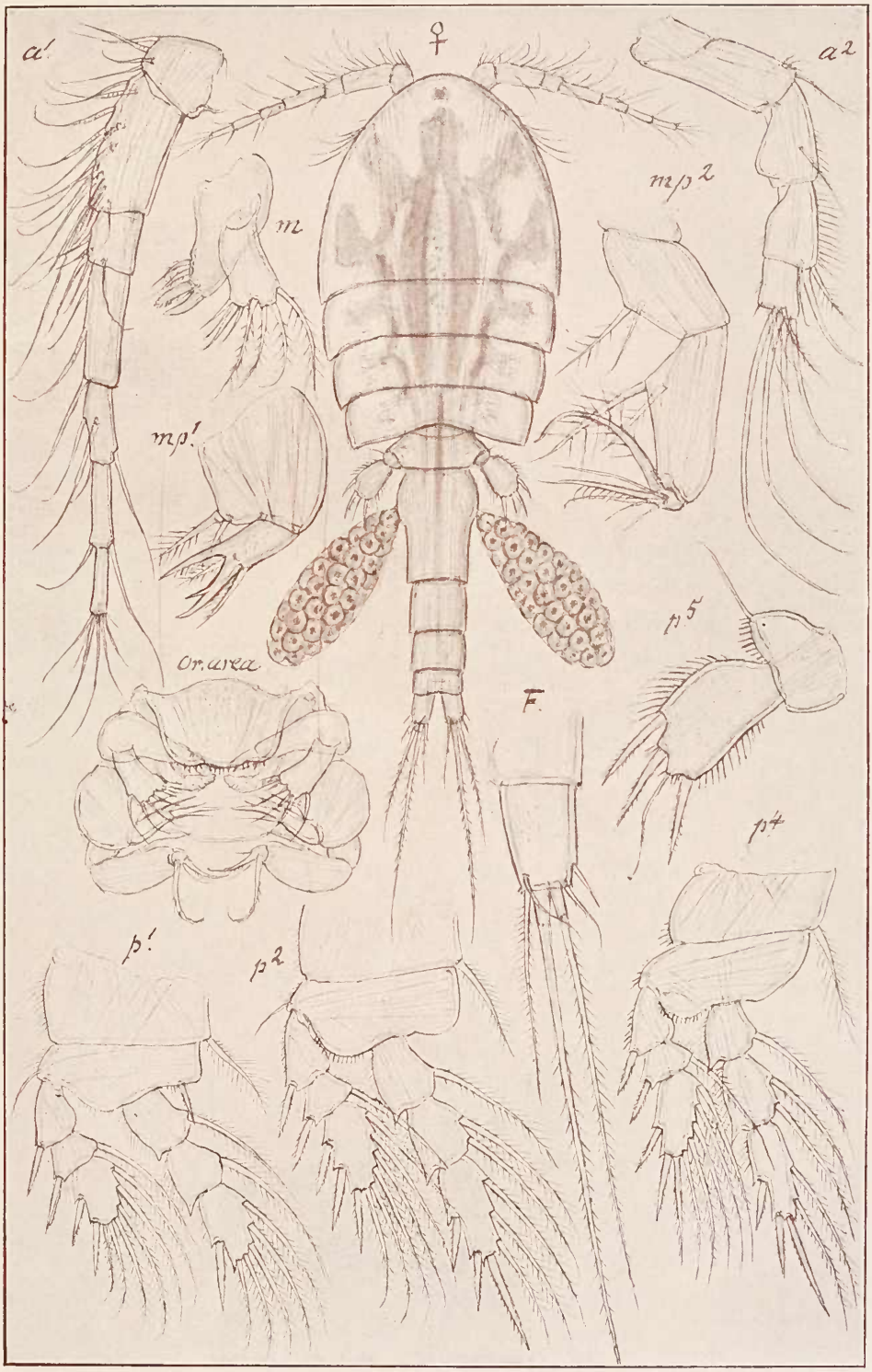
Length of the specimen examined about 1 mm.

Remarks.—The above-described form agrees on the whole pretty well with the description and figures given by Canu of his species, and I cannot therefore doubt the identity of the two. It is an easily recognisable species, being especially distinguished by the peculiar compressed form of the anterior division of the body, making it rather difficult to get a dorsal view of the animal. In some of the structural details also it exhibits well-marked differences from the other species.

Occurrence.—Only a solitary female specimen of this form has as yet come under my notice. It was found, some years ago, at Risör, south coast of Norway, being selected from some dredged material obtained from a depth of about 20 fathoms. Canu has stated the occurrence of this species as a parasite on the well-known Spatangoid, *Echinocardium cordatum*.

Distribution.—Coast of France (Canu).

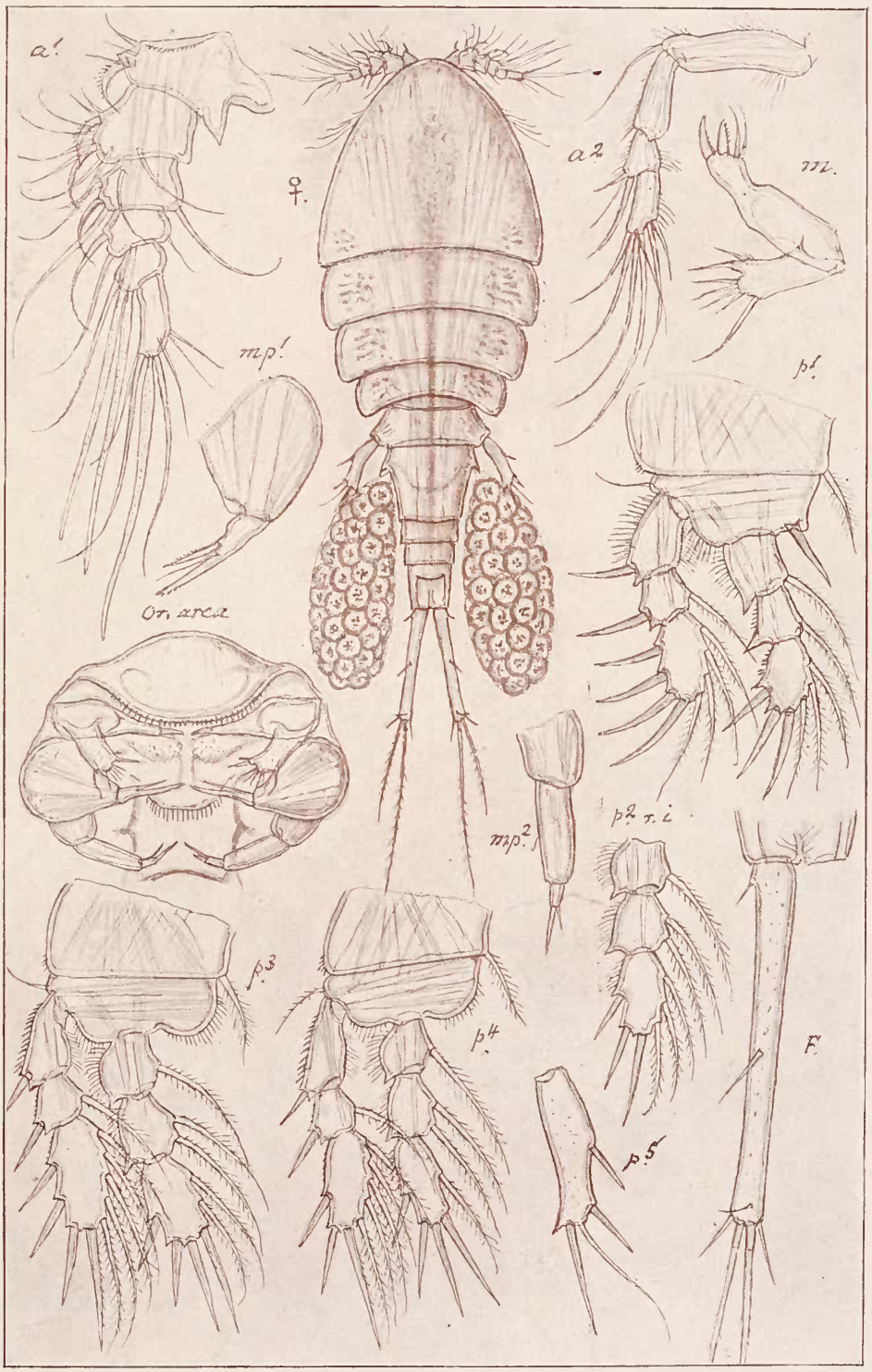
Copepoda.



G. O. Sars, del.

Hemicyclops purpureus, Boeck.

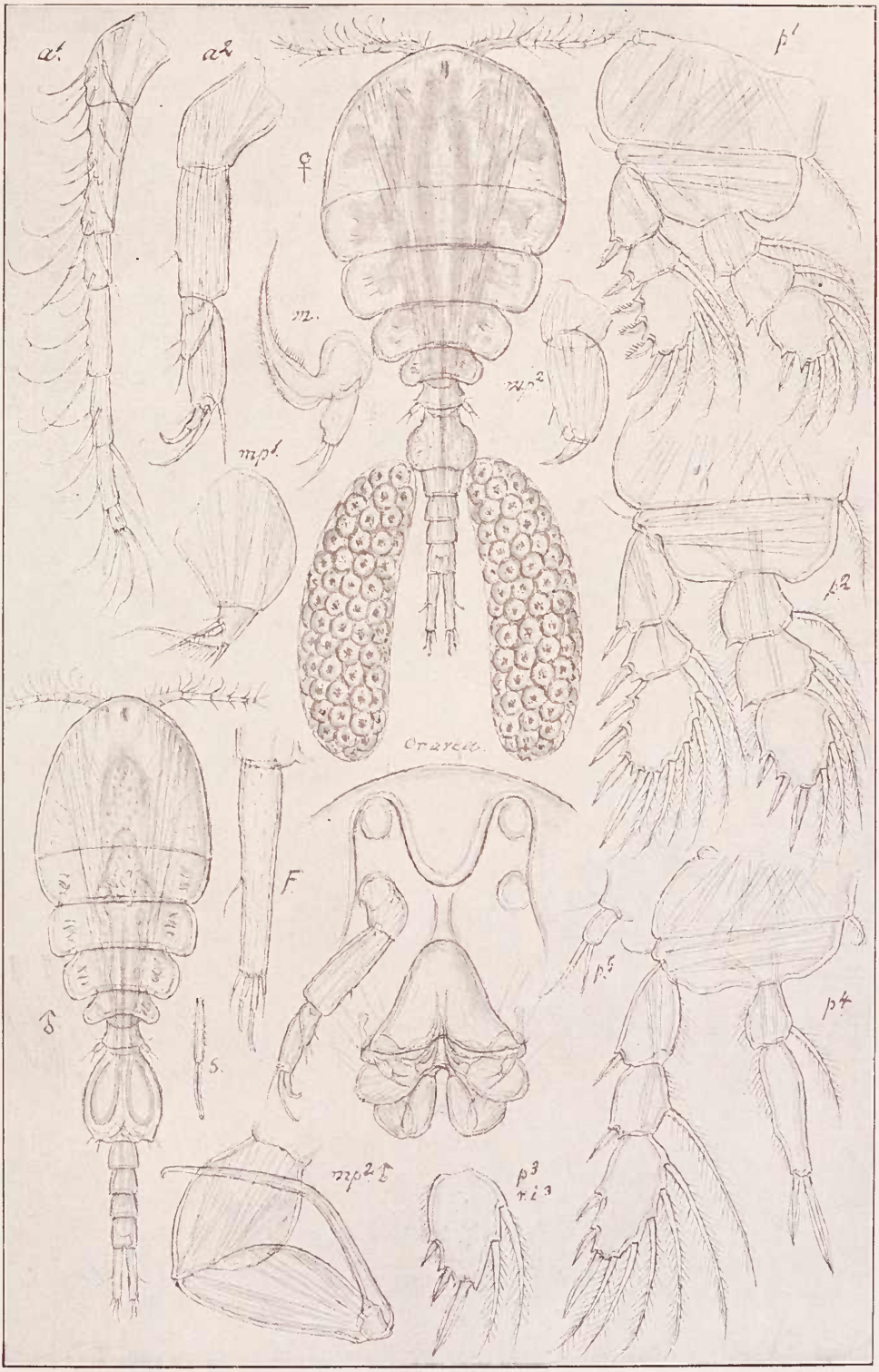
Copepoda.



G. O. Sars, del.

Hippomolgus furcifer, G. O. Sars.

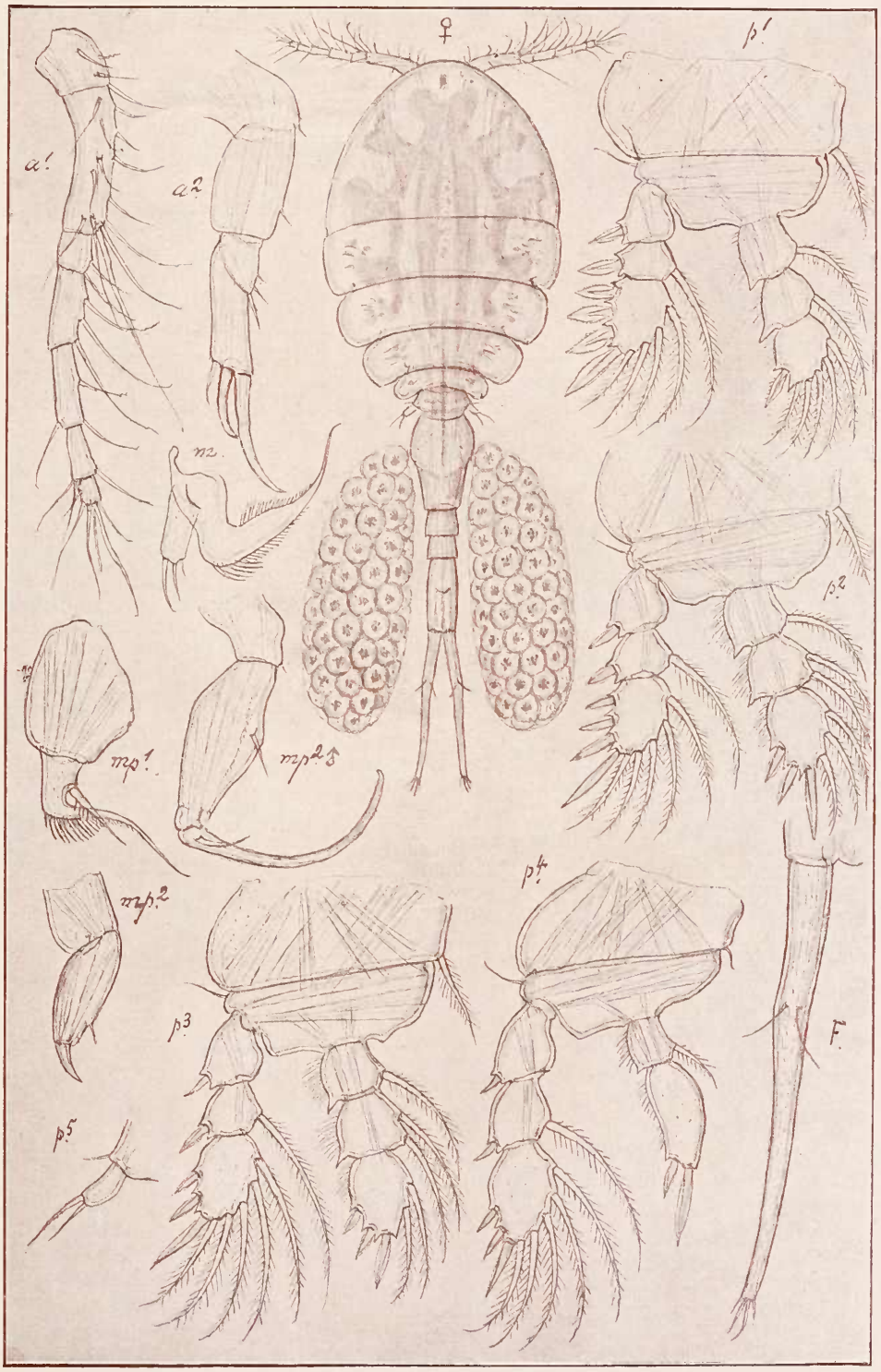
Copepoda.



G. O. Sars, del.

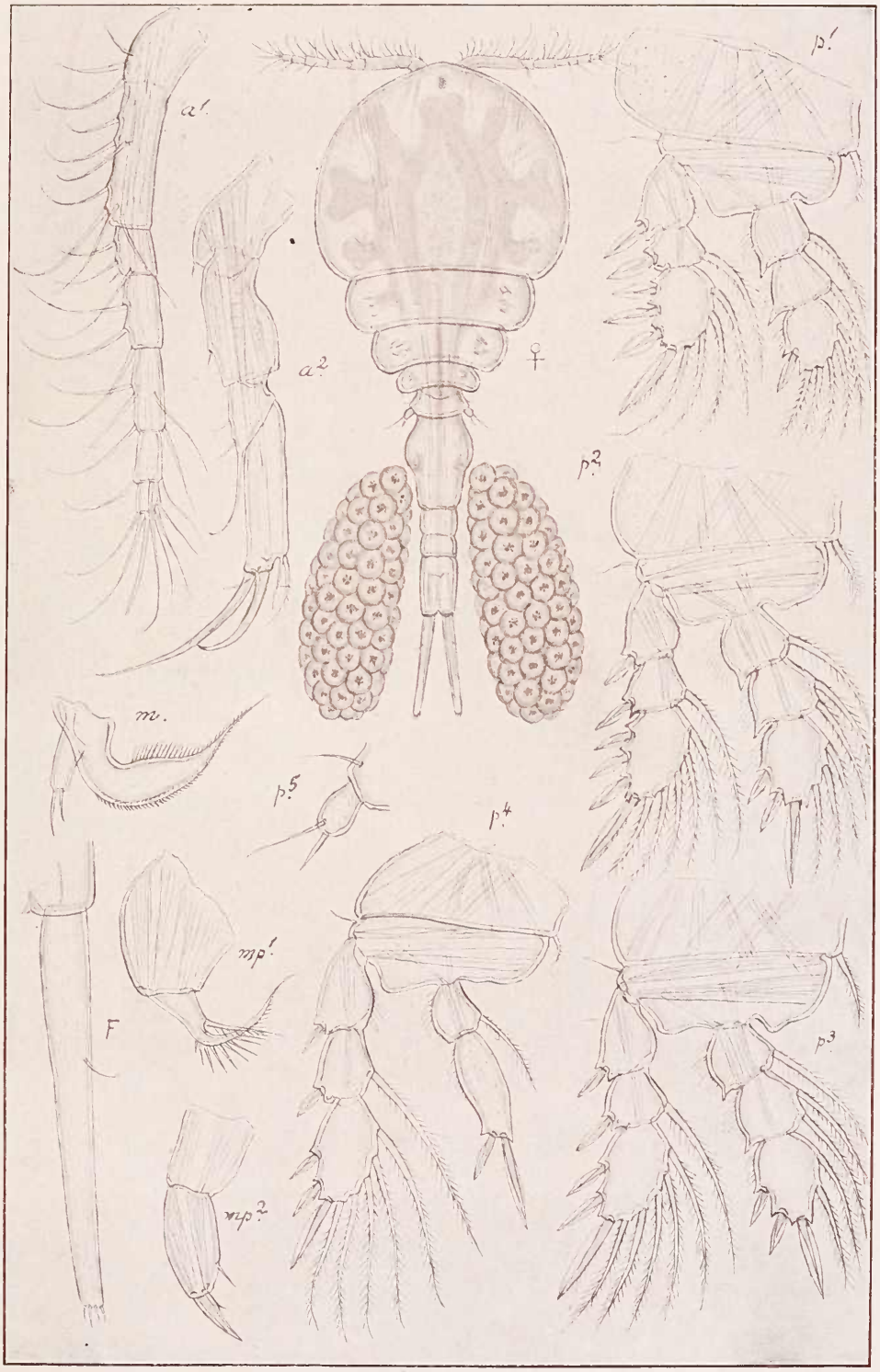
Lichomolgus albens, Thorell.

Copepoda.



G. O. Sars, del.

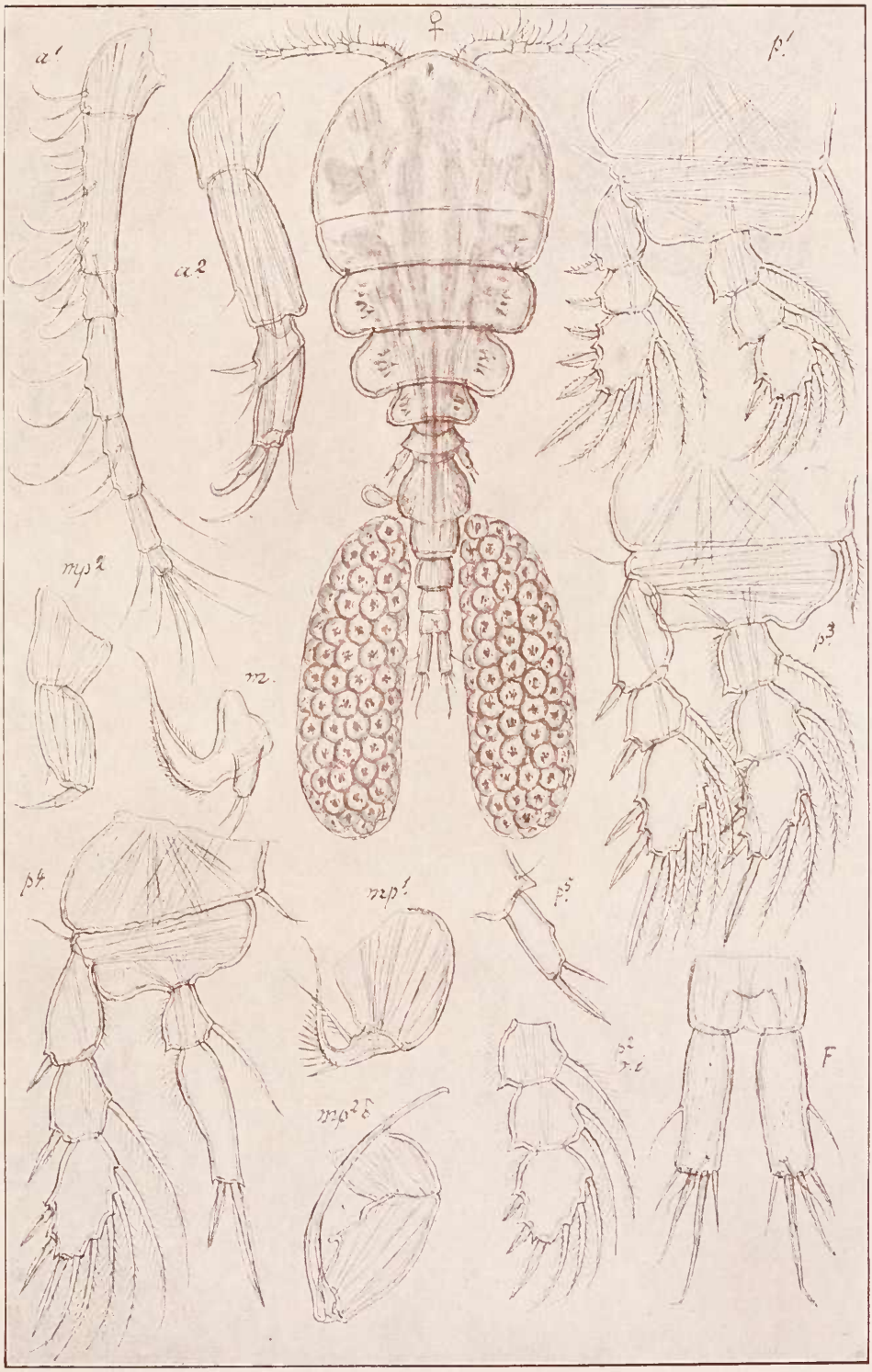
Lichomolgus forficula, Thorell.



G. O. Sars, del.

Lichomolgus marginatus, Thorell.

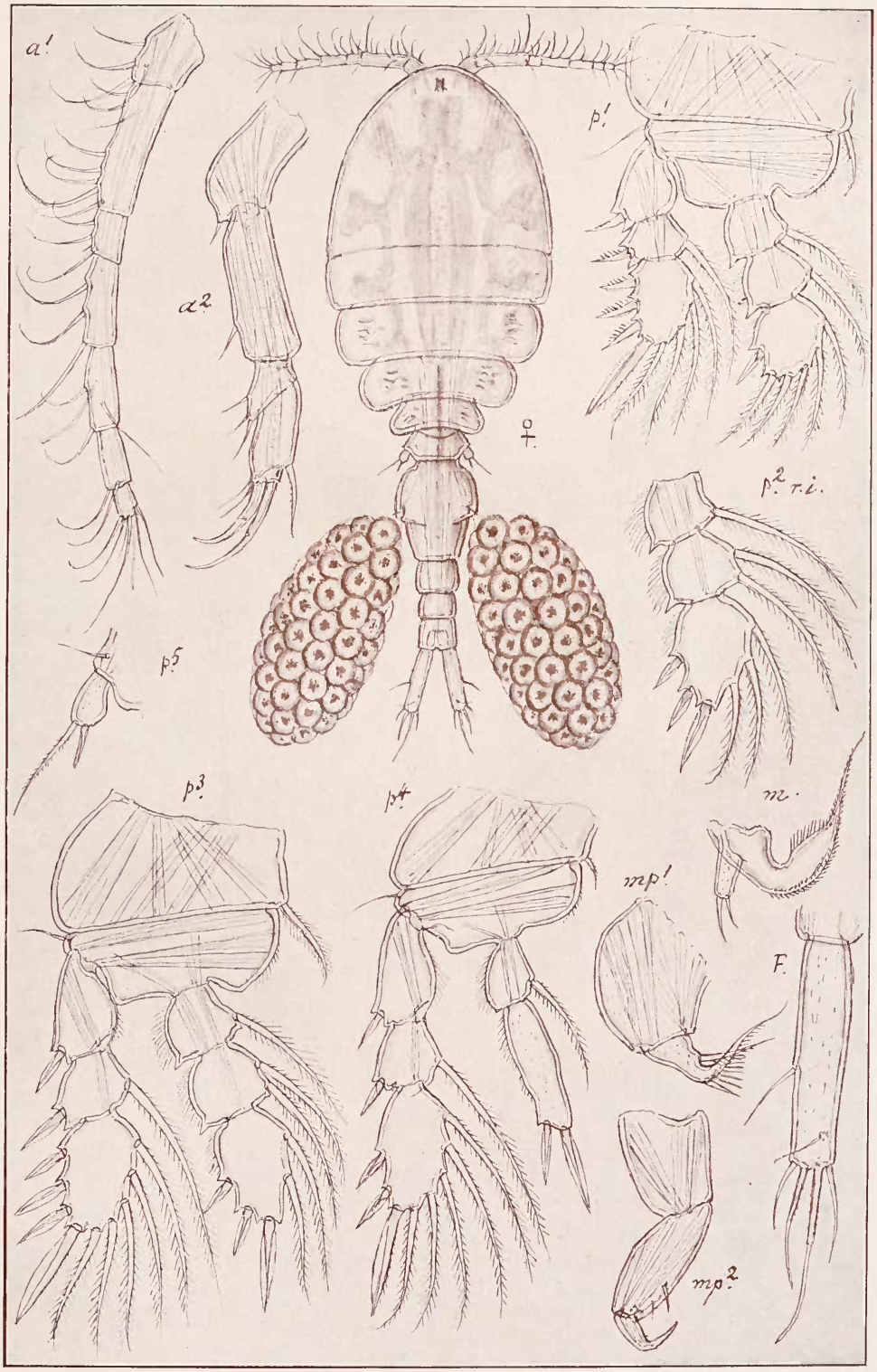
Copepoda.



G. O. Sars, del.

Lichomolgus furcillatus, Thorell.

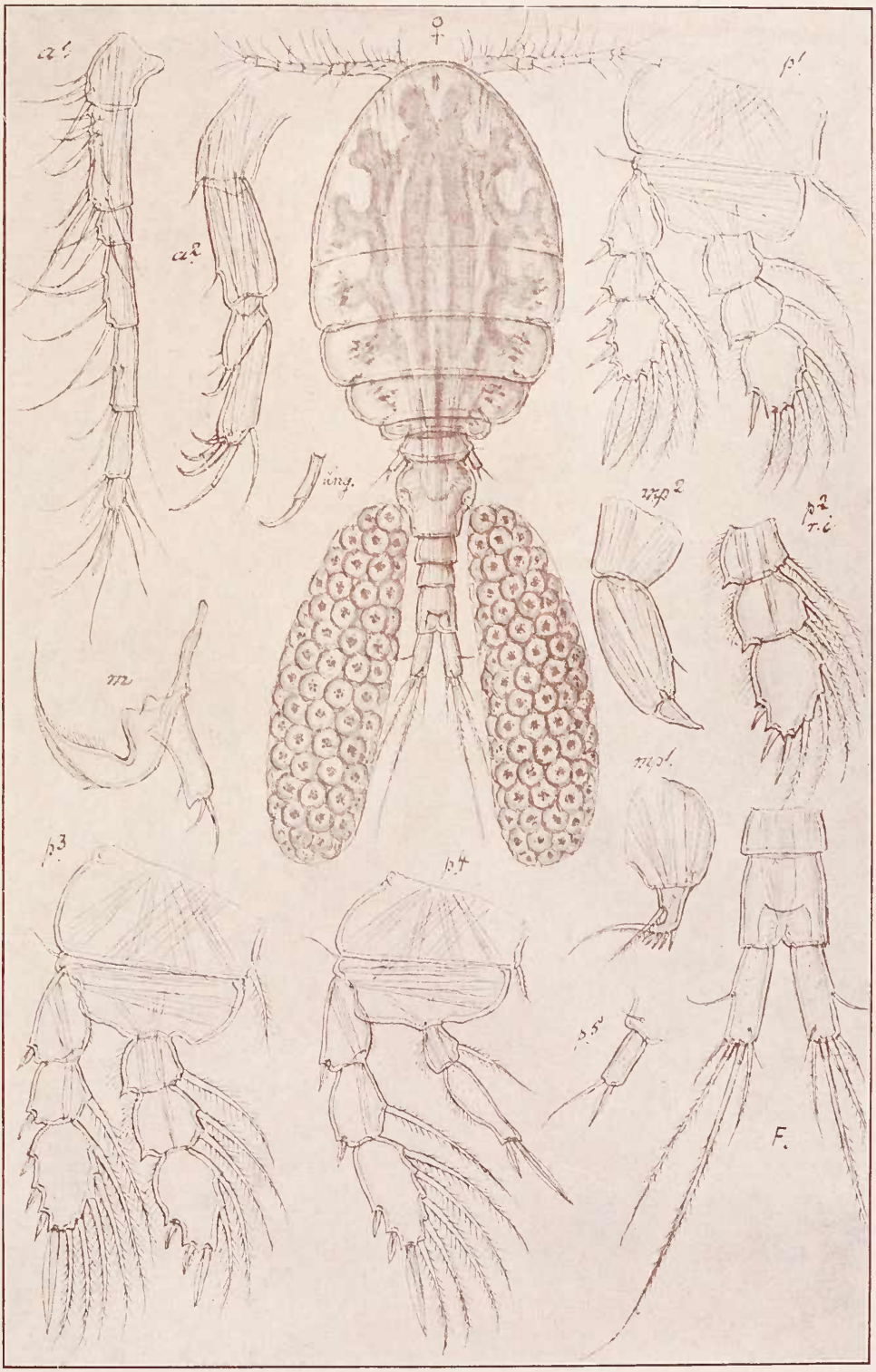
Copepoda.



G. O. Sars, del.

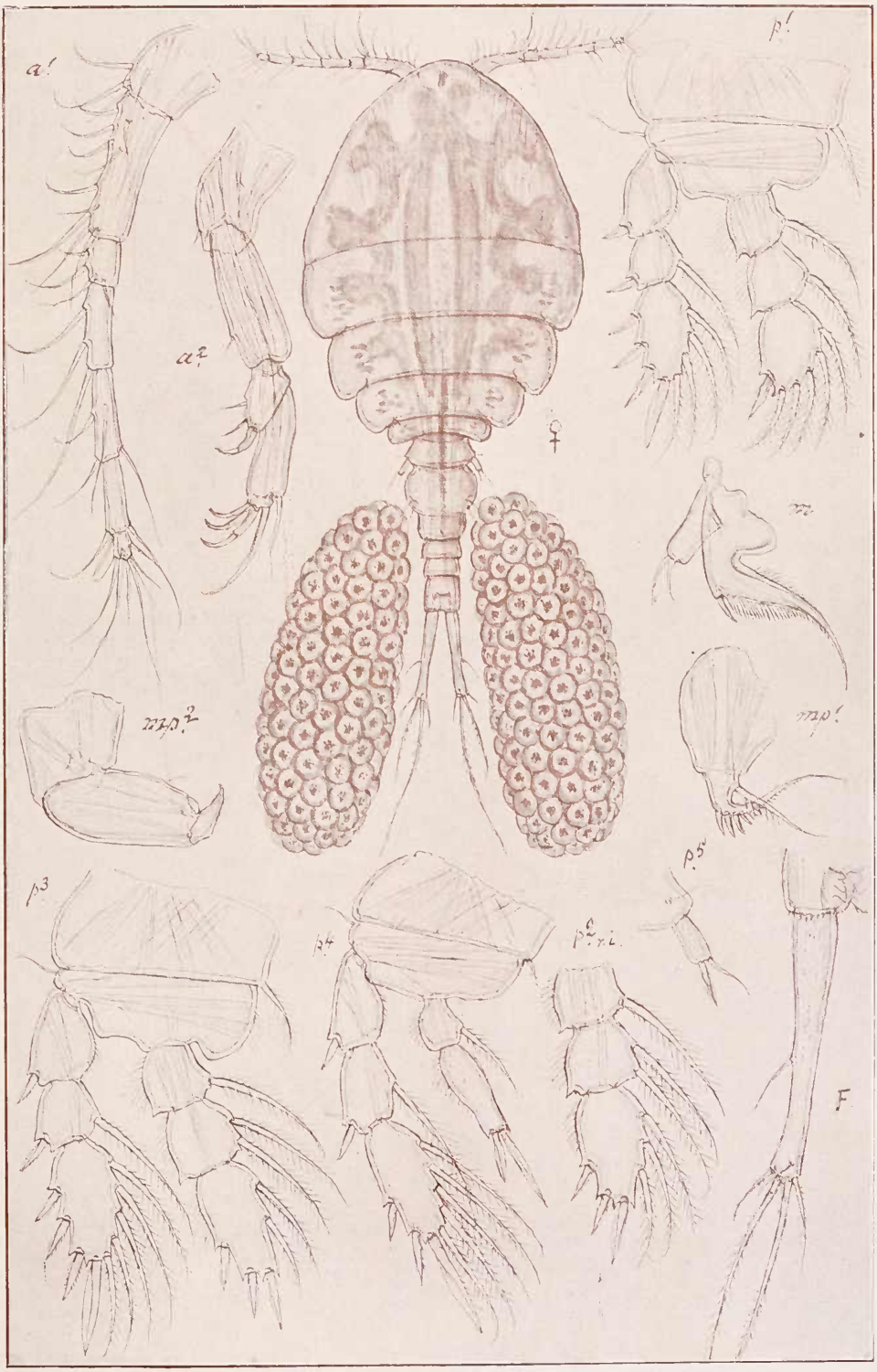
Lichomolgus Canui, G. O. Sars.

Copepoda.



G. O. Sars, del.

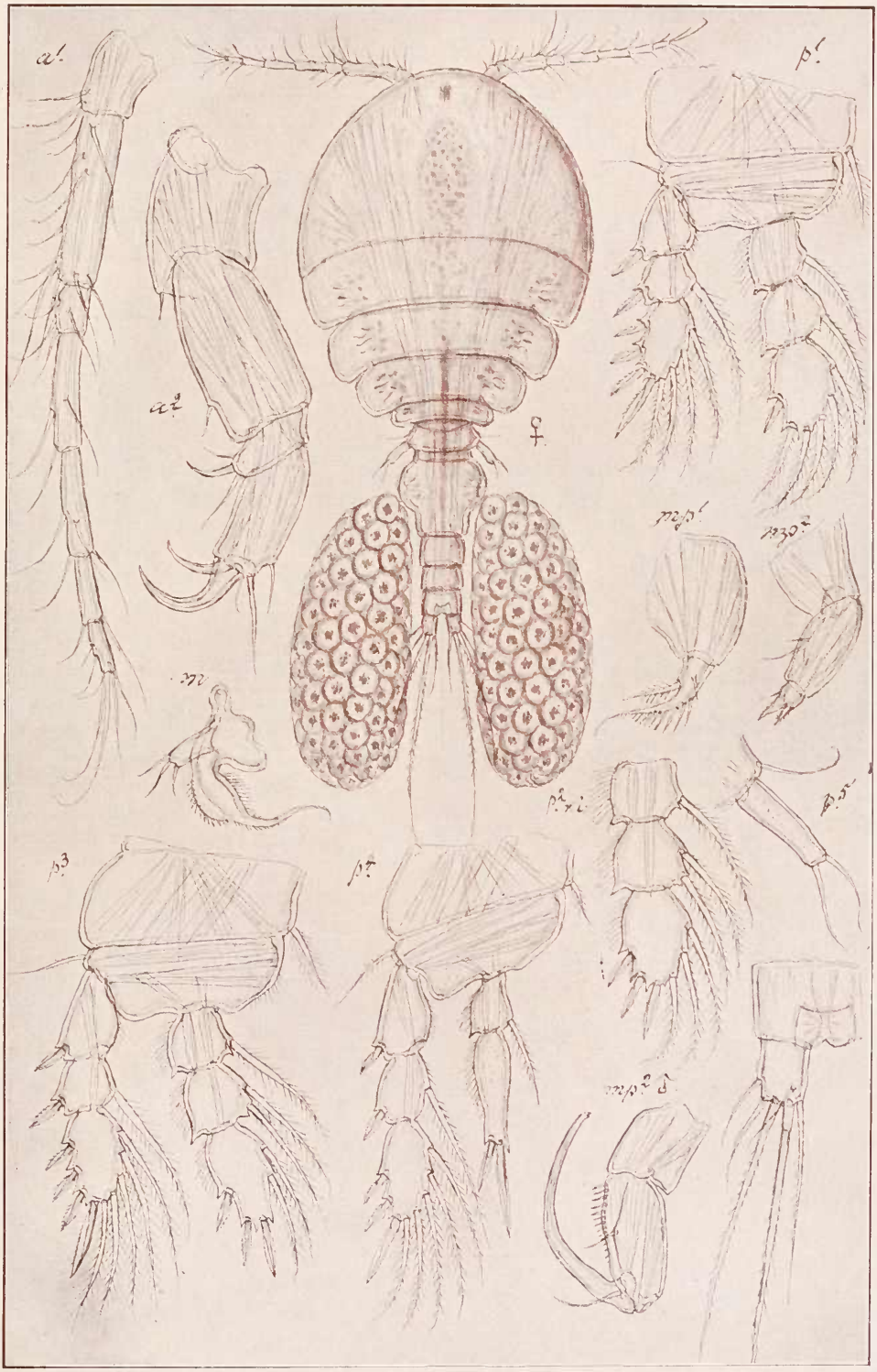
Lichomolgus Poucheti, Canu.



G. O. Sars, del.

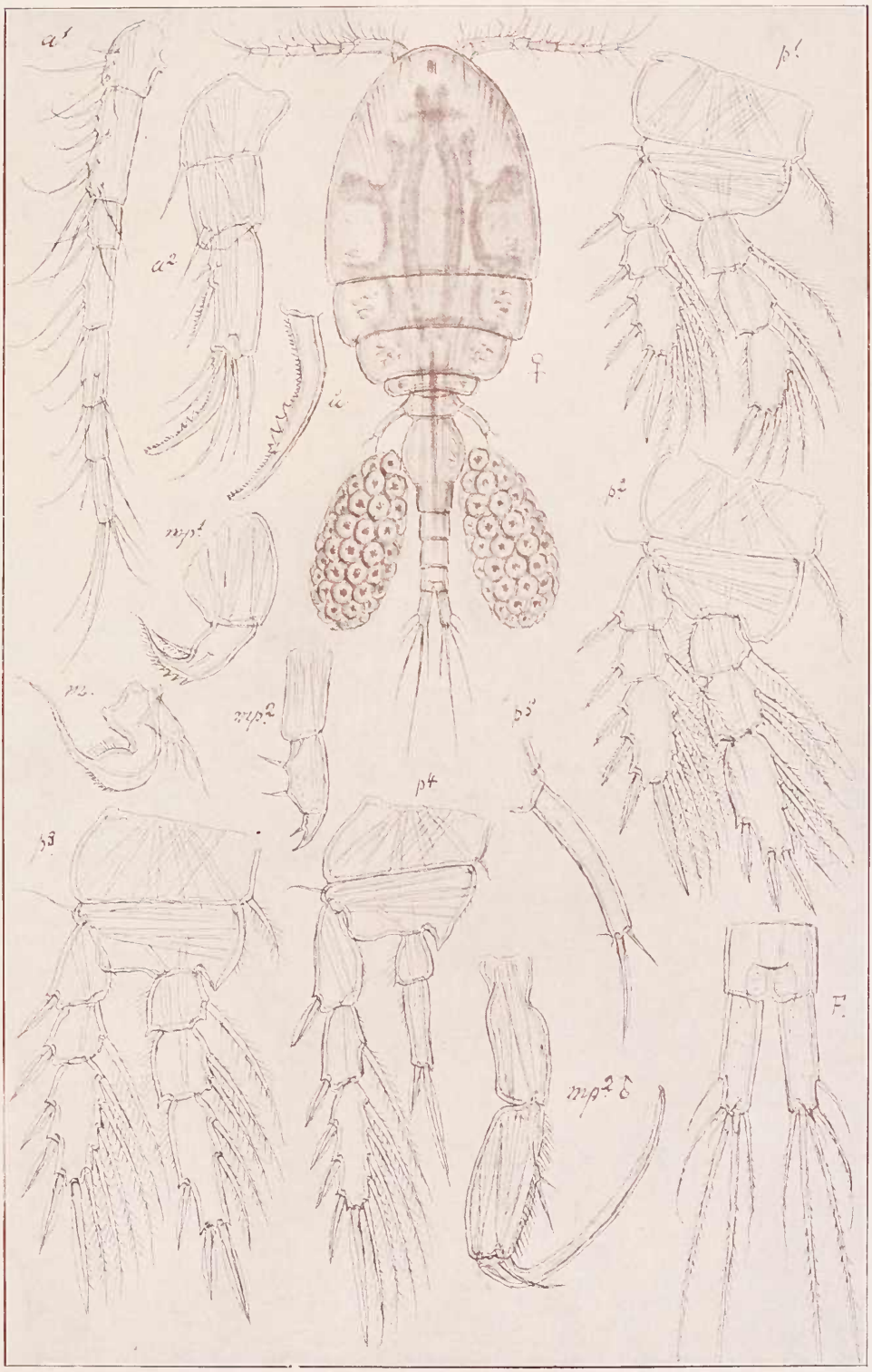
Lichomolgus tenuifurcatus, G. O. Sars.

Copepoda.



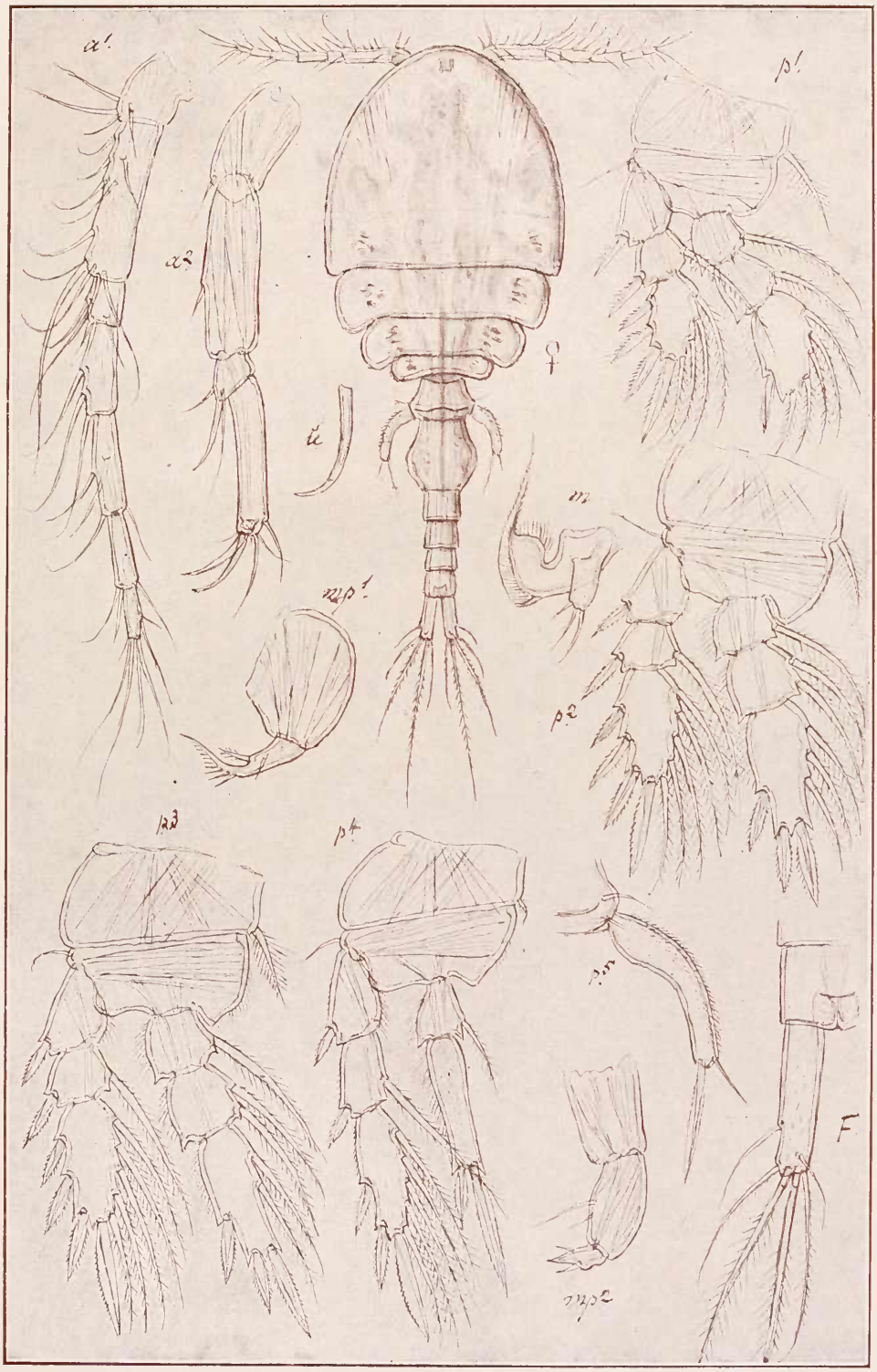
G. O. Sars, del.

Lichomolgus agilis, Leydig.



G. O. Sars, del.

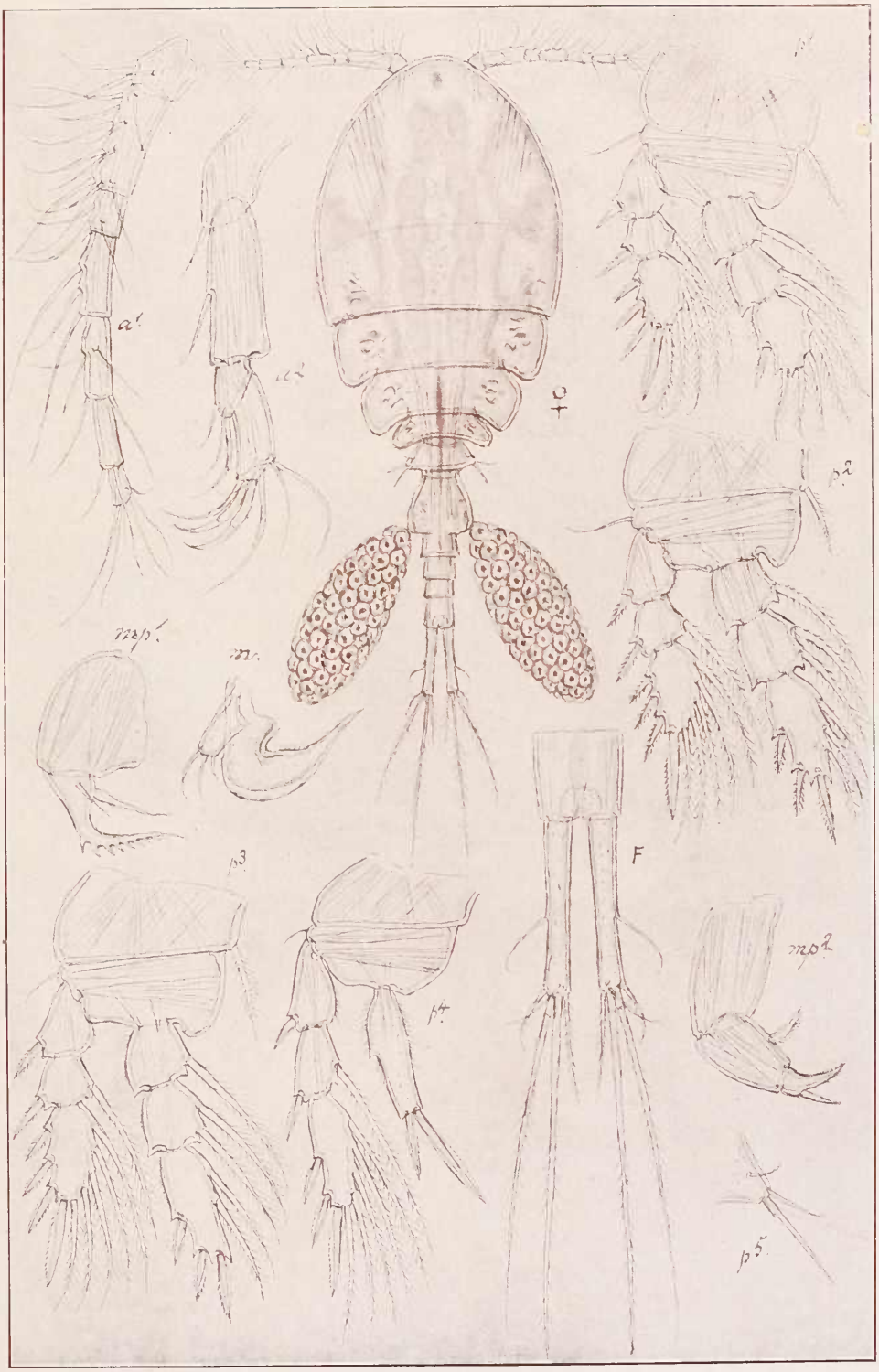
Macrocheiron fucicolum, Brady.



G. O. Sars, del.

Macrocheiron hirsutipes (Scott).

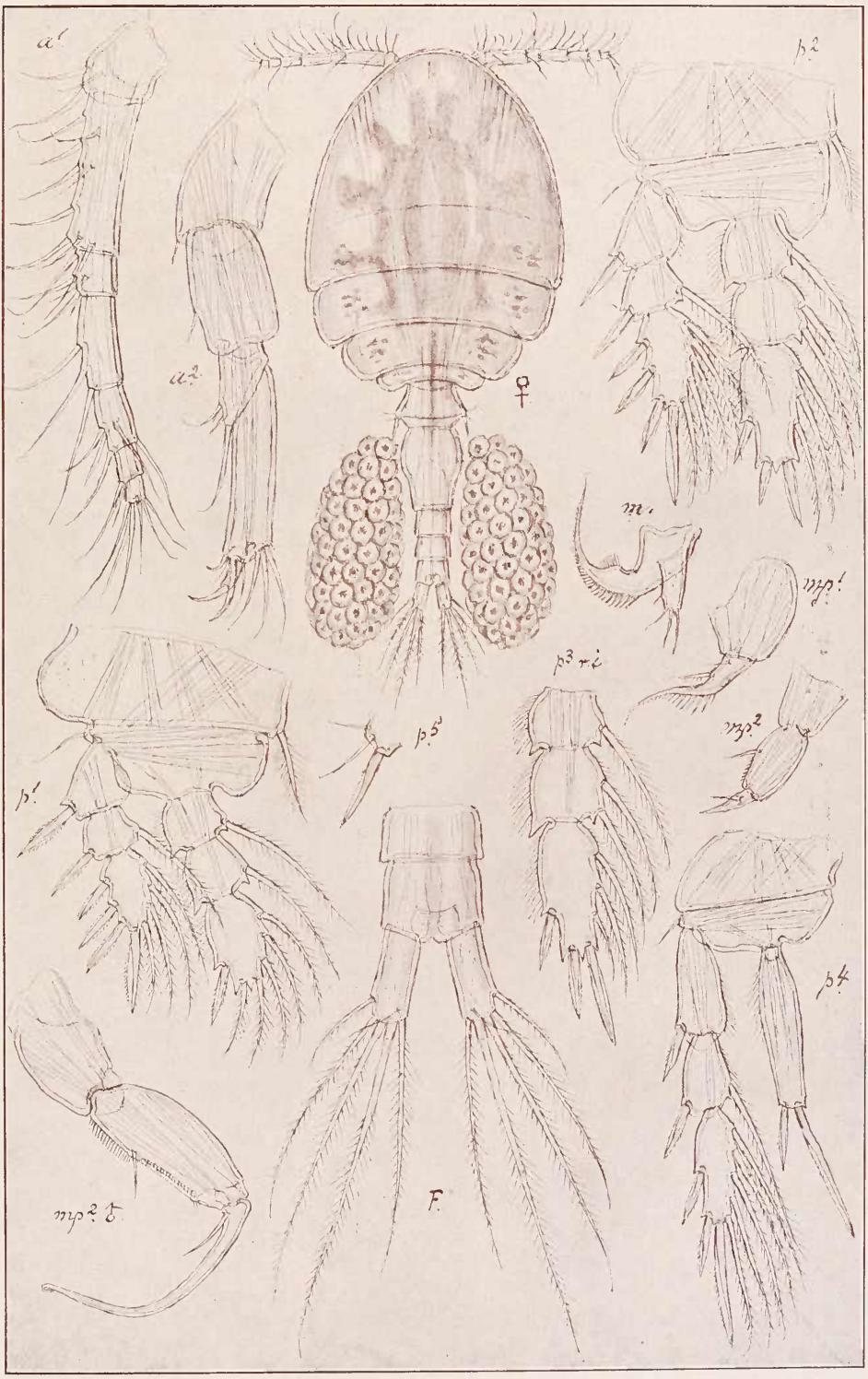
Copepoda.



G. O. Sars, del.

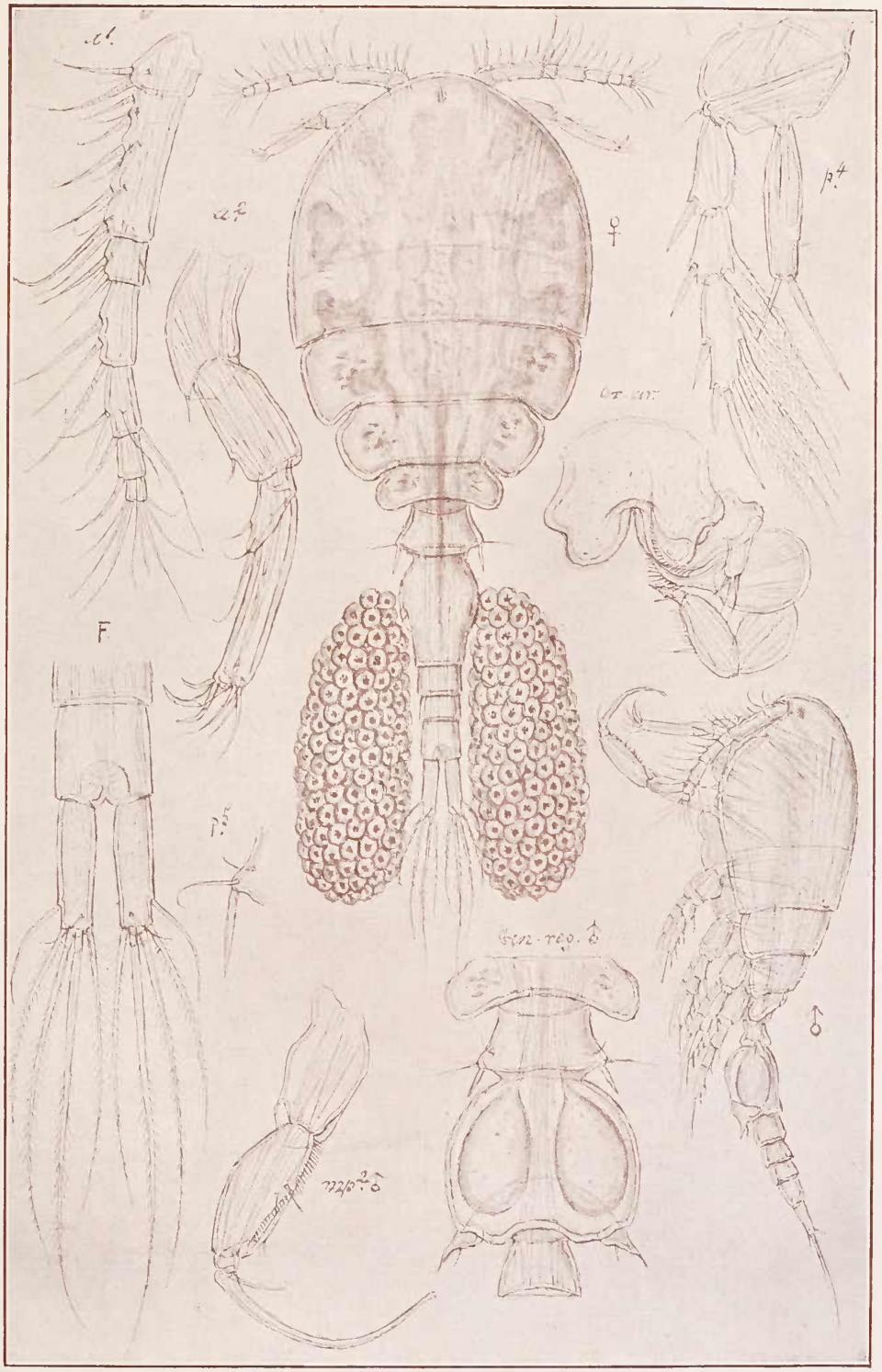
Pseudanthessius gracilis, Claus.

Copepoda.



G. O. Sars, del.

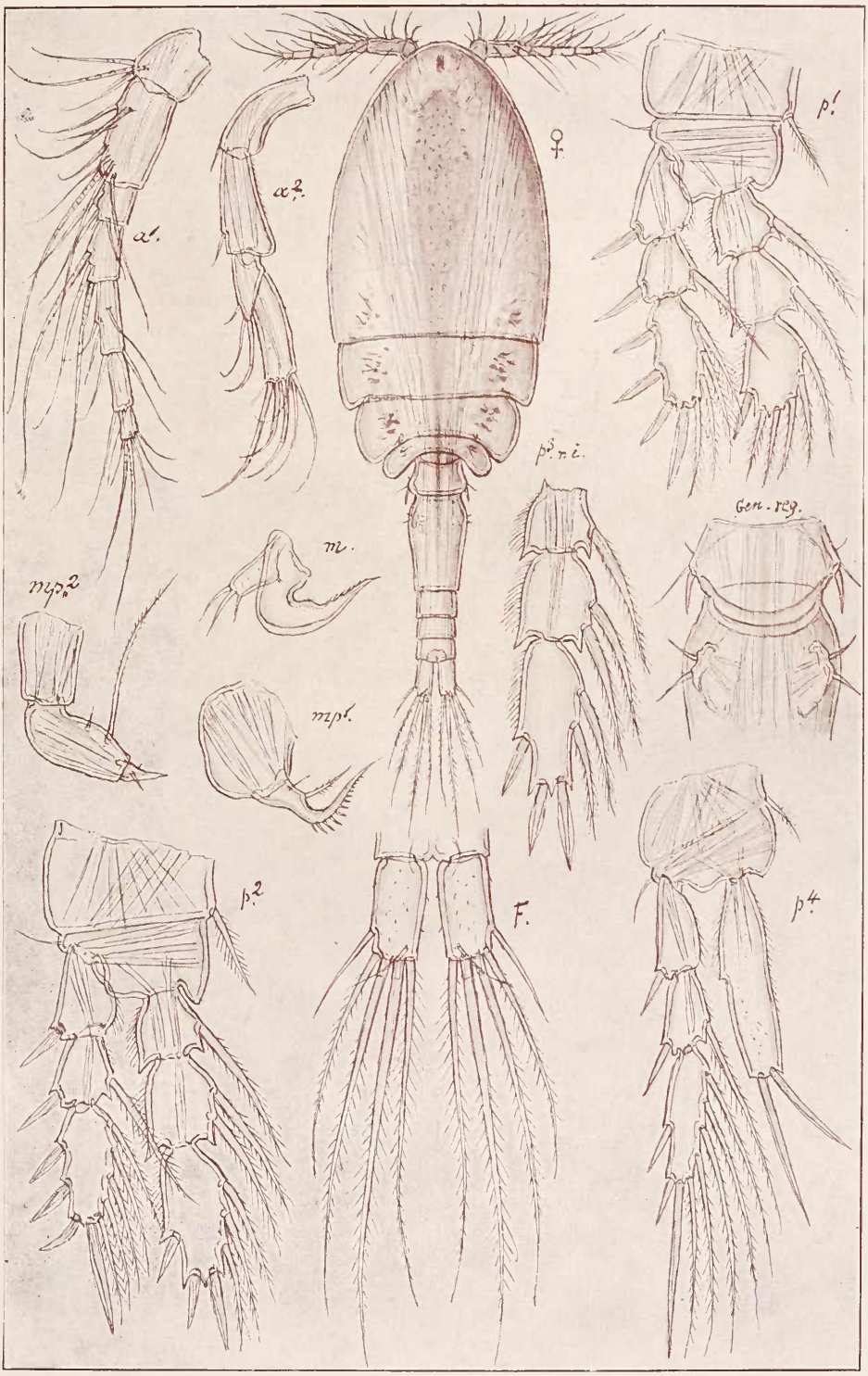
Pseudanthessius liber (Brady).



G. O. Sars, del.

Pseudanthessius assimilis, G. O. Sars.

Copepoda.



G. O. Sars, del.

Pseudanthessius Sauvagei, Canu.