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# ОГЛАВЛЕНІЕ. — SOMMAIRE.

# Pelagic Entomostraca of the Caspian Sea.

By

**G. O. Sars.**

[Plates I—VIII.]

(Présenté le 4 décembre 1896.)

## INTRODUCTION.

The material upon which the present paper has been founded, consisted of a number of samples belonging to the collection of Dr. O. Grimm, and another sample taken in 1895 by Dr. Andrussow in the bay of Karabugas. The samples of Dr. Grimm are stated to have been taken (probably by the aid of the tow-net) in the middle and southern parts of the Caspian Sea from rather considerable depths, ranging from 75 to 400 fathoms. It may be a fact that the tow-net has been immerged to these depths; but whether the specimens in reality are derived from such deep water, seems to me very doubtful. For, unless the townet be particularly constructed, it will continue to collect during the whole time it is being hauled up. It therefore appears to me rather probable, that the greater number of the specimens have in reality been collected from the more superficial strata of the sea. The bottles were labelled „*Bythotrephes socialis* Grimm", and they also contained a considerable number of this peculiar form; but in addition to these, there were in all the bottles numerous specimens of 2 different Calanoid Copepoda not mentioned by Dr. Grimm. Moreover, a closer examination of the *Bythotrephes* (or rather *Cercopagis*) has shown, that several nearly-allied species were intermingled with that originally described by Dr. Grimm.

The sample taken by Dr. Andrussow contained, besides true pelagic forms, several specimens of a small Cumacean *(Pseudocuma cercaroides)* described by the present author in another paper, and also a rather considerable number of small Copepods belonging to the *Harpactoid* and *Cyclopoid* groups. These Copepods have evidently, like the above-mentioned Cumacean, been derived from the bottom, and may only accidentally have been caught in the tow-net, apparently owing to the shallowness of the water. They are therefore omitted in the present paper, but will be treated of in detail on another occasion. In addition to the above-named material, a series of surface-gatherings from the northern part of the Caspian Sea have been kindly forwarded to me from the Zoological Museum of the Imp. Academy of Sciences.

These were taken several years ago, from lagoons at the mouth of the Volga at various distances from the shores, and contained numerous *Entomostraca*; but by far the greater number of the species have turned out to be referable to well-known freshwater forms, and in all probability therefore, the water in these lagoons is perfectly fresh. The several species represented in these samples will be enumerated on another occasion, and only 3 Calanoid Copepods be treated of here, one of them *(Heterocope caspia)* having also been found occasionally in the other samples, the other 2 belonging to a genus *(Temorella)*, which is not peculiar to fresh-water, and of which, indeed, a third new Caspian species has proved to belong to the true pelagic fauna of that basin.

The contents of all the bottles have been very carefully examined by me by the aid of the microscope, and, though this examination involed much expenditure of time and trouble, I have been much pleased by the unexpected results of my examination, numerous rather interesting forms, partly new to science, having been detected and submitted to a detailed investigation. Indeed, the present paper, which only comprises a certain number of these forms, — the true pelagic species — will, I hope, be a rather important contribution to the knowledge of the pelagic fauna of the Caspian Sea; and as, moreover, the *Entomostraca* are known to form the bulk of the food of fishes, both adult and young, this part of the fauna has a particular interest, not only in a strictly scientific, but also in a more practica sense.

The pelagic *Entomostraca* of the Caspian Sea belong to 2 different orders, viz., the *Branchiopoda* and *Copepoda*. Of the first-named order only the Cladoceran family *Polyphemidæ* is represented, of the last — named, the Calonoid family *Diaptomidæ*. The number of species treated of in the present paper is 18 in all, viz., 12 *Cladocera* and 6 *Copepoda*. Of these only 5 have been previously described; the 13 others I regard as new to science.

As to its general character, this part of the fauna cannot be said to be strictly either marine or fresh-water; but it constitutes, as it were, a peculiar mixture of both, exhibiting perhaps more properly the character of a brackish-water fauna, as might be expected from the probably very different degrees of saltness of the superficial strata in different parts of the basin. There is, however, among the *Cladocera*, at least one genus well represented in the Caspian Sea, viz., that of *Evadne* Lovén, which may be considered as pronouncedly marine in character. On the other hand, the genus *Polyphemus*, of which a true pelagic species occurs in the Caspian Sea, has hitherto been regarded as peculiar to fresh-water. As to the genus *Bythotrephes*, I have found that neither the form recorded by Dr. Grimm as *Bythotrephes socialis*, nor the additional new species described in the present paper, can properly be referred to that genus, but must be included in two nearly-allied genera, viz., *Cercopagis* and *Apagis*, the former being also represented in the Sea of Azov. Of the 4 Calanoid genera of *Copepoda* represented in the Caspian Sea, those of *Heterocope* and *Poppella* have hitherto been regarded as peculiar to fresh-water, whereas the genera *Limnocalanus* and *Temorella* have been found to contain both marine and fresh-water species. Among the several Entomostraca found in the Caspian Sea, at least one species, viz., *Limnocalanus Grimaldii*, may with absolute certainty be stated to be of true arctic origin.

The plates accompanying this paper have been executed with the greatest care in the authographic manner employed by the present author in most of his later papers, and will, I hope, fully answer their purpose of illustrating the several species.

All the figures, both habitus and detail, have been drawn by the aid of the camera lucida, and their correctness is thereby guaranteed.

# Cladocera.

## Tribe: Gymnopoda.

Fam.: *POLYPHEMIDÆ.*

### Gen. 1. **Cercopagis**[1]), G. O. Sars, n.

Syn.: *Bythotrephes*, Grimm & N. Pengo (not Leydig).

**Generic Characters.** — General habitus that of the genus *Bythotrephes*, the head being rather large and more or less procumbent, with a distinct dorsal depression in the middle. Abdominal part of the body, or metasome, more or less strongly developed, and very movably articulated to the tail proper, or urosome; the latter produced into a setiform caudal process of enormous length, and having its hindermost part bent in a peculiar sling-like manner, the opposite edges of the sling armed with a double row of recurved denticles. Incubatory pouch very sharply marked off from the body and more or less pointing anteriorly, being of different shape in the different species. Eye very large, with the crystalline cones arranged in 2 sets, one dorsal and one ventral, the latter containing several transverse, flabelliform rows of cones; ocular pigment of very limited extent. Antennulæ (of female) comparatively more slender than in *Bythotrephes*, being scarcely clavate in form. Antennæ having both rami provided with only 7 natatory setæ. Labrum simple, flap-shaped, without any process below. Mandibles with the cutting edge knife-shaped and but slightly denticulate, molar tubercle extremely minute. First pair of legs very slender and, elongated, doubly geniculated, and, on the whole, resembling in structure those in *Bythotrephes*, but without any trace of coxal lobe. Intestinal tube forming in the metasome a more or less pronounced sling-like flexure.

**Remarks.** — As above stated, I have been induced to establish this new genus for the reception of a number of Caspian species, which, though exhibiting a great resemblance to the

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1) Derived from κερκος, tail, and παγις, a sling.

fresh-water genus *Bythotrephes*, yet differ very pronouncedly in some points common to all of them, thus entitling them more properly to be combined into a separate generic group. The most prominent feature is undoubtedly the peculiar prehensile character of the caudal process, which has given rise to the generic name here proposed; but, the structure of the labrum and partly too, that of the mandibles is also somewhat different. Moreover, the number of natatory setæ on the antennæ or oars, which seems to be perfectly constant in all Cladoceran genera, does not entirely agree with that found in the species of *Bythotrephes*; the antennulæ too, differ somewhat in shape, being scarcely, as in that genus, claviform. Finally, the 1st pair of legs, though exhibiting a similar slender and elongated form to that in *Bythotrephes*, are prominently distinguished by the absolute want of any coxal lobe. As an additional peculiar feature may be named the more or less distinctly pronounced sling-like flexure of the posterior part of the intestinal tube, never found in any of the species of *Bythotrephes*. No less than 6 different Caspian species have been examined by me, and will be described below. Moreover, the form recorded in the year 1879 by Mrs. Neonila Pengo from the Sea of Azov, unquestionably belongs to the same genus though apparently specifically distinct from any of the Caspian species.

## 1. **Cercopagis socialis** (Grimm).

(Pl. 1.)

*Bythotrephes socialis* Grimm.

**Specific Characters.** — Body moderately slender, with the metasome about as long as the mesosome, and of cylindrical form, not being particularly tumefied. Caudal claws of moderate size; caudal process 5 to 6 times as long as the body. Incubatory pouch, when fully developed, narrow oblong in form, defined from the body by a pronounced constriction, and always pointing obliquely in front, tip obtusely rounded. Intestinal tube forming in the posterior part of the metasome a well-marked sling-like flexure. Length of body to the base of the caudal process about 2 mm.

**Remarks.** — This form was recorded in the year 1877 by Dr. Grimm as *Bythotrephes socialis* n. sp., and some figures of it were given in a work written in the Russian language, and treating of the biological results of the exploration of the Caspian Sea. Unfortunately I am quite unable to read Russian, and of course have only been in a position to consult the plates appended to the work. The figures 9—12 given on Pl. IX, though apparently not very correct, undoubtedly represent the species here under consideration, which of course should be regarded as the type of the genus *Cercopagis*. It may therefore be expedient to give a more exhaustive description of this species, of which, moreover, I have had a very large material at my disposal.

**Description of the female.** — The length of the body in fully adult specimens, measured from the frontal edge of the head to the base of the caudal process, is about 2 mm. Measured to the tip of the caudal process, however, the length amounts to nearly 12 mm.

The body (see fig. 1) admits of being divided into 4 chief parts, viz., the head or cephalon, the truncal part or mesosome, the abdominal part or metasome, and the tail proper or urosome.

The cephalon (see also fig. 3) is rather large, and defined from the mesosome dorsally by a slight depression, in the middle of which is a small rounded prominence, to which the rotatory muscles of the mandibles are attached. It is to a certain extent mobile, being capable of raising itself a little, and of again curving downwards. It occupies, however, always a more or less prone attitude, so that its axis forms an angle with that of the remaining part of the body. By a rather deep dorsal depression occurring in the middle, the head is divided into 2 well defined parts, the anterior of which (the frontal part) is nearly globular in form, and almost completely filled up with the enormous eye. From the inferior face of this part the antennulæ originate, issuing close together from a somewhat projecting common base. The proximal part of the head is considerably vaulted above, and carries on each side the strongly developed antennæ or oars. Immediately behind the base of the latter, the mandibles are seen on each side, exending transversally, with their masticatory part incurved to-

wards the oral orifice. Ventrally, this part is continued in the flap-shaped labrum curving over the oral orifice, and immediately behind the latter, the rudimentary maxillæ project on each side. From the dorsal depression between the frontal and proximal parts of the head, a sharply marked flexuous line is seen to pass downwards on each side, forming a deep curve, and then running backwards just above the base of the antennæ, and joining its counterpart at a short distance from the dorsal depression defining the head from the trunk. By these lines, which are also continuous in front, a saddle-like dorsal area is defined, apparently answering to the fornical part of the head in other Cladocera.

The mesosome is a little shorter than the cephalon, and of nearly uniform breadth throughout. From this part projects dorsally the greatly-developed incubatory pouch, and ventrally 4 pairs of legs of rather different size originate, all prehensile in character and, excepting the last pair, distinctly articulated, but without any external appendages. On each side of this division, the shell-gland may be traced as a narrow tube coiled up in several coils, and apparently debouching in front, at some distance from the mandibles.

The metasome is about the length of the mesosome, but considerably narrower, and is defined from it by a distinct articulation. It is generally found extended straight posteriorly in the axis of the body, but may admit of being slightly moved out of the axis by several muscles passing to it from the mesosome, both ventrally and dorsally. It exhibits a simple cylindric form, and is quite devoid of any appendages.

The urosome, or tail proper, is very sharply defined from the metasome, being connected with it by a highly movable articulation. It projects at the base below, in a short rounded prominence carrying 2 juxtaposed claws, between which the anal orifice occurs. Opposite this prominence, there is dorsally a deep sinus, behind which the urosome is abruptly narrowed, passing immediately into the enormous caudal process. The latter does not extend in the axis of the body, but is somewhat upturned (see fig. 1a), and in fully grown specimens generally exhibits, at some distance from the base below, a pair of claws exactly resembling those issuing from the anal prominence. On a closer

examination, these claws (see fig. 1) are found to originate in a thin sheath enveloping the caudal process, and sharply cut off in front. This sheath is nothing less than a part of the old skin, which after exuviation remains on this place, a circumstance also observed in the species of the genus *Bythotrephes*.

I will now proceed to a more detailed description of the several parts.

The eye (see fig. 3) is of enormous size, almost completely fillingup the frontal part of the head. It exhibits a great number of visual elements in the form of elongated pyriform crystalline cones, radiating from a comparatively small pigmentary mass, which is placed at the hind part of the eye, and nearer the ventral, than the dorsal face of the head. The cones are arranged in 2 well-marked sets, a dorsal and a ventral, defined in front by a distinct interval. The cones of the dorsal set are densely crowded together, whereas those of the ventral set form several transversal, fan-shaped rows defined by well-marked, though narrow interspaces, and successively diminishing in size from front to back (see also fig. 2). The outer part of all the cones is highly refractive, and divided into 4 facets answering to as many longitudinal segments. The whole eye is surrounded by a very thin capsule, and is to a certain extent movable by the aid of 3 distinct muscles joining it on each side. The 2 upper muscles converge on each side to a point at the base of the labrum, and join the eye, the one at its upper corner, the other at about the middle. They apparently serve to roll the eye upwards, whereas the lowest of the 3 muscles, being more lateral in its origin, and joining the eye at its inferior corner, is designed to roll it in the opposite direction.

The antennulæ (see fig. 4) are very small and, it would seem, quite immovable. They issue close together from a knob-like prominence on the ventral side of the frontal part of the head, and extend straight forwards. In shape, they somewhat differ from those organs in the genus *Bythotrephes*; for whereas in that genus they are rather broad in proportion to their length, and pronouncedly claviform, in the present genus they exhibit a nearly cylindrical form, being scarcely at all dilated in their outer part. On the obtusely rounded tip, each antennula carries 6 very delicate olfactory papillæ, arranged in 2 fascicles.

The antennæ, or oars (see fig. 1, 2 and 5), constituting the chief locomotory organs of the animal, are rather strongly developed, and very movably connected with the head, admitting of being moved in several directions. They are, as usual, composed of a cylindrical muscular scape, showing at the base numerous imperfectly-defined joints, and 2 terminal rami, which are considerably shorter than the scape. The inner ramus, issuing from the lower, somewhat projecting corner of the scape, is triarticulate, and a little longer than the outer, which exhibits at the base a small additional joint, and consequently is 4-articulate. Each of the rami is provided with 7 finely plumose and distinctly biarticulate natatory setæ, whereas in *Bythotrephes* the outer ramus has 8 such setæ. On the inner ramus, each of the first 2 joints carries only a single such seta, the 5 others belonging to the last joint, and arranged in such a manner, that 2 setæ issue from separate ledges of the lower edge, the other 3 from the obliquely-truncated tip. On the outer ramus, the small basal joint has no setæ, the 2nd joint a single one, the 3rd two, and the 4th 4 setæ, one at the lower edge, and 3 at the tip. In *Bythotrephes*, the terminal joint of this ramus has 5 setæ, like that of the inner one. A strong muscle is seen to join these limbs on each side from above (see figs. 1 & 3), serving to lift them, whereas other muscles, less conspicuous, act upon them in an opposite direction.

The labrum, or anterior lip (see fig. 3), has the form of a comparatively simple, flap-shaped expansion of the ventral side of the head, covering over the oral orifice. Its lower face is somewhat convex, and does not exhibit any trace of the large, curved, spiniform process found in the species of *Bythotrephes*. In the middle it has a slight depression, and terminates in a narrowly-rounded lobe, densely hairy inside. By the aid of a strong muscle joining its base on each side from above, the labrum admits of being to some extent removed from the other oral parts, and from the point of insertion of this muscle, some other muscles are seen radiating within the body of the labrum, acting upon its soft terminal part. In the interior of the labrum, moreover, a number of cellular bodies may be observed, apparently of glandular nature. Of a posterior lip, I have failed to detect any trace.

The mandibles are rather strong, and lie as 2 sharply curved bows, one on each side, at the junction between the cephalon and mesosome (see fig. 3), their masticatory part being wedged in between the labrum and the maxillæ. The body of the mandible (see fig. 6) is navicular in form, terminating above in an acute point, by which it is articulated to the skin of the head. It is hollow inside, to receive the strong adductor muscle, but outside exhibits a perfectly smooth and evenly vaulted surface. The masticatory part is strongly incurved, forming almost a right angle with the body. It is produced at the end outside to a compressed, knife-like projection, the sharpened inner edge of which is divided into 2 small teeth, the outer tooth being, however, nearly obsolete. Inside this cutting part, is a very small molar tubercle tipped by 4 minute spinules. In *Bythotrephes*, the lateral teeth of the cutting part are much more distinct, and the molar tubercle coarser, with a considerable number of apical spinules.

The maxillæ, as in *Bythotrephes*, have only the character of 2 simple hairy lobes issuing one on each side immediately behind the oral orifice (see fig. 3). Between them, the terminal part of the labrum is received, when bent in against the mouth (see fig. 2).

The legs (see figs. 1 & 2), at first sight, look very like those in *Bythotrephes*. As in that genus, the 1st pair are exceedingly slender and elongated, attaining, when fully extended, almost the length of the whole body, not including the caudal process. They are more or less curved, forming a double geniculate bend, and are composed of 4 distinctly defined joints. The 1st or basal joint is rather thick, being filled by strong muscles passing into it from the side of the mesosome and partly joining the next joint. It does not exhibit any appendages whatever, whereas in *Bythotrephes* this joint carries inside a well defined coxal lobe. The 2nd joint is nearly 3 times as long, and gradually tapers distally, being very movably connected with the 1st. It carries, along the posterior edge, 5 spiniform setæ, of which the 4th is the longest, and occurs about in the middle, the 5th being placed at rather a long distance from the others, near the end of the joint. The 3rd joint, which, with the 2nd, generally forms a well-marked geniculate bend, is scarcely more than half as long, and very narrow, without

any trace of setæ or spines. The 4th or last joint is still narrower, linear in form, and considerably longer, and is very movably articulated to the preceding one, with which it generally forms a geniculate bend. It carries on the tip (see fig. 8) 4 strong, claw-like spines, the 2 inner of which are secured to a separate ledge, and are somewhat longer than the other 2. The spines are slightly curved and minutely spinulose in their proximal part, terminating in a very acute point.

The 3 succeeding pairs of legs (see figs. 1 & 2) are much smaller, and rapidly diminish in size. They are, as a rule, more or less strongly incurved, and, like the 1st pair, are destitute of any outer appendages. The 2nd and 3rd pairs (figs. 9 & 10), not taking in to consideration their different size, are of essentially the same structure, being, like the 1st, composed of 4 distinctly defined joints. The basal joint is rather thick and muscular, and exhibits in both pairs a well-marked coxal lobe turned inwards and terminating in a pointed projection, inside which there are several small spinules. The 2nd joint somewhat tapers distally, and on the 2nd pair, is about as long as the basal joint, whereas in the 3rd pair it is considerably shorter. Along the hind edge of this joint, there is a series of spiniform setæ also continued on the basal joint. The number of these setæ on the 2nd pair is 6, on the 3rd pair only 4. The 2 outer joints are of exactly the same structure in the 2 pairs. The 1st of them is rather short, and carries at the end posteriorly 2 juxtaposed spines; the second is somewhat longer, and is armed with 4 claw-like spines, 2 of which issue from the tip, 2 from a separate ledge on the hind edge. The spines are comparatively short, except one of those issuing from the above-named ledge, which is considerably longer than the others and strongly incurved, being, moreover, fringed along the one edge with minute spinules. The last pair of legs (fig. 11) are very small, and have the terminal part quite obsolete, so that they only correspond to the basal part of the others. They are each produced inside to a conically-pointed projection, which undoubtedly answers to the coxal lobe, and are, moreover, armed with 7 spiniform setæ, 4 of which issue from the obtusely-rounded tip, the other 3 from the inner edge.

The incubatory pouch varies considerably in size and also somewhat in form, according to the number and develop-

ment of the enclosed embryos; but, when fully developed, it generally exhibits a rather narrow oblong or almost cylindric shape, being pronouncedly constricted at the base, and obtusely rounded at the tip. It always extends more or less forwards, sometimes in such a manner, that it appears, as it were, to be doubled upon the adjacent forepart of the body, as indicated in the figure given by Dr. Grimm. In some individuals I have found it of quite an extraordinary size, fully equalling in length the whole body, not including the coxal process.

The caudal claws (see fig. 1) are not particularly strong, being about as long as the caudal process is broad at the base. They are perfectly smooth, somewhat divergent (see fig. 2), and slightly curved, terminating in a sharp point.

The caudal process is of quite an enormous length (see fig. 1a), being in some individuals fully 6 times as long as the body. It gradually tapers distally so as to assume the character of a slender, flexible seta; which is often found to be bent in different directions. In its hindermost part, it exhibits in all specimens a peculiar sling-like, or rather a strongly sigmoid bend (see fig. 12), and at this place, it appears to be of a much firmer consistency, so as to keep the sling quite unaltered. The opposite edges of the sling are to some extent armed with a double row of short, recurved denticles, more strongly developed at the place where the sling passes into the straight terminal part of the process. The latter is very thin, and at first sight appears to end in a simple point. On applying very strong magnifying powers, however, 2 extremely small bristles are seen to issue from the point, representing the rudiment of the usual caudal setæ (see fig. 12a). As to the true significance of this peculiar structure of the caudal process found in all the species of the present genus, it is rather difficult to say anything with certainty. In every case, it is found that the caudal process in these animals, on account of its peculiar sling-like bend, and the recurved denticles occurring on the latter, is admirably adapted for taking hold of any object coming in contact with it. When therefore, a number of specimens are brought together in a small vessel, they will invariably after some time be found to be fastened together by these means, and, as the sling of one individual fits pretty well into the sling of another, it not infrequently happens,

that several individuals are found coherent in a radiating manner, being fastened only by the slings of their caudal processes. Indeed, in all the samples that contained this form, the individuals formed a confused coherent mass, and were so firmly united that it was only with the greatest difficulty that they could be separated without injury. The specific name *socialis* proposed by Dr. Grimm would seem to have been derived from this peculiarity. But it is hardly likely that in the free state of the animals, such clusters of coherent individuals would ever be formed, and in any case it can scarcely be supposed that this, even if possible, could be of any benefit to the animal. I am therefore of opinion, that the caudal process, besides acting in the usual manner as a balancing apparatus, has the additional significance of a preying organ, by the aid of which, other Entomostraca may be grasped. The flexibility of the caudal process in connection with the very movable articulation of the urosome with the metasome, will allow the animal, in such cases, so to turn itself, as to seize the captive prey with its long anterior pair of legs, and thus bring it within reach of the other legs and the oral parts. As is well known, the species of *Bythotrephes* are true carnivorous animals, and the structure of the mandibles in the species of the present genus seems indeed to indicate a still more voracious character, so that the presence of an additional very effective preying apparatus may hereby be explained.

Inner Organs. Though an examination of the inner organisation in alcoholic specimens is connected with several difficulties, and cannot therefore be instituted with such an exactness as in the case of living specimens, I have succeeded, by a suitable preparation of a number of the specimens at my disposal, to study most of the inner organs in detail, and I will try to give below a short account of the results of this examination.

The intestinal tract begins with a short muscular œsophagus (see fig. 3), which ascends nearly perpendicularly from the oral orifice to the stomachal part of the intestine, projecting into its lumen by 2 valve-like lips. The stomach (ibid.), which is confined to the proximal part of the head, forms a rather capacious bag, defined behind from the intestine proper, by a well-

marked constriction. It is produced in front to a rounded cœcal expansion, and has its walls everywhere clothed with large secretory cells. The intestine proper (see fig. 1) is of considerable length, forming a perfectly cylindrical tube, which extends throughout the whole mesosome and metasome. It forms, in the posterior part of the latter division, a well-marked, sling-like flexure, which, however, in alcoholic specimens, may be easily overlooked, as this part of the intestine in such specimens is more or less completely concealed by the strong muscles extending on each side through the metasome. The intestinal tube, like the stomach, is everywhere clothed with large secretory cells, and terminates in a short rectum, which passes into the basal part of the urosome, debouching ventrally between the caudal claws.

The heart (see fig. 1) is situated in the dorsal part of the mesosome, immediately below the origin of the incubatory pouch. It has the form of a rather large pellucid bag, with a pair of lateral venous ostia, and it opens in front by a somewhat tubiform projected orifice, through which the blood is expelled. No true blood-vessels exist.

Of the central nervous system, the part occurring in the head is not difficult to observe (see fig. 3). It consists of 2 rather large nerve-masses, placed one behind the other, and each composed of 2 symmetrical halves. They are connected by 2 rather short longitudinal commissures, between which is a small rounded opening (see fig. 13). The anterior nerve-mass represents the optic ganglion, and occurs immediately behind the ocular pigment, to which numerous fine nerve-fibres are sent off. The commissures connecting this ganglion with the next, are more properly the optic nerve-stems. The other nerve-mass is somewhat larger than the optic one, and represents the cephalic ganglion. It sends off below 2 fine nerves, which run forwards along the ventral surface of the frontal part of the head, forming in the antennular protuberance a ganglionic swelling (see fig. 4). From this swelling, fine nerve-fibres issue, penetrating the antennulæ, and ending at the base of the olfactory papillæ in a number of small ganglionic cells. Another nerve is sent off on each side to the ocular muscles, and a 3rd pair of nerves would seem to exist, passing upwards to the dorsal face

of the head, at the junction between the frontal and proximal parts. From the hind end of the ganglion, the great œsophageal commissures pass backwards. These commissures give origin to the strong nerves entering the oars, and, farther back, are concealed by the bodies of the mandibles. The remaining part of the central nervous system is much more difficult to examine, as it lies partly imbedded in the strong muscles passing to the several legs. In a few specimens, prepared in a suitable manner, and mounted from the ventral side (see fig. 2), I have, however, succeeded in tracing it rather distinctly. It consists (see fig. 13) of 2 strong nerve-stems forming the immediate continuation of the œsophageal commissures, and lying rather apart from each other. In each of the segments of the mesosome, these nerve-stems are connected by a double transversal commissure, and in these places they swell out to a distinct ganglion, sending off laterally nerves for the legs. Besides the 4 pairs of pedal ganglia, the last of which is rather small, another pair of ganglia, much larger then the others, is seen in front. These ganglia, which, owing to their concealed position, are rather difficult to observe, would seem to give origin to the nerves for the several oral parts, and probably also for the anterior part of the intestinal tract. From the hindmost pedal ganglia 2 rather strong nerves originate, which enter the metasome, and probably send off ramifications to the intestinal tube, and to the strong muscles extending through that division, and joining the urosome.

The ovaries, I have not been able to see distinctly. In *Bythotrephes*, they are located in the posterior part of the mesosome, and I believe that they may have a similar position in the present genus.

The ova, when recently received into the incubatory pouch (see fig. 14) are extremely small and perfectly globular, containing but a very small amount of nutritive yolk. For the nourishment of the embryos during their development, a nutritive fluid accumulates within the cavity of the incubatory pouch, as first shown by Prof. Weissman in the case of *Moina*. This fluid is secreted from a dense cellular layer occurring inside the anterior surface of the incubatory pouch, and fairly well observable also in alcoholic specimens (see fig. 1). The young, when ready to

escape from the incubatory pouch of the mother, are of comparatively very large size, and lie densely crowded together within its cavity, their long caudal processes coiled up in numerous irregular coils partly surrounding their bodies.

Male specimens I have not succeeded in finding, either of this or the other species here described. Their existence is most probably, as is the case with *Bythotrephes*, restricted to a comparatively short period of the season, later in the autumn.

**Occurrence.** — As above stated, all the samples belonging to the collection of Dr. Grimm contained this form in rather considerable numbers. The samples were taken at 5 different Stations (69, 73, 107, 108, 110), the first 2 located in the southern part of the Caspian Sea, outside the bay of Lenkoran, the other 3 at a rather considerable distance from the shore, north of the peninsula Baku. In the sample taken by Mr. Andrussow from the bay of Karabugas, not a single specimen of this form occurred, nor was it found in any of the samples examined from the North Caspian Sea. It would therefore appear that this form is confined to the deeper parts of the Caspian Sea, but here forming a considerable bulk of the „plankton".

### 2. **Cercopagis robusta**, G. O. Sars, n. sp.

(Pl. 2, fig. 1, 1a.)

**Specific Characters.** — Body considerably more robust than in the type species, with the metasome exceedingly thick and massive, bulging considerably below. Caudal claws extremely small. Caudal process about 4 times and a half as long as the body. Incubatory pouch very large and capacious, of a rather regular oval form, and terminating in a small, knob-like projection. Intestinal tube forming a very distinct sling-like bend in the anterior part of the metasome. Length of adult female, not including the caudal process, 2,40 mm.

**Remarks.** — Though very nearly allied to the preceding species, this form may be at once distinguished by the exceedingly tumid metasome, and the very small size of the caudal claws. The incubatory pouch, moreover, is considerably broader in proportion to its length and terminates in a distinct knob-like prominence, not found in the type species.

**Description.** The length of the body in the largest specimen examined measures, not including the caudal process, 2.40 mm., and this form would accordingly seem to grow to a somewhat larger size than the preceding species.

The body appears on the whole (see Pl. 2, fig. 1) considerably more robust than in *C. socialis*, and exhibits its 4 chief divisions very sharply defined. The cephalon about equals in length the mesosome, and has its frontal part comparatively less expanded than in the type species, and not nearly attaining the size of the proximal part. The metasome looks very different from that in the said species, being clearly distinguished by its large size and massive form. It is scarcely narrower than the mesosome, but somewhat exceeding it in length, and has the dorsal face nearly plain, whereas the ventral face is strongly bulging, with the inferior margin in the lateral view of the animal, forming a bold and quite even curve. The urosome appears to be abruptly narrowed, and as in the other species, is immediately continued into the setiform caudal process. The latter, in the specimens examined (see fig. 1a), is somewhat shorter than in *C. socialis*, being about 4 times and a half as long as the body. In structure, however, it exactly agrees with that in the said species.

The caudal claws, on the other hand, differ conspicuously in their much smaller size, being scarcely more than half as long as the caudal process is broad at the base. As in *C. socialis*, an additional pair of caudal claws are seen at a short distance behind the first pair, belonging to the sheath-like part of the old skin enveloping the caudal process.

The incubatory pouch, in the specimens examined, is very large and capacious, exhibiting a rather regular oval or elliptic form, and extends upwards and a little forwards. It is defined from the mesosome by a very pronounced constriction, and terminates in a well-marked, though rather small, knob-like prominence not found in the type species.

The intestinal tube, as in *C. socialis*, forms in the metasome a well-marked sling-like flexure; but this flexure occurs here considerably more in front, and is also rather more pronounced. As to the structure of the eye and the several appendages, no essential difference seems to exist from that found in the preceding species.

**Occurrence.** — Of this form 3 specimens, exactly agreeing in all essential characters, were found in one of the samples taken by Dr. Grimm at Stat. 107.

### 3. **Cercopagis micronyx**, G. O. Sars, n. sp.

(Pl. 2, figs. 2, 2a.)

**Specific Characters.** — Body rather short and stout, with the metasome of inconsiderable size, not attaining the length of the mesosome, and much narrower, short cylindric in form. Caudal claws extremely small, almost obsolete. Caudal process about 6 times as long as the body. Incubatory pouch large, almost globular in form, tip evenly rounded. Intestinal tube forming a well-marked, sling-like bend about in the middle of the metasome. Length of adult female, not including the caudal process, 1.20 mm.

**Remarks.** — The present new species may be easily distinguished from the 2 preceding ones by the comparatively poor development of the metasome, and by the globular form of the incubatory pouch. Moreover, the caudal claws are so extremely small as to be almost obsolete, which latter character has given rise to the specific name here proposed.

**Description.** — The length of a fully adult, gravid specimen measures, not including the caudal process, only 1.20 mm., and this form is accordingly rather inferior in size to the 2 preceding species.

The body (see Pl. 2, fig. 2), as compared with that in the other species, is of a rather short and stout form. The cephalon is scarcely longer than the mesosome, and has the frontal part rather expanded, being of about the same size as the proximal one. The metasome is much smaller than in the 2 preceding species, not nearly attaining the length of the mesosome, and considerably narrower. It exhibits a short cylindrical form, with the ventral face but very slightly vaulted, the dorsal one almost plain, and the end somewhat obliquely truncated.

The caudal claws are extremely small and imperfectly defined from the urosome, looking merely like a pair of very minute dentiform projections of the anal prominence. At a short di-

stance behind them, another pair of claws of a similar rudimentary appearance occur, belonging to the old sheath-like skin remaining on the caudal process. The latter (see fig. 2a) is very much elongated, being fully 6 times as long as the body, and exhibits at its end the usual sling-like bend.

The incubatory pouch, in the specimens examined, is rather large and of an almost globular form, being sharply defined from the mesosome, and quite evenly rounded at the end. As in the other species, it extends somewhat obliquely forwards.

The intestinal tube forms in the metasome a very pronounced sling-like bend, which here occurs about in the middle of that division.

The structure of the eye and of the several appendages does not seem to differ, in any essential respect, from that in the 2 preceding species.

**Occurrence.** — Some few specimens of this form were found among *C. socialis*, in the samples taken by Dr. Grimm at Stat. 107 and 108.

### 4. **Cercopagis prolongata**, G. O. Sars, n. sp.

(Pl. 2, figs. 3, 3a.)

**Specific Characters.** — Body rather slender, with the metasome very much elongated, exceeding in length the mesosome and cephalon combined, straight, subcylindric in form, very slightly widening in its distal part. Caudal claws small, but distinctly defined. Caudal process about 4 times as long as the body. Incubatory pouch narrow oblong, scarcely constricted at the base, and terminating in a very small knob-like prominence. Intestinal tube forming in the posterior part of the metasome a very slight sigmoid flexure. Length of adult female, not including the caudal process, 1.95 mm.

**Remarks.** — The exceedingly elongated, straight metasome at once distinguishes this form from any of the 3 preceding species, and the specific name here proposed refers to that peculiarity. Moreover, the incubatory pouch differs somewhat in shape, being very narrow and scarcely at all constricted at the base.

**Description.** — The largest of the specimens examined measures, not including the caudal process, 1.95 mm.; but more than half this length is made up of the metasome, so that this form, though nearly attaining the same length as the type species, is in reality rather inferior in size.

The form of the body (see Pl. 2, fig. 3) appears rather more slender than in any of the 3 preceding species. The cephalon and mesosome exhibit the usual shape, though in all the specimens examined, the former division is remarkably procumbent, with the proximal part strongly vaulted above. The metasome, on the other hand, is peculiarly distinguished by its unusal length, exceeding even that of the mesosome and cephalon combined. It extends straight behind, and is rather narrow, and subcylindrical in form, though widening a little in its posterior part. In the lateral view of the animal, the inferior margin of this division is nearly straight, whereas the upper margin is slightly concaved in front of the middle.

The caudal claws are comparatively small, though well defined, and sharply pointed at the tip. At a short distance behind them, the usual pair of spurious claws occur.

The caudal process (see fig. 3a), in all the specimens, is extended straight behind, almost in the axis of the body. It is about 4 times as long as the body, and exhibits the structure characteristic of the genus.

The incubatory pouch, in the specimens examined, is of a very narrow oblong form, extending obliquely upwards. It is scarcely at all constricted at the base, and terminates in a very small, knob-like prominence.

The intestinal tube does not form any pronounced sling-like bend, but only exhibits in its most posterior part a very slight sigmoid flexure.

**Occurrence.** — Of this form, 5 specimens, all exactly agreeing with each other, were found in one of the samples taken by Dr. Grimm at Stat. 108.

### 5. **Cercopagis tenera**, G. O. Sars, n. sp.

(Pl. 2, figs. 4, 4a.)

**Specific Characters.** — Body very slender, with the metasome narrow cylindrical in form, and equalling in length the mesosome and the proximal part of the cephalon combined. Caudal claws

very much elongated, with their outer part abruptly curved; spurious claws present in one or 2 pairs occurring at rather a long distance from the first pair. Caudal process very slender and elongated, about 6 times as long as the body, and turned obliquely up. Incubatory pouch rather narrow, oblong fusiform in shape and pointing more or less obliquely forwards, tip produced to a sharp spiniform projection. Intestinal tube only slightly flexuous in its hindmost part. Length of adult female, not including the caudal process, 1.50 mm.

**Remarks.** — In some points, and particularly in the acutely produced incubatory pouch, this species would seem to approach somewhat to the form described by Mrs. Neonila Pengo from the Sea of Azov, and indeed at first I believed it to be the very same species. A closer comparison of the figure here given with that reproduced by Mrs. Neonila Pengo, will however at once show the Caspian form to be a much more slender and delicate species, and also that the shape of the incubatory pouch and of the caudal claws in the two species is rather different.

**Description.** — The length of the largest specimens examined, not including the caudal claws, is about $1^1/_2$ mm.

The form of the body (see fig. 4) is extremely slender and elegant, more so than in any of the other species. The cephalon considerably exceeds the mesosome in length, and has the frontal part rather greatly expanded; it is, moreover, less procumbent than in most of the other species. The metasome is very slender and narrow, and perfectly cylindrical in form, and equals in length the mesosome and the proximal part of the cephalon combined. The urosome is scarcely narrower at the base than the metasome, and has the anal protuberance considerably projecting.

The caudal claws are rather fully developed, being twice as long as the caudal process is broad at the base, and they have their outer part abruptly curved. The caudal process (see fig. 4a) is exceedingly long and slender, being fully 6 times as long as the body; it extends obliquely upwards, forming, with the basal part of the urosome, almost a right angle. It exhibits, at rather a long distance from its base, the usual spurious claws, and in one of the specimens, the one here drawn, another pair of such claws occurred farther behind. The outermost part of the process exhibits the usual sling-like bend.

The incubatory pouch is very slender and elongated, and of a narrow fusiform shape, being distinctly constricted at the base. It extends more or less obliquely forwards, and terminates in a rather strong spiniform projection. In one of the specimens it almost attained the length of the whole body, not including the caudal process.

The intestinal tube, as in *C. prolongata*, forms only a very slight sigmoid flexure in the hindmost part of the metasome.

In the structure of the eye and the several appendages, I have not found any essential differences from that in the other species.

**Occurrence.** — The present species was found in the greater number of the samples taken by Dr. Grimm, but in none of them did it occur in any abundance.

### 6. **Cercopagis anonyx,** G. O. Sars, n. sp.

(Pl. 2, figs. 5, 5a.)

**Specific Characters.** — Body rather short and stout, with the metasome of inconsiderable size, scarcely exceeding in length the mesosome, and subcylindric in form. Caudal claws wholly absent. Caudal process about 5 times as long as the body. Incubatory pouch not nearly so slender as in *C. tenera*, oval fusiform in shape, tip produced into a rather strong spiniform projection. Intestinal tube forming a well-marked, sling-like bend in the anterior part of the metasome. Length of adult female, not including the caudal process, 1.20 mm.

**Remarks.** — The most prominent feature distinguishing this form from the other species, is undoubtedly the absolute want of the usual caudal claws, and it is indeed from this character, that the specific name here proposed has been derived. In the fusiform shape of the incubatory pouch and its spiniform tip, it somewhat resembles *C. tenera*; but the metasome is far less developed, and the whole body much more robust.

**Description.** — The length of a fully adult female specimen measures, not including the caudal process, only 1.20 mm., and this form accordingly belongs to the smaller species of the genus.

The body (see fig. 5) is on the whole rather short and stout, resembling in this respect the above-described *C. micronyx*, and is also of about the same size. The cephalon is somewhat procumbent, and about equals the mesosome in length, having its proximal part rather strongly vaulted. The metasome is of inconsiderable size, scarcely exceeding the length of the mesosome, and much narrower. It is subcylindric in form, and somewhat upturned, with the ventral face slightly convex, the dorsal nearly plain, and the end transversely truncated. The urosome exhibits the usual shape, and projects at the base below to an obtusely rounded protuberance, on the tip of which the anal orifice occurs; but not the slightest trace of any caudal claws is to be found either there or on the caudal process. The latter (see fig. 5a) is rather slender and elongated, about 5 times and a half as long as the body, and extends straight behind, almost in the axis of the body. Its structure is that characteristic of the genus.

The incubatory pouch is fusiform in shape, and turned obliquely up, terminating in a rather strong spiniform projection, like that found in *C. tenera*. The pouch, however, is comparatively much shorter and thicker than in that species.

The intestinal tube forms, within the anterior part of the metasome, a very pronounced sling-like flexure.

**Occurrence.** — Only 2 or 3 specimens of this form have come under my notice, these being found in one of the samples taken by Dr. Grimm at Stat. 107.

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## Gen. 2. **Apagis,** G. O. Sars, n.

**Generic Characters.** — Cephalon and mesosome, as also the several appendages belonging to these divisions, nearly as in the genus *Cercopagis*. Metasome, on the other hand, of quite an extraordinary development, considerably exceeding the 2 anterior divisions in length, cylindric, vermiform, and very sharply defined from the urosome; the latter rather robust, without true caudal claws; caudal process comparatively short, straight, without any apical sling-like bend. Intestinal tube not forming any flexure within the metasome. Incubatory pouch well defined from the body.

**Remarks.** — I have found it necessary to establish this new genus, to include a very remarkable Caspian form, which, though apparently nearly allied to *Cercopagis*, yet differs in some points so very markedly, as to justify its being generically separated. The most prominent features are the extraordinary development of the metasome, and the very different structure of the caudal process, which, contrary to what is the case in the species of the genus *Cercopagis*, is comparatively short and entirely without the terminal sling-like bend so characteristic of that genus. The generic name here proposed refers to the latter character.

### 7. **Apagis cylindrata,** G. O. Sars, n. sp.

(Pl. 3, figs. 1, 2.)

**Specific Characters.** — Body very slender, and slightly curved in a sigmoid manner, with the metasome fully one and a half times as long as the mesosome and cephalon combined, and very narrow, perfectly cylindric, vermiform, and gently curved upwards. Urosome obtusely produced at the base below, and gradually continued in the slightly upturned caudal process; the latter scarcely as long as the metasome, with its proximal part rather thick, and exhibiting below, traces of 2 pairs of denticles. Incubatory pouch very narrow, subfusiform, upturned, and terminating in a small, knob-like prominence. Length of adult female, not including the caudal process, 2.30 mm.

**Remarks.** — This is the only as yet known species of the genus, and may easily be recognized from all other *Polyphemidæ*, by the extraordinary development of the metasome.

**Description.** — The length of the solitary specimen examined, not including the caudal process, is 2.30 mm.; but about $^3/_5$ of this length belongs to the metasome alone.

The body (see Pl. 3, fig. 1) appears on the whole extremely slender, and exhibits a slight sigmoid flexure, the head being, as usual, somewhat procumbent, whereas the remaining part of the body curves gently upwards. The cephalon considerably exceeds the mesosome in length, and exhibits an appearance similar to that found in the species of the genus *Cercopagis*, its frontal part being sharply defined from the proximal, and of

nearly globular form. The metasome, on the other hand, is peculiarly distinguished by its extraordinary length, having the appearance of a long narrow cylinder, exceeding the length of the fore-part of the body by about ⅓. It seems to have been very flexible, and in the specimen examined, is slightly curved upwards. The urosome, as in *Cercopagis*, is very movably articulated to the metasome, and exhibits at the base, ventrally, a rounded protuberance, on the tip of which, the anal orifice occurs. This protuberance is quite smooth, without the slightest trace of caudal claws. Behind it, the urosome is immediately continued into the somewhat upturned caudal process. The latter is rather short, scarcely exceeding the length of the metasome, and does not exhibit any trace of the sling-like bend, characteristic of the preceding genus. Its proximal part is rather thick, and shows, ventrally, traces of 2 very small successive denticles, whereas the distal part gradually tapers to a fine point, carrying 2 extremely small juxtaposed bristles, the rudimentary caudal setæ (see fig. 2). The outermost part of the caudal process is covered all over with minute, adpressed spikes.

The incubatory pouch, as in the genus *Cercopagis*, is very sharply marked off from the body, and exhibits a very narrow, somewhat fusiform shape. It extends obliquely upwards, and terminates in a small, knob-like protuberance.

The intestinal tube runs through the axis of the metasome, without forming any bend or flexure whatever.

As to the structure of the eye and the several limbs, I have not been able to detect any other essential differences from that found in the species of the genus *Cercopagis*, than that the 1-st pair of legs are somewhat less elongated.

**Occurrence.** — A solitary, but well-preserved specimen of this remarkable form was found in one of the samples taken by Dr. Grimm at Stat. 69.

## Gen. 3. **Polyphemus,** O. Fr. Müller.

**Remarks.** — Of this genus we have hitherto only been acquainted with a single species, the well-known fresh-water form, *P. pediculus* Müller. It is therefore most interesting to discover that in the Caspian Sea another form exists, which undoubtedly is specifically distinct, though it is easy to believe, that it may have originally descended from the fresh-water species.

### 8. **Polyphemus exiguus,** G. O. Sars, n. sp.

(Pl. 3, figs. 3—9.)

**Specific Characters.** — ♀ General form of body resembling that in *P. pediculus*, though the head appears comparatively larger and more procumbent. Incubatory pouch not sharply defined from the body, but evenly rounded. Eye large, but with the pigment of very slight extent, forming a rather small central mass. Legs comparatively short, the 3 anterior pairs each having only 2 strongly-curved apical claws, branchial lamella rather large, with 6 densely plumose setæ; last pair of legs very small and rudimentary. Caudal process comparatively longer than in the type species; caudal setæ about same length as the process. Length of body, measured from the front to the end of the incubatory pouch, scarcely exceeding 0.40 mm.

**Remarks.** — In general habitus, this new species strongly resembles the well-known fresh-water form *P. pediculus*, but is of inferior size, and is moreover at once distinguished by the small extent of the ocular pigment, which gives the eye a similar appearance to that found in the species of *Cercopagis* and *Apagis*. Moreover, the legs appear shorter, whereas the caudal process is comparatively longer than in that species. Only female specimens have come under my notice.

**Description.** — The length of fully adult, gravid specimens, measured from the front to the end of the incubatory pouch, does not nearly attain half a millimeter, the average length being from 0.30 mm. to 0.40 mm., and this form is accordingly far inferior in size to the type species.

The form of the body (see Pl. 3, fig. 3), as in the latter species, is very short and compact, and somewhat compressed. Only 3 chief divisions can be distinguished, viz., the cephalon, the mesosome, and the urosome, the metasome not being developed. The cephalon is rather large, equalling in length, the other 2 divisions combined, and is somewhat procumbent, forming with the mesosome a pronounced angle. It is defined above by a rather deep depression, and has in the middle, another rather shallower depression, by which the frontal part is defined from the proximal one. The former part is evenly rounded in front, and almost completely filled by the large eye; the latter is but slightly vaulted above. The mesosome is abruptly bent downwards, and dorsally is continuous with the large incubatory pouch, whereas ventrally it carries the 4 closely placed pairs of legs. The urosome is very small, and not defined from the adjacent part of the body by any distinct articulation. It forms below, a small rounded prominence, occurring immediately behind the last pair of legs, and containing the anal orifice. Behind this prominence, the urosome is continued into the caudal process, which is rather more fully developed than in the type species, its length almost equalling the height of the body. It is extended straight backwards, lying generally immediately beneath the incubatory pouch; and it carries on the transversely truncated tip, 2 rather large, biarticulate and finely plumose setæ, of about the same length as the process itself.

The eye is of very large size, and is distinguished from that in the type species by the very slight extent of the ocular pigment, which, as in the species of *Cercopagis* and *Apagis*, forms a comparatively small, irregularly rounded, central mass, from which the long crystalline cones radiate. The latter are of same structure as in the above-named genera, but do not seem to be arranged, like those, in 2 different sets.

The antennulæ are extremely small and, it would seem quite immovable, originating close together from a slight swelling of the ventral surface of the head, beneath the eye. They are extended forwards, and carry, at the tip, the usual delicate olfactory papillæ.

The antennæ, or oars, are rather strongly developed, and have the rami almost as long as the scape, the inner one being

3-articulate, the outer 4-articulate. The number and arrangement of the natatory setæ is the same as in the genera *Cercopagis* and *Apagis*.

The labrum forms a short, thick, fleshy lobe of rounded form, covering the oral orifice, and having the terminal edge finely ciliated. In a lateral view of the animal, it is generally concealed by the bases of the 1-st pair of legs.

The mandibles (fig. 4) are rather strong, with the masticatory part incurved at a right angle to the corpus. It is cylindrical in shape, and is divided at the end into 2 dentated projections, the outer of which represents the true cutting part, whereas the somewhat narrower inner projection may answer to the molar tubercle. Both projections are divided into 3 teeth, but on the outer one, these teeth are much coarser than on the inner, one of them being of considerable size, and knife-shaped.

Of legs there are, as in other Polyphemidæ, 4 pairs, all densely crowded together and more or less incurved. They are comparatively shorter than in the type species, and successively diminish in size, the last pair being extremely small, so as easily to escape attention. Excepting this last pair, they are all (see figs. 6—8) composed of 4 well-defined joints, the 2-nd of which carries outside a rather large, and very delicate branchial plate fringed with 6 densely plumose setæ. In addition, the 2 middle pairs have each, inside, a well-marked, incurved, coxal lobe. From the tip of the terminal joint in all these 3 pairs of legs, 2 rather strong, curved, claw-like spines issue, finely denticulated on theconcave edge; at the end, posteriorly, of each of the 2 preceding joints, there are, 2 similar spines, followed along the hind edge of the leg, by a row of more delicate, ciliated spines, 5 on the 1-st, 3 on the 2-nd, and 2 on the 3-rd pair. In *P. pediculus* the number of spines is rather greater, and the terminal joint carries 4 such spines, instead of 2. The last pair of legs (fig. 9) are very rudimentary, having the appearance of 2 short, rounded lobes, each carrying outside, a small protuberance tipped by 2 unequal bristles, probably answering to the branchial plate.

The incubatory pouch (see fig. 3) varies considerably in size, according to the number and development of the enclosed embryos, but is always evenly rounded, and never so strongly marked off from the body as in the genus *Cercopagis*.

The intestine may, in suitably prepared specimens, be distinctly traced through the integuments, extending in the axis of the body, and forming in front a rather strong bend corresponding to the curvature of the body in this place. Its most anterior, or stomachal part is somewhat expanded, but less sharply defined behind, than in the genus *Cercopagis*. The posterior part of the intestine is quite straight, not forming any flexure, and debouches with a short rectum on the ventral side of the urosome.

Of the nervous system, the cephalic and optic ganglia are pretty easily discernible, both being rather large, and lying the one behind the other, the optic ganglion in close proximity to the ocular pigment.

The heart is seen as a comparatively small, rounded bag placed above at the base of the incubatory pouch; and at some distance from it, on the sides of the mesosome, the shell-gland may be traced.

The ova recently received within the incubatory pouch are rather small and globular in form, though comparatively larger than in the genus *Cercopagis*. Their number varies from 3 to 8.

**Occurrence.** — A rather considerable number of specimens of this dwarfed form were picked up from the sample taken by Mr. Andrussow in the bay of Karabugas. It also occurred occasionally in another sample taken outside Baku, which did not contain any other Entomostraca, except larvæ of Copepoda.

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## Gen. 4. **Evadne,** Lovén.

**Remarks.** — As mentioned above, this genus, established by Prof. Lovén, has hitherto been regarded as exclusively marine, and only 2 species have been recorded, viz., *E. nordmani* Lovén and *E. spinifera* P. E. Müller. It was therefore rather surprising to find this genus represented in the Caspian Sea by no less than 4 different species, all quite distinct from the 2 previously known forms. The near relationship between the genera

*Evadne* and *Podon* has been pointed out by P. E. Müller, and, as the only more essential distinguishing characters, he mentions the form of the incubatory or marsupial part, which is triangular in *Evadne*, and rounded in *Podon*, and the presence or absence of a dorsal depression between it and the head, the depression being distinct in *Podon*, but wanting in *Evadne*. According to the form of the marsupial part, as also to the external appearance of the animal, all the Caspian species are most assuredly referable to the latter genus; but in 3 of the species there is a cervical depression, fully as distinct as in the species of *Podon*, whereas in the 4-th species this depression is wanting. It would thus seem, that the Caspian species combine characters of both these genera, and thereby tend to efface the limits between them. If it should be found advisable to combine these 2 genera into one, the name *Evadne* ought to be preferred to that of *Podon*, the former name being of much older date. It may be noted, that in such case also the remarkable form described by Mrs. Neonila Pengo from the Sea of Azov as *Corniger maeoticus* ought to be referred to the same genus.

### 9. **Evadne producta**, G. O. Sars, n. sp.

(Pl. 3, figs 10—17.)

**Specific Characters.** — Cephalon defined behind by a deep dorsal depression, and extended straight forwards at right angles to the mesosome, its dorsal face but slightly vaulted, and exhibiting in the middle a sharply defined rounded area. Urosome without any caudal claws; caudal process extremely small, knob-like. Marsupial part of body greatly produced, being twice as long as it is broad at the base, and considerably narrowed in its outer part, terminating in a sharp point. Length of body, measured from the front to the extremity of the marsupial part, 1.40 mm.

**Remarks.** — This is the largest of the 4 Caspian species, and, according to its whole external appearance, shows itself to be a true *Evadne*, though differing very pronouncedly from the 2 previously known species in the deep dorsal depression defining the head behind. Only female specimens have hitherto been found by me, but of rather different degrees of development.

**Description.** — The length of the largest specimen examined, measured from the frontal edge of the head to the extremity of the marsupial part, is 1.40 mm., the height, from the dorsal surface of the head to the end of the urosome, measuring only 0.60 mm.

The body (see Pl. 3, fig. 10) exhibits the peculiar shape characteristic of the genus, the marsupial region constituting much the larger part. The true axial part of the body, as in *Polyphemus*, is composed of 3 chief divisions, viz., the cephalon, the mesosome, and the urosome, the first-named division extending straight forwards, whereas the remaining part of the body curves abruptly downwards, at almost a right angle to the former. The cephalon about equals the mesosome in length, and is defined behind from the marsupial part by a very strongly marked and deep, dorsal depression. Its dorsal face is but slightly vaulted, and exhibits, at about the middle, a sharply-defined circular area, apparently answering to the so-called affixing organ in the 2 previously-described species. The frontal part of the head is not so distinctly defined from the proximal part as in other *Polyphemidæ*, and is also less expanded, being obtusely truncated anteriorly. The mesosome gradually tapers distally, and dorsally is continuous with the marsupial part of the body. From its anterior (ventral) side, the 4 pairs of legs are seen to originate, being contiguous at the base, but otherwise more or less diverging. The urosome is very small and not distinctly defined from the adjacent part of the body. It exhibits (see fig. 17) an obtusely conical form, and terminates in 2 very short, juxtaposed lobes, between which the anal orifice occurs. These lobes, in other species, are produced to more or less strong unguiform projections, the caudal claws; but no traces of such projections occur in the present species. Dorsally the urosome carries a small knob-like prominence tipped by 2 very minute bristles. This is the rudiment of the caudal process, so enormously developed in the genus *Cercopagis*.

The marsupial part of the body (see fig. 10), which cannot properly be named a true incubatory pouch, since it is only a comparatively limited part of its inner cavity that seems to be destined for the reception of the developing embryos, is of very considerable size, being almost twice as large as the remaining part of the body. It extends straight posteriorly, and has its outer part conically tapered and slightly deflexed, ter-

minating in an acute point. The far greater part of its cavity is filled with a perfectly clear hyaline fluid, and only in its most proximal part is there a separate chamber lined by a thin membrane, and containing the developing embryos. The walls of the marsupial chamber exhibit a delicate cellular texture, more distinct in its outermost part.

The eye is rather large, filling up the greater part of the frontal division of the head. It exhibits a comparatively small, somewhat triangular mass of dark pigment, from which numerous densely-crowded crystalline cones radiate, each ending in a highly refractive lenticular body. Three distinct muscles are seen joining the eye on each side, being inserted at different heights, so as to admit of its being rolled to some extent within its hollow.

The antennulæ are extremely small, arising from the end of a fleshy prominence, which bends round the inferior corner of the head. They point straight upwards, and carry on the tip a number of extremely delicate olfactory papillæ.

The antennæ, or oars (see figs. 10, 11), are not particularly strong, but, as in other *Polyphemidæ*, consist each of a cylindrical scape, very movably connected with the head, and 2 terminal rami, the inner of which is 3-articulate, the outer 4-articulate. The rami are of about equal length, and each carry 6 natatory setæ, 4 of which issue close together from the end of the comparatively short terminal joint. The setæ are very long and slender, except that issuing from the antepenultimate joint, which is considerably shorter than the others.

The labrum (see fig. 10) forms a very broad, but rather short and rounded, fleshy lobe issuing from the lower face of the head, immediately behind the antennular prominence. It is densely ciliated both at the end and in front, and exhibits in its basal part a dense layer of cellular bodies. In a lateral view of the animal, it is generally concealed by the bases of the 1-st pair of legs.

The mandibles (fig. 12) are well developed, with the masticatory part almost as long as the body of the mandible, and incurved at right angles to the same. It gradually tapers distally, and terminates in a sharp, knife-like point, inside which, is a somewhat smaller bidentate projection, apparently answering to the molar tubercle (see fig. 13).

The legs (figs. 14—16) are rather strongly built, and rapidly diminish in length posteriorly, the last pair being very small. They are more or less incurved, and, excepting the last pair, very distinctly segmented; the 1st pair (fig. 14) are divided into 4, the 2 succeeding pairs (fig. 15) into 3 joints, the 2 proximal joints being here confluent. The terminal joint, in all these pairs, is rather short, and carries 4 slender, unguiform spines, which, especially in the 1st pair (fig. 14) are very long, curving posteriorly. The penultimate joint is comparatively large, and carries, along the posterior edge, a limited number of spines, 4 on the 1st pair, 3 on the 2nd, and 2 on the 3rd. Outside, these legs are each provided with a rather narrow appendage, carrying on the tip 2 unequal spines. This appendage, which in the 1st pair (fig. 14) originates from the end of the 2nd joint, and in the 2 succeeding pairs (fig. 15) from the basal joint itself, undoubtedly answers to the branchial plate in *Polyphemus*; but its structure does not here seem to make it suitable for respiration. From the basal joint of the 2 middle pairs (fig. 15), a very large coxal lobe is seen projecting inwards, terminating in 2 strong, unguiform spines of unequal size, and being moreover, densely clothed with hair-like bristles. This lobe is only faintly indicated on the 1st pair (fig. 14), by a slight nodiform projection of the 2nd joint. The last pair of legs (figs 16, 17) are rather small, though less rudimentary than in *Polyphemus*, showing traces both of a terminal part, and of an outer appendage. The latter has the form of a small nodiform prominence, tipped by a rather long spiniform seta extending downwards; the former carries in all 6 short spines, some of which, however, more properly belong to the basal part.

The intestine may be easily traced, in specimens suitably prepared, running as a rather capacious tube through the axis of the body, and terminating in a short rectum, which debouches on the tip of the urosome (see fig. 17). In the head it forms only a very slight stomachal expansion, which does not seem to be much bent in front, nor to give origin to any distinct cæcal appendages.

At the sides of the intestine the shell-gland is seen extending downwards, and above it, at the base of the marsupial part, the small bag-like heart may be traced.

Of the nervous system, the part occurring in the head admits of being pretty well observed. It consists of the 2 usual ganglia, cephalic and optic, the latter occurring immediately behind the ocular pigment, and apparently consisting of 2 successive divisions.

The ovaria I have not been enabled to examine closely.

The embryos contained in the incubatory chamber of the marsupial room, were of rather different development in the different specimens. In the one here drawn, this chamber contained 2 rather fully developed young ones.

**Occurrence.** — Of this form, a limited number of specimens, all perfectly agreeing with one an other, were found in 3 of the samples taken by Dr. Grimm, partly in the southern part of the Caspian Sea (Stat. 69), partly in the middle part (Stat. 107 and 108). A single specimen of this form was also found in the sample taken by Mr. Andrussow from the Bay of Karabugas.

### 10. **Evadne anonyx**, G. O. Sars, n. sp.

(Pl. 3, figs 18, 19.)

**Specific Characters.** — ♀ Very like the preceding species, but of rather smaller size. Head remarkably procumbent, and not defined behind by any distinct depression. Urosome without a trace of caudal claws. Marsupial part somewhat less produced than in the preceding species, though exhibiting a rather similar form, with the outer part conically tapered, and terminating in an acute point. Length of adult female, measured from the front to the tip of the marsupial part, scarcely exceeding 1 mm.

**Remarks.** — The present form is very nearly allied to the preceding species, and indeed, I have been in some doubt, whether it should in reality be regarded as specifically distinct from it. There is, however, at least one character whereby the present form distinguishes itself very pronouncedly, viz., the total absence of any dorsal depression defining the head behind, in which respect it agrees with the 2 previously known species of the genus; and as this character has been formerly regarded not only of specific, but even of generic value, I think that a specific distinction in this case is fully justified.

**Description.** — The largest specimens examined, these having fully developed young within the incubatory chamber, do not exceed a length of 1 mm., measured from the frontal edge of the head to the tip of the marsupial part of the body, and this form is accordingly rather inferior in size to the preceding one.

The general form of the body (see fig. 18) looks rather like that in *E. producta*; but, on a closer comparison, some well-marked differences may in fact be found to exist. Thus the head in all specimens appears much more procumbent, with the dorsal face strongly vaulted in the middle, and with no distinct depression between it and the marsupial part, the dorsal edge of the head, and that of the marsupial part forming together, in most of the specimens (see also fig. 19), a perfectly even and uninterrupted curve. The urosome is blunted at the tip, and does not exhibit the slightest trace of caudal claws.

The marsupial division of the body is not nearly so much produced as in the preceding species, though its outer part is conically tapered in a very similar manner. In young specimens (see fig. 19) this part is often abruptly narrowed, and has the walls very distinctly cellular.

In the structure of the eye and of the several appendages, no essential differences from that found in the preceding species seem to exist.

**Occurrence.** — Several specimens of this form, all of the female sex, but of rather different development, were found in the sample taken by Mr. Andrussow from the Bay of Karabugas. In the samples belonging to the collection of Dr. Grimm, on the other hand, this form did not occur.

### 11. **Evadne camptonyx,** G. O. Sars, n. sp.

(Pl. 3, figs 20, 21.)

**Specific Characters.** — ♀ Head very large and somewhat erect, defined behind by a deep dorsal depression, frontal part broadly rounded, dorsal circular area occurring far behind. Urosome terminating in 2 juxtaposed unguiform projections of considerable length, and strongly curved. Marsupial division of body rather considerably produced, with the outer part conically narrowed, and terminating in a very acute point. Length of adult female, measured from the front to the tip of the marsupial part, 0.80 mm.

**Remarks.** — This is a very distinct species, in some points combining characters of the two genera *Evadne* and *Podon*, as formerly defined, though on account of the shape of the marsupial part of the body, more properly referable to the firstnamed genus. The specific name is derived from the strongly developed and curved caudal claws.

**Description.** — The length of a fully adult specimen, with large young ones in the incubatory chamber, is 0.80 mm., measured from the frontal edge of the head to the tip of the marsupial part, and accordingly this form is rather inferior in size to the 2 preceding ones.

The general form of the body (see fig. 20) on the whole agrees with that characteristic of the genus *Evadne*. The head, however, is much more erect than in any of the other species, thereby more resembling that in the genus *Podon*. It is also of rather considerable size, and defined behind by a very distinct and deep dorsal depression. Its frontal part is broadly rounded, and not defined from the proximal part by any constriction. The circular dorsal area is very sharply defined, exhibiting a pronounced radiating striation, and occurs far behind, close to the cervical depression. The urosome (see fig. 21) terminates in 2 juxtaposed claw-like projections of considerable length, strongly recurved, and terminating in a very acute point. Behind them, the small, knob-like caudal process, with its 2 small bristles, is seen.

The marsupial division of the body is considerably produced, being almost twice as long as it is broad at the base, and has the distal part considerably narrowed, and tapering to a very acute point. The eye is very large, with the pigmentary mass of a pronounced trigonal form, but otherwise agrees in its structure with that in the other species.

The structure of the several appendages would also seem to be quite normal.

In the specimen drawn, the incubatory chamber was much distended, occupying the greater part of the marsupial room, and containing 2 rather fully developed young ones, on which the ocular pigment was already perceptible.

**Occurrence.** — Only 3 specimens of this pretty form, all exactly agreeing with one another, were found in the sample taken by Mr. Andrussow from the Bay of Karabugas.

## 12. **Evadne trigona**, G. O. Sars, n. sp.

(Pl. 3, figs. 22—25.)

**Specific Characters.** — Head of moderate size, extended straight in front, and defined behind by a well-marked dorsal depression, circular area of the dorsal face occurring far behind. Urosome terminating in 2 juxtaposed, nearly straight, spiniform projections. Marsupial part of body rather broad, triangular in form, being, in female, scarcely longer than it is broad at the base, in male, somewhat more produced. Length of adult female, measured from the front to the tip of the marsupial part, 0.56 mm.

**Remarks.** — This also is a very distinct species, easily recognizable from any of the other species, and likewise exhibits some peculiar features apparently unfamiliar to the genus *Evadne*, though its whole external appearance must place it within this genus.

**Description of the female.** — The length of the largest specimens examined, measured as above, but slightly exceeds half a millimeter, and this form is accordingly of very small size.

The form of the body (see Pl. 3, fig. 22) appears, on the whole, rather short and compact, almost trigonal in outline. The axial part of the body is strongly bent, its hind portion (mesosome and urosome) curving abruptly downwards, at right angles to the anterior. The head is of moderate size, and extends straight in front. It has the dorsal face but slightly vaulted, and is defined behind by a well-marked, and rather deep cervical depression. The frontal part is obtusely rounded, and not distinctly defined from the proximal one. The circular dorsal area, as in *E. camptonyx*, is very sharply marked off, and occurs close to the cervical depression. The urosome (see fig. 23) terminates in 2 rather long, spiniform projections, representing the caudal claws; but in the present species these claws are almost perfectly straight. The knob-like caudal process with its 2 small bristles, resembles that in the other species.

The marsupial part of the body is very broad, triangular in form, and almost gibbously expanded behind the cervical depression. It is scarcely longer than it is broad at the base, and terminates in an obtuse point, which, however, sometimes

appears to be almost effaced (see fig. 24). In some of the specimens examined, the incubatory chamber was greatly distended by the developing young, and thus occupied the greater part of the marsupial cavity (see fig. 22). Some other specimens carried within this chamber only a single large globular body, of a very opaque appearance, and pronouncedly granular structure (see fig. 24), evidently representing a so-called winter-egg.

The adult male (fig. 25) is of about the same size as the female, and has the marsupial part fully as large, though somewhat differing in shape, being comparatively less broad, with the outer part more produced. It is, moreover, easily distinguished by the structure of the 1st pair of legs, each of which terminates in a small, but well-defined, upturned claw. The testes are very conspicuous, occurring on the sides of the marsupial part below, in the shape of a pair of pyriform bags, containing a limited number of large cellular bodies. They gradually contract in front to narrow ducts, which debouch at the tip of the urosome, one on each side of the anal orifice.

**Occurrence.** — A rather considerable number of specimens of this form were found in the sample taken by Mr. Andrussow from the Bay of Karabugas. Moreover, a solitary specimen was found in one of the samples belonging to the collection of Dr. Grimm, and taken in the southern part of the Caspian Sea at Stat. 79, outside the Bay of Lenkoran. The species is thereby proved to occur also in the deeper parts of the Caspian Sea.

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## Copepoda.

### Tribe: Calanoidea.

Fam.: *DIAPTOMIDÆ.*

### Gen. **Limnocalanus,** G. O. Sars.

**Remarks.** — This genus was established by the present author in the year 1863, to include a peculiar fresh-water Calanoid, which in its habits showed some points of resemblance to the marine species of *Calanus*, for which reason the above

generic name was proposed. The genus, however, is not referable to the same family as the marine genus *Calanus*, but must enter the family *Diaptomidæ*, to which all the fresh-water forms of this tribe in fact belong. This family answers to the family *Centropagidæ* of Dr. Giesbrecht; but as the genus *Diaptomus* is of much earlier date than *Centropages*, the name of the family must, according to the rules of terminology, be derived from the former genus, and not from the latter. In the structure of the last pair of legs, the present genus shows itself to be nearly allied to the genus *Centropages* of Kröyer, but in several other respects is rather distinct. In addition to the type species, *L. macrurus* G. O. Sars, another rather aberrant fresh-water species has recently been recorded from China by Dr. Poppe as *L. sinensis*. On the other hand, the form at first described by Mr. J. de Guerne as *Centropages grimaldii* from the Gulf of Finland, has subsequently been withdrawn by the same author as merely a synonym to *Limnocalanus macrurus*. It will, however, be shown below, that this form must in fact be restored as a well-defined third species of the genus.

### 1. **Limnocalanus grimaldii** (de Guerne).

(Pl. 4.)

*Centropages Grimaldii*, J. de Guerne, Description d'un Copépode nouveau du golfe de Finland. Bull. Soc. Zool. France, XI.

**Specific Characters.** — In outward appearance very like *L. macrurus*, but of larger size, and having the frontal part of the cephalic segment rather different in shape, with the dorsal face not at all vaulted, and the rostral projection abruptly bent downwards. Last pedigerous segment produced on each side to a well-marked, though rather short, triangularly-pointed prominence. Caudal rami in female considerably exceeding in length the last 2 caudal segments combined. Length of female 2.80 mm., of male, somewhat less.

**Remarks.** — As above stated, this form was at first described by M. Jules de Guerne, from specimens taken by the prince Albert de Monaco in the Gulf of Finland, as a new species of the genus *Centropages* Kröyer. Subsequently he considered, however, that it was more properly referable to the genus *Limnocalanus*

G. O. Sars, and in the work on the fresh-water Calanoids edited by him and M. Jules Richard, it was identified with *L. macrurus* G. O. Sars. The same had also been done some years previously by Dr. O. Nordquist. Having, however, through the kindness of the last-named author, had an opportunity of examining the Baltic form more closely, I find that it in fact differs very pronouncedly in some points from the fresh-water form, and should thus more properly be regarded as a distinct, though nearly-allied species. At the same time, I have convinced myself, that the Caspian *Limnocalanus* here described is most certainly referable to the same species; and I now regard it as beyond doubt, that the form recorded by Prof. Lilljeborg from the coast of Spitsbergen and from the Kara Sea, also belongs to this, and not to the fresh-water species. We have thus 2 nearly-allied European species of *Limnocalanus*, the one marine, the other limited to fresh water, the 1st being of true arctic origin, and in the Caspian Sea constituting a part of the interesting „relict" glacial fauna of that basin. As to the fresh-water form, it may most probably be assumed, that it is originally descended from the marine form; but at present it has assumed the character of a well-defined species, being especially easily distinguishable by the very different shape of the frontal part of the cephalic segment (compare figs. 2 and 19 on Pl. 4).

**Description of the female.** — The body in the Caspian form, measured from the front to the tips of the caudal rami, attains a length of 2.80 mm., a size never attained by the fresh-water species. According to Dr. Nordquist, this species occasionally attains a still larger size, some specimens taken by him in the Åland Sea measuring 3.15 mm. in length. The form of the body (see Pl. 4, figs. 1 and 2) is very slender and elegant, with the 2 chief divisions sharply defined. The anterior division, comprising the head and trunk, is of oblong fusiform shape, the greatest width equalling about $^1/_3$ of the length, and occurring in the middle. It is divided into 6 well-defined segments, of which the foremost (the cephalic segment) is much the largest, exceeding in length the 3 succeeding ones combined. Seen from above (fig. 1), this segment gradually tapers in front, and has the extremity narrowly rounded. Seen from the side (fig. 2), it appears but very slightly vaulted above, with a rather

small, and indistinct cervical depression in front of the middle. The frontal part (see also fig. 3) has the dorsal face nearly plain, and only at the extremity does it curve abruptly downwards to form the deflexed rostral projection. In the fresh-water species this segment exhibits, in the lateral view of the animal (see fig. 19), a totally different appearance, its frontal part being very strongly vaulted, so as to form an almost gibbous protuberance bounded behind by a slight sinus, whereas anteriorly the dorsal face declines evenly to the short rostral projection. This peculiar shape of the cephalic segment, mentioned by the present author in his original diagnosis of the species, is pretty constant in all Norwegian specimens of *L. macrurus*, which I have examined, and is quite as pronounced in specimens kindly sent me by Dr. NORDQUIST, and taken by him in the Finland lake, Suolijarvi, whereas in the present species not the slightest suspicion of a similar curvature of the front is to be detected. To the end of the rostral projection, as in the fresh-water spcies, 2 very delicate tentacular appendages are secured, but these appendages would seem to be somewhat more fully developed in the species here under consideration. The 5 pedigerous segments succeeding the cephalic segment, successively diminish both in length and width, the last segment being much smaller than the others. This is deeply emarginated in the middle, and on each side projects to a well-marked, though not very prominent, triangularly-pointed lobe (see figs. 1 & 2). In *L. macrurus*, on the other hand, these lobes (see fig. 19) are much shorter, and rounded off at the tip.

The posterior division of the body, or tail, is very movably connected to the anterior one, a thin-skinned, very flexible part being interposed between them. It is (see figs. 1 & 2) fully as long as the 5 pedigerous segments of the anterior division combined, and of a very slender form, being composed of 3 well-defined segments, not including the caudal rami. The 1st or genital segment is about the length of the 2nd, but considerably broader in its anterior part, bulging somewhat ventrally to form the genital prominence. The 3rd segment (see also fig. 16) is considerably shorter than the 2 preceding ones, and exhibits dorsally, at some distance from the end, a transversal valvular ridge, bounding in front the soft-skinned anal region. At the end it has a small median incisure, just in front of which the anal orifice occurs.

The caudal rami (see fig. 16) are very slender and elongated, exceeding in length the last 2 caudal segments combined, and extend straight posteriorly, so as generally to lie close together. They are clothed with very delicate hairs, and have the extremity slightly dilated. Each of the rami carries 5 rather strong and finely plumose setæ, 4 of which issue from the tip, the 5th from a separate ledge on the outer edge, at some distance from the end. The setæ are of somewhat different size, increasing in length to the 4th, which is the longest, the 5th or innermost being considerably shorter. In addition to these, a 6th seta of a rather different structure originates from the end of each ramus dorsally, near the inner corner. This seta is extremely delicate, so that it is only with difficulty that it can be discerned in its whole length, and appears to be without any cilia.

The eye (see fig. 3) can be only faintly traced, lying somewhat ventrally between the bases of the superior antennæ. In the fresh-water species it is well developed, with dark red pigment and distinctly projecting lenticular bodies.

The anterior antennæ (see figs. 1 & 2) are very slender, and extend, when reflexed (see fig. 2), about to the base of the caudal rami. They gradually taper distally, and are each divided into 25 joints carrying in front scattered bristles, some of which are rather elongated. Of the joints, the 2 innermost are somewhat larger than the next succeeding ones, which are comparatively short. From the 11th or 12th articulation the joints become rather elongated, but the outermost joints again diminish somewhat in length, the last one being extremely small, conic in form, and tipped by a number of slender bristles. The penultimate joint carries at the end posteriorly 2 rather long setæ, and each of the 2 preceding joints has a single such seta posteriorly, whereas the other joints are only setiferous anteriorly.

The posterior antennæ (fig. 4), as in other Calanoids, are composed of a short, biarticulate basal part and 2 unequal rami. The last joint of the basal part is rather broad, and carries at the end anteriorly 2 short, juxtaposed setæ, whereas the 1st has only a single such seta. The inner ramus, which forms the immediate continuation of the basal part, is composed of only 2 joints, the 1st of which is rather elongated, sublinear in form, and provided, at some distance from the end, anteriorly,

with 2 juxtaposed setæ of the same structure as those issuing from the basal part. The outer joint is quite short, and somewhat flattened, forming at the end 2 unequal lobes, the anterior of which is the shorter, and carries 8 finely ciliated setæ rapidly increasing in length inwards. The posterior lobe is clothed with 7 rather elongated setæ of a similar structure. The outer ramus is considerably longer than the inner, and very movable, being divided into 6 rather unequal joints. The 1st joint is comparatively short, and carries anteriorly one short seta. The 2nd joint is more than 3 times as large as the 1st, and is provided with 3 similar setæ, and also with a much more elongated seta issuing from the end. The 3 succeeding joints are very short, and each carry a much elongated seta. The last joint is about the length of the 2nd, and somewhat fusiform in shape, having at the tip 4 exceedingly long setæ, and also a much shorter one, secured to a separate ledge on the anterior edge. All the setæ, but especially the apical ones, are densely plumose.

The anterior lip (see figs. 3 & 5) is rather large and prominent, forming a broad, fleshy lobe covering the oral orifice, and densely hairy at the end. It has the terminal edge slightly emarginated, and exhibits in the middle a rounded prominence clothed with long divergent hairs.

The posterior lip (fig. 6) is well defined, consisting of 2 divergent lobes, confluent at the base. The lobes are slightly narrowed distally, with the end indistinctly bilobed, and the inner edge finely ciliated.

The mandibles (fig. 7) consist each of a highly chitinized body, and a very movable biramose palp. The body is navicular in form, with a rather deep hollow inside, to receive the strong adductor muscle. The masticatory part is securiformly expanded, with the cutting edge divided into 7 teeth, the 5 inner of which are bidentate, whereas the 2 much larger outer ones are simple, the outermost being particularly strong and sharply pointed. Inside the innermost tooth, moreover, 2 short bristles are secured. The palp about equals in length the body of the mandible, and consists of a biarticulate basal part and 2 short rami. The 1st joint is so very small, as easily to escape attention, whereas the last joint is of considerable size, and irregularly fusiform in outline. It carries, inside, 4 short setæ, and exhibits in its interior several

strong muscles acting upon the 2 rami. Of these the inner one forms the immediate continuation of the basal part, and consists of 2 short joints of about equal size, curving obliquely outwards the 1st carrying, inside, 4 setæ, the 2nd having on the tip 6 rather longer setæ. The outer ramus is very movably attached to the basal part at about the middle of its length, and is divided into 5 short joints, rapidly diminishing in size, each carrying, inside, a strong curved seta. The setæ successively diminish in length distally and, like those of the inner ramus, are densely ciliated.

The maxillæ (fig. 8) are of a rather complicated structure, being divided into several unequal setiferous lobes. Yet it is possible to distinguish the same chief parts as in the mandibles. The body, or basal part, is produced inside to a wellmarked masticatory lobe armed with numerous strong, denticulated spines arranged in a double row. The palp is membranous in character, and is provided at the base outside with a lamellar expansion edged with 9 particularly strong, and densely plumous setæ extended straight outwards. This lamella is generally termed the branchial plate, and may indeed be assumed to be at least subservient to respiration. Opposite this plate issue, inside, 2 small, partly superposed lobules, each carrying on the tip 2 or 3 setæ. The outer part of the palp is divided into 2 setiferous lobes, the inner of which forms the immediate continuation of the palp, and exhibits a narrow linguiform shape. This lobe, apparently answering to the distal part of the basal part, together with the inner ramus of the mandibular palp, carries at the tip 5 densely crowded setæ and inside, 4 similar setæ issuing in pairs from slight ledges. The outer lobe, which undoubtedly answers to the outer ramus of the mandibular palp, has the form of a rather small oblong oval lamella, carrying 7 setæ outside, successively increasing in length distally. All the setæ are finely plumose.

The anterior maxillipeds (fig. 9) are very powerfully developed, each forming a rather thick and muscular stem gradually tapering distally, and divided into 7 or 8 segments. The 1st segment is much the largest, being fully as long as the remaining part of the maxilliped. It sends off anteriorly 3 small lobules, carrying on their tips strong, anteriorly curving setæ, 3 on the innermost lobule, 2 on each of the others, besides 1 or 2

much smaller bristles. The 2 succeeding segments are each produced to a similar setiferous lobule. All the setæ are coarsely ciliated, and increase somewhat in length distally. From the distal part of the maxilliped, issue 6 much longer and coarser setæ, of which particularly the 4 innermost are exceedingly strong and spiniform, with the outer part bent in a peculiar flexuous manner, and terminating in an unguiform point, finely denticulate inside. These spines, which, throughout the greater part of their length, are coarsely ciliated along the one edge, likewise curve anteriorly, and extend as far as the front of the animal (see fig. 2).

The posterior maxillipeds (fig. 10) are not nearly so strongly built as the anterior, but are much more slender and elongated. They are divided into 7 well-defined segments, the first 2 of which are much the largest, and together form the basal part. The 1st segment is produced at the end anteriorly to a rounded lobe, carrying 5 coarsely-ciliated setæ. Just above this lobe, there is a strongly-marked ledge, to which 3 setæ are secured, one of which is particularly long and flexuous, and above it again, another ledge is seen, carrying 2 somewhat shorter setæ. The 2nd segment is of about the same length as the 1st, but much narrower, and sublinear in form. It is very movably articulated to the former, and carries at the end anteriorly a strong spiniform seta, above which 3 other much smaller setæ originate, each exhibiting a very dense ciliation in the middle of the one edge. Above them again, there is a row of about 8 small denticles. The terminal part of the maxilliped, comprising the 5 outer joints, is very slender and flexible, with the joints rapidly diminishing in size distally. The 1st joint carries anteriorly, 3 spiniorm setæ, the outermost of which is much the largest; and from each of the succeeding joints originates a single slender spine, all the spines curving anteriorly.

The legs (figs 11—14) are all natatory, each consisting of a somewhat flattened, biarticulate basal part, and 2 triarticulate rami, the outer of which is the larger.

The 1st pair of legs (fig. 11) are rather smaller than the others, and without the spines occurring in the latter on the first 2 joints of the outer ramus outside, whereas the last joint of this ramus, as in the other pairs, carries 2 short spines outside, the

one at about the middle, the other at the tip. This ramus, moreover, is provided with 7 natatory setæ, 5 of which belong to the last joint. The inner ramus is considerably shorter than the outer, and has, in all, 9 natatory setæ, 1 on the 1st, 2 on the 2nd and 6 on the last joint. Of these 6, 3 issue from the inner edge, 2 from the tip, and 1 from the outer edge of the joint.

In the 3 succeeding pairs of legs (figs. 12, 13) the basal part is considerably narrower and more elongated, and the terminal joint of both rami is likewise more produced, having a greater number of natatory setæ. The apical seta of the outer ramus, moreover, has assumed the character of a slender spine, being only ciliated inside, whereas outside it exhibits a pellucid border divided into numerous fine denticles. The true natatory setæ on this ramus are 7 in all, 5 of which belong to the terminal joint. In the 2nd and 3rd pairs (fig. 12) the terminal joint of the inner ramus carries 8 setæ, in the 4th pair (fig. 13) 7 setæ, 2 of them issuing from the outer edge of the joint.

The 5th or last pair of legs (fig. 14) are somewhat smaller than the preceding ones, and differ in the absence of the usual plumose seta, found in all the other pairs at the inner corner of the 1st joint of the basal part. The outer ramus, moreover, is destitute of the usual natatory setæ on the first 2 joints. On the 2nd joint, this seta is replaced by a very strong spiniform projection forming the immediate continuation of the joint, and curving downwards in an unguiform manner, its outer part being finely denticulated on the concave edge. The terminal joint of this ramus has only 4 natatory setæ in addition to the apical spine. The inner ramus is quite normally developed, but, like the outer, has a smaller number of natatory setæ than in the other pairs, viz., only 8 in all, 6 of which belong to the terminal joint, and are arranged in such a manner, that 2 issue from each edge, and 2 from the tip.

The adult male (fig. 17) is somewhat smaller than the female, scarcely exceeding a length of 2.50 mm., and is easily recognized by the structure of the right anterior antenna, the last pair of legs, and the tail.

The right anterior antenna (see fig. 17), as in all other *Diaptomidæ* is prehensile, its outermost extremity, comprising the 5 outer joints, admitting, by a very movable intervening articulation, of being doubled upon the adjacent portion of the

antenna. This portion, comprising 6 joints, contains a strong muscular band joining the movable terminal part, but in the present form, is far less tumefied than in most other *Diaptomidæ*.

The last pair of legs (fig. 18) have the inner ramus developed in a manner similar to that found in the female, whereas the outer ramus is rather different, and dissimilar in the two legs. In the left leg, it consists of only 2 joints, the 1st of which has the usual short spine outside, but no natatory seta inside. The 2nd joint is somewhat longer than the 1st, rather narrow, and slightly incurved. It is finely ciliated along the inner concave edge, and has 3 rather small spines outside, whereas a considerably longer spine issues from the tip, and curves slightly outwards. On the right leg, this ramus is considerably shorter and stouter, the 1st joint, as in the left leg, being destitute of the natatory seta, whereas a short spine is seen issuing from the end of the joint anteriorly. The terminal part of the leg is club-shaped, and exhibits an indication of a sub-division into 2 joints, the outer of which forms a rounded nodule, carrying on the tip 2 or 3 small spines; the inner joint is produced inside to a very large, deflexed, knife-shaped projection, apparently answering to the spiniform process issuing from the 2nd joint of this ramus in the female.

The tail (see fig. 17) is much more slender than in the female, and is divided into 5 well-defined segments, not including the caudal rami. Of these segments, the 1st is comparatively short and somewhat asymmetrical, being obtusely produced on the left side. The 3 succeeding segments are of about equal length, whereas the last is rather short.

As to the inner organisation, it can of course only be imperfectly examined in alcoholic specimens. Yet, by a suitable preparation of the specimens, some of the inner organs may be rather distinctly traced. The intestinal canal extends in the anterior division of the body somewhat nearer the ventral than the dorsal face, and is rather capacious in its anterior part, forming in front a short cœcal expansion. Behind, it gradually contracts to a narrow duct, which enters the tail, running through its axis, and debouching at the end of the last segment, somewhat dorsally. In living specimens of the fresh-water species, a very large, reddish orange oil-bladder is generally found ex-

tending through the greater part of the anterior division of the body immediately above the intestine, and it is most probable, that a similar accumulation of oil also exists in living specimens of the present species; but the action of the spirit tends to dissolve this oil more or less completely, so as to leave no trace of it in specimens preserved for any length of time in alcohol.

The heart, as in other Calanoids, is well defined, forming a small pellucid bag, which occurs dorsally at the junction between the 1st and 2nd pedigerous segments.

The generative organs I have not been able to examine closely, and in no specimens was any outer ovisac found. Nor in the fresh-water species have I ever seen any such ovisac, and it is therefore most probable, that the ova, immediately after leaving the body, drop to the bottom, and undergo their development, without being appended to the body of the female. On the other hand, I have found in some of the female specimens (see fig. 2) one or two spermatophores adhering to the genital segment below. These spermatophores, as in other Calanoids, have the form of slender cylindrical bags, contracted in front to a very narrow, and somewhat twisted duct (see fig. 15).

The musculature of the body (see figs. 1, 2 and 17) is very conspicuous in alcoholic specimens, and becomes still more apparent, when the specimens are stained and rendered transparent in oil of cloves. Immediately beneath the dorsal skin of the anterior division an assemblage of rather strong muscular bundles is seen, extending throughout the greater part of that division. The bundles are arranged in 2 longitudinal sets, lying rather close together, though leaving a narrow interspace in the middle, and converge to the base of the tail, joining it dorsally. Another set of longitudinal muscles (see figs. 2 & 17) extends more ventrally through this division, forming 2 rather narrow bundles, which lie far apart on each side, just above the epimeral edges of the segments, and join the tail ventrally. The above-named muscles would seem to act chiefly upon the tail, performing the various movements of this part, though the dorsal muscles may also partly act upon the several pedigerous segments. Within the tail likewise, several narrow muscles may be observed extending longitudinally, and forming, as it were, the continuation of the muscles of the anterior division. On the sides of the latter

division, moreover, numerous strong muscular bundles are seen converging to the bases of the several appendages (see figs. 2 & 17), the muscles moving the natatory legs especially being very powerful, and easily observable both in the lateral and dorsal views of the animal.

**Occurrence.** — This form occurred in great abundance in all the samples taken by Dr. Grimm. On the other hand, not even a single specimen was found in the sample taken by Mr. Andrussow from the Bay of Karabugas, nor in those taken in the North Caspian Sea. It would therefore seem, that this form is limited to the deeper parts of the basin, but apparently forming the chief bulk of the „plankton" there.

**Distribution.** — As above stated, this form occurs rather plentifully in the innermost part of the Baltic: the Gulf of Finland, the Åland Sea and the Gulf of Bothnia. Farther south in the Baltic it has only occasionally been observed, the most southern place being, according to Dr. Aurivillius, the coast of Småland. In other parts of the European seas it has never been met with, and the supposition at first set forth by Dr. Nordquist, that this form may more properly be regarded as a „relict" arctic species, has been fully confirmed by the interesting fact, that, during the Expeditions of Prof. Nordenskjöld, the same species has been found to exist in the Arctic Ocean, off Spitsbergen and in the Kara Sea. Quite recently, I have had an opportunity of examining some specimens of this form taken by Dr. Alex. Bunge in the lower part (mouth) of the East-Siberian river Jana. It occurred here among multitudes of a little, true marine Calanoid, apparently belonging to the genus *Paracalanus* of Claus. The circumstance that the present form has hitherto been confounded with the fresh-water species, *L. macrurus*, cannot be said to throw doubt on the correctness of the above-named supposition, as regards the species here under consideration.

## Gen. 2. **Heterocope**, G. O. Sars, 1863.

**Remarks.** — Of this genus, likewise established by the present author, 3 species have hitherto been recorded, viz., *H. saliens* Lilljeb., *H. appendiculata* G. O. Sars, and *H. borealis*

Fischer[2]), all of which are true fresh-water species. It was therefore rather surprising to find this genus also represented in the Caspian Sea by a form, which, on a closer examination, has turned out to be specifically distinct from any of the others. Whereas, however, the above-described *Limnocalanus* is undoubtedly of marine origin, I am much inclined to believe, that the Caspian species of *Heterocope* has descended from some fresh-water form, having adapted itself to salt water.

### 2. **Heterocope caspia,** G. O. Sars, n. sp.

(Pl. 5.)

**Specific Characters.** — Form of body comparatively slender, resembling that in *H. appendiculata*, the anterior division having its greatest width far in front, and gradually tapering behind. Posterior division exceeding half the length of the anterior, 1st segment in female rather large and provided on each side of the genital orifice with a spiniform projection. Caudal rami nearly 3 times as long as they are broad, and having each only 3 terminal setæ. Anterior antennæ considerably elongated, extending, when reflexed, beyond the last caudal segment. Last pair of legs in female comparatively small, with the terminal joint scarcely as long as the preceding one, straight, slightly tapering, and armed with 6 simple denticles, the apical one not being much longer than that immediately precedingit; those in male with the left leg nearly as in *H. appendiculata*, whereas the right leg is very different, and more resembling that in *H. borealis*. Length of adult female not quite attaining 2 mm.

**Remarks.** — In outward appearance, this form looks very like *H. appendiculata*, and may easily be confounded with it. On

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2) The identification of this species with *H. weismanni* Imhof from the Boden-Sea, I have recently been enabled to affirm by the examination of a collection of fresh-water Copepoda from Siberia, kindly sent me from the Zoological Museum at St. Petersburg. As this collection contained the said species in rather great numbers, there cannot be any doubt that it is the form originally recorded by S. Fischer as *Cyclopsina borealis*. I have myself found this form rather plentifully in the eastern part of Finmark, and had also previously identified it with Fischer's species.

a closer examination, however, it is found to exhibit several well-marked differences, thus showing itself to be, in fact, specifically distinct. For instance, the 1st caudal segment in the female is wholly wanting in the peculiar appendages found in *H. appendiculata* in front of the genital orifice, whereas on each side of it, only a single spiniform lappet occurs. Moreover, the last pair of legs are of a very different appearance, having the terminal joint much shorter, and the apical spine not very dissimilar, either in size or structure, from those preceding it.

**Description of the female.** — The length of the largest specimens examined does not fully attain 2 mm., and this form accordingly is of about the same size as *H. appendiculata.*

The body (see Pl. 5, figs. 1 & 2) is on the whole of a rather slender form, with the anterior division gradually tapering behind, and having its greatest width across the middle of the cephalic segment. The latter exhibits a very strongly marked cervical depression, and the part lying in front of this depression appears, in a dorsal view of the animal (fig. 1), abruptly contracted, with the tip narrowly truncated. Seen laterally (fig. 2), the front is found to be devoid of any deflexed rostral prominence, nor is any trace of tentacular appendages to be detected. Of the 5 pedigerous segments succeeding the cephalic segment, the last 2 are imperfectly defined from each other, though a slight suture may be observed between them on each side. The last segment is very small, and has the lateral corners rounded off, without forming any projecting lobe.

The tail somewhat exceeds half the length of the anterior division, and, as in *Limnocalanus*, is divided into 3 segments, not including the caudal rami. Of these segments, the 1st is much the largest, being rather tumid and somewhat bulging ventrally (see fig. 2). It is without any trace of the peculiar appendages occurring in *H. appendiculata* in front of the genital orifice. On the other hand, it is provided, on each side of this orifice, with a single pointed lappet extending straight downwards. The 2 succeeding segments are of about equal length, or the last one a little longer than the penultimate; the former exhibiting dorsally the usual valvular ridge defining the anal area in front. The caudal rami (see fig. *) are not quite as long as the last caudal segment, but exhibit the structure characteristic of the genus, being

rather broad and somewhat flattened, with the tip transversely truncated. They extend straight behind, lying close together, and have the outer edge perfectly smooth, terminating in a short dentiform point. Each ramus carries only 3 caudal setæ, issuing close together from the tip, and almost of equal size, all 3 being very strong and densely plumose. In addition to these, a very small and delicate bristle is seen originating from the dorsal face of each ramus, close to the inner corner.

The eye (see fig. 3) occurs at a short distance from the front, somewhat ventrally, and is comparatively larger than in *Limnocalanus*.

The anterior antennæ (see figs. 1 & 2) are rather slender and elongated, extending, when reflexed, a little beyond the last caudal segment. As in the other species of the genus, they are composed of 24 joints, the first 2 of which are considerably larger than the succeeding ones. In the outer part of the antenna, the joints become very slender and elongated; but the last joint is very small and conical in form, carrying on the tip a fascicle of short bristles. The penultimate joint is provided at the end posteriorly with 3 much larger bristles, and each of the 2 preceding joints has a single similar bristle, that issuing from the antepenultimate joint being particularly long and distinctly ciliated. Otherwise, the antenna bears scattered bristles along the whole anterior edge.

The posterior antennæ (fig. 4) exhibit a similar structure to that in the genus *Limnocalanus*, but appear on the whole rather more robust, the inner ramus especially being considerably stronger than in that genus.

The anterior lip (fig. 5) is very large and prominent, with the median lobe much projecting, and clothed with long diverging hairs.

The mandibles (fig. 6) have the cutting edge divided into 6 teeth, the outermost of which is remarkably strong and undivided, whereas the others are bifid. At the inner corner of the cutting edge, as in *Limnocalanus*, 2 short setæ are secured. The palp resembles that in the above-named genus, except that the basal part has only 3 setæ inside, and that the 1st joint of the inner ramus is considerably larger than the 2nd.

The maxillæ (fig. 7) likewise exhibit much the same structure as in *Limnocalamus*, and need not therefore here be described in detail.

The anterior maxillipeds (fig. 8) are well developed, though not nearly so strongly built as in the genus *Limnocalanus*. They are divided into 5 segments, the 1st of which is rather large, and shows indication of a subdivision. It sends off anteriorly 4 short lobes, each tipped with 2 coarsely ciliated, anteriorly curving setæ, accompanied by one or 2 much smaller bristles. The 2nd segment is very much constricted at the base, and gradually expands distally; and it carries at the end anteriorly a rather strong curved seta similar to those issuing from the preceding segment, and likewise accompanied by a smaller bristle. The 3rd segment is rather small, and sends off anteriorly a single curved seta, ciliated only on the concave edge. Finally the 2 outer segments are extremely small, and not easy to distinguish from each other. They give origin to 3 spiniform, curved setæ, which are not ciliated, and gradually diminish in length, none of them exceeding that of the preceding setæ.

The posterior maxillipeds (fig. 9) are less slender than in *Limnocalanus*, but are constructed in a similar manner. The 1st segment has the anterior edge divided into 3 lobes, each carrying 2 strong and coarsely ciliated setæ. The 2nd segment is both shorter and narrower than the 1st, being rather constricted at the base. It carries near the end, anteriorly, 2 unequal setæ, the outer of which is much the longer, and is clothed with scattered hairs, whereas the other seta exhibits, in the middle of the inner edge, a very dense ciliation. The terminal part of the maxilliped scarcely attains the length of the 2nd segment, and is only composed of 4 joints, armed with incurved, claw-like spines, some of which exhibit a similar dense ciliation to that found on the shorter seta of the 2nd segment. The number of the spines is 8 in all, the 1st joint carrying 2, the 2nd one, the 3rd 2, and the last 3, besides a very small bristle.

Of the legs only the 4 anterior pairs are natatory, the last pair being very small, and of a very different structure. The natatory legs (figs. 10, 11) each consist, as in other Calanoids, of a somewhat flattened, biarticulate basal part carrying at the end, inside, a strong plumose seta, and of 2 rami; but of these rami

only the outer one, as usual, is triarticulate, whereas the inner is very small, and consists of only a single joint.

The 1st pair (fig. 10) are considerably shorter than the 3 succeeding ones, and have the basal part broader in proportion to its length. Of the 3 joints composing the outer ramus, the 1st is much the largest, and has, outside, a comparatively short, but coarsely-ciliated seta, inside, a normally-developed natatory seta. The comparatively short 2nd joint is armed in a similar manner, whereas the last joint has 4 natatory setæ, and outside, 2 shorter setæ similar to those issuing from the 2 preceding joints. The inner ramus is scarcely more than half as long as the outer, and, as stated above, consists of a single joint of oblong oval form, and carrying 5 long natatory setæ, 3 of which issue from the inner edge, 2 from the tip. The outer edge of the ramus is finely ciliated, and on the outer ramus a dense ciliation of the edge may also be observed.

The 3 succeeding pairs of legs (fig. 11) agree exactly with one another in structure, and differ from the 1st in the greater length of the basal part, and in the transformation of the exterior setæ of the outer ramus in to short, thick spines. The last joint of this ramus is comparatively larger than in the 1st pair, and has, on the tip, a long straight spine, coarsely denticulated outside. The inner ramus is of exactly the same appearance as in the 1st pair.

The last pair of legs (fig. 11) are very small, and consist each of a simple stem, tapering distally, and divided into 4 segments, the first 2 representing the basal part. Of the 2 outer joints, the 1st has a very small bristle outside, near the end, and a similar bristle is also seen issuing from the last joint of the basal part. The terminal joint (see also fig. 12a) looks very different from that in the 3 other species, being rather short and slightly narrowed distally. It is divided into 6 simple dentiform projections, 2 of which issue from the outer edge, and are very small. The other projections somewhat increase in length distally; but the apical one does not distinguish itself by any considerable length, nor by a different structure.

In some of the specimens, a number of eggs were found adhering to the genital segment ventrally, apparently held together by a thin membrane, forming a kind of outer ovisac, a peculiarity never found in any of the other 3 species.

The **adult male** (fig. 13) is somewhat smaller than the female, scarcely attaining a length of 1½ mm., and may be easily recognized by the usual sexual characters.

The body appears on the whole more slender than in the female, and the tail is rather narrower, being divided into 5 well-defined segments, not including the caudal rami. Of these segments the 1st is quite short, whereas the 2nd is considerably larger than any of the others.

The right anterior antenna (fig. 14) is composed of only 23 joints, and exhibits, between the 18th and 19th joints, the usual geniculation. The adjoining part of the antenna, comprising the 6 preceding joints, is but slightly tumefied, and contains a rather narrow, band-like muscle joining the terminal part. The latter is composed of 5 joints, the 1st of which is the largest.

The last pair of legs (fig. 15) are modified in a similar manner to that found in the other species of the genus. The left leg is much the larger, and somewhat resembles that in *H. appendiculata*, though having the terminal joint comparatively more elongated, and its spines extremely small. The curved process issuing from the 2nd joint of the basal part inside, appears, moreover, somewhat more tumefied in its outer part. The right leg is very small, and rather unlike that in *H. appendiculata*, resembling more in structure that found in the 2 other species, though on a closer comparison, it differs from both of them in the shape of the terminal part, which forms a soft, somewhat curved appendage, irregularly lobulate outside.

**Occurrence.** — Of this form several specimens were found in one of the samples collected in the north Caspian Sea, near the mouth of the Volga. It here occurred together with true fresh-water forms, and the water must therefore be assumed to have been almost fresh at that place. But the same species, though of somewhat smaller size, was also found occasionally, both in the sample taken by Mr. Andrussow in the Bay of Karabugas, and in samples taken by Dr. Grimm from the southern and middle parts of the Caspian Sea. The species is thereby proved to form in reality a part of the true pelagic fauna of that basin.

## Gen. 3. **Poppella,** Richard, 1888.

**Remarks.** — This genus was established in the year 1888 by Dr. J. Richard, to include a peculiar Calanoid found in the southern part of France, in a single locality. The genus exhibits some points of resemblance to the genus *Temorella*, though differing conspicuously both in the structure of the tail, and in that of the legs, especially the last pair. Only a single species has hitherto been recorded.

### 3. **Poppella guernei,** Richard.

(Pl. 6.)

*Poppella Guernei*, Richard, Bullet. Soc. Zool. France XIII, p. 43.

**Specific Characters.** — Body rather slender, with the anterior division oblong fusiform in shape, cephalic segment strongly vaulted above, and without any distinct cervical depression, last pedigerous segment with the lateral corners rounded off. Tail comparatively slender and elongated, being composed, in female, of 4 well-defined segments, not including the caudal rami, 1st segment armed on left side with a peculiar recurved spiniform process. Caudal rami narrow and somewhat divergent, about 1/3 as long as the tail, caudal setæ 5 in number. Anterior antennæ extending, when reflexed, to the end of the 1st caudal segment, and composed of 25 joints. Natatory legs with both rami triarticulate. Last pair of legs in female comparatively strong, simple, 5-articulate, last joint sending off, inside, a strong dentiform projection, and terminating in a long unguiform spine; those of male very large, both legs with a rudimentary inner ramus, outer ramus of right leg 3-articulate and remarkably strong, penultimate joint abruptly curved, being set on at right angles to the preceding joint, and produced at the base outside to a strong elbow-like projection, terminal joint transformed to an elongated claw curving outwards; outer ramus of left leg biarticulate, 1st joint produced outside to a long spiniform process extending downwards, 2nd joint sublamellar and bidentate at the tip. Length of adult female 1.30 mm., of male 1.04 mm.

**Remarks.** — This peculiar Calanoid was at first announced by Dr. RICHARD in the above-quoted paper, and a short description in Latin, accompanied by a cut of the last pair of legs in the 2 sexes, was subsequently given in the work on the fresh-water Calanoids, edited by him and Prof. J. DE GUERNE. There are, however, some characteristic features, which seem to have escaped the attention of the said authors, and as, moreover, the 2 detail-figures given, cannot be said to illustrate the species sufficiently, I propose here to describe and figure it more in detail, from Caspian specimens, of which I have had a large material at my disposal.

**Description of the female.** — The length of the body in fully grown specimens, measured from the front to the end of the caudal rami, is 1.30 mm. According to Dr. RICHARD, the length of the French specimens was somewhat greater, viz., 1.45 mm.

The form of the body (see Pl. 6, figs. 1 & 2) appears on the whole rather slender, with the 2 chief divisions sharply defined from each other. Seen dorsally (fig. 1), the anterior division is of an oblong fusiform shape, with the greatest width about in the middle, and but slightly narrowed posteriorly. It is, as usual, composed of 6 segments, the anterior of which, the cephalic segment, is much the largest, equalling in length the 3 succeeding ones combined. Seen laterally (fig. 2), this segment appears strongly vaulted above, without any distinct cervical depression, and has the front abruptly deflexed, and terminating in an obtuse point, to which, according to Dr. RICHARD, 2 extremely small tentacular appendages are attached. Seen dorsally (fig. 1), the frontal part of this segment appears narrowly rounded. The last pedigerous segment is rather small, though well defined, and has the lateral corners rounded off.

The tail is comparatively slender, exceeding in length $^2/_3$ of the anterior division, and is divided into 4 well-defined segments, not including the caudal rami. Of these segments, the 1st, as usual, is much the largest, and projects (see fig. 1) on the left side into a peculiar, recurved, dentiform projection, not observed by Dr. RICHARD. The genital prominence (see fig. 2) is rather produced, and obtusely rounded at the tip. The last 2 segments are of about equal length, and somewhat shorter than the antepenultimate one. The caudal rami (see fig. *) are rather

narrow, linear, and somewhat divergent, equalling about 1/3 of the length of the tail proper. They are densely ciliated inside, and each carry 5 finely plumose setæ, the outermost of which is secured to a separate ledge on the outer edge, at some distance from the tip. Of the apical setæ, as usual, the innermost but one is the longest. In addition to these, a very delicate bristle is attached dorsally, near the inner corner of each ramus.

The eye (see figs. 1 & 2) is rather small, and placed as usual.

The anterior antennæ (see figs. 1 & 2) are comparatively slender, though not particularly elongated, extending, when reflexed, about to the end of the 1st caudal segment. They are composed of 25 well-defined joints, exhibiting the usual shape and setous armature.

The posterior antennæ (fig. 3) are of normal structure, with the outer ramus somewhat longer than the inner, and divided into 6 joints, the 2nd and last of which are the largest, with 3 extremely short joints between them. The apical setæ are 3 in number, those of the inner edge 9, 4 of which belong to the 2nd joint.

The mandibles (fig. 4) have the cutting edge divided into 8 teeth, the outermost of which is the largest, though not particularly strong. All the teeth appear to be simple, and within them a single short seta is secured. The palp resembles in structure that in the 2 preceding genera, but has the 1st joint of the inner ramus imperfectly defined from the basal part, and the outer ramus comparatively more fully developed.

The maxillæ (fig. 5) are of quite normal structure, resembling those in the 2 preceding genera.

The anterior maxillipeds (fig. 6) are very short and thick, being apparently divided into 5 segments, the first 2 of which are much the largest, and together form the basal part. In front, this part sends off 4 short lobes, tipped in the usual manner with coarsely ciliated setæ curving anteriorly. The joints of the terminal part are not distinctly defined from each other, though 2 setiferous lobes, indicating as many joints, may be easily distinguished, the proximal one being rather prominent. From the tip of the maxillipeds, 3 spiniform setæ issue, provided only inside with coarse cilia. The number of anteriorly

curving setæ is 16 in all, not including some small bristles accompanying them.

The posterior maxillipeds (fig. 7) are of a rather delicate structure, and are composed of 7 segments, the first 2 of which are much the largest, and together represent the basal part. The 1st of these segments carries anteriorly 8 ciliated setæ, 4 of which originate from a rounded lobe at the end of the segment. The 2nd segment is strongly constricted at the base, but forms anteriorly, in the middle, a rather large and broad expansion carrying 3 setæ. At the tip this segment sends off a very small lobe tipped with 2 setæ. The 5-articulated terminal part does not attain the length of the preceding segment, but is very flexible, carrying in front a great number of delicate setæ, which curve more or less downwards. Moreover, each of the 3 outer joints has, posteriorly, a strongly recurved and densely ciliated seta.

As in the preceding genus, only the 4 anterior pairs of legs are natatory. They are each composed of a biarticulate basal part and 2 rami, both of which are 3-articulate and rather fully developed, though the inner one, at least on the 3 posterior pairs, is somewhat shorter than the outer.

The 1st pair of legs (fig. 8) are considerably shorter than the succeeding pairs, and have the rami but little different in size. They differ, moreover, in the fact, that the first 2 joints of the outer ramus are devoid of any spine outside, whereas the last joint has a single short spine near the end. The number of natatory setæ on these legs is also smaller, being on the outer ramus 6, 4 of which belong to the terminal joint, and on the inner ramus 8, 6 belonging to the last joint.

The 3 succeeding pairs (figs. 9, 10) have the outer ramus particularly strong, and issuing from a well-defined protuberance of the basal part. Its terminal joint has outside, near the tip, 2 short spines, inside, 5 natatory setæ, and at the tip, a strong elongated spine, finely denticulated outside. On the inner ramus, the 2nd joint has 2 natatory setæ, and the rather large terminal joint, from 7 to 8 such setæ, 2 of which issue from the tip, and 2 from the outer edge.

The last pair of legs (fig. 12) are unusually strong, and but little shorter than the natatory legs. They each form a

simple, thickish stem, slightly tapering distally, and divided into 5 well-defined joints, the first 2 constituting the basal part. The antepenultimate joint carries at the end, outside, a strong, deflexed spine, whereas the comparatively short penultimate joint is produced inside to an acute dentiform projection. The last joint is produced inside to a similar, though somewhat larger, acute projection, and is continued beyond it to a very strong unguiform spine, finely ciliated outside. The above description does not agree with that given by Dr. Richard and J. de Guerne, according to whom the penultimate joint projects into 3 strong spines. But this is undoubtedly a miscomprehension, apparently caused by the specimen examined having been about to cast its skin, the 2 additional spines being nothing else than the newly-formed terminal, part of the leg, appearing within the old skin.

In several of the specimens examined, a rather large, rounded, and somewhat flattened egg-bag was appended to the genital prominence, containing rather a large number of globular ova held together by a delicate membrane (see figs. 1 & 2).

The **adult male** (fig. 13), as usual, is somewhat smaller than the female, scarcely exceeding a length of 1 mm., and is, moreover, easily recognizable by the rather pronounced sexual characters.

The body is rather more slender, and the tail considerably narrower, being moreover divided into 5 well-defined segments, not including the caudal rami. The 1st caudal segment is rather short, and does not exhibit a trace of the peculiar dentiform projection found in the female on the left side.

The right anterior antenna (see also fig. 14) is modified in the usual manner to a prehensile apparatus, its 4 outer joints forming together a movable terminal part which admits of being doubled upon the adjacent part of the antenna. This part, comprising 6 joints, is not a little tumefied, is elongated fusiform in shape, and is traversed by a strong muscle joining the terminal part. Its penultimate joint, as in most other Diaptomidæ, projects at the end anteriorly to a short straight spine, and the adjacent edge of the last joint exhibits a row of small denticles. The 1st joint of the terminal part has in front 2 rather large adpressed spines, finely denticulated outside.

The last pair of legs (fig. 15) are very powerfully developed; but the 2 legs are rather unequal both in size and structure, although agreeing in this respect, namely, that both of them, unlike these members in the female, are biramous, having a well-defined inner ramus of a structure similar to that found in the genus *Diaptomus*. In both legs, however, this ramus is of inconsiderable size, and only composed of a single joint, being somewhat more elongated on the left than on the right leg. The outer ramus of the right leg is distinctly 3-articulate, and much longer than that of the left. Its 1st joint is armed at the end outside with a strong deflexed spine, and somewhat exceeds the inner ramus in length. The 2nd joint is strongly curved, and articulated to the 1st in a most peculiar manner, so as to form with it almost a right angle, extending inwards and downwards. At the base, it is produced on the outer side to a strong deflexed, elbow-like projection terminating in a sharp point, and at a short distance from this projection a slender spine is secured to the concave outer edge of the joint. The last joint has the form of a slender claw, very movably articulated to the preceding joint, in the interior of which a strong muscle is seen joining the claw. In the left leg, the outer ramus is only composed of 2 joints, the 1st of which is produced at the end outside to a very elongated spiniform process curving over the terminal joint. This last is lamellar in structure, of oblong oval form, and slightly curved, terminating in 2 unequal points.

**Occurrence.** — This peculiar Calanoid occurred in great abundance in the sample taken by Mr. Andrussow from the Bay of Karabugas, there constituting, it would seem, by far the greater bulk of the plankton. It was also found occasionally in the samples taken by Dr. Grimm in the southern and middle parts of the Caspian Sea, whereby its character as a true pelagic form was ascertained.

**Distribution.** — The specimens examined by Dr. Richard were taken in December 1887 and 1888 by M. L. Roubau near Toulouse, in the „Canal du Midi", where the water is always found to be perfectly fresh. This is the only place where the species had previously been observed.

## Gen. 4. **Temorella**, Claus, 1881.

Syn.: *Eurytemora*, Giesbrecht.

**Remarks.** — The names *Temorella* and *Eurytemora* were proposed in the very same year, the former by Prof. Claus, the latter by Dr. Giesbrecht. But whereas the name *Temorella* was applied to designate a distinct genus, that of *Eurytemora* was proposed by Dr. Giesbrecht merely to indicate a subdivision of the old genus *Temora*, the marine forms of which were referred to another subdivision, viz., *Halitemora*. It therefore appears to me more appropriate to retain the generic denomination proposed by Prof. Claus, though it may indeed be found to be a little later in date than that applied by Dr. Giesbrecht for his sub-genus. We know, at present, of 4 species belonging to this genus one of which seems to be exclusively a fresh-water form, whereas the other 3 have been found in more or less brackish water. In the Caspian Sea 3 species occur, 2 of which I have been enabled to identify with previously described species, whereas the 3rd is new to science.

### 4. **Temorella grimmi**, G. O. Sars, n. sp.

(Pl. 7.)

**Specific Characters.** — Body comparatively short and stout, with the anterior division rather tumefied, and having its greatest width far in front. Cephalic segment not produced dorsally at the junction with the next segment. Last pedigerous segment simple in both sexes. Tail slender, with the caudal rami very narrow and elongated, not divergent, apical setæ rather slender. Anterior antennæ much attenuated, though scarcely longer than the anterior division, and composed in the female of 25 joints. Natatory legs without the seta usually found at the end of the basal part inside, both rami unusually narrow, though otherwise exhibiting the structure characteristic of the genus. Last pair of legs in female very small, with the penultimate joint produced inside to a slender spiniform projection, and having outside, a single spine, last joint small, tipped by 2

very unequal spines; those in male modified in the usual manner. Length of adult female 1.70 mm., of male 1.33 mm.

**Remarks.** — This is a very distinct species, easily distinguishable from any of the previously known forms, and in some points even differing in characters generally regarded as of generic value. Thus, the anterior antennæ in the female are composed of 25 well-defined joints, whereas in all the other known species only 24 joints are counted. Moreover, the cephalic segment does not form above, at the junction with the next segment, any trace of the very conspicuous projection found in all the other species. Finally, the form of the anterior division of the body is rather dissimilar, approaching the characteristic appearance in the marine genus *Temora*.

**Description of the female.** — The length of fully adult, ovigerous specimens measures 1.70 mm., and this form accordingly grows to a somewhat larger size than the 4 previously known species.

The form of the body (see Pl. 7, figs. 1 & 2) appears, as compared with that in the other species, rather short and compact, though the tail, as usual, is very slender. The anterior division is exceedingly tumid, approaching in form that of the marine *Temora longicormis*. As in the latter, it has, seen dorsally (fig. 1) its greatest width far in front, across the fore-part of the cephalic segment, and from thence gradually tapers somewhat behind, whereas in front it is broadly rounded. Seen laterally (fig. 2), this segment appears strongly vaulted above, and obtusely truncated in front, without any rostral projection. At the junction with the succeeding segment, no trace of a dorsal prominence is found to exist. Of the 5 pedigerous segments the 1st is considerably larger than the others, the last being extremely small, with the lateral parts not at all expanded, but evenly rounded off.

The tail considerably exceeds in length $^2/_3$ of the anterior division, and is very narrow, consisting of only 3 segments, not including the caudal rami. The 1st segment, as usual, is the largest, and forms on each side in the middle a slight expansion. The last segment (see also fig. 13) is about the same length as the 1st, but much narrower, and exhibits dorsally the usual transverse ridge defining the anal area in front. At the end, this

segment is slightly insinuated, and joins the caudal rami by a rather oblique suture. The caudal rami are exceedingly narrow and elongated, fully equalling in length the last 2 segments combined, and extend straight behind, lying close together. They are densely ciliated inside, and each carry 5 slender, plumose setæ, the outermost of which is secured to a separate ledge of the outer edge, at rather a long distance from the tip. Of the apical setæ, the innermost but one is the longest, somewhat exceeding the ramus in length. As in most other Calanoids, moreover, a very delicate bristle is seen issuing dorsally from near the inner corner of each ramus.

The eye is only faintly traceable in alcoholic specimens, but seems to be of the usual structure.

The anterior antennæ (fig. 3) about equal in length the anterior division of the body, and are rather attenuated distally, the outer part being very slender. Unlike these antennæ in the other known species, they are here divided into 25 well defined joints, the first 2 of wich are much the largest and rather broad. All the joints are setiferous in front, and the outer joints, moreover, carry scattered bristles behind.

The posterior antennæ (fig. 4) are rather fully developed, with the outer ramus considerably longer than the inner, and are divided into 7 joints, the 2nd and last having between them 4 very short joints, each carrying a rather long seta. The apical setæ are 3 in number, and are exceedingly elongated.

The several oral parts are on the whole constructed in a manner very similar to that found in the genus *Poppella*, as shown by the figures here given (figs. 5—8), and I do not therefore consider it necessary to describe them in detail.

The natatory legs (figs. 9—11), on the other hand, exhibit some well-marked differences. They are not nearly so strongly built as in *Poppella*, and are wholly destitute of the usual plumose seta issuing from the 1st joint of the basal part inside, in which respect this form differs from most other known Calanoids. The rami are very slender and rather unequal, the inner one being much shorter than the outer. On the 1st pair (fig. 9) this ramus is only composed of a single, narrow oblong joint, carrying 6 natatory setæ, none of which issue from the outer edge; on the 3 other pairs it is biarticulate, with from

7 to 8 natatory setæ, 3 of which belong to the 1st joint. The last joint of this ramus, on the 4th pair (fig. 11), is considerably smaller than on the 2 preceding pairs, and has only 5, instead of 6 natatory setæ. The outer ramus in all pairs is armed outside with 4 short spines, 2 of which belong to the last joint, and moreover, at the tip, it has a much longer spine, coarsely denticulated outside. The terminal joint is rather narrow and elongated, being, on the 3 posterior pairs, fully as long as the other 2 joints combined, and provided, inside, with 5 natatory setæ. On the 1st pair (fig. 9), this joint is somewhat shorter, and has only 4 natatory setæ.

The last pair of legs (fig. 12) are extremely small and simple in structure, each leg forming a simple stem, divided into 4 joints, the first 2 representing the basal part. The 1st joint of the terminal part is considerably longer than the last joint of the basal part, and is produced at the end inside, to a slender spiniform projection, finely denticulated on the lower edge. Outside, this joint carries a single short spine, occurring about in the middle. The last joint is extremely small, and oblong oval in shape, and is tipped by 2 very unequal spines, the outer one being extremely small, whereas the inner is rather elongated and quite straight.

In several of the specimens, besides a varying number of spermatophores, a rather large, globular egg-bag, containing numerous ova, was found appended to the genital prominence (see figs. 1 & 2).

The **adult male** (fig. 14) is considerably smaller than the female, scarcely exceeding a length of 1.30 mm., and is, moreover, easily recognizable by its more slender body, and by the usual sexual characters. The tail is extremely slender, and, as usual, composed of a greater number of segments than in the female, viz., 5, not including the caudal rami.

The right anterior antenna (fig. 15) is modified in the usual manner to a grasping organ, and apparently on this account, the number of joints is somewhat reduced, being only 23 in all. The movable terminal part comprises the 5 outer joints, the 1st of these being much the largest, and armed in front with 2 adpressed spines. The adjoining part of the antenna, consisting of 6 joints, is rather tumefied, and contains the usual strong muscle acting upon the terminal part. Between this fusi-

form division and the basal part of the antenna, there is a conspicuous constriction, and some of the sutures between the joints appear here very oblique.

The last pair of legs (fig. 16) are modified in the manner characteristic of the genus. Both legs are simple, and strongly incurved, being composed of 4 joints, the first 2 of which represent the basal part. The terminal parts of the 2 legs are rather unlike, that of the right being much more slender and elongated, and generally also, less strongly curved than that of the left side. Its first joint is rather narrow, almost linear in form, whereas the last joint has the character of a slender claw, abruptly bent in the middle. On the left leg the 1st joint of the terminal part is somewhat dilated, and has outside, at some distance from the tip, a strong spine. The last joint expands at the end to a somewhat spoon-shaped dilatation, produced into 2 diverging, and somewhat unequal, triangular lappets, clothed with delicate cilia.

**Occurrence.** — This form occurred in great numbers in all the samples taken by Dr. Grimm, whereas in the other samples examined, it was wholly absent. It would accordingly seem that the present species is confined to the deeper parts of the Caspian Sea, leading there, like *Limnocalanus grimaldii*, a true pelagic life.

### 5. **Temorella lacinulata** (Fischer).

(Pl. 8, figs. 1—12.)

*Cyclopsina lacinulata*, Fischer, Bullet. de la Soc. Imp. des Natural. de Moscou. Vol. XXVI, p. 86, Pl. II, figs. 4—17 & 34.

Syn.: *Temora velox*, Lilljeborg ♀.
„ *Temora Clausii*, Hoek.
„ *Eurytemora Clausii*, Brady.
„ *Eurytemora lacinulata*, Rich. & de Guerne.

**Remarks.** — This form having been very fully described by several recent authors, I do not consider it necessary to give here a fresh description of it. On the other hand, I have thought it appropriate to give, on Pl. 8, some habitus and detail figures drawn from Caspian specimens, to serve for comparison with the new species described above. The present species, whose identity

with *Cyclopsina lacinulata* of Fischer was first proved by Messr. Richard & de Guerne, may be easily recognized from its nearest allies, at least in the female sex, by the peculiar shape of the lateral expansions of the last pedigerous segment. It may, however, be observed, that these expansions are only present in fully adult females, whereas in young specimens no trace of them is to be found. In such specimens too, the last pair of legs (fig. 7) look rather different from those in adult specimens (fig. 6), the 2 outer joints being confluent, and the spiniform projection of the inner edge much shorter. In the adult male, the caudal rami (fig. 12) are considerably more elongated than in the female (fig. 8), and the caudal setæ also more fully developed.

The Caspian specimens are somewhat larger than those recorded by other authors, the length of the female reaching to 1.70 mm., that of the male to 1.30 mm.

**Occurrence.** — Some specimens of this form were found in one of the samples taken in the North Caspian Sea from lagoons at the mouth of the Volga. It occurred here together with true fresh-water forms, and it is therefore highly probable that the water of these lagoons is nearly fresh.

**Distribution.** — Mouth of the Neva (Fischer), Gulfs of Finland and Bothnia (Nordquist), Sweden, both in lakes and brackish water (Lilljeborg), British Isles (Brady), Holland (Hoek), France (Richard), Germany, both in fresh and brackish water (Poppe, Schmeil). In Norway, I have observed it very plentifully in small rock-pools brackish water on the islands outside Arendal.

### 6. **Temorella affinis**, Poppe.

(Pl. 8, figs. 13—19.)

*Temora affinis*, Poppe, Abh. d. naturw. Ver. Bremen. VII, p. 55, Pl. III.
Syn.: *Eurytemora affinis*, Rich. & de Guerne.

**Remarks.** — This species has also been very fully described by some of the recent authors, and I will therefore here only give some short notes on the Caspian variety, referring, in addition, to the figures given on Plate 8.

The female of the Caspian form (fig. 13) looks somewhat more robust than the typical form, as represented in Dr. Schmeil's

recent work of and has the lateral expansions of the last pedigerous segment still larger. But the 1st caudal segment in particular (see fig. 18), is distinguished by the considerable size of the lateral protuberances. The caudal rami (ibid.) are also somewhat more elongated, exceeding in length the 2 preceding segments combined, and have the caudal setæ remarkably short and thick. Otherwise this form seems to agree pretty well with that described by Poppe and Schmeil. It is, as also opined by Dr. Schmeil, without doubt specifically distinct from *T. hirundo* of Giesbrecht, of which I have had Norwegian specimens for examination. The last-named is a much more slender species, and moreover differs rather markedly in some of the anatomical details. I am much inclined to believe that the male specimen figured by Prof. Lilljeborg belongs to that species, and not to the present one.

**Occurrence.** — Several specimens of this form occurred in the same sample as the preceding species, and both species would therefore seem to thrive under similar conditions, being able to adapt themselves to both fresh and salt water. They would also both seem to be littoral in character, and therefore cannot properly be included in the true pelagic fauna of the Caspian Sea, as is the case with *T. grimmi*.

**Distribution.** — Northern part of Germany (Poppe, Schmeil), Åbo Sea (Nordquist), France (Richard).

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## Explanation of the Plates.

### Pl. 1.

**Cercopagis socialis** (Grimm).

Fig. 1. Adult gravid female, seen from left side (only the base of the caudal process drawn); magnified 45 diameters.

Fig. 1ª. Same specimen, fully drawn, and but very slightly magnified.

Fig. 2. Another specimen, viewed from the ventral face, magnified to the same scale as fig. 1.

Fig. 3. Head, without the oars, viewed from left side; magnified 68 diameters.

Fig. 4. Antennula with adjoining part of the head, magnified 144 diameters.

Fig. 5. Outer part of an oar, magnified 100 diameters.
Fig. 6. Mandible, same magnification.
Fig. 7. Masticatory part of same, more highly magnified.
Fig. 8. Extremity of a leg of 1st pair, magnified 100 diameters.
Fig. 9. Leg of 2nd pair.
Fig. 10. Leg of 3rd pair.
Fig. 11. Leg of last pair.
Fig. 12. Terminal part of the caudal process, highly magnified.
Fig. 12a. Extremity of same, still more highly magnified, showing the minute caudal setæ.
Fig. 13. Central nervous system, viewed from the ventral face.
Fig. 14. Young specimen, with the incubatory pouch in process of development, viewed from left side (oars, 1st pair of legs and caudal process not fully drawn); magnified 45 diameters.

## Pl. 2.

### Cercopagis robusta, G. O. Sars, n. sp.

Fig. 1. Adult gravid female, viewed from left side, with base of caudal process; magnified 44 diameters.
Fig. 1a. Same specimen, with the caudal process fully drawn, very slightly magnified.

### Cercopagis micronyx, G. O. Sars, n. sp.

Fig. 2. Adult gravid female from left side, with base of caudal process; magnified 52 diameters.
Fig. 2a. Same specimen fully drawn, slightly magnified.

### Cercopagis prolongata, G. O. Sars, n. sp.

Fig. 3. Adult female from left side, with base of caudal process; magnified 52 diameters.
Fig. 3a. Same fully drawn, slightly magnified.

### Cercopagis tenera, G. O. Sars, n. sp.

Fig. 4. Adult gravid female from left side, with base of caudal process; magnified 52 diameters.
Fig. 4a. Same specimen fully drawn, slightly magnified.

### Cercopagis anonyx, G. O. Sars, n. sp.

Fig. 5. Adult gravid female, with base of caudal process; left side view; magnified 52 diameters.
Fig. 5a. Same specimen, but slightly magnified, with the caudal process fully drawn.

## Pl. 3.

### Apagis cylindrata, G. O. Sars, n. gen. n. sp.

Fig. 1. Adult female viewed from left side, magnified 52 diameters.
Fig. 2. Tip of the caudal process, highly magnified.

### Polyphemus exiguus, G. O. Sars, n. sp.

Fig. 3. Adult gravid female, viewed from left side; magnified 145 diameters.
Fig. 4. Mandible, magnified 340 diameters.
Fig. 5. Masticatory part of same, more highly magnified.
Fig. 6. Leg of 1st pair from the outer side, magnified 340 diameters.
Fig. 7. Leg of 2nd pair.
Fig. 8. Leg of 3rd pair.
Fig. 9. Leg of last pair.

### Evadne producta, G. O. Sars, n. sp.

Fig. 10. Adult female, viewed from left side; magnified 75 diameters.
Fig. 11. Outer part of an oar, magnified 145 diameters.
Fig. 12. Mandible, magnified 220 diameters.
Fig. 13. Masticatory part of same, more highly magnified.
Fig. 14. Leg of 1st pair from the outer side, magnified 220 diameters.
Fig. 15. Leg of 2nd pair.
Fig. *) Leg of 3rd pair.
Fig. 16. Leg of last pair.
Fig. 17. Urosome, with last leg, viewed from left side; magnified 145 diameters.

### Evadne anonyx, G. O. Sars, n. sp.

Fig. 18. Adult female from left side, magnified 75 diameters.
Fig. 19. Younger female specimen, viewed from right side; same magnification.

### Evadne camptonyx, G. O. Sars, n. sp.

Fig. 20. Adult gravid female, viewed from left side; magnified 110 diameters.
Fig. 21. Urosome together with last leg, viewed from left side, magnified 185 diameters.

### Evadne trigona, G. O. Sars, n. sp.

Fig. 22. Adult gravid female from right side, magnified 105 diameters.
Fig. 23. Urosome, with last leg, from right side; magnified 185 diam.

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*) Not numbered in the plate.

Fig. 24. Marsupial part of another specimen, inclosing a „winter-egg"; magnified 105 diameters.

Fig. 25. Adult male specimen, viewed from right side; magnified 105 diameters.

## Pl. 4.

### Limnocalanus grimaldii (de Guerne).

Fig. 1. Adult female, seen dorsally (right anterior antenna not fully drawn); magnified 44 diameters.

Fig. 2. Same viewed from left side, with the anterior antennæ reflexed.

Fig. 3. Extremity of the cephalic segment, viewed from left side, showing the anterior and posterior lips (posterior antennæ and mandibles removed); magnified 110 diameters.

Fig. 4. Posterior antenna, magnified 132 diameters.

Fig. 5. Anterior lip from below.

Fig. 6. Posterior lip do.

Fig. 7. Mandible with palp.

Fig. 8. Maxilla.

Fig. 9. Anterior maxilliped.

Fig. 10. Posterior maxilliped.

Fig. 11. Leg of 1st. pair.

Fig. 12. Leg of 2nd pair.

Fig. 13. Leg of 4th pair.

Fig. 14. Leg of last pair.

Fig. 15. Spermatophore.

Fig. 16. Extremity of tail, with the caudal rami, viewed from the dorsal face.

Fig. 17. Adult male, viewed from right side; magnified 44 diameters.

Fig. 18. Last pair of legs of same, viewed from the anterior face, magnified 132 diameters.

Fig. 19. Anterior division of the body of a female specimen of *Limnocalanus macrurus* G. O. Sars, viewed from left side (appendages omitted).

## Pl. 5.

### Heterocope caspia, G. O. Sars, n. sp.

Fig. 1. Adult female, seen dorsally (left anterior antenna not fully drawn); magnified 56 diameters.

Fig. 2. Same viewed from left side, with the anterior antennæ reflexed.

Fig. 3. Extremity of the cephalic segment, left side view.

Fig. 4. Posterior antenna, magnified 200 diameters.

Fig. 5. Anterior lip from below.

Fig. 6. Mandible with palp.

Fig. 7. Maxilla.

Fig. 8. Anterior maxilliped.

Fig. 9. Posterior maxilliped.

Fig. 10. Leg of 1st pair.
Fig. 11. Leg of 2nd pair.
Fig. 12. Last pair of legs.
Fig. 12a. Extremity of a leg of last pair, very strongly magnified.
Fig. *) Extremity of tail, with the caudal rami, dorsal view.
Fig. 13. Adult male, viewed from the dorsal face (left antenna not fully drawn); magnified 56 diameters.
Fig. 14. Right prehensile anterior antenna of same, magnified 114 diameters.
Fig. 15. Last pair of legs of same, viewed from the posterior face.

## Pl. 6.

### Poppella guernei, Richard.

Fig. 1. Adult ovigerous female, viewed from the dorsal face (left anterior antenna not fully drawn); magnified 95 diameters.
Fig. 2. Same from left side, with the anterior antennæ reflexed.
Fig. 3. Posterior antenna, magnified 295 diameters.
Fig. 4. Mandible with palp.
Fig. 5. Maxilla.
Fig. 6. Anterior maxilliped.
Fig. 7. Posterior maxilliped.
Fig. 8. Leg of 1st pair.
Fig. 9. Leg of 4th pair.
Fig. 10. Leg of 2nd pair.
Fig. 11. Apical spine of the outer ramus, more strongly magnified.
Fig. 12. Last pair of legs.
Fig. *) Extremity of tail, with the caudal rami, dorsal view; magnified 170 diameters.
Flg. 13. Adult male, viewed from the dorsal face; magnified 95 diam.
Fig. 14. Outer part of right anterior antenna of same, more highly magnified.
Fig. 15. Last pair of legs of same, viewed from the posterior face, magnified 295 diameters.

## Pl. 7.

### Temorella grimmi, G. O. Sars, n. sp.

Fig. 1. Adult ovigerous female, viewed from the dorsal face; magnified 56 diameters.
Fig. 2. Same viewed from left side, with the anterior antennæ reflexed.
Fig. 3. Anterior antenna, magnified 156 diameters.
Fig. 4. Posterior antenna, magnified 200 diameters.
Fig. 5. Mandible with palp.
Fig. 6. Maxilla.

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*) Not numbered in the plate.

Fig. 7. Anterior maxilliped.
Fig. 8. Posterior maxilliped.
Fig. 9. Leg of 1st pair.
Fig. 10. Leg of 3rd pair.
Fig. 11. Leg of 4th pair.
Fig. 12. Last pair of legs.
Fig. 13. Extremity of tail, with the caudal rami, dorsal view; magnified 155 diameters.
Fig. 14. Adult male, viewed from the dorsal face, magnified 56 diam.
Fig. 15. Right anterior antenna of same, magnified 155 diameters.
Fig. 16. Last pair of legs of same, magnified 200 diameters.

## Pl. 8.

### Temorella lacinulata, (Fischer).

Fig. 1. Adult female, dorsal view; magnified 56 diameters.
Fig. 2. Same viewed from left side, with the anterior antennæ reflexed.
Fig. 3. Anterior antenna, magnified 100 diameters.
Fig. 4. Leg of 1st pair, magnified 200 diameters
Fig. 5. Leg of 3rd pair.
Fig. 6. Last pair of legs.
Fig. 7. Last pair of legs of an immature female specimen.
Fig. 8. Extremity of tail, with the caudal rami, dorsal view, magnified 130 diameters.
Fig. 9. Adult male, viewed from right side; magnified 56 diameters.
Fig. 10. Outer part of right anterior antenna, magnified 155 diameters.
Fig. 11. Last pair of legs of same, viewed from the anterior face; magnified 200 diameters.
Fig. 12. Extremity of tail of same, dorsal view; magnified 155 diam.

### Temorella affinis, (Poppe).

Fig. 13. Adult female, viewed from the dorsal face, magnified 56 diam.
Fig. 14. Anterior antenna, magnified 100 diameters.
Fig. 15. Leg of 1st pair, magnified 200 diameters.
Fig. 16. Leg of 3rd pair.
Fig. 17. Last pair of legs.
Fig. 18. Tail with the left expansion of the last pedigerous segment, dorsal view; magnified 110 diameters.
Fig. 19. Last pair of legs of an adult male, viewed from the anterior face; magnified 200 diameters.

# Chrysomelidae palaearctici novi vel parum cogniti.

Auctore

**G. Jacobson.**

(Présenté le 4 décembre 1896.)

## I.

### Xenomela [1]) regeli sp. n.

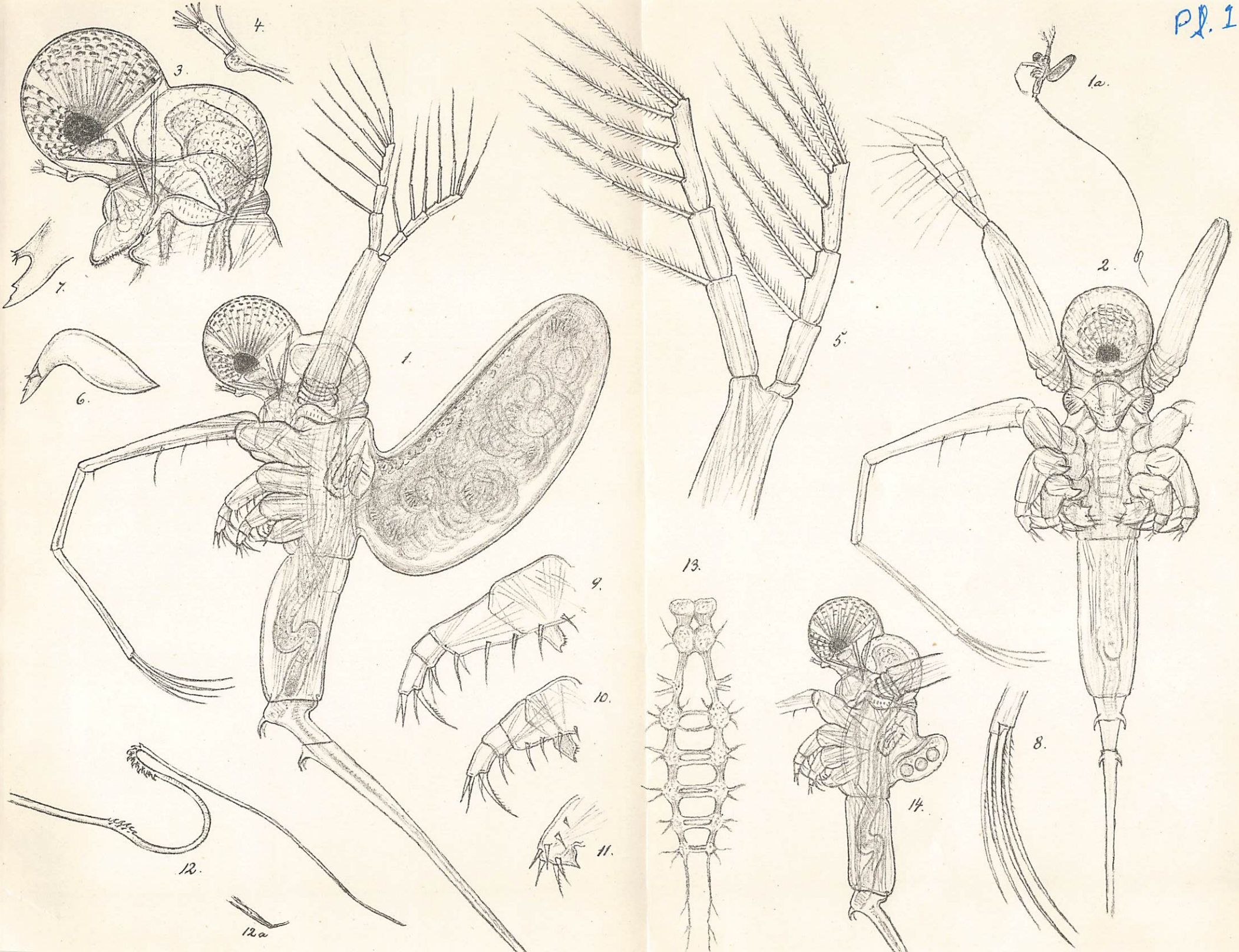
Species maxima generis, *Xenomelae dohrni* (Solsky) proxima, sed differt punctură subtiliore, rugositate minus evolută, elytris proportionaliter angustis, colore pedum elytrorumque nec non longitudine totius corporis.

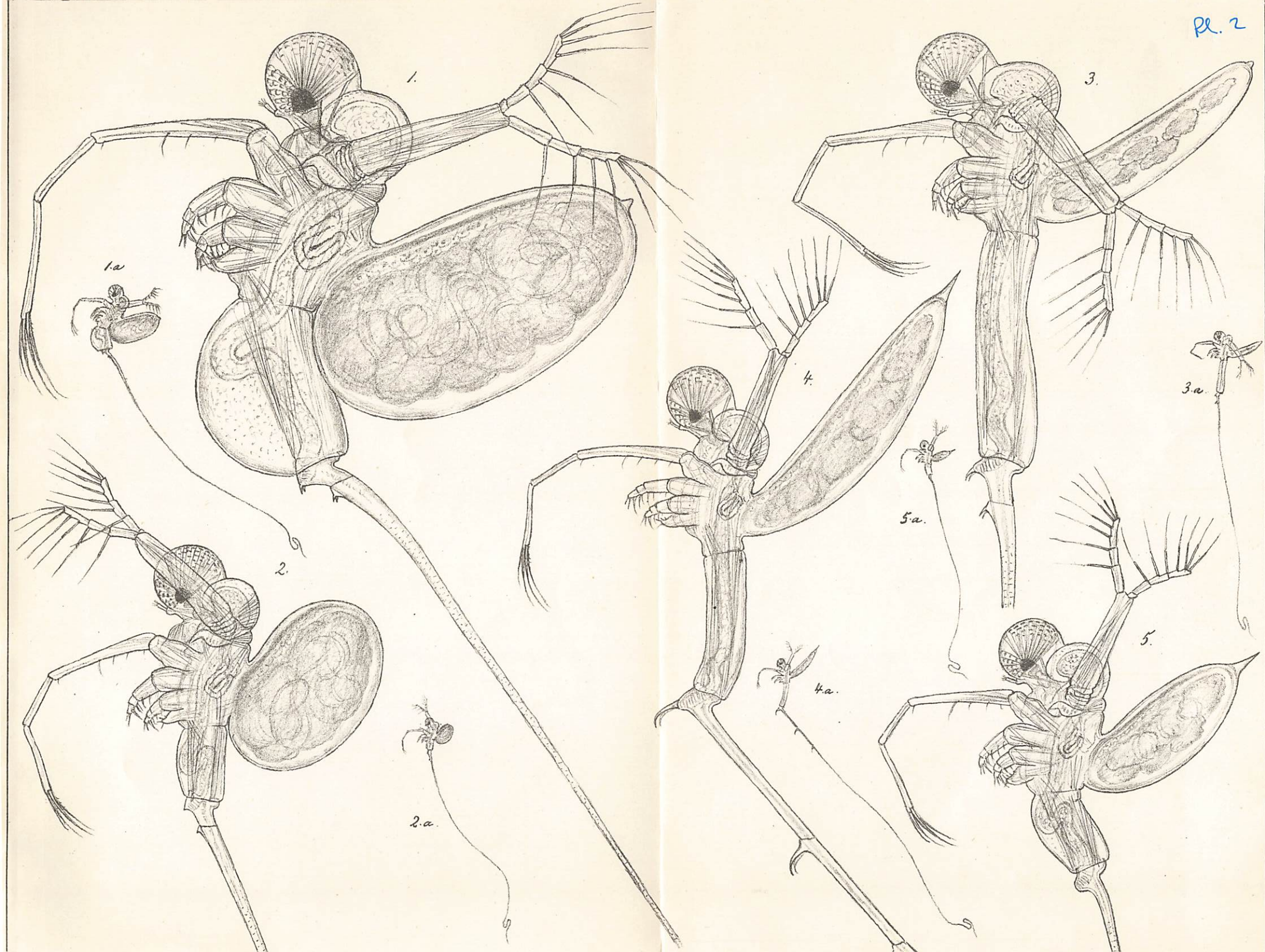
♂. Parum nitida, vix sericeo-micans, supra nigra, vix coeruleo-resplendens; antennarum articulis duobus primis, capite (ore, labro punctoque frontali nigris exceptis), prothoracis lateribus (hoc omnino ut in *X. dohrni* colorato), elytrorum margine toto (scutello nigro interrupto), epipleuris, pygidio, pedibus totis cum coxis rufo-cinnamomeis; subtus piceo-nigra.

Oblonga, parallela. Caput clypeo longitudine subtriplo latiore, dense punctulato, fronte sparsim tenuissime punctulată, impressionibus juxtaocularibus lineiformibus, post oculos punctis copiosis praeditum. Prothorax longitudine subduplo (5:3) latior, convexus; angulis anticis omnino rotundatis, posticis distinctis, obtusis; marginibus antico et lateralibus tenuissime marginatis;

1) De hoc et sequentibus generibus vide opuscula mea in Horis Soc. Ent. Ross., t. XXIX, 1895, p. 271—281 et 294—296.

Pl. 1

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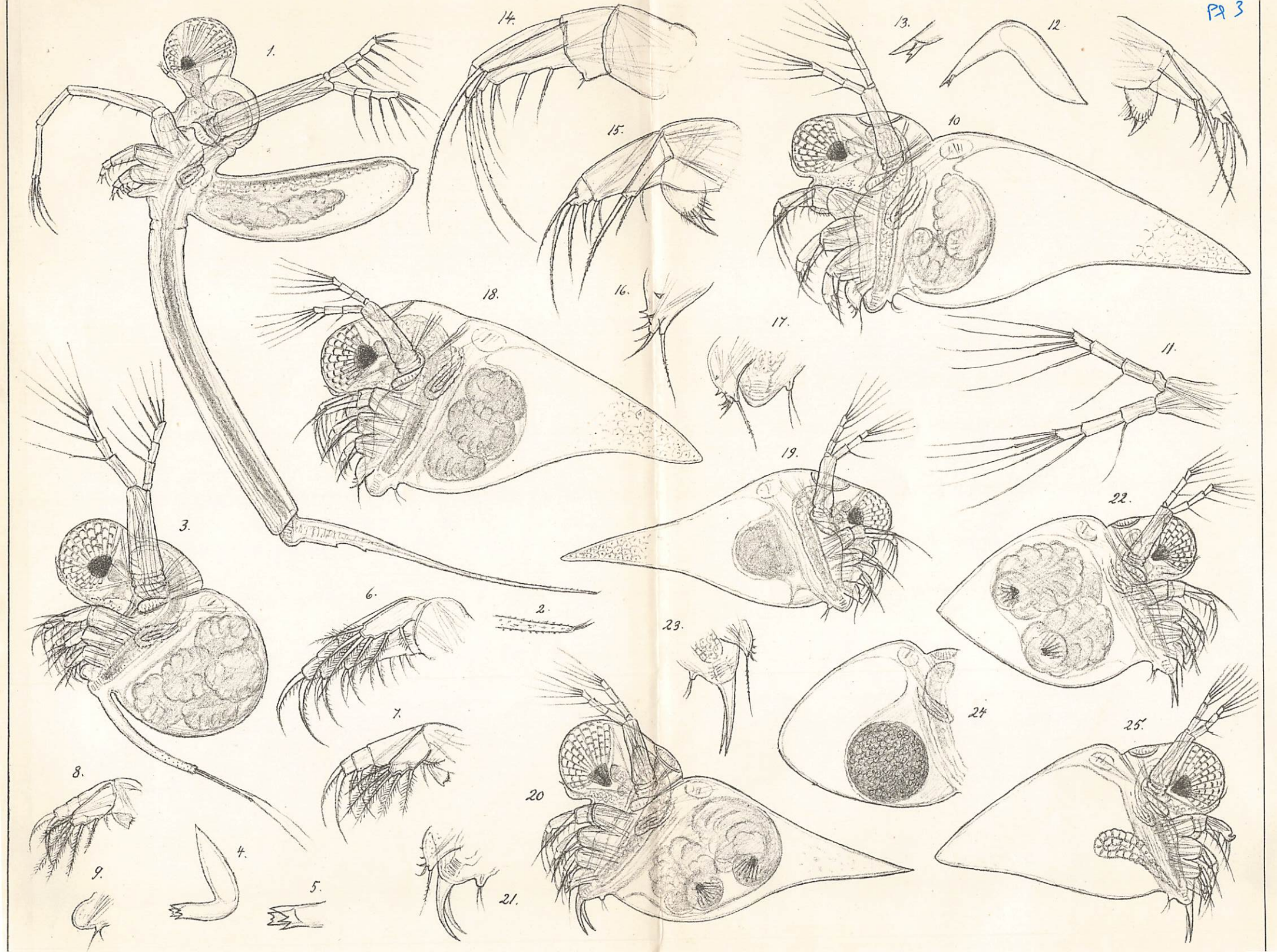
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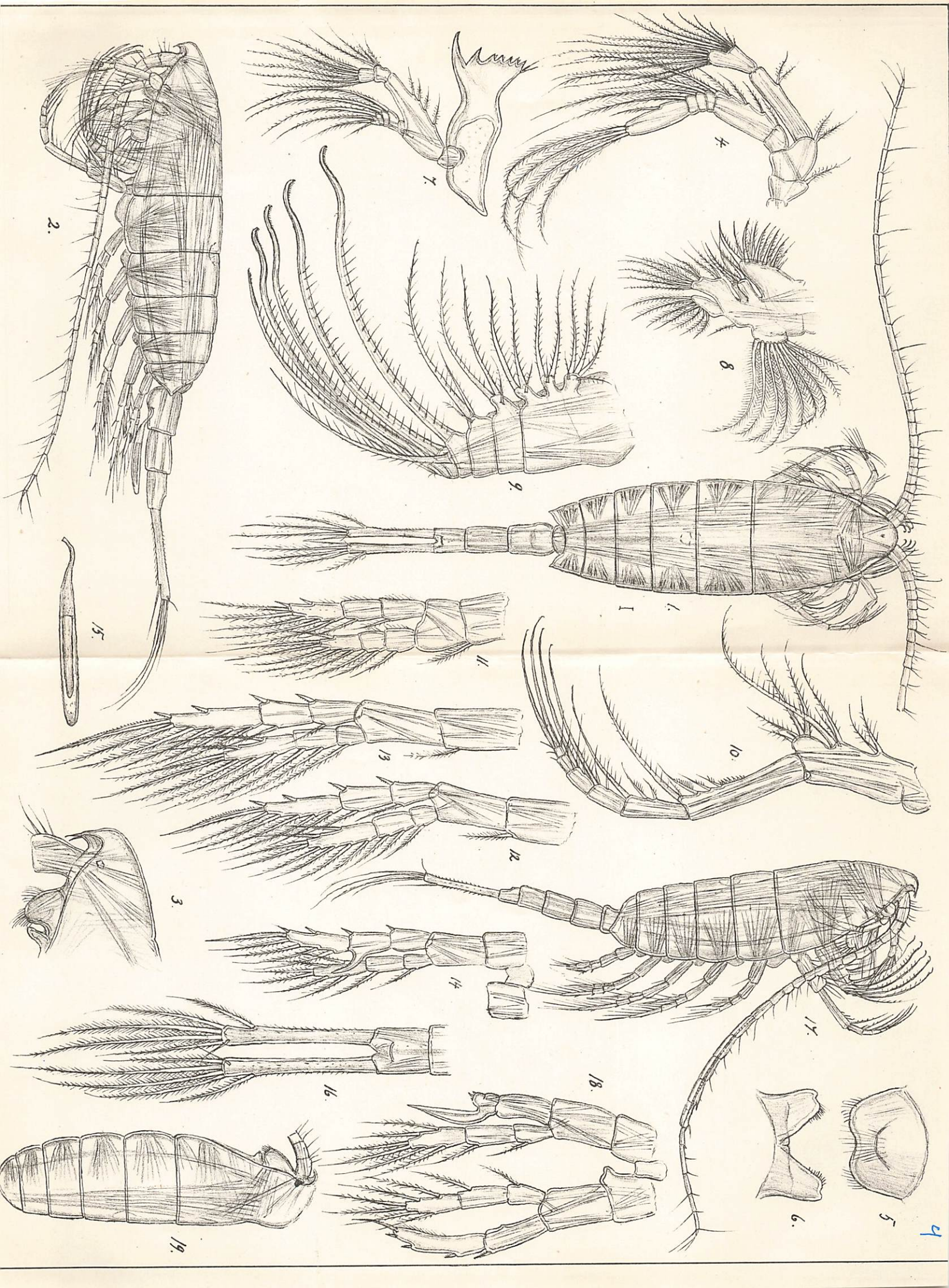
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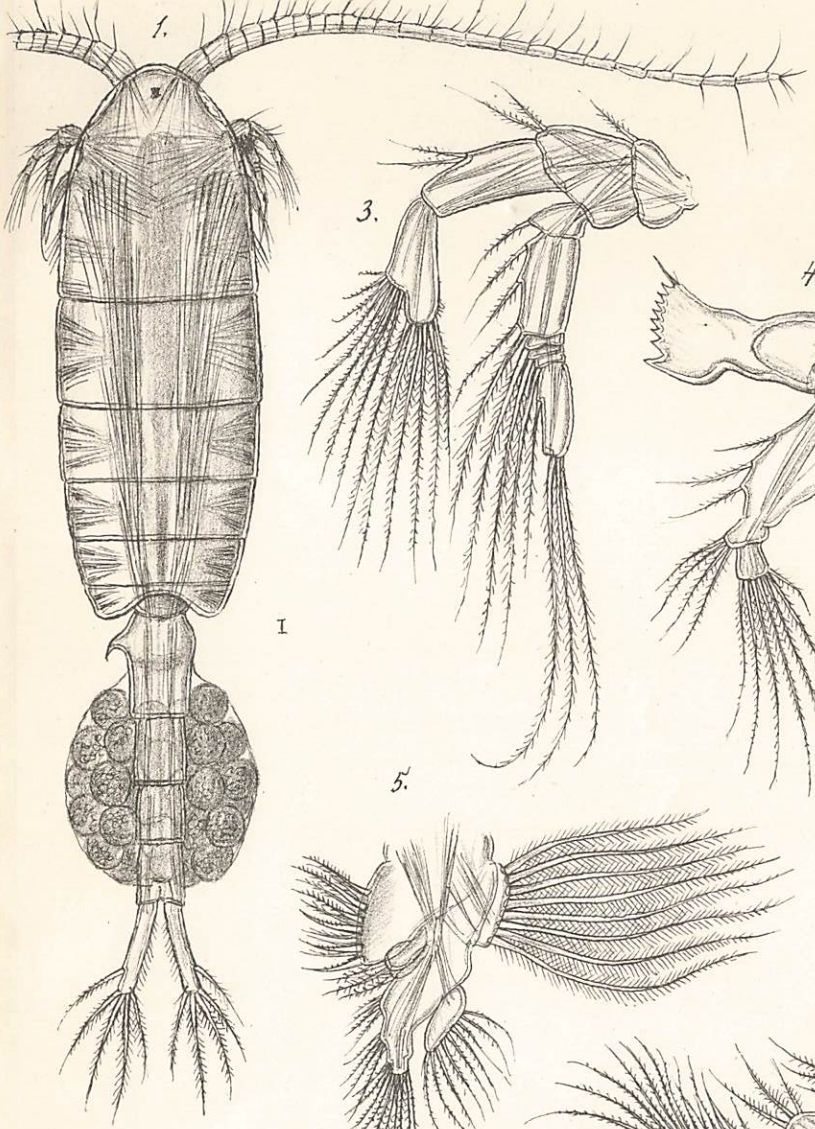
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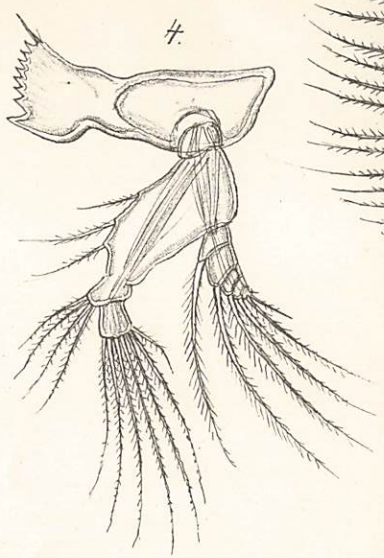
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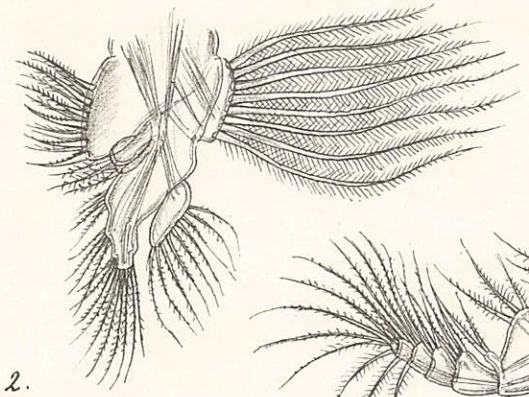
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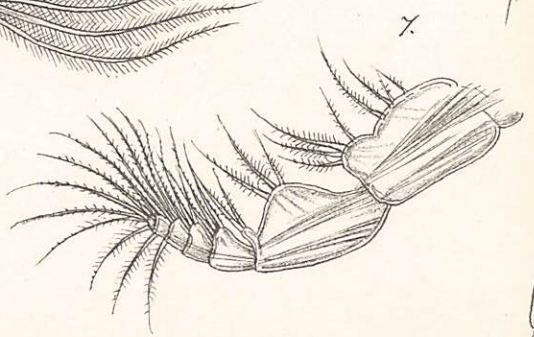
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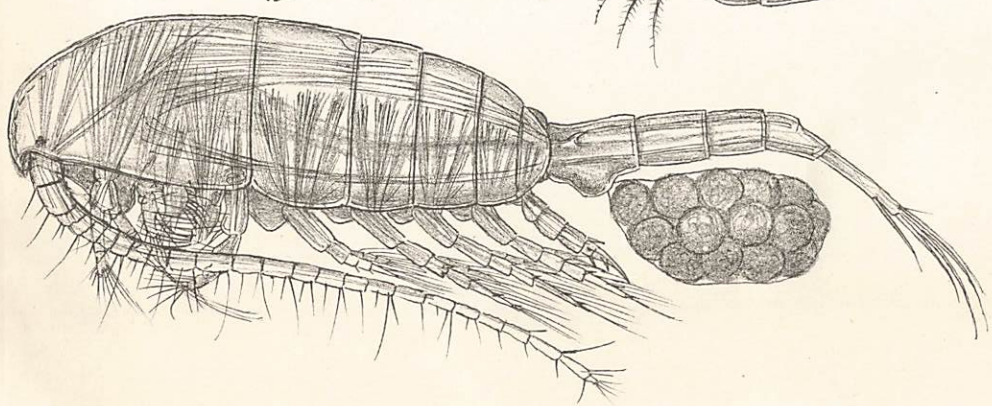
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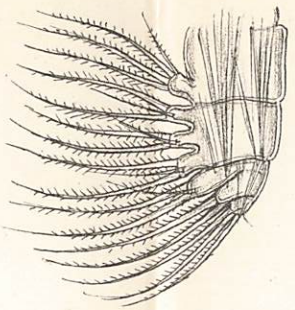
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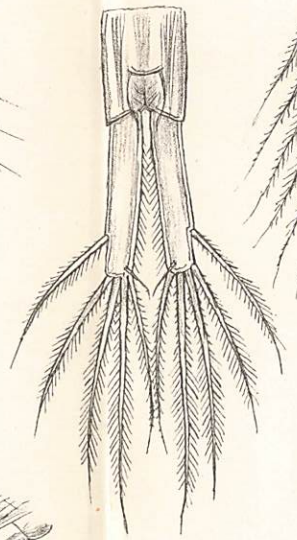


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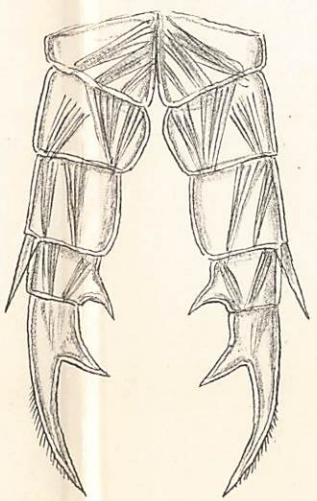
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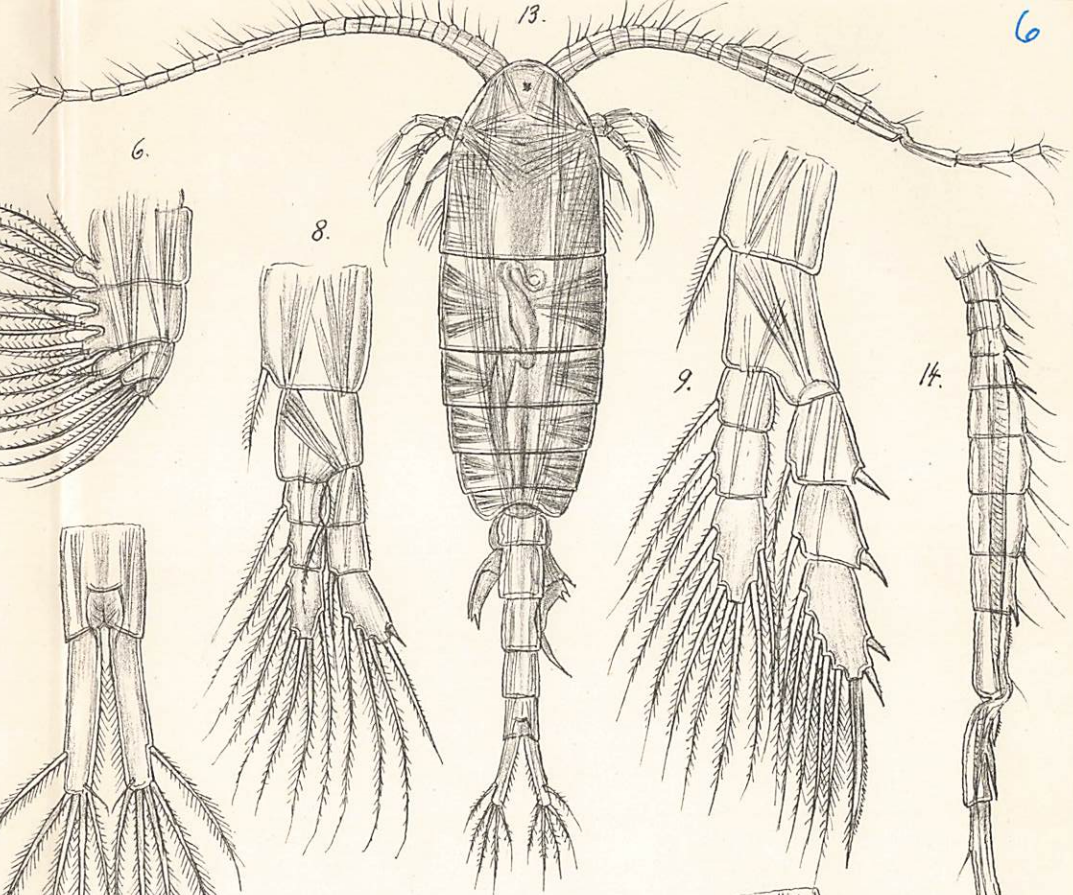
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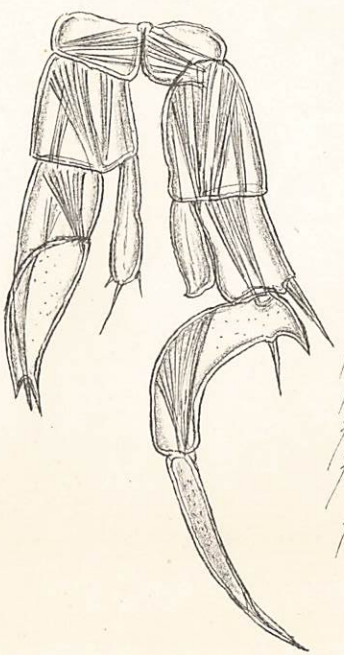
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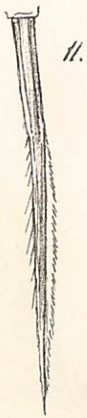
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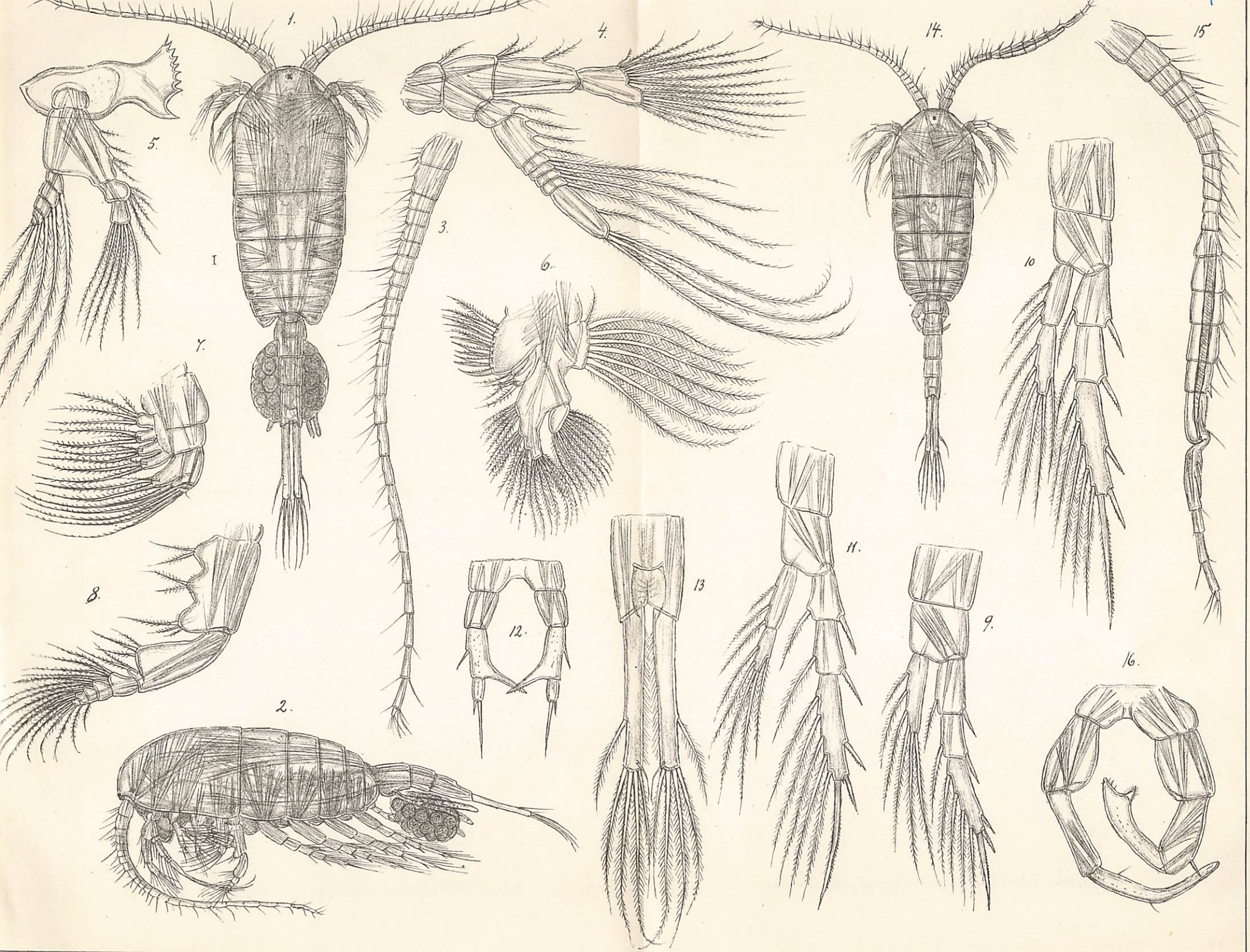
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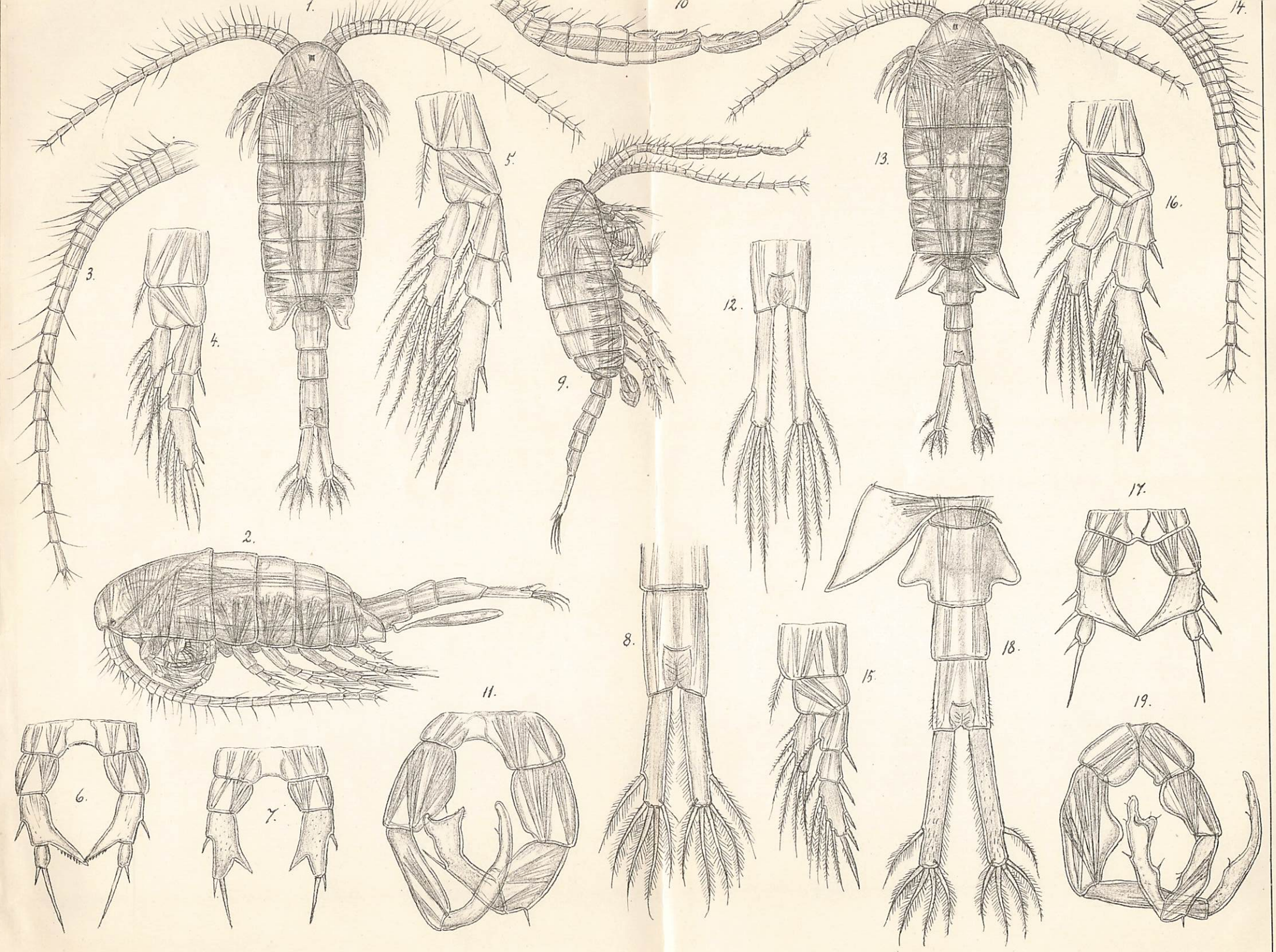
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