NOTES ON THE COLLECTION OF COPEPODA.

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(With Plates XCVI—C.)

The collection of Copepoda made by Mr J. Stanley Gardiner around the Maldive Islands, and handed to me for examination and determination is extremely interesting, especially when compared with that made by Professor Herdman on the Ceylon Pearl Fishery Banks. As the Maldive Archipelago lies between 7° 7′ N. to 0° 42′ S. it occupies a length of about 540 miles, and is distant from Ceylon about 7° or about 420 miles in a westerly direction. Notwithstanding this short distance there is a very striking difference in the fauna of the two regions. In the list of species given by Thompson and Scott of the Ceylon banks are enumerated 78 species of *Harpacticidae*, amounting to over one quarter of the whole number of species determined. In the Maldive Archipelago, the number of purely littoral as distinguished from the pelagic *Harpacticidae* is very small. Of the latter occur four species, viz., *Microsetella atlantica, Setella gracilis, Miracia efferata, Clytemnestra scutellata* and *rostrata*; of the former (littoral) only five or six species with not more than a dozen examples altogether. This paucity of *Harpacticidae* is in striking contrast to the richness in the same group of the Ceylon Fishery Banks, and seems difficult to account for, since Mr Gardiner's collections were made both in lagoons and the open sea. Dahl has already remarked upon the occurrence of purely oceanic forms round oceanic islands,—"So scheinen sie die Küsten der oceanischen Inseln weit näher zu kommen als den Festland Küsten, namentlich wenn es sich an letzteren von tiefe Buchten handelt, oder von Stellen an welchen Flüsse ausmünden[1]."

Very little work with tow-nets has been done, or at least published, concerning the Indian Ocean[2].

[1] *Deutschen Zool. Gesellschaft*, Leipzig, 1894, April.

[2] "Leider liegen uns aus dem indischen und pacifischen Ocean nicht entsprechend zahlreiche Fänge vor und von manchen Stromgebieten jener Meere wissen wir noch gar nichts. Es ist deshalb klar, dass unsere Angaben hier weit unsicherer ausfallen werden. Ausser den wenigen, theilweise noch unsicheren Fundorten, welche wir Dana und Brady entnehmen können, liegt hier namentlich die Giesbrechtische Bearbeitung des Materials der Chierchia-Expedition vor. Ich selbst habe ausserdem das von Herrn Dr Schott und Capitän Bruhn im indischen Ocean gefangene Material und einige von Behn auf der Galathea-Expedition im pacifischen Ocean gemachte Fänge in Händen. Zuverlässige Angaben über die verticale Verbreitung der Tiefenthiere fehlen ganz. Die von Giesbrecht gegebenen Zahlen besitzen geringen Werth, weil es sich meist um Tiefen handelt, bis zu welchen ein offenes Netz herabgelassen wurde." Dahl, *loc. cit.*

Dahl lays down the following propositions[1]:

1. The deeper living kinds are in all three oceans completely, or nearly completely, alike, and this applies to the tropics. Conditions of life in deeper parts of ocean are the same.

2. In the Indian and Pacific Oceans, the surface-living animals of the tropical parts are either exclusively or nearly the same, intercommunication taking place by the warm streams.

3. The Copepods of the tropical surface regions of the Atlantic are different in many of their kinds from those of the Indo-Pacific Oceans. There occur certain very nearly related kinds, also vicarious types. The physical relations in both oceans are similar and yet somewhat different, great areas of the Pacific existing permanently warmed over 29°, whilst in the Atlantic the highest temperature is about 28°. Intermixture is further arrested at the south point of Africa by the meeting of a colder Atlantic with a warm Indo-Pacific stream.

The most southerly portion was touched by the "Challenger," south of Kerguelen Island, *i.e.* between 45°—60° S., from which Brady records 16 species of Copepoda, seven of which appear in the Maldive Archipelago and are marked with an asterisk in the following list[2]: *Aetideus armatus, Calanus propinquus, *Drepanopus pectinatus, Rhincalanus gigas, Scolecithrix minor, *Eucalanus attenuatus, Hemicalanus aculeatus, *Pleuromamma abdominalis, Heterochaeta spinifrons, *Leuckartia flavicornis, *Euchaeta prestandreae, *Candace truncata, *Sapphirinella stylifera, Pseudothelestris imbricata, Zaus spinatus, Machairopus idyoides.*

In the voyage of the "Belgica[3]," the Copepoda of which were reported upon by Giesbrecht, and the limits of which were 69° 48′ and 71° 18′ S., during April—December, 1898, the following species were recorded: **Calanus acutus, C. propinquus, Ctenocalanus vanus* (recorded by Wolfenden from the Faroe Channel, N. Atlantic and West of Ireland: also by Farran from the W. of Ireland), **Euchæta antarctica, *E. austrina, *Heterorhabdus austrinus, *Metridia Gerlachei, Microsetella atlantica, Monstrilla conjunctiva, Oithona similis, *O. frigida, Oncœa conifera, O. curvata, O. notopus, *Pseudocalanus pygmaeus, *Racovitzanus antarcticus, *Rhincalanus grandis, *Scolecithrix glacialis, *Stephus longipes.*

Littoral species, **Cyclopina belgica, *Dactylopus antarcticus, *D. crassus, *Ectinosoma antarctica, *Idya racovitzai, *Nitokra gracilimana, *Idya tenuimana, *Harpacticus furcifer, H. brevicornis, H. chelifer, Scottocheres stylifer.*

Those marked with an asterisk are new species.

Heterorhabdus austrinus	is nearly related to	*H. clausi* and *norwegica*,	}	Northern species.
Metridia Gerlachei	„ „	*M. lucens*,		
Oncœa curvata	„ „	*O. subtilis*,		
Idya tenuimana	„ „	*I. furcata*,		
Harpacticus furcifer	„ „	*H. flexus*		
Rhincalanus grandis	„ „	*R. gigas*[4],	}	Southern and Northern species.
Scolecithrix glacialis	„ „	*S. alyssalis*[5]		

[1] Dahl, *Verhand. Deutschen Zool. Gesellschaft*, Leipzig, 1894, April.

[2] *Challenger Report*, Copepoda, Brady.

[3] Giesbrecht, *Voyage du Belgica*, Copepoden, 1902.

[4] Recorded by Scott from the Firth of Forth, Scotland.

[5] Recorded by Wolfenden from the Atlantic, West of Ireland.

Of these species seven are undoubtedly bipolar (viz. *Microsetella atlantica, Oithona similis, Oncœa conifera* and *notopus, Pseudocalanus pygmaeus, Harpacticus chelifer* and *Ctenocalanus vanus*): and seven others are very closely related to boreal species.

Not many of these however find their way apparently into the tropical parts of the Indian Ocean, at least in the Epiplankton, viz. *Microsetella atlantica, Oithona similis, Oncœa conifera* and *notopus*, and these are species which are eurythemic and eurybathic.

Between 45° S. (Kerguelen Island) and Southern India (Ceylon) no work appears to have been done[1], and there is a huge gap to be filled by future observation. This, embracing part of the Indian Ocean to a depth of 2000 fathoms and over, should yield results of very great interest, when observations are made, especially with efficient deep-water closing-nets. This, in fact, is what is urgently wanted throughout the Indian Ocean and Arabian Sea, the collections brought home up to the present being surface gatherings. Clearly there are obstacles in the way of admixture of surface and epiplanktonic forms between the Southern Ocean and the Atlantic and the Indian Ocean, the Copepod fauna of which greatly resembles that of the Pacific, intermixture being possible and easy. We should not however expect to find such obstacles in the admixture throughout the oceans of deep water of mesoplanktonic forms since the conditions physically more nearly approximate.

Of the records of surface gatherings in the Arabian Sea, Indian Ocean, and Southern Ocean we have the following:

Cleve. Record of a voyage made by Thorild Wulff to and from Bombay. *Arkiv für Zoologie*, Band I., 1903[2].

Cleve. Plankton organisms from the Indian Ocean and Maldive Archipelago. *Kong. Sv. Vet. Akad. Handlingar*, B. 35, N.O. 5.

Scott, A. Some Red Sea and Indian Ocean Copepoda. *Trans. Liverpool Biol. Soc.*, vol. XVI., 1902.

Thompson, I. C., and Scott, A. *The Copepoda of the Ceylon Pearl Fishery Banks*, 1902[3].

[1] This gap has been now partially filled by the collections of the German ship "Gauss," a very extensive series being now in my hands undergoing examination, and comprising the area from the South of Madagascar to the ice of Kaiser Wilhelm II. Land.

[2] The result of examination of four collections:

(1) between Aden and Java in March, 1897, by Dr Nyman;

(2) between Aden and Java in February, 1899, by Dr Aurivillius;

(3) in the Malay Archipelago, May—Sept., 1899, by Dr Aurivillius;

(4) from 45° S.—22° E. to 30° S.—91° E., 1899—1900, by Dr Willemsen;

all surface collections, comprising 86 species.

The similarity of the Copepod Fauna of the Malay Archipelago with that of the Arabian Sea is indicated by the following list of captures in this latter region:

Acartia erythrea, spinicauda, tonsa, Acrocalanus gibber, longicornis, pediger,—Calanopia Aurivillii, elliptica,—Calanus Darwinii, minor, pauper, vulgaris,—Calocalanus pavo,—Candace catula, pachydactyla, simplex,—Centropages calaninus, furcatus, gracilis, orsinii,—Clausocalanus arcuicornis, furcatus,—Clytemnestra scutellata,—Copilia mirabilis,—Corycæus Danae, elongatus, furcifer, gibbulus, gracilicaudatus, longistylis, obtusus, ovalis, robustus,—Eucalanus attenuatus, crassus, monachus, mucronatus, subcrassus, subtenuis,—Euchaeta concinna, longicornis, marina,—Euterpe acutifrons,—Heterochaeta papilligera,—Labidocera acuta, Kröyeri, minutum, nerei, pavo, —Leuckartia Clausi, flavicornis,—Metacalanus Aurivillii, —Microsetella atlantica,—Monops armatus, regalis, strenuus,—Oithona brevicornis, nana, plumifera, rigida, similis,—Oncœa conifera, media, mediterranea, venusta,—Paracalanus aculeatus, parvus,—Pleuromamma abdominale, gracile,—Pontellina plumata,—Pseudodiaptomus Aurivillii, Reticulina Aurivillii (= Porcellidium),—Rhincalanus cornutus,—Sapphirina auronitens, metallina, nigromaculata, vorax,—Scolecithrix Bradyi, Danae,—Setella gracilis,—Temora discaudata, stylifera, —Tortanus gracilis.

For the Malay Archipelago the temperature reaches from 25°—29° C. and the salinity from 30—33 (and over) per mm. (i.e. between 0°—10° S.).

[3] The Report of Thompson and Scott deals with Calanidae 44 species, Centropagidae 29 species, Pseudocyclopidae 1 species, Candaciidae 10 species, Pontellidae 31 species, Cyclopidae 8 species, Harpacticidae 78 species, Oncœidae 8 species, Corycaeidae 29 species, Ascidicolidae 3 species, Lichmolocidae 13 species, Asterocheridae 18 species, Ergasilidae 2 species, Caligidae 4 species, Chondrocanthidae 2 species, Lerniopida 3 species.

Giesbrecht. Elenco dei Copepodi pelagici raccolti dal' tenente di vascello G. Chierchia, durante il viaggio della R. Corvetta Vittor Pisani, e dal tenente di vascello, F. Orsini, nel Mar Rosso nel 1884. *Accad. Lincei*, vol. 4, 5, 7.

Giesbrecht. *Ueber pelagischen Copepoden des Rothen Meeres*, 1896.

Comparing the records of Copepoda taken in these various expeditions we find (omitting the littoral *Harpacticidae*)

from the Gulf of Manaar, Ceylon,	139	species.
„ „ Arabian Sea and Red Sea	111	„
„ „ Malay Archipelago	83	„
„ „ Maldive Archipelago	117	„

Many of these are also common to the Mediterranean, viz. 66 species, and 37 species also appear in the North Atlantic. Of the Copepoda of the southernmost part of the Indian Ocean and Antarctic, it is evident that the further south the more characteristically distinct is the fauna[1], for though seven species of Brady's list find a habitat in the tropical Indian Ocean, only three or four of Giesbrecht's Antarctic list occur in this area and these are also boreal (*Microsetella atlantica, Oncœa conifera*, and *notopus, Oithona similis*).

While there are amongst the Antarctic species some which, as Giesbrecht points out, are very closely allied to northern species, viz., *Heterorhabdus austrinus, Metridia Gerlachei, Oncœa curvata, Rhincalanus grandis, Scolecithrix glacialis, Idya tenuimana, Harpacticus furcifer*, so there are in the tropical part of the Indian Ocean species which are very closely related to their Atlantic allies[2], but have undergone a variation, even occasionally amounting to specific difference. This is instanced in the case of *Bradyidius armatus*, which in the Mediterranean agrees with the Atlantic form, but in the Maldive Archipelago, though similar in all other respects, is only half the size; in *Paracalanus parvus*, which certainly presents varietal differences from the northern species (smaller, with more numerous spines, and less slender feet); in *Pleuromamma Indica*, which has a near relationship with *Pl. robusta*, Dahl, and is probably that species which has at some antecedent period found a habitat in the Indian Ocean, and undergone such varietal changes as to amount to specific differences; and in several species (which will be appropriately referred to subsequently) in which the tail hairs have undergone a most remarkable subdivision, doubling, or more than doubling, the area which they would ordinarily cover. It is well known that species, apparently the same, found in the boreal region have, when compared with those of the more southern and warmer areas, often undergone some variation (especially is this the case as to average size), and that some species are known to vary very greatly within certain defined limits, e.g. the common *Calanus finmarchicus* in the 5th foot, *Temora* species in the length and form of the furcal segments, *Metridia lucens* ♂ in the position of the clasping antennæ (indifferently right or left sided), &c.

[1] Since the above was written, the collections made by the German Antarctic Expeditionary ship, the "Gauss," and also those made by the "Discovery" Antarctic ship, have been placed in my hands. The first-named has been only partially examined as yet, but so far as I have gone I find a Copepod fauna quite distinct from that of the Indian Ocean, and characteristically different from that of the boreal and polar regions as at present known.

[2] Alcock (*Naturalist in the Indian Seas*) speaks of the remarkable similarity of the bottom fauna of the Laccadive Sea with that of the Atlantic.

[3] First pointed out by Vanhöffen (Grönlands Expedition), frequently observed by me in the Faroe Channel specimens and lately also by Farran (Report Irish Fishery Board).

These small variations which are perhaps caused by, or assisted by, difference of environment, are most probably the commencement in varietal differences of anatomical changes which in time will amount to specific differences. The same general process is seen in the boreal Atlantic in such genera as *Gaetanus* and *Gaidius* in which the species, though closely allied to the Pacific forms, are generally distinctly and specifically different, also in the *Aetideus armatus* of the Mediterranean and of the North Atlantic, and in some *Xantho-calanus*. While in the case of similarity of the Copepod fauna of the Antarctic with that of the Arctic region such intermixture is possible by means of the deep continuous layer of cold-bottom water, an intermixture of species between the Indian Ocean and Atlantic is rendered almost impossible by physical conditions, the Agulhas current forming a sufficient barrier. The pelagic Copepod fauna of the Indian Ocean is much more nearly allied to that of the Pacific and Mediterranean than the Atlantic[1], and such species as are common to the Indian Ocean and Atlantic may perhaps be regarded as the existing remnant in the former ocean of a fauna which was common to both, before physical barriers arose to prevent intermixture, especially heightened temperature and increased salinity locally, and the presence of great water barriers like the Agulhas current.

The paucity of littoral forms in the Maldive group is difficult of explanation. Abundant as they apparently are in the Gulf of Manaar, the distance of 500 miles only does not appear to be a sufficient barrier to admixture[2]. That a littoral Harpacticide can exist at the bottom at 400—500 fathoms is proved in the case of *Longipedia coronata* which at two different localities I have found in bottom scrapings of the Atlantic, West of Ireland, at this depth. Water of 1000 fathoms depth separates the Maldive group from the Indian mainland, at which depth the temperature may probably be not more than 35°—38° F.[3] It remains to be proved that this is a sufficient barrier. The islands are of much more recent growth than the mainland, near which a rich Copepod fauna has probably existed from time immemorial. Possibly the water barrier has remained since then, a sufficient obstacle to the extension of the main coast littoral Copepod fauna, though it has not been, or could not have been expected to be, such a barrier to species of other groups, which are essentially pelagic.

A very small part of the Antarctic Copepod fauna appears in the warmer part of the Indian Ocean and *vice versâ*, and these three or four species are cosmopolitan. While it is possible that some representatives of the Southern Ocean fauna may find their way into the Indian Ocean by the cold undercurrent, observations are wanting to demonstrate this. Deep tow-nettings in the Indian Ocean are greatly required. So far our knowledge is limited to the forms which occur at or near the surface.

The following species which occur in the Maldive collections do not appear in the lists of Thompson and Scott, or Cleve; *Bradyidius armatus, Calanus Caroli, Acrocalanus Gardineri,*

[1] While numerous observations are continually extending the area of distribution of known forms, it is fallacious to base arguments upon statistics of distribution in the great oceans. In general terms about 90 °/₀ of the pelagic Copepoda of the Indian Ocean occur in the Atlantic and its offshoot the Mediterranean, and of the whole number about 40 °/₀ occur also in the boreal region of the Atlantic. Of the 90 °/₀ of Atlantic species mentioned above at least 25 °/₀ are purely Mediterranean, i.e. have not as yet been recorded from the Atlantic. Though an offshoot of the Atlantic Ocean this partially enclosed sea, as is well known, is quite different in its physical characters.

[2] Such few species as do occur in the Maldive collection are quite specifically distinct from those recorded from the Gulf of Manaar.

[3] In the Laccadive Sea at 1000 fathoms the temperature is 38° F., at 1300 fathoms 35° F., but 250—300 species of 160 genera of many different families are found in this depth. Alcock, *Naturalist in Indian Seas*, p. 166.

Euchaeta Indica, Thaumaleus tropicus, Parapontella brevicornis, Euchirella bella, Pleuromamma Indica, Pleuromamma ziphias, Haloptilus longicornis, Haloptilus spiniceps, Anomalocera Pattersoni, Corycaeus amazonicus. Also *Peltidium elegans, Porcellidium tuberculatum, Sappirella abyssicola,* Scott (Gulf of Guinea), *Dactylopus Maldivensis,* besides several varieties of known species referred to subsequently.

The drawings which accompany this paper are from the pencil of Miss Marion Lees, and are distinguished by the accuracy and finish which characterises all her work.

Some of the more uncommon and debatable forms together with a few new forms are discussed in this paper. For the rest great care has been taken by dissecting every species to ensure accurate identification.

Gen. *Calanus* Leach.

1. *Calanus vulgaris* (Dana). Giesb. *F. u. Fl. Neap.* v. 19.

Very common in this collection, the size agreeing more with that given by Giesbrecht, viz. 2·5—2·8 mm., than with Brady's measurements, 3·1 m.

2. *C. vulgaris,* var. *plumosus.* Nov.

A most remarkable modification of the bristles of the tail, in which one or more has undergone more or less dichotomous branching, repeated in the sub-branches, the whole forming a sort of brush. There is great irregularity in the side affected, and in the number and position of the affected bristles, and it occurs in both males and females, with such frequency that quite ten per cent. of the whole number of examples are so affected. While the main stem of the bristle is feathered, this ceases at the commencement of the branching, and from this point the bristles are naked. (Plate XCVI. figs. 21 and 22.)

3. *Calanus Darwinii.* (Giesb. *loc. cit.*)

This species is also very common in this collection.

4. *Calanus Caroli* (Giesb.). (Giesb. 1892, *loc. cit.*)

The ♀ of this species is not known, only the ♂ being described by Giesbrecht, who remarks that it differs from *C. Darwinii* chiefly in the anatomy of the 5th foot, the differences being "constant in the length of the shears, the complicated anatomy of the 3rd joint of the exopodite, and the relative position of the proximal hook on the inner side of the long hook into which the marginal horn of the 2nd joint of the exopodite is transformed." While it may be questioned if this is a distinct species, I find in the Maldive collection several examples in which the 5th feet agree with Giesbrecht's description and drawings, and these variations from the type of *C. Darwinii* are constant. The animals are also a little less in size than *C. Darwinii.* See Plate XCVII. fig. 42.

♀. I have met with an adult Copepod which, while closely resembling the ♀ *C. Darwinii,* differs from it in the fact that the denticulation of the last joint of the exopodite of the 2nd feet (external margin) is absent, and also in the 3rd pair, and on the first basal joint of the 1st pair of feet possesses three or four very fine teeth. In other respects the animal agrees with *C. Darwinii,* but I suggest that it may be the ♀ of *C. Caroli.*

It must be admitted that it is very difficult to discriminate the one species from the other.

For the purpose of comparison the 5th feet of this species are shown in the fig. 42, Plate XCVII., along with the same organs of *C. vulgaris* and *C. Darwinii* (figs. 39 and 40).

5. *Calanus pauper*, Giesb. 1888, *Atti Acc. Lincei Rend.* Ser. 4, v. 4; 1892, *F. u. Fl. Neap.* v. 19.

This Copepod is only briefly described by Giesbrecht, and is therefore referred to here at greater length.

In the ♀, the head and 1st thoracic segment are united, the last thoracic segment has rounded margins. The anterior antennæ (25 joints) do not reach as far as the 2nd abdominal segment. The basal joints are thick, distally the antenna tapers; the bristles on Aa 2 and 3 are the longest, with the exception of the whip-like bristles on Aa 24. Aesthetasks are short but numerous. The mouth organs resemble those of *Calanus*. The posterior foot jaw has two dorsal recurved bristles and one terminal dorsal bristle.

The first pair of swimming feet is peculiar and characteristic and the same in both sexes (Plate XCVII. figs. 29 and 32). The second basal segment carries at the distal inner margin a modified spine of pyriform shape, with a tooth at the lower inner margin, is thick at the base, and distally tapers and ends in a whip-like bristle. In the second 5th pairs, the third joint of the exopodite is divided by the marginal spines in the following proportions respectively,

8 : 6; 2 : 1; 2 : 1; 2 : 1.

Proximally these segments are haired on the margins, but distally naked. The abdomen is of four segments, the furcal segments are nearly twice as long as broad, each carrying five bristles and an accessory bristle. The first basal joint of the 3rd and 4th feet is twice as long as broad. The bristles of the posterior antenna are not all naked, half of them being feathered on each side. The left 5th foot is slightly longer than the right, each foot consisting of a thin jointed exopodite and endopodite, the first basal joint of each being feathered on the inner margin.

The ♂ (Plate XCVII. figs. 31, 35) has a 24 or 25 jointed anterior antenna, the articulation between 1 and 2 clear, but not complete, the 24th separate from the 25th. The antenna is sharply bent at the 3rd segment, and on the anterior margin of this segment is a process carrying 4 long stout bristles, the only long bristles on the antenna. The posterior bristle of the posterior foot jaw (Plate XCVII. fig. 34) is short and feathered on both sides. The two branches of the mandible palp are nearly equal and resemble that of *C. gracilis*, except that the last joint of the exopodite carries no long bristle. The fifth pair of feet are characteristic. The left carries a peculiar hammer-like process, and is often twice flexed, once between the 2nd and 3rd joints, and again between the 1st and 2nd basals (Plate XCVII. figs. 30, 33). In many specimens this is the common post-mortem condition, in others the flexure is only at the terminal joint which is carried at right angles to the rest of the foot.

Size, ♀ 1—5 mm., ♂ 1—3 mm.

6. *Calanus minor*, Claus. 1863, *Cetochilus minor*, Freileb. Cop.; 1883, *C. valgus*, Brady, *Chall. Rep.*; 1892, *C. minor*, Giesbrecht, *F. u. Fl. Neap.* v. 14; 1894, *C. appressus*, Dahl, *Ver. d. Zool. Gesells.*

Giesbrecht was of the opinion that the *Calanus valgus* of Brady was identical with his *C. minor*. The drawing of the 5th feet of the ♂ as given by Brady does not agree with Giesbrecht's figure in small particulars, and especially in the much coarser dentation of the inner margins of the 1st basals in Brady's species, and in the spinulation of the last segments of the endopodites. The size of the latter species is also much greater than Giesbrecht's or the Maldive examples (Plate XCVII. fig. 37). The latter agree with Giesbrecht's species as to size and anatomy. The 5th feet of the ♂ do sometimes vary considerably from the normal type (see the figure), both as to the structure of the segments and denticulation of the basals. In the anomalous form figured there is no denticulation on the basal of the left side, that of the right side is comparatively coarse. On the left side there are only two joints in the endopodite (Plate XCVII. figs. 36, 38). Average size of the Maldive examples, ♀ 1·8—2·0; ♂ 1·7 mm. This species is not common in the Maldive collection and there are very few males.

7. *Calanus robustior* Giesb. (*F. u. Fl. Neap.* v. 19.)

There is a very puzzling resemblance between this species and *C. gracilis*, the distinction consisting in the much more swollen genital segment, and rounded projection of the first basal of the anterior foot jaw, and more robust build of the whole animal. Plate XCVI. figs. 5 and 6.

Gen. *Eucalanus* Dana.

8. *Eucalanus attenuatus* (Dana).

The examples from Mr Gardiner's collection average a size of 4 mm., and the species entirely replaces *E. elongatus* characteristic of the North Atlantic.

9. *Eucalanus subtenuis* (Giesb.).

Very common.

10. *Eucalanus pileatus* (Giesb.).

Common.

11. *Eucalanus crassus* (Giesb.).

Of very wide distribution, occurring frequently as far north as the Faroe Channel; this Copepod is found plentifully in the Maldive collection.

12. *Eucalanus mucronatus* (Giesb.).

Very common.

13. *Eucalanus subcrassus* (Giesb.).

14. *Eucalanus monachus* (Giesb.).

Gen. *Rhincalanus* Dana.

15. *Rhincalanus cornutus* (Dana).

16. *Rhincalanus nasutus* (Giesb.).

The former species almost entirely replaces *Rh. nasutus* in this collection, only one specimen of *Rh. nasutus* being discovered, while the former is extremely common.

Gen. *Paracalanus* (Boeck, 1864).

Two different species are common in the Maldive collections, viz. *P. parvus* and *P. aculeatus* Giesb.

It appears singular that with respect to such a common species as *P. parvus* there should be a divergence of opinion, but if Giesbrecht's figures are compared with those given by Sars (*Crust.* Norway) and by Scott (description of *P. parvus* in *Entomost. of the Gulf of Guinea*, p. 26 and Plate I.) a great dissimilarity is noticed, and it is evident that these are not the same species. As it is of importance to determine whether the species *P. parvus*, as found in the Indian Ocean, is really identical with that found in the northern temperate and boreal area, I have submitted the species to a detailed comparison with specimens taken in the Faroe Channel. There are such points of difference between the Mediterranean species of Giesbrecht and the Indian Ocean examples, and those described by Sars from Norway, and collected by me in the Faroe Channel, that they can scarcely be considered identical. The Northern and the Southern species form two distinct varieties.

17. *Paracalanus parvus*

This species as described and figured by Giesbrecht (*F. u. Fl. Neap.*) may be summarised as follows:

Size, 0·8—1 mm.; AA reaching the end of Ab 3: the innermost seta of the furca scarcely longer than the furcal segments; the first basals of the 2—4th pairs of feet with a slightly convex inner margin; the inner distal margin of the first ending in a short spine (in 3rd and 4th feet), the surface of the 1st basal of the 4th pair richly covered with spines and hairs; the last segment of the exopodite of the 4th four-and-a-half times as long as broad and the end saw only three-fourths the length of the segment; a corona of spines on the exop. of the 1st and 2nd feet, and 2 or 3 spines on the exop. 2 of the 2nd pair: the surfaces of the exop. 1 and 2 of the 3rd and of the end. 2 of the 4th feet naked, but of the 2nd and 3rd pairs with a few spines.

The species as described by Sars is "scarcely exceeding 1 mm." in length, and differs from Giesbrecht's species in the following points:

The 1st basals of the feet are longer in proportion to their breadth and their edges more parallel, especially is this the case in the 4th pair; there are no spines on the surfaces of the first basals of the 2nd, 3rd, and 4th pairs; the endop. 2 of the 2nd and 3rd feet have each a small corona of spines; the first and third joints of the expodite of the 1st pair have each an outer marginal seta. The exop. 3 of the 4th foot is nearly 5 times as long as broad.

The differences between the two forms, Mediterranean and Norwegian, are not great, but are constant, and while all the Indian Ocean examples which I have dissected approximate closely to that described by Giesbrecht, the Faroe Channel examples are more like the figures of Sars.

Paracalanus parvus (from the Faroe Channel), var. *borealis*.

Average size of ♀, 1·0—1·1 mm., AA reach to the end of the Ab 3; caudal segments twice as long as broad and as long as Ab 4; innermost seta very small; basals of the 3rd and 4th feet twice as long as broad, the inner margins rather convex, and with a few short spines

below the origin of the inner seta: more spines on the surface of the 3rd (basal) than in the 4th pair. 1st foot, with no outer marginal seta except the middle of the exop. 3. Outer margin of endop. 1 not ending in points, first basal of 4th feet, inner distal margin stumpy, but in 3rd feet with a little point. Endop. 2 of 2nd and 3rd feet with coronals of spines on the surface. 4th pair, basals without spines, except for 2 or 3 short points just below the inner seta, the exop. 3 five times as long as broad, the end saw three-fourths the length of the last segment, proximal outer edge with rather coarse teeth, and marginal spines very small.

P. parvus (from Indian Ocean), var. *Indicus*.

Average size, 0·8 mm. The basal of the 4th feet is very spiny, those of the 2nd and 3rd pairs also with spines on the margins and surfaces. The inner margins of the basals rather convex. The last joint of the exopodite of the 4th feet four times as long as broad, the end saw three-fourths the length of the segment, marginal spines small, proximal part of the segment with five teeth on the outer margin. Anterior antennæ reaching to the caudal segments.

In this variety the basal joints of the feet are more covered with spines, are broader in proportion to length, and the same is true of the last exopodite segment, and the animal is constantly of smaller size than the northern variety, and the anterior antennæ are longer.

	22	23	24	
Ant. ant., *P. parv.*	4	3½	4½	the last joint 1 broad, i.e. 4½ times as long as broad,
P. acul.	6	6	9	„ „ 1·5 „ i.e. 6 times as long as broad;

the lower margins of the 10th—22nd segments are armed with a row of fine spines, absent in *P. parvus*.

The *Parac. parvus*, described and figured by Scott, from the Gulf of Guinea, is clearly not identical with the same species from the North.

The 4th pair of feet (Pl. XCVI. fig. 11) are those of *P. aculeatus*, Giesb. (in the proportions of the exop. 3, length of saw, spinulation of segments), as are also the abdomen (long inner bristle), and 5th feet (long outer bristle), and the size (1·12 mm.) and the longer last joint of the anterior antennae, which is nearly double the length of the penultimate joint.

Scott's *Paracal. pygmaeus*, though regarded by Giesbrecht as identical with Dahl's *P. crassirostris*, is probably the southern variety of *P. parvus*.

Pl. XCVI. figs. 7, 8, 9, 10, 11, 16.

18. *Paracalanus aculeatus* (Giesb.). Pl. XCVI. figs. 12, 13, 14, 15.

♀ 1·1 mm. long: the anterior antennæ reaching beyond the end of the furca, the last joint nearly 6 times as long as broad, and one-third longer than the penultimate joint: furcal segments two-thirds as broad as long, with innermost bristle about half as long as the next one. The basals of the 2nd—4th pairs of feet without spines. The fourth pair with the exopodite last segment four times as long as broad (a little broader proportionately than in *P. parv.*), the end saw as long as the segment; 13 or 14 rather coarse teeth on the proximal part of the outer margin, the distal margin ending externally in three much stouter spines than in *P. parvus*: a few spines on the surface of the exop. 2, the end. 2 with a corona of stout spines, the end. 3 with two rows of shorter spines. The end. 2 of the 3rd feet with a similar corona. 5th feet with the first segment more than twice as long as broad, the second segment

four times as long as broad, the inner terminal bristle nearly half as long as the outer one, a very short bristle on the external margin near the distal end.

This species is rather larger than *P. parvus*, especially differing from it in the length of the anterior antennæ, the innermost tail seta, and the characters especially of the fourth feet.

The ♂ of *Paracalanus parvus*, from the Maldives, shows the same spinulation of the basal segments of the feet as the ♀, only that this is even more marked, especially on the 3rd and 4th feet. The teeth of the edges of the last exopodite segment are coarser and larger, and the distal part of the margin of exop. 2 has teeth of the same character. The proportions of the exop. 3 of the 4th feet are the same as in the ♀, but the saw is longer, as long as the segment itself. The anterior antenna has many of the basal joints coalesced, the posterior foot-jaw has three very strong and well-feathered dorsal bristles, the anterior foot-jaw maxilla are greatly retrograded, the mandible palp well formed, but the masticating plate wanting. The 5th feet, of one long foot of the right side (often strongly flexed at the 2nd basal) and a very short two-jointed left foot, shows no essential differences in the Northern and Indian Ocean varieties.

Most examples of *P. parvus*, var. *Indicus*, have the tail bristles entirely pigmented a bright red.

19. *Paracalanus aculeatus*, var. *plumulosus*.

As in some allied genera, there are some examples of *Paracalanus* in this collection in which the tail setae have undergone the dichotomous branching before mentioned. From the size (1·2 m.), the long anterior antennæ (longer than the whole animal), denticulation of the lower margins of many of the antennal segments, size of the furcal segments, basals of the 2nd—4th feet without spines, and terminal saw of the 4th foot equal in length to the last exopodite segment, it is a variety of *P. aculeatus*. Pl. XCVI. fig. 23.

Gen. *Clausocalanus* Giesbrecht.

20. *Clausocalanus arcuicornis* (Dana).

21. *Clausocalanus furcatus* (Giesb. = *Drepanopus furc.* of Brady).

The former is the more common in this collection and of average size, 1·1—1·3 mm., rather smaller than the examples described by Giesbrecht.

Gen. *Calocalanus* Giesbrecht.

22. *Calocalanus pavo* (Dana).

23. *Calocalanus pavo*, var.

Apparently similar to the type species, but differing in the dichotomous branching of the tail setae, and the possession of a row of very stiff spine-like bristles on the external margin of the 1st joint of the exopodites of the 3rd feet.

24. *Calocalanus plumulosus* (Claus).

25. *Calocalanus styliremis* (Giesb.).

Gen. *Acrocalanus*, Giesb.

1888, *Atti Acc. Lincei Rend.* Ser. 4; 1892, *Fauna u. Fl. Neap.* v. 19.

The genus is related to *Paracalanus*, but the anatomy of the swimming feet is at once distinctive. The outer margins of the last joint of the exopodites are divided by the

external spines into portions more nearly equal and the proximal part is never double the length of the distal; the outer edges of the exopodites are toothed, in the 2nd pair in all joints, in the 3rd pair proximally only, and in the 4th pair strongly in the proximal portion and with finer teeth in the distal portion; the terminal bristle of the 3rd pair is never longer than the last joint of the exopodite; the end joint of the endopodite of the first pair carries 5, and the same joint (the third) of the endopodite of the second pair carries only 6 bristles. In the ♀ the 5th pair of feet is usually entirely absent, and represented only by one or a pair of short and easily overlooked stumps but a 5th foot occurs in some ♀s and is small, simple, and exists only on the left side, very similar to that of the ♂ but in the latter the foot is much longer, though only occurring on the left side. The ♂ very closely resembles the ♀, but since the anal segment is always the largest and showing only partial segmentation from the preceding segment, and the mouth organs are usually very similar to those of the ♀, and not retrograded as is the case in allied genera (viz. *Paracalanus*), I think it must be concluded that none of the very numerous male examples found are really mature except in the species *Acroc. Gardineri*. I have found a few ♀s apparently of *Acrocal. longicornis*, *Acrocalanus gracilis* and of *Acroc. gibber* with a small left 5th foot, so it appears that a 5th foot is sometimes present in both sexes.

Giesbrecht originally described four species of *Acrocalanus*.

1. *A. longicornis*, in which the anterior antennae are longer than the whole body by 5 joints.

2. *A. monachus*, in which the head is produced, so as to be almost quadrate in shape.

3. *A. gibber*, with oval-shaped head, but the back strongly swollen into a hump.

4. *A. gracilis*, with oval-shaped head, without any dorsal hump.

Giesbrecht cast some doubt upon the validity of the specific distinction between *A. gibber* and *A. gracilis* ("nicht ganz zweiffellos" Giesb. *F. u. Fl.* p. 175), but he remarked upon its relationship to *A. longicornis* in the fact that in both species there was a partial segmentation of the head from the thorax. The observation and dissection of a great number of specimens has shown the truth of Giesbrecht's deduction, and there can be no doubt that they are distinct species.

In *A. longicornis* and *A. gibber* the partial but distinct line of segmentation between Ce. and Th. 1 is always present, as well as a strong dorsal hump.

In *A. monachus* and *A. gracilis* there is never any line of segmentation between Ce. and Th. 1, and never any dorsal hump, the back being in each regularly rounded. In *monachus*, however, the front of the head is produced, giving an appearance of a monk's hood, while in *gracilis* it forms an even curve. The fifth species, to which I have given the name *Acrocal. Gardineri*, presents some peculiarities but possesses so many of the generic characters of the genus *Acrocalanus* that it must be included in this genus.

26. *Acrocalanus longicornis* (Giesb.).

The ♀ is from 1·14—1·2 mm. and possesses the characters of the genus, but is at once distinguished from other species by the great length of the anterior antennæ, which reach beyond the end of the furca by 5 joints. The front of the head is rounded, but there is a strong dorsal hump or swelling on the 1st cephalothoracic segment about on a level with

the mouth. There is a distinct attempt at articulation between the head and 1st thoracic segment, and the 5th (last) thoracic segment is also partially divided.

The abdomen of 4 segments has the genital segment broader than long, and as large as Ab. 2 and 3, laterally swollen and protuberant ventrally, the largest and longest joint of the abdomen, the anal segment, is nearly twice as long as the third, the furcal segments twice as long as broad and symmetrical. The innermost tail bristle is short, the outermost still shorter.

In the posterior antenna the exopodite is a little shorter than the endopodite, the 7th (last joint) longer than exop. 1 or exop. 2 and than exop. 2—6. The end. 1 is nearly twice as long as end. 2. The anterior foot-jaw has the 4th and 5th lobes larger than the others, the endopodite short, but distinctly 3 segmented, the hook bristle on lobe 4 longer and thicker than that on lobe 5. The posterior foot-jaw has a broad first basal, with strong hump on the distal inner margin, the 2nd basal nearly three times as long as broad, the endopodite as long as the 1st basal, and longer than the second basal. The dorsal bristle of the 4th joint (exop.) is short (= the dorsal bristle of exop. 5). Exop. 5 has 4 bristles, the middle one the longest, and only the posterior bristle feathered. Only the proximal bristles of the 3rd and 4th joints are feathered; the two proximal bristles of the 2nd joint, and all three of the 1st joint are feathered. All the bristles of the 1st and 2nd basals are feathered.

The swimming feet are segmented as indicated in the generic characters. The 1st basal of the 1st pair is strongly convex on the inner margin, and without inner bristle, the surface covered with short prickles, haired on the inner margin and with a few stiff short bristles on the proximal part of the outer margin.

The 2nd basal is also strongly convex on the inner margin with a strong coronal of spines distally, and short stiff hairs on the inner margin with a long inner bristle.

The basals of the other feet are less convex than in the first pair. The first joints of both exop. and end. are small. In the 2nd pair the external margin of exop. 1 has a corona of spines distally and externally, exop. 2 has 4 or 5 sharp teeth in the middle of the outer edge, and the spine of the distal outer margin is comparatively long, the surface is distally armed with a corona of spines. The last joint of the exopodite is divided into two nearly equal portions by the marginal spine, and both proximal and distal portions are armed with marginal teeth. Both the basals and the exop. 3 are armed on the surface with short prickles.

The 3rd feet have the external distal spine of exop. 2 large, with shorter spines internal and external to it. The whole outer margin of exop. 2 and the distal only of exop. 3 is armed with teeth. The surfaces of the segments of the exop. are armed with spines, those in exop. 2 in two rows, and in exop. 3 with a number of short prickles. The surface of end. 2 has a series of long sharp spines on the surface, and the end. 3 a few short surface spines. The terminal saw of this foot is only about three-quarters the length of exop. 3. The basal joints, especially the first, are armed with coronals of spines on the distal surface and smaller spines proximally.

The 4th feet in general resemble the 3rd, but are longer. The exop. 3 has coarse teeth along the proximal external margin, and along the distal margin a few fine teeth only. The segment is divided, proximal : distal :: $9\frac{1}{2} : 8\frac{1}{2}$. See Pl. XCVII. figs. 1, 6, 11, 12, 13, 22.

The ♂ with a length of ·9 mm., of which several examples occurred resembling the figure, has a 5th foot only on the left side, consisting of 4 segments with relative proportionate lengths of 5 : 2¼ : 3 : 6; the distal and largest joint with 3 very rudimentary marginal spines and one terminal bristle five-sixths as long as the last segment. This foot is as long as the abdomen, and nearly as long as both basals of the two proximal endopodite joints of the 4th foot. The head is only partially segmented from the 1st thoracic segment, and the large 4th abdominal segment is only partially and dorsally segmented. The mouth organs are not retrograded, and these and the 1st to the 4th pair of feet resemble the same organs in the female. Probably this is a not quite mature ♂, but the single long left foot is more robustly built than the same (rudimentary) structure occurring in any adult female. Pl. XCVII. figs. 23, 24.

A ♀ of this species, of length 1·1 mm., possessing an abdomen with distinct genital swellings, with anterior antennæ exactly resembling *Ac. longicornis*, and with the 1—4th pairs of feet also exactly the same, had one (left) 5th foot, of 4 segments, the relative proportions of which were 3 : 2 : 2½ : 3 (distal), with a fine short terminal bristle only half as long as the end joint. The whole foot was very short and only as long as the 1st basal joint of the 4th foot. The appearance of the abdomen and of the genital segment so clearly indicate the ♀ sex of this animal, that it must be concluded that the ♀ *Acrocal. longicornis* occasionally has a rudimentry left 5th foot.

27. *Acrocalanus monachus* (Giesb.).

This species is very briefly described by Giesbrecht. Many examples occurred in Mr Gardiner's collection, and agreed in length with the measurements given by Giesbrecht, viz. ·91—·92 mm. It is a very much smaller animal than any of the other species, and is at once recognisable by the peculiar shape of the head, which is produced anteriorly, and forms a sort of hood. In the dorsal aspect the cephalon is very narrow as compared with the rest of the cephalothorax. There is in this species no trace of division of the head and Th. 1, and very little dorsal hump. The anterior antennæ reach beyond the end of the furca only a little, at most two or three joints. Essentially there is no difference in the structure of mouth organs or feet, from *Ac. longicornis*, except that the marginal teeth of the exop. 3 are coarser in structure, the number of marginal and superficial spines and teeth on the exopodites of the 2nd and 3rd feet is greater, and the teeth are rather coarser. The distal margin of the exop. 3 of the 4th foot has 10 rather coarse teeth of the same character as the 16 teeth on the proximal margin of the same foot. In the posterior foot-jaw the bristles of the 1st and 2nd basal and the first joint of the endopodite are feathered. All the rest are naked. The 1st joint of the endopodite of the posterior antenna has a more pronounced external swelling than in the type species. Otherwise there appears to be little difference in the structure of the appendages from those of *Ac. longicornis*. See Pl. XCVII. fig. 49.

♂s of this species occurred in this collection, but as in the case of the previously described species, none of them were probably mature—one however is figured on Plate XCVII., with one fifth foot only on the left side reaching beyond the distal end of the third abdominal segment. The anal segment, which is nearly as long as the proximal three abdominal segments, and the unretrograded condition of the oral organs are probable indications of sexual immaturity. See Pl. XCVII. figs. 27, 28.

28. *Acrocalanus gibber* (Giesb.).

The animal is comparatively small (♀ 0·93—1 mm. in length), and is more compact than the other species. The head is rounded anteriorly and has a strong dorsal hump, and there is a distinct though partial indication of segmentation between the head and 1st thoracic segment. The greatest breadth of the thorax is to the length in the proportion of $5\frac{1}{2}$: 13; the proportion of the cephalothorax to abdomen is 14 : 4. The genital segment is the largest, with very prominent ventral swelling. Ab. 2 and 3 are small, the anal segment larger than either; the furca, as in other species, twice as long as broad.

The anterior antennæ do not reach the end of the abdomen. The mouth parts resemble the other species of the genus, but the outer tooth of the mandible is perhaps more set back and more below the level of the other teeth, and there is a wider space between this and the next inner tooth.

The swimming feet have the general characters of the genus, very closely resembling *Ac. longicornis*, and not so heavily armed with surface spines as *Ac. monachus*. The marginal teeth of the 2nd, 3rd and 4th feet (exop. 3) are very coarse and strong, and the distal part of the 3rd exop. of the 4th feet is also armed with strong teeth, instead of the fine teeth of *Ac. longicornis*.

The first impression given by the general appearance of this animal is that it is a smaller example of *Ac. longicornis*, but the examination of a large number of examples has convinced me that Giesbrecht was quite correct in assigning to it a different specific rank. Fully adult females show constantly comparatively shorter anterior antennae and segmentation of the 1st cephalothoracic segment, a more compact and robust body and smaller size, as well as coarser teeth on the margins of the feet segments. Pl. XCVII. fig. 38.

Several apparently immature males occurred in this collection.

29. *Acrocalanus gracilis* (Giesb.).

This species is at once distinguished from the others by its larger size, anterior antennae only a little extending beyond the end of the furca (by about 2 joints), rounded shape of the head, continuous curve of the 1st thoracic segment without any dorsal hump, and with no trace of segmentation of the head and 1st thoracic segment. The average size of the females is 1·3—1·4 mm.; the abdomen is one-third the length of the cephalothorax. Of the abdominal segments the genital is not as proportionately large as in the other kinds; and the furcal segments are not twice as long as broad. The mandibles and posterior antennæ resemble those of *Ac. monachus*, the anterior foot-jaw also, except that there are short stiff marginal bristles on the 3rd, 4th and 5th lobes, and a stout dorsal feathered bristle on the margin of the second basal joint. The posterior foot-jaw resembles that of *monachus*, but the bristles of the 1st basal are stouter and longer.

In the 1st feet the second basal is more convex than in *monachus*. The marginal teeth of the last joint of the exopodite of the 2nd feet are strong (6 proximal, 5 rather shorter, distal). The 3rd foot is very similar to that of *Ac. longicornis*, the marginal teeth of the exopodite the same, but a few more spines on the first basal joint. The 1st basal of the 4th feet is more convex than in *longicornis*, and there are more spines distally; there are two rows of long spines on the exop. 2, and a few scattered spines on exop. 3; none on the surfaces of exop. 1, 2 and 3, and none on the second basal. The marginal teeth of exop. 3 are on the proximal portion more numerous and smaller than on the distal part. The 5th

feet are absent, but the short stumps, which in this genus represent the rudiments of feet, are in this species a little larger than in the others.

Just as in *Acrocalanus longicornis*, I have met with occasional examples in this species of females with a rudimentary left 5th foot, of three segments, the whole foot not as long as the first basal joint of the 4th pair. These examples agree entirely with the type species of *Ac. gracilis* and are undoubted females, the genital segment being well developed with prominent genital orifices. See Pl. XCVII. figs. 2, 7.

The ♂ of *Acrocalanus gracilis* is of size of 1·09—1·14 mm.; the cephalothorax ·83 mm., the abd. ·30 mm.; the head is rounded, there is no dorsal hump, but, as in other males of this genus, there is partial segmentation of the cephalon and 1st thoracic segment. The anterior antennæ reach beyond the furca by about 2 joints, and are of 25 distinct segments. The abdomen consists of 5 segments, the 4th and anal not however clearly separated throughout, the anal segment the longest, the furcal segments are larger than broad (as 5 : 3), and rather divergent.

The feet resemble those of the female, but the external spines (distal spine of exop. 2 of 2nd feet, marginal spine of exop. 3 of the 3rd joint) are the largest. Otherwise there is no difference essentially in the feet of the two sexes. The 5th pair is represented as in other ♂s of this genus by one (left) foot, of 4 segments, the distal the largest, ending at the inner distal margin in a short curved spine; there are two rudimentary spines on the outer margin of this segment, and the marginal terminal spine of the end segment is much shorter than the bristle of the ♂ of *Ac. longicornis*. The ♂ of this species is distinguished from that of *monachus* by the shape of the head, and from those of *longicornis* and *gibber* by the absence of the dorsal hump. Probably however the ♂ described is not quite mature. Pl. XCVII. figs. 25, 26.

30. *Acrocalanus Gardineri*, nov.

Many examples occurred in Mr Gardiner's collection of an adult ♂ of this genus.

♂, length 1·25 mm. (cephalothorax ·9 mm., abd. ·3 mm.); the abdomen is therefore only one-third the length of the cephalothorax. The latter comprises five segments. The head is oval, ending in a 2-pointed rostrum. The curve of the back is continuous, and there is no dorsal hump. The head and 1st thoracic segment are united. In the abdomen, distinctly of 5 segments, the 2nd segment is twice as long as the 1st, and the anal a little longer than the furcal segments. The latter are longer than broad (as 5 : 3), each with four bristles, and the segments very divergent. The anterior antennæ do not reach much beyond the end of the trunk, the basal joints are very thick and many joints are coalesced, 18 only being clearly marked.

The posterior antennæ have an exopodite with 5 marginal bristles, but the last joint has no bristles on the end of the segment, appearing only as a short stump; the last joint of the endopodite bears distally 6 + 5 bristles. Both rami are nearly equal in length.

The mandibles have a well-developed palp, but no trace of a masticatory plate, the exopodite of five segments, the endopodite of two, the 1st longer than the 2nd.

The maxilla is retrograded. The exopodite is well developed, but the inner lobes are rudimentary and without bristles. The endopodite has only two weak bristles, and the 1st outer lobe 5 long bristles.

The anterior foot-jaw is reduced to a small stump. The posterior foot-jaw, on the contrary, is well developed. The 1st basal is a little longer than the 2nd, and the latter is as long as the endopodite (proportions B 1 : B 2 : End. :: 8·5 : 6·5 : 6·5). There is a long feathered bristle dorsally on exop. 4 (as long as the whole foot-jaw), a shorter and thinner dorsal bristle on exop. 5, and the dorsal terminal bristle of this segment is the shortest of the three recurved dorsal bristles. The ventral bristles of this limb are all short, and the proximal ones feathered.

The 1st feet have the end joint of the endopodite with 5 bristles, and the proximal portion of the exop. 3 is toothed with rather coarse teeth.

The 2nd feet have the exop. 1, 2 and 3 each ending in a sharp spine distally on the outer margin: the last joint has 6 bristles, the last joint of the exopodite is divided by the marginal spine into two portions, proximal and distal respectively, in proportions of 8 : 6, and the terminal scalpel-shaped bristle has an undentated edge, rather curved tip, and is shorter than the end segment.

The 3rd feet have the last joint of the exopodite divided in the proportion of 9 : 8, and both proximal and distal margins (externally) armed with coarse teeth, rather finer in the distal portion. The terminal bristle is three-fourths the length of the segment.

The 4th feet have the external margin of exop. 3 divided in proportions of 8 (distal) to 11 (proximal), both portions with strong teeth.

The 5th foot (left side only) is of 5 distinct joints: the 1st basal a little shorter than the 2nd, but the latter is capable of a considerable degree of flexion, and, in nearly all examples seen, this joint, along with the three terminal joints, is flexed at right angles to the 1st basal. All the segments are of nearly equal length, the last segment bearing a short terminal bristle and a rudimentary spine on the external margin, and the penultimate segment ending at the outer distal margin in a short strong spine.

With strongly marked sexual characters it does not seem possible to identify the animal with other known species of *Acrocalanus*, especially as it differs greatly from other though possibly immature males met with. The 2nd—4th feet have the endopodites and basals especially spinous. See Pl. XCVII. figs. 5, 10, 14, 15, 16, 17, 18, 19, 20, 21.

[Since writing the above I have compared it with the description given by Prof. Cleve of his new Malayan species *Ac. pediger*. They appear to be distinct. The 5th feet of the latter alone are quite sufficient to prove this, being, in the ♂ of *pediger*, a pair, the right foot half the length of the left.]

Gen. *Bradyidius* Giesb.

31. *Bradyidius armatus*, ♀. Giesb. *Zool. Anz.* v. 40. *Tierreich*, p. 32. *Pseudocal. armat.* Brady, *Cop. Brit. Isles*. *Bradyanus*, Vanhöffen, *Zool. Anz.* v. 20. *Undinopsis*, Sars, *Crustacea of Norway*.

The occurrence of this copepod in Mr Gardiner's collection is remarkable, for it has as yet been known only as a species of strict northern habit. A very careful comparison of the only two examples from the Maldives with those taken by me in the Faroe Channel and in the neighbourhood of the Shetland Islands, reveals no essential points of difference. The northern species is about 2·4 mm. in length, those from the Maldives are only 1·2 mm. in length. Beyond this difference in size, and the fact that the terminal saws of the feet are

armed with teeth, which are fewer in number and rather coarser in structure, there is no essential difference between the specimens from the two localities. These are not, however, points of sufficient specific importance to justify creating a new species. Should this, however, be thought desirable the name *Bradyidius tropicus* might be suggested. While at Naples in April, 1902, Dr Giesbrecht showed me an example of *Bradyidius* taken in the Mediterranean, which I compared with my Faroe Channel specimens, with which it was identical, except that the saws of the swimming feet were armed with fewer teeth. A connecting link is thus formed between the extreme North and the Indian Ocean, and it is probable that the distribution of this copepod may be found eventually to be much wider than has been thought, especially when captures are made with the tow-net near the bottom of the sea; for it is distinctly, as Sars has pointed out (*Crust. of Norway*), a bottom species. I find it occur not uncommonly in samples taken by scraping the bottom with a specially devised triangular-shaped net frame, while only occasionally in captures made by the tow-nets which have not scraped the bed of the sea.

Gen. *Euchirella* Giesb.

32. *Euchirella bella*, var. *Indica* (Giesb.). 1888, *Atti Acc. Lincei Rend.* Ser. 4; 1892, *F. u. Fl. Neap.* v. 19.

Several examples of this species occurred in Mr Gardiner's collection. The average size of the fully developed ♀ was 3·5 mm. The cephalothorax is nearly 5 times as long as the short thick abdomen. The broad head carries in front a strong one-pointed rostrum. The last thoracic segment has rounded edges. Of the swimming feet, the 1st has a one-jointed endopodite and two-jointed exop.; the 2nd pair a one-jointed endopodite; the 3rd and 4th pairs 3-jointed endopodites; and the 2nd, 3rd and 4th pairs 3-jointed exopodites. The first basal joint of the 4th pair have on the inner margin 4 stout spines, and this character differentiates this 4th pair from the corresponding foot of any other *Euchirella*. The inner branch of the posterior antennæ is very rudimentary, not more than a quarter of the length of the exopodite. The latter carries distally 5 + 5 bristles. In other respects the animal agrees with *Euchirella bella* as described by Giesbrecht. The description of this species is, however, not very detailed, and I do not feel sure that the Maldive examples agree entirely with Giesbrecht's species. The proportion of the abdomen to the cephalothorax is perhaps a little different (Ct. = 3·03 mm., Ab. = ·62); the bristles of the endopodite of the posterior antennæ differ (being 5 + 5, instead of 6 + 5 of *E. bella*); and the character of the spines of the 4th feet. These do not spring directly from the margin of the 1st basal joint, but are at the distal end of a short stalk which springs from the joint (see the figure).

The maxilla, though in general resembling that of *E. messinensis*, has an exopodite with only 9 bristles instead of 11.

The 2nd pair of feet have the external spines of the second joint of the exopodite much longer and thicker than the spines of the 3rd joint, and the 1st and 2nd basals of the 1st pair have on the inner margins each a tuft of long and rather broad hairs, midway in character between hairs and the lamellar processes of a *Gaidius*. See Pl. XCVII. figs. 17, 18, 19, 20.

I have met with one ♂ specimen in which the 5th feet are evidently rudimentary, and the animal is therefore only a young example. The male of this species is hitherto unknown.

In one example, evidently that of a young female, there is the curious condition of the tail bristles found in *Calanus valgus* and *Paracalanus aculeatus*. All the hairs of the right side are branched in a manner similar to those previously described.

The process of the 4th foot and the bristling of the posterior antennæ may be sufficient to justify this animal as a different species from Giesbrecht's *E. bella*.

Gen. *Euchæta* (Philippi).

Three species of *Euchæta* are common in the Maldive collections, two of which may be referred to recognised species, while the third does not appear to entirely agree with any described species. As in other Euchætas the most constant characters in the females are to be found in the shape and outgrowths of the genital segment, and the structure of the 1st and 2nd pairs of feet.

33. *Euchæta marina* (Prestand, 1833). Giesb. *Fauna u. Fl. Neap.*; Claus, *Freileb. Cop.*

E. wolfendeni
McScott 1909
P69

This species in the Maldive Archipelago is not quite identical with the Mediterranean species described by Giesbrecht, but the differences are only such as to distinguish it as a variety. See Pl. C. figs. 7, 8, 10, 11, 17, 18.

♀. Size 3·3 m.: last thoracic segment with rounded margins, with short bunches of hairs, cephalothorax 2½ times as long as the abdomen, the latter having the genital segment not quite as long as the two succeeding segments; the anterior antennæ in length reaching a little further than the end of the genital segment.

The genital segment is without any dorsal hump, but not symmetrical, being more swollen on the right side, but this swelling does not occupy the whole length of the segment. The genital opening occupies the upper half of the segment and is guarded by two vulvar flaps, of which that on the right side extends rather lower than that of the left side.

The exopodite of the first foot is concave above, convex below on its external margin, the distal seta of the first joint about half as long as the second joint.

In the second pair the external marginal spine of the 2nd exopodite segment reaches to the base or a little beyond it of the first external spine of the 3rd joint, the 2nd spine of this segment is long with an outward bend, and reaches nearly to the end of the segment.

The posterior antenna has a prominent bulging of the external margin of the 1st joint of the exopodite; the outer margin of the first basal of the anterior foot-jaw is rather convex, the maxilla has a first outer lobe with four long and one short (5 in all) bristles, the endopodite 2nd joint with 4 bristles.

The whole of the chitin covering of the thorax with the exception of the fore part of the head is densely covered with short prickles, long hairs in bunches on the last segment, dorsally and marginally, and bunches of long hairs on the abdominal segments.

The adult females have egg-sacs attached with 10—18 eggs.

The 5th feet of the ♂ present only slight differences from those figured by Giesbrecht (*F. u. Fl. Neap.* v. 19), which may be seen on comparing the two figures. See Pl. C. figs. 19, 20.

The ♀ differs from Giesbrecht's species chiefly in the greater length of the anterior body in proportion to the abdomen, and shorter length of the anterior antennæ, and the denser covering of the chitin with small spines or prickles.

34. *E. marina*, var. Pl. C. fig. 9.

Size 3·3 mm. Cephalothorax 2½ times as long as the abdomen. Anterior antennæ reaching about the middle of the genital segment. The latter as long as the two succeeding joints, swollen on both sides but mostly on the right, without dorsal swelling, not possessing the distinct vulvar flap of *E. marina*, and carrying an egg-sac with 16—18 eggs. Oral organs like *E. marina*. 1st and 2nd pairs of feet like *marina* except that the marginal spine of the exopodite is rather longer, reaching the end of the spine above.

Densely clothed with long hairs over the abdominal segments and margins of the last thoracic segment dorsally, and the chitin very prickly.

35. *Euchæta concinna* (Dana). Giesb. *Fauna u. Fl. Neap.* v. 19. = *E. concinnoides* Sewell, 1947

♀, 2·75—3·0 mm. long. Cephalothorax more than twice as long as the abdomen, the former nearly three times as wide as long, the latter 4½ times.

Anterior antennæ not reaching to the end of the 2nd abdominal segment. The genital segment longer than the three succeeding segments, the four tail bristles of equal length, the two long ones much thicker than the others. The last thoracic segment prolonged on each side, but on the left much more than the opposite side and ending in a blunt rounded process. The thorax is not covered with such dense or prominent prickles as in the last species, and there are only a few hairs on the last thoracic segment; the abdomen is covered with short prickles, and each segment is haired.

The genital segment is characteristic, and possesses a hump on the dorsal surface, a strongly projecting flap on the right side, the lower margin of which is armed with short blunt spines, and a larger and more ventrally projecting flap on the right side.

The posterior antenna has the first segment of the exopodite with an external bulge as in *E. marina*, and the shape of the basals of the anterior foot-jaw is the same as in this species. The posterior foot-jaw in general resembles that of *E. marina*. The first outer lobe of the maxilla possesses 6 bristles instead of 5 as in *E. marina*.

The feet are characteristic. In the 2nd pair, the external marginal spine of the 2nd exopodite joint is the longest of all the marginal spines, reaching the tip of the spine above it. The two proximal marginal spines of the exop. 3 are of similar size, the segment is divided by the deeply incurved cleft into two equal portions.

The external margin of the exopodite of the 1st pair is rather concave, the bristle on the 1st joint and very thin, and does not reach the distal margin of the last segment. See Pl. C. figs. 1, 2, 3, 4, 5, 6.

There is little doubt that this species is identical with the *E. concinna* of Dana and with Giesbrecht's description.

36. *Euchæta indica* (nov. sp.).

♀, 2·31 mm. long, the cephalothorax 2⅓ times as long as the abdomen. The division of the head from the thorax is in this species scarcely distinguishable, the last segment of the thorax possesses unequal rounded margins, a rather prominent ventral projection on

the right side, and the whole thorax, except the front part of the head, is densely covered with small prickles.

The anterior antennæ are longer than the thorax, reaching about the end of the genital segment. The latter is as long as the next succeeding segments and about half the furca, and is asymmetrical, being more swollen on the right side, with a slight rounded protuberance of this side at the distal margin. The genital opening is protected by a ridge of chitin above and below, and a pair of prominent cushions.

There is only very slight swelling of the upper part of this segment on the left side, and no dorsal swelling. The abdomen is covered with short hairs.

The oral organs are like those of *E. marina*, the maxilla having a first outer lobe with 5 bristles, the proximal the longest, the distal the shortest; the anterior foot-jaw has the basals scarcely convex.

The 1st pair of feet have the external margin of the exopodite nearly straight, the spine of exop. 1 as long as the terminal segment. The 2nd pair have the external marginal spine of exop. 1 stout and reaching beyond the base of the spine above it: the second marginal spine of exop. 3 as long as the distal portion of this segment.

The species is therefore very different from *E. marina*, in the proportions of the genital segment and its structure, and especially in the anatomy of the second pair of feet, in the proportionate length of the antenna &c., and from *E. concinna* in the form of the genital segment and the structure of the 2nd pair of feet especially.

A good many females were found, each bearing an egg-sac with 6—10 eggs. Pl. C. figs. 12, 13, 14, 15, 16.

Gen. *Phaenna* Cls.

37. *Phaenna spinifera* (Claus).

Only very few examples of *Phaenna spinifera* (Claus) occurred in this collection and these were not quite adult females for the most part, only one, of a length of 1·9 mm., being mature. It differed in no way from the Mediterranean species. Probably it is not of frequent occurrence in the Indian Ocean.

Gen. *Scolecithrix* Brady.

38. *Scolecithrix danae* (Lubbock). *Tr. Ent. Soc. London*, Vol. IV. p. 15.

Identical with the Mediterranean and Atlantic species, it occurs in considerable abundance in this collection.

Gen. *Mecynocera* Thompson.

39. *Mecynocera clausi* (Thompson). *Journ. Linn. Soc.* Vol. XX. 1888.

This extremely characteristic species, which appears to be of world-wide distribution (Mediterranean, Atlantic and Pacific Oceans between 30° N. and 3° S.[1], and lately recorded by the writer from the neighbourhood of the Irish coast in lat. 52° N.), occurs only sparingly (two or three examples only) in this collection. In the report upon the Ceylon Copepoda

[1] Giesb. and Schmeil, *Das Tierreich*, p. 23.

by Thompson and Scott[1], it is mentioned as occurring "throughout the Indian Ocean," and it is evident that its distribution is of much greater range than hitherto supposed. The Maldive examples are identical with the northern.

Gen. *Haloptilus* Giesb.

40. *Haloptilus longicornis* (Claus).

Of the two species of this genus which occur in this collection, the above is of wide distribution, occurring in the Faroe Channel and Atlantic, and West of Ireland (Wolfenden), the Mediterranean and Pacific Ocean (Giesbrecht), and now recorded from the Indian Ocean. It is rather singular that it should not have been recorded in the list of Ceylon Copepoda of Thompson and Scott, considering its very frequent occurrence in the Maldive collection.

The animal is distinguished by its very long anterior antennæ, which are longer by the last 9 or 10 segments than the whole body, and the last segment of which is invariably, in all the specimens I have seen from the Atlantic and Indian Oceans, coloured a bright chlorophyll green; by the median papilla instead of a pointed process of the head, and by the anatomy of the maxilla (endopodite of 2 segments bearing 5 bristles, exopodite with 6 bristles). The size of the adult female, 2·2 mm., agrees with that of the Mediterranean and Atlantic examples.

In the *Challenger Report* Brady very briefly mentioned a species which he named *H. orientalis*. The description however occupied only four lines of text, but a comparison of the six figures given in the Plates IX. and X. with some of the Maldive specimens leads me to the conclusion to which Giesbrecht (*F. u. Fl. Neap.*) has already arrived, that Brady's species is only the young and immature form of *H. longicornis* (Claus). In many of these examples there occurs (as in Brady's species) a pair of 5th feet in which the endopodites and exopodites are respectively only of two segments, but which animals differ in no respect except in size, and the apparently immature nature of the genital segment, from other and larger mature specimens of *H. longicornis* which occur in the same gatherings. *H. longicornis* of the Maldives does not differ in any essential particulars from the more northern species.

41. *H. spiniceps* (Giesb.). *F. u. Fl. Neap.* Vol. XIX. p. 384.

Two adult and one immature females of this beautiful species occurred in Mr Gardiner's collection.

The essential differences between the Maldive and the Mediterranean examples are in the structure of the posterior antennæ and the 3 bristles in place of 2 of the maxillary endopodite. In all other particulars the species are identical. See Pl. XCVI. fig. 45.

Gen. *Pleuromamma* Giesb.

42. *Pleuromamma abdominalis* (Lubbock). Giesb. *Fauna u. Fl. Neap.* Vol. XIX.

The species shows no essential difference from the Mediterranean examples described by Giesbrecht (*F. u. Fl.* Vol. XIX.). See Pl. XCVI. figs. 28, 29, 30.

43. *Pleuromamma indica* (nov. sp.).

Very closely resembles *Pl. abdominalis*, but is constantly smaller in size, the largest examples only 2·5 mm. in length (varying between 2·3—2·5 mm.). The cephalothorax is nearly 2⅓rd times as long as the abdomen (Ct. 1·65 mm., Abd. ·75 mm.).

All the female examples referred to have a well developed genital segment ventrally enlarged, and with deeply black pigmented vulvar papilla. This segment is as long as the two succeeding segments and half the furcal, thus much larger than in *Pl. abdominalis*. The furcal segments are twice as long as broad.

The anterior antennæ possess short teeth only on the 1st and 2nd (coalesced) joint, and also on the 4th, 5th and 6th segments. These teeth are however much smaller than those of *Pl. abdominalis*, and no recurved tooth is ever present. The 17th joint is longer than the 16th (the reverse of *Pl. abdominalis*), the 7th is not so distinctly coalesced with the 8th, and the 9th and 10th are distinctly separated.

The posterior antennæ, maxillæ, mandibles and anterior foot-jaws resemble the same organs in *Pl. abdominalis*, the posterior foot-jaw resembles that of *Pl. robusta*.

The swimming feet resemble those of *Pl. abdominalis*, only that the cleft distally on the exop. 1 of the 3rd pair and the thumb-like extension of the joint are comparatively larger; the endopodite of the 4th pair has the first two segments without the bulging of the outer margins, and with nearly parallel margins.

The head is without process in front, and the pigment ocellus is placed either on the right or the left side.

The species therefore differ from *Pl. abdominalis*,

(1) in the constantly smaller size of adult females;

(2) in the absence of recurved teeth on the anterior antennæ and longer 17th joint, and less fusion of the basal joints;

(3) in small differences in the structure of the feet.

The ♂ of this species is 2·0—2·05 mm. in length, the pigment spot is on the left side, and the geniculating antenna always on the right side. In the latter the first and second joints are coalesced, the 7th, 8th and 9th, the 12th and 13th, the 17th joint (i.e. the one before the elbow joint) is only half the length of the next, and the 24th is coalesced with the 25th.

The 17th segment is armed with a row of short teeth, which also occur on the proximal part of the 18th, on which are two spines directed forwards, the distal one comparatively long. The left antenna resembles that of the ♀, with short teeth, not recurved, on the first, none on the 3rd, and very short teeth on the 4th and 5th segments, four aesthetasks on the basal joint, a pair on the third, and doubled as far as the 13th segment, after which they are single.

The furcal segments are very divergent, and both 2nd feet are notched, thus differing from *Pl. abdominalis*.

The 5th feet resemble in general those of *Pl. abdominalis*, the bird's head process of the left foot however more erect and not so wide and without any hairs on the external margin, the short segment proximal to this with a strong upward curved spine, the next

segment with a short straight spine, the 2nd basal segment with inner margin haired. The right foot is like that of *Pl. abdominalis* but more slender.

The chief points which distinguish this male from *Pl. abdominalis* are the characters of the anterior antenna (no strong or recurved teeth), the notching of both 2nd feet, and the slenderer 5th feet, also the much smaller size of the whole animal.

From *Pl. robusta* the anterior antennæ are strikingly different, in the possession of small straight teeth, and in being only half the size, though agreeing in the notching of both pairs of 2nd feet. From *Pl. gracilis* the notching of these feet, and especially the structure of the 5th pair in the ♀, the right geniculating antenna, the left-sided pigment ocellus, and 2nd feet are quite distinctive. See Pl. XCVI. figs. 24, 25, 26, 31, 32, 33.

[For the purpose of comparison, figures 34, 35 and 36 of *Pleur. robusta*, from the Faroe Channel, are included in Table I.]

44. *Pleuromamma gracilis* (Claus, *Freileb. Cop.* p. 197; Giesb. *Fauna u. Fl. Neap.* Vol. XIX.).

This is a common species in the Maldive collection.

45. *Pleuromamma ziphias*, Giesb. *F. u. Fl. Neap.* Vol. XIX.

This species occurs sparingly in the Maldive collection. In Giesbrecht's short description of the species, no mention is made of the peculiar character of the 1st pair. The distal margin of the outer half of the 2nd basal carries two spines, the external one very small, the inner one in the form of a curved upright tooth, broad at the base, situated at the articulation of the 1st joint of the exopodite with the basal.

In size the ♀ is from 4·45—4·50 mm. Males were not found. See Pl. XCVI. figs. 27, 37, 38, 39.

Gen. *Lucicutia* Giesb.

46. *Lucicutia flavicornis* (Giesb.).

Average size of the ♀ 1·43 mm.; of the ♂ 1·30 mm. The species occurs with frequency in the Maldive seas.

Gen. *Heterorhabdus* Giesb.

47. *Heterorhabdus papilliger* (Giesb. and Claus).

Occurs sparingly in this collection.

Gen. *Candacia* Dana.

48. *Candace catula* (Giesb.). *Atti Acc. Lincei Rend.* Ser. 4, and *Fauna u. Fl. Neap.* Vol. XIX.

A number of specimens were found, in size reaching to 2·0 mm. and slightly over, but in these the last thoracic segment was produced into rather more acute points, the ventral flap-swelling of the genital segment was more in the middle of the segment, and the 5th feet varied, inasmuch as there were only two bristles on the inner margin, not distally placed as in the type species, but about halfway up the last segment.

This animal, larger and more robust than the type species *C. catula*, occurred frequently, and may be distinguished as a variety of the type species *C. catula*, var. *similis*.

49. *C. curta* (Dana). *P. Amer. Ac.* Vol. II., and Giesbrecht, *Fauna u. Fl. Neap.* Vol. XIX.

50. *C. truncata* (Dana, and Giesbrecht, *Fauna u. Fl. Neap.* Vol. XIX.).

51. *Candace tuberculata*, nov. sp. = C. bradyi A Scott 1902 ? A Scott 1909 - but see Lawson 1973

♂ 1·9 mm. long. Cephalothorax twice as long as the abdomen, the latter a little unsymmetrical, and with a prominent swelling of the right side of the first segment, extending to the ventral surface, of a warty appearance, three-lobed, and with fine teeth, and a much smaller outgrowth of the right side of the 2nd segment. The right anterior antenna with 6 broad basal joints, the 12th, 13th, 14th and 15th segments swollen, on the 16th joint a row of short rather coarse teeth, a row of strong teeth on the 17th, and fine teeth on the 18th joint proximally. The elbow joint between the 17th and 18th joints. All the teeth pigmented, but none of the segments. The proximal hook of the middle segment of the anterior foot-jaw a little longer and three times as thick as the distal, and deeply pigmented. The 5th feet nearly equal in length, on the left side of three nearly equal segments and a distal lamellar-shaped segment placed at right angles to the others, strong and deeply coloured, and denticulated at the distal end of the 3rd segment. The right foot with the usual spoon-shaped claw and process. The third foot is constructed similarly to the fourth.

This *Candace* has most affinity with *C. catula*, from which it differs in the structure of the 5th feet, the anterior antennæ, and the curious tubercular outgrowths of the abdominal segments. It is also larger. Examples were very numerous in this collection. In a paper by A. Scott ("Some Red Sea and Indian Ocean Copepoda," *vide ante*) is described a species, *Candacia bradyi*, which may possibly be the same animal. Scott's description is of the briefest character—"in general appearance it resembles the male of *C. varicans* Gbt., but the terminal spines of the last thoracic segment are much smaller and the abdomen is slightly asymmetrical.... The chief difference is in the structure of the 5th pair of feet...which is practically the same as the fig. given by Prof. Brady (Pl. XXX.), Challenger Copepoda, but is quite different from the 5th feet of the ♂ of *C. pectinata*." Four figures are given in the accompanying plate. The characters of the abdomen which I have mentioned above are not referred to in Scott's paper, though they are so very characteristic that they could scarcely have been overlooked; and though his drawings of the 5th feet have great similarity with the same in this species there are small differences, especially in the length of the last segment of the left foot. I do not therefore feel assured that these species are identical, and I retain the name I had attached to the species before Mr Scott's paper came into my hands. See Pl. XCVI. figs. 40, 41, 42, 43, 44.

52. *Candace pachydactyla* (Dana), and Giesb. *Fauna u. Fl. Neap.* Vol. XIX.

This Copepod is very abundant in the Maldive collection.

Gen. *Centropages* Kröyer.

53. *Centropages gracilis* (Dana, *P. Amer. Ac.* Vol. II.; Giesb. *Fauna u. Fl. Neap.* Vol. XIX.).

This is very liable to confusion with *C. violaceus*. In general characters both are very similar, the most striking difference being in the structure of the ♀ abdomen, which in

C. gracilis has the genital segment very protuberant ventrally, armed with a knob bearing teeth, and in all Maldive examples with side knobs on the next segment, each bearing ventrally directed teeth, and a large central outgrowth also armed with teeth; between this and the lower end of the genital segment there is also a transparent rounded bladder-like outgrowth.

The anterior antennæ are longer than the whole body by about 5 joints; and without any teeth; of 24 segments, the 1st and 2nd clearly distinct.

The swimming feet have their rami each three-jointed, the 5th pair with the first joint of the exopodite with squarely-shaped inner margin in the distal two-thirds, with rather prominent knob at the proximal end; the long inner spine process of the 2nd exopodite not reaching to the end of the last exopodite joint, and with short bristles distally.

Size of ♀ 1·7 mm.—1·8 mm. See Pl. XCVIII. fig. 7.

The ♂ is 1·7 mm. long, with geniculating antenna on the right side, 2—3 joints longer than the body, of 23 joints, the geniculation between the 18th and 19th, the 17th, 18th and 19th with strongly denticulated upper margin.

AA.	13	14	15	16	17	18	19	20	21	22	23
	13	18	19	20	20	13	15	22	13	13	14

The 5th feet agree with the same feet as figured by Giesbrecht, and differ from those of *C. violaceus*.

It is somewhat curious that though *C. gracilis* occurs with frequency in the Maldives, *C. violaceus* appears to be absent, though mentioned by Scott as occurring "throughout the Indian Ocean." Described by Giesbrecht from the W. Mediterranean, while *C. gracilis* is a Pacific Ocean species, it is probable that the Indian Ocean species of Thompson and Scott is really *C. gracilis*, of which no description is given[1] by which it may be identified.

54. *C. calaninus* (Dana, *P. Amer. Ac.* Vol. II.; Giesb. *Fauna u. Fl. Neap.* Vol. XIX.).

The ♀ is distinguished from the allied species by the shortness of the anterior antennae (only as long, or a little longer, than the furca), the comparatively long anal segment (twice as long as the middle abdominal segment), and the asymmetry of the furcal segments. These are over four times as long as broad, the left one a little shorter and with more convex bend externally than the right segment. The right side of the anal segment has on the ventral surface a flap-like outgrowth in the lower part, appearing in side-view as a ventrally projecting outgrowth. The swimming feet have three segmented exopodites and endopodites, the 5th pair resmbling those of *violaceus* and *gracilis*, except that the spine on the inner side of the exop. 2 is more upright and longer, reaching quite to the end or a little beyond the distal margin of the exop. 3. The 1st joint of the exopodite has the same square inner margin with proximal knob, as in *C. gracilis*. Size 1·9 mm.

See Pl. XCVIII. figs. 6, 15.

55. *C. elongatus* (Giesb. *Zool. Jahrb. Syst.* Vol. IX. p. 322) is remarkably like *C. calaninus*, but differs essentially in the anatomy of the abdomen of the ♀, the furcal segments being quite symmetrical, the genital and succeeding segments without lateral knobs, the anal and

[1] *Report on Pearl Oyster Fisheries of Ceylon*, Copepoda.

middle abdominal segments about the same length. The anterior antennae are only one or two segments longer than the whole body.

The 5th feet resemble those of *C. calaninus*, the spine of exop. 2 being however not much longer than the end joint of the exopodite, and shorter than in *C. calaninus*. Size of the ♀ 1·54 mm.

The species is fairly common in this collection.

The ♂ is 1·8 mm. long, with geniculating antenna on the right side not quite reaching the end of the furca, of 23 joints, with elbow joint between the 18th and 19th.

AA.	12	13	14	15	16	17	18	19	20	21	22	23
	7	9½	13	14	15	13	14	13½	13½	8½	9½	10½

The 5th feet are quite characteristic (see figure). The conjoined 2nd and 3rd exopodites of the left foot appear to terminate in a hollow tube-like opening, guarded on each side by the fringed margins of the anterior and posterior chitinous surfaces. The female segments are quite symmetrical.

See Pl. XCVIII. figs. 6, 15.

56. *C. orsinii* (Giesb. *Atti Acc. Lincei Rend.* Ser. 4, Vol. v.; *Fauna u. Fl. Neap.* Vol. XIX.).

The last thoracic segment on each side carries on its rounded margin a small lateral point. The anterior antennæ are only about 4 or 5 joints longer than the cephalothorax. The 1st and 2nd joints of the endopodites of the first, second and 3rd feet are coalesced, those of the 4th pair partially fused. The abdomen is characteristic, the genital segment with a downward and forward projecting spine on the ventral surface, the anal segment much shorter than the middle abdominal segment, and the furcal segments only as long as the anal.

The 5th feet are different on each side; that of the right side with short, stout spines on the distal margin of the 2nd exopodite, directed nearly at right angles to the foot, and denticulated on the upper distal margin; that of the left side with a curved stout spine arising from the distal inner margin of the exop. 2, distally ending in three divergent spines.

Size of the ♀ 1·7 mm. Pl. XCVIII. figs. 5, 13.

The ♂ has the right antenna geniculating, of 23 joints, the 14th to the 16th joints very broad, the elbow joint between the 19th and 20th. The 18th, 19th and 20th joints with strongly denticulated upper margins, the 16th and 17th segments each with strong forward projecting spines.

The 5th feet of the left side with 2-jointed exopodite, strong marginal spine on exop. 2, and distal curved spine on exop. 3; the endopodite as long as the exopodite. The right foot with 3-jointed exopodite, long curved hook on the proximal inner margin of the exop. 2, the exop. 3 rather pyriform basally and produced into a curved spine like a Heterorhabdus foot. The 2nd basal of the right fourth foot has two singular curved processes, the thick proximal portion being much hardened and of almost calcareous feeling, with a short erect spine just distal to the process.

Size of the ♂ 1·54 mm. Pl. XCVIII. figs. 1, 4, 8, 11, 12.

C. orsinii occurs with frequency in this collection.

57. *C. furcatus* (Dana). Giesb. *Fauna u. Fl. Neap.* Vol. XIX.

The ♀, 1·6 mm., is distinguished by the prominent and deeply orange pigmented 'eye' on the ventral aspect of the head, the possession of strong hooks on the 1st, 2nd and 5th segments of the anterior antennæ, the length of these organs not reaching more than two to three segments longer than the whole body: the possession of external strong spine projection of the last thoracic segment extending beyond the end of the genital segment, and a second smaller spine internal to this. The abdomen has the genital segment and anal segment of about equal length, each more than twice as long as the short middle segment, the furcal segments equal in length, longer than the anal. The 5th feet are in general form like *calaninus*, *gracilis*, &c., but the spines of exop. 2 are much shorter than the exop. 3.

The ♂, 1·55 mm. long, has the right antenna of geniculating form, the elbow between the 18th and 19th segments, spines on the enlarged 15th and 16th joints very small or absent, the denticulations on the margins of 17th, 18th and 19th fine; the 19th segment (the one after the elbow joint) larger than the next two, and not quite twice as long as the 18th. The 5th pair of feet, on the right side with strong claw arising from the base of the exop. 2; exop. 3 a curved spiny process with short marginal spine; the exopodite of the left foot of only 2 segments, the distal much larger than the proximal, ending squarely and with strong apical external marginal spine, curved bristle on the inner margin and between them a broad-based conical spine, covered with short stiff bristles.

C. furcatus occurs with frequency in this collection.

Gen. *Labidocera* Lubbock.

58. *Labidocera acuta* (Dana). Giesb. *Fauna u. Fl. Neap.* Vol. XIX.

59. *Labidocera kröyeri* var. *similis* (*L. kröyeri*, Brady, *Challenger Report*, Copepoda).

♀, length 2·0—2·3 mm. Last thoracic segment with short spines on each side and with partial segmentation by a line on the anterior margin of the segment, but no trace on the back. Anterior antenna of 23 joints, a little longer than the cephalothorax. Head with side hooks and pair of dorsal lenses separated from each other by much more than the width of a lens, and a rather large ventral 'eye.'

Abdomen of 3 segments, very unsymmetrical.

G. S. : Ab. 2 : Anal :: 17 : 11 : 9 (dorsal aspect). Anal segment much shorter on the right side than the left. Furcal segments very unsymmetrical, the right much broader and longer than the left, each with 5 apical setæ and a dorsal short appendicular bristle. The bristle next to the innermost is the longest, and little more than half the length of the abdomen. The abdomen is beset with spines and bristles. The genital segment has on the dorsal aspect two very stout rather long spines (one on each side), the middle segment has warty outgrowths from the posterior margin, and the anal has two outgrowths, spiny or warty, from the right distal margin, and spiny outgrowths from the other side. The ventral side of the genital segment is armed at the distal margin with 6 short spines, two below the genital orifice, and in pairs, laterally there are no other spines. The whole surface, back and front, of the abdominal segments, is covered with short hairs and prickles, especially prominent being bundles of short stiff hairs on the middle segment.

The 5th feet consist of a pair of basal segments, and on each side an endopodite and exopodite, the former very short, not half the length of the exopodite, rather pyriform in shape and bifid at the apex. The exopodites of the two sides are rather different in length, that of the left side longer and thinner than the right, three very short marginal and an apical spine, and on the inner margin, two prominent spines distal of the centre. See Pl. XCVIII. figs. 22, 23, 33.

At first sight this Copepod appears to suggest identity with *L. kröyeri* (Giesb.). But very distinct differences are to be found in the anatomy of the furcal segments, the length of the anal segment (as long as the middle) and of the fifth feet. It does not either resemble Brady's *Pontella kröyeri* (which Giesbrecht has regarded as identical with *L. kröyeri*).

60. *L. Wollastoni* (Lubbock). *Ann. Nat. Hist.* Ser. 2, Vol. XX.

This animal is distinguished by the possession of extremely large dorsal 'eyes,' side hooks on the head, the abdomen of 3 segments, of which the genital segment exhibits a remarkable dorsal swelling, the furca similarly but less swollen. The last thoracic segment is prolonged on each side into rather long and at the tips slightly divergent spines. The 5th feet have very broad and long basals, and comparatively short exopodites and endopodites, the latter about three-fourths as long as the former, very conical, thick basally and ending in a distal point, without spines, the exopodite of similar shape but much larger, with two very small terminal teeth, but no marginal spines.

The ♂, 2·0 mm. long, has a characteristic pair of 5th feet. The 'bird's head' process of the right foot has a prominent tubercular outgrowth in the middle of the margin, a smaller one proximally with a seta, and a long broad based spine at the proximal end. The left foot, of two branches, has the outer unsegmented and ending in a strong curved tooth, the external margin strongly haired; the small inner branch of two segments distinctly with two marginal and one terminal spines.

The right anterior antenna, with short broad based process on the 17th segment, strongly denticulated margin on the next segment, the distally following joint with less prominent marginal teeth, the proximal of the three end joints with rather long spines distally, nearly as long as the next segment. Pl. XCVIII. figs. 17, 30, 31—35.

61. *Labidocera detruncata*, var. (*L. detrunc.*, Dana, *P. Am. Ac.* Vol. II.; Giesb. *Fauna u. Fl. Neap.* Vol. XIX.).

♀ 2·4 mm. long, without cephalic side hooks; dorsal eyes rather small, ventral eye very large and plum-coloured; large splashes of plum-coloured pigment in the lower part of the thorax. Abdomen of 3 segments, genital very large, anal very small, the former with prominent swelling dorsally in the lower part, and with ventral swelling, though much less. The genital orifice ventrally projecting and placed at the lower part of the segment, the dorsal swelling with several transparent tubercles projecting.

The last thoracic segment pointed on each side and projecting dorsally. Furcal segments of similar size, reniform, the right one on a higher plane than the left, with on each side one bristle with bulbous swelling at the base, the others less thickened. The anal segment with a conical swelling projecting downwards between the furcal segments. The 5th feet with strongly bent exopodite with rather long terminal spine, a shorter spine on the inner margin distally, the outer margin with 3 stout spines. The endopodite is short (about

one-third the length of the exopodite, very thick basally, conical and tapering to a point. See Pl. XCVIII. figs. 16, 19, 21, 34, 36.

This Copepod closely resembles either *L. detruncata* or *L. pavo*, and is difficult to identify with either of these.

Brady (in *Challenger Report*) has under the name of *Pontella detruncata* figured two pairs of 5th feet of females, the one of which on Pl. XLV. corresponds entirely with the specimen described above. Brady's figure of the abdomen is however quite different; probably his description is made up from more than one species.

A ♂, which is referred to below, appears to agree with Brady's *Pontella detruncata* ♂, but is larger than the female above described and the two are therefore probably not the same species. One female and three males only were found in this collection.

The female does certainly not entirely agree with Giesbrecht's description of *L. detruncata*[1], especially in the spinulation of the 5th feet, though it is more decidedly not identical with *L. pavo* Giesb.

The ♂ is 2·6 mm. long, with dorsal and ventral eyes, the right side of the last thoracic segment a little more produced than the left, abdomen of 5 segments, the tail segments not unsymmetrical or broadened. Right anterior antenna 17-jointed, the 9th, 10th, and 11th swollen, the 12th, 13th, and 14th segments bearing toothed or tuberculated upper margins, the elbow between the 13th and 14th segments. The left antenna 23-jointed. The geniculating antenna closely resembles Brady's figure of *P. detruncata*. The 5th feet are not so disproportionate in size as figured by Giesbrecht in *L. detruncata*, the 'bird's head' process is without processes or spines on its margin, the last joint of the left foot is haired all along one margin, and with four rather long but not bent processes on the opposite margin.

The animal is distinguished by a great deal of blue pigment especially colouring the antennæ and feet, the dorsal eyes are very large and close together, the ventral eye deeply pigmented and red-currant jelly colour.

62. *Labidocera minuta* Giesb. (*F. u. Fl. Neap.* Vol. XIX.).

♀ 2·0 mm. long. Head with small side hooks. The last thoracic segment produced distally on the right side and carrying a short spine directed forwards almost horizontally. The left side not produced and rounded without any spine. The dorsal eyes are comparatively small and close together. Anterior antennæ of 23 joints reaching beyond the end of the genital segment. The abdomen of three segments, of which the genital is much longer than the middle one, and the anal is very short. Furcal segments a little unsymmetrical, the right one a little broader than the left, and both about the same length.

The genital segment has a lateral swelling on the right side occupying the whole segment, and an outgrowth of the left side originating in its upper fourth. In the centre (of the ventral aspect) in its upper portion is a chitinous outgrowth of small size. The genital opening is situated at the extreme distal end of the segment. The middle segment has an

[1] *L. detruncata*, abd. 3-jointed, 'analdeckel' long, furca broad. Exop. of 5th foot with two points at the end. End. half as long as exop., thick conical. Size ♀ 2·25—2·58 mm. *L. pavo*, abd. 2-jointed, genital segment with median and right-sided outgrowths, furca broad kidney-shaped. Exop. of 5th foot with three points at the end, and two rather large points on the outer margin. ♀ 2·12 mm. (the endopodite of one side is only a small process of the 2nd basal, not articulating). Giesbrecht u. Schmeil, *Tierreich*; Giesbrecht, *F. u. Fl. Neap.* Vol. XIX. p. 457.

outgrowth occupying the right side and ventrally projecting, and the ventral surface of this segment is covered with small prickles and chitinous tubercles. The anal segments are a little asymmetrical and produced on the dorsal aspect over the corresponding right furcal segment. The tail seta next to the innermost is very long.

The 5th feet of the female have a broad based tapering exopodite ending in two rather deeply cleft upright points; the endopodite is in the natural condition in all cases bent outwards over the exopodite, is short, broad based, and ends in an apical spine and a rather shorter spine on the inner margin. Several specimens were found in this collection, and in all except one the whole abdomen was invested with a tough colourless membrane of irregular shape, resembling that described by Scott in his *L. darwinii* (*Tr. Linn. Soc.* Vol. VI. Part I. p. 84). Pl. XCVIII. figs. 18, 24, 25.

The ♂ is 1·54—1·6 mm. long. The last thoracic segment is produced on the right side into a long narrow process; the left side ends in a very much shorter process. Except for slight swelling of the left side of the 1st abdominal segment the abdomen is perfectly symmetrical.

The 5th pair of feet have the usual 'bird's head' process on the right foot, with a transparent rounded outgrowth of the inner margin with seta proximal to it, the first basal joint with a few marginal spines; the left foot of three segments has the last one haired marginally, and with a distal short spine and two terminal short broad processes.

The anterior antenna of the right side has the 17th joint with rather long, horizontally lying, and attenuated spine on the upper margin, the following joint with two rows of fine teeth on the upper margin, the succeeding joint the longest, with a row of fine marginal teeth, the most proximal of the distal three segments with short rather thick spine on the upper margin distally, slightly denticulated. Pl. XCVIII. figs. 29, 32, 37.

63. *Labidocera laevidentata.* Brady (*Challenger Report,* Vol. VIII.).

Only males of this species are known, and several examples occurred in this collection.

Size 1·9 mm. Head with side hooks; the right side of the last thoracic segment ending in two spines, the left with only one.

The anterior antenna of the right side, on the joint before the segment bearing the denticulated margin, bears distally a triangular process on the external margin, rather like the plume of a feather, with a midrib; the next joint has the proximal portion of the teeth-bearing margin raised and rounded, the following joint has a denticulated margin throughout only its proximal half, and distally this is produced into a stout upward curved spine.

The 5th feet, of the usual Labidocera structure, have the proximal extension of the 'bird's head' process simple, with only a few distal marginal hairs, the margin of this process without spines or tubercles, the long spoon-shaped distal process quite simple. The left foot with short broad terminal joint with four rather long simple processes, one of which, the longest, is bent backwards at the base, the other three being straight. On the proximal surface of this segment is a number of rather stiff bristles radiating outward.

Brady (*Challenger Report,* p. 93) described the species from only one specimen captured off the Philippines and Giesbrecht[1] mentions it but does not describe it. Although there

[1] *F. u. Fl. Neap.* Vol. XIX.

are some small points of difference according to Brady's drawings, I have little doubt that this Maldive species is identical, but a little larger. See Pl. XCVIII. figs. 20, 26, 27, 28, 38.

Gen. *Anomalocera* Templ.

64. *Anomalocera pattersoni* (Templeton).

The occurrence of an undoubted example of *A. pattersoni* in this collection is curious. The specimen was a ♀ of 3·6 mm. length. There is no essential difference between it and females from more northern latitudes.

Gen. *Pontella* Dana.

65. *Pontella spinipes* (Geisb.). *F. u. Fl. Neap.* Vol. XIX.

♀. Dorsal, ventral and rostral lenses, the latter rather small. Last segment of the cephalothorax asymmetrical, the lateral point on the right side very much shorter than the left; inside these two spiny prolongations a rounded plate on each side. Abdomen two segments only, the right distal portion of the genital segment prolonged on the dorsal surface over the right furca and also into an outgrowth dorsally on the same side. The anal segment very short, the right furcal not really longer than the left but lower distally.

Fifth feet with exopodite ending in a point and curved inwards distally with 2 short spines about the middle of the external margin, the endopodite about half the size and bifid at the apex.

The animal is very highly coloured with streaks of red and much blue pigment, especially about the foot-jaws, bases of the antennae, feet and tail. Size 4·5 mm.

The ♂, 4·0 mm. long, hitherto unknown, closely resembles that of *P. securifer*, but differs in the structure of the 5th feet and in slight differences in the clasping antenna. The former is best understood from the drawing, and consists chiefly in the absence of the big spiny process on the proximal part of the claw of the right foot which occurs in *P. securifer*, and in the presence of a very rounded outgrowth of the margin of the claw near its middle and leaving some distance between it and the proximal spine process. In the left foot, the last joint has one long external marginal spine and three terminal spines, of which the outer is the largest, the surface and inner margin of the joint haired.

The segment of the anterior antenna after the elbow joint in *P. spinipes* has an elevated rounded projection with three arrow-shaped teeth, which in *P. securifer* are represented by a number of lamellar-like processes. The marginal teeth on this segment are rather larger than in *P. securifer*, and the toothed plate[1] articulating with the joint before the elbow is comparatively a little larger in *P. securifer* than in *P. spinipes*.

The relative lengths of the joint before the elbow, the joint after, and the long end joint are proportionately:

	1	2	3
P. spinipes	47	45	60
P. securifer	40	50	60

Thus in the former species the joint before the elbow is a little longer than the succeeding joint, while in *P. securifer* the segment after the elbow joint is the larger.

[1] The 'Reibleiste' of Giesbrecht.

The last thoracic segment in *P. spinipes* ♂ is much more produced anteriorly than in *P. securifer*. The rostral lenses in this species are large, but in *Pontella* species it often happens that this organ is larger in the ♂ than in the ♀. The abdomen and furcal segments are quite symmetrical.

There is no doubt a very considerable resemblance in this animal to the ♂ of *P. securifer*. Three females occurred in one plankton sample along with one male, and it may be inferred that *P. spinipes* is not uncommon in this locality. Only one example of *P. securifer* ♂ occurred in the collection. *P. spinipes* ♂ as well as the ♀ is coloured much like *Anomalocera*, on the thorax with blue and red pigment, the ventral eye especially of a deep cherry-red, violet and red coloration predominating on the thorax, feet, antennæ and foot-jaws.

66. *Pontella securifer* (Brady).

Rare in this collection.

67. *Pontella mediterranea* (Claus, *Freilebende Cop.*; Giesb. *F. u. Fl. Neap.* Vol. XIX.), var. *indica*.

♀ 3·1 mm. long, ventral eye cherry-red, rostral lenses flat and insignificant; furcal segment of the right side a little the longest, that of the opposite side bent and distorted. Last segment of the thorax with rounded and symmetrical margins. Abdomen of only two segments, the genital segment long, not strongly projecting ventrally, and nearly four times as long as the anal.

Fifth feet with exopodite comparatively broad, and not curved, three terminal spines, the middle one the largest, two spines wide apart on the external margin, and two strong spines close together in the distal half of the inner margin. The endopodite very short, pear-shaped, ending in a broad point uncleft.

These feet differ a little from the same feet of *P. mediterranea* as described and figured by Giesbrecht (*F. u. Fl. Neap.* Vol. XIX. Pl. XXIV. fig. 48), in the size of the external spines of the exopodite and the uncleft endopodite, but the differences are only varietal.

68. *Pontella fera* (Dana, *P. Amer. Acad.* Vol. II.; Giesb. *F. u. Fl. Neap.* Vol. XIX.).

One ♀ occurred in this collection and there is no doubt that it is identical with *P. fera* as described by Giesbrecht.

Gen. *Pontellopsis* Brady.

69. *Pontellopsis krämeri* (Giesb. *Zool. Jahrb. Syst.* Vol. IX.), var.

♀, size 2·0 mm., the cephalothorax broad posteriorly, narrow anteriorly, the last segment ending in two stout lateral spines, that of the left side straight, that of the right side standing out more horizontally. Abdomen of 2 segments, the genital large and with a dorsal process, the anal short, the furcal segments (and anal in less degree) asymmetrical, the right one much broader and a little longer than the left. A strong bifid rostrum and ventral eye, partially covered ventrally by a large epistome strongly haired: no dorsal or rostral lenses. Anterior antennæ 16-jointed, with strong forward projecting hook on the 5th segment. Posterior antennæ with long endopodite and extremely short exopodite, only about the length of the 1st basal joint.

Mandibles with numerous but stumpy closely set teeth. Anterior foot-jaws with long distal bristles. Posterior foot-jaws with all lobes on a forward process of the 1st basal, the

second basal and four-jointed endopodite forming a secondary branch. The maxillæ with strong 2nd inner lobe with three teeth like those of the 1st inner lobe, 2nd basal and outer lobes small.

Feet like *Pontella*. 5th pair comparatively short, exopodite curved, with two slender external spines, two terminal spines, and a strong and longer spine arising as a process of the segment at the distal inner margin. Endopodite three-fourths as long as the exopodite, with stout terminal spine and similar spines arising just below it from the inner margin.

Pl. XCVIII. figs. 39, 40, 41.

This animal bears much resemblance to *P. krämeri* Giesb., as described and figured by Giesbrecht in *Zoolog. Jahrbuch*, 1896, but the furcal segments are not nearly so asymmetrical, and the 5th feet differ a little in the form of the end spines of the exopodite and length of the endopodite.

Only one example was found in this collection.

70. *Pontellopsis armata* (Giesb. *F. u. Fl. Neap.* Vol. XIX.).

♀ size, 2·4 mm.; last thoracic segment produced into long spines reaching to the end of the genital segment. Abdomen of 2 segments, anal nearly as long as the genital, both segments very unsymmetrical, the genital with strong dorsal lateral swellings, the anal with strong projection distally, covering the furcal segments partially on the dorsal surface and projecting between them, also raised dorsally at the proximal extremity; furcal segments not really unequal in length, but apparently so from the anal segment asymmetry. Genital orifice with strong spine at lower margin directed towards the right side.

Feet like *Pontella*. 5th pair with endopodite half the length of the exopodite. The former distally cleft and ending in two rather long spines, the latter curved, with three distal marginal spines, the median one much the longest and stoutest, the outer and inner of about the same length, two short spines on the external distal margin, and a short one about midway on this margin.

The whole abdomen is especially hirsute, with short stiff bristles; the thorax similarly hirsute, but with shorter bristles, and prickles. The ventral eye rather large and deeply cherry coloured.

The animal bears a close resemblance to Giesbrecht's description and figures, but the marginal spines of the thorax are not quite so long. Only one specimen was met with.

See Pl. XCIX. figs. 1, 2, 3.

Gen. *Pontellina* Dana.

71. *Pontellina plumata* (Dana) is common in this collection, and except that in some examples there is considerable asymmetry in the anal segment of the female (the anterior aspect being produced over the right furcal segment), the latter being placed at a lower level than the left one (apparently though not really larger), there is no essential difference between this species and the same species from the Mediterranean.

Gen. *Parapontella* Brady.

72. *Parapontella brevicornis* (Lubbock).

One male specimen occurred, which in no way differed from examples of the same

species from the Atlantic or Mediterranean. Size 1·2 mm. Its occurrence in this region is somewhat remarkable.

Gen. *Temora* Baird.

73. *Temora discaudata* (Giesb.).

74. *Temora stylifera* (Dana).

Both common.

Gen. *Calanopia* Dana.

75. *Calanopia elliptica* (Dana).

76. *Calanopia minor* (A. Scott, *Liverpool Biol. Soc.* Vol. XVI. 1902).

Gen. *Acartia* Dana.

77. *Acartia negligens* (Dana).

78. *Acartia Danae* (Giesb.).

79. *Acartia tonsa* (Dana).

80. *Acartia erythreae* (Giesb.).

Gen. *Oithona* Baird.

81. *Oithona plumifera* (Baird).

82. *Oithona similis* (Claus).

83. *Oithona rigida* (Giesb. *Zool. Jahrb.* 9 Band, 1896).

Several examples of this little-known species occurred in this collection. The pointed frontal process is absent and the head is square, between the antennae, the latter are very short, not reaching beyond the second thoracic segment, the genital segment is not more than twice the length of the next, the furcal segments are $2\frac{1}{2}$ as long as broad, and the external bristle only as long as the furca. The marginal spines of exop. 3 of the three first pairs of feet are very similar.

The whole animal is very rigid in appearance. Size 0·80 mm. As Giesbrecht remarks it is nearly related to *O. nana*. Pl. XCIX. fig. 42.

84. *Oithona nana* (Giesb.).

85. *Oithona tropica*, nov. sp.

♀, length 1·75 mm. Cephalothorax and abdomen about equal in length. Head produced in front into strong pointed process, slightly bent downwards at the tip; visible from the dorsal aspect, long and sharply pointed.

Anterior antennæ reach about the end of the genital segment and are of 13 segments:

1	2	3	4	5	6	7	8	9	10	11	12	13[1]
10	14	12	4	18	25	22	7	11	25	5	5	6

Mandibles and maxillæ of the usual *Oithona* type, the former with four bristles on the endopodite, the proximal one very stout, the other three much shorter and more slender, and two stout hook-like bristles on the end of the 2nd basal. Maxilla with 2nd basal rather

[1] The small 4th joint, clearly segmented in one antenna, is not present in the other, the 4th (4+5) being one long joint and making the number of segments in the antenna 12.

extended, endopodite with one short bristle; second basal with a short bristle, 3rd inner lobe with two stout hooks and one fine bristle. Anterior and posterior foot-jaws of the usual type and not very unequal in size.

1st pair of feet with	1, 1, 3	marginal	spines	on	the	exopodite			
2nd „ „	1, 0, 2	„	„	„	„	„	„	„	
3rd „ „	1, 0, 1	„	„	„	„	„	„	„	
4th „ „	0, 0, 1	„	„	„	„	„	„	„	

The inner marginal bristles of the 2nd basal not swollen like *O. setigera*.

The relative lengths of the 4 abdominal segments, 34 : 19 : 17 : 21. The furcal segments 17 long and 6 broad.

In the feet the marginal spines of the 1st pair are unequal in size, that of exop. 1 very long and stout, the proximal of exop. 3 the shortest, the middle one a little longer, the distal the longest. A short marginal bristle exists on the inner side of the exop. 1, a short straight spine-like seta on the 2nd basal inner margin, the seta of the outer margin of the 1st basal is not as long as the exopodite, the inner marginal bristle is comparatively long and thin (not club-shaped as in *O. setigera*). The outer marginal spines of the 3rd and 4th feet delicate, those of the exop. 3 long and thin. In the 4th foot the endopodite is short, only reaching as far as the first inner marginal bristle of the exop. 3 (differing from *O. frigida* or *plumifera*). The 1st exopodite in all pairs with a short bristle on the inner margin.

There has always been doubt as to the identity of Brady's *O. challengeri* (*Chall. Rep.* p. 97). In size greater than any known species, viz. 1·8 mm., abdomen nearly as long as the cephalothorax, the various joints nearly equal in length: anterior antenna of 13 joints (second, third and last four very short, 4th, 5th, 9th the longest). First feet with 3 marginal spines on last joint of the exopodite, branches of the 2nd, 3rd, 4th with no marginal spines; fifth foot consisting of a small tubercle with two long biarticulate setae: caudal segments nearly as long as anal, with 6 setae, the outermost and innermost the shortest. Such is Brady's description, and the species has not been completely identified since. As Giesbrecht remarks (*F. u. Fl.* p. 540), all Brady's Challenger *Oithonas* are grouped together under one specific name and probably comprise several kinds, and he further remarks that Brady's figures 1 and 2 show most resemblance to *O. setigera*.

The large species captured in the Maldive Archipelago shows some resemblance to Brady's *O. challengeri*, but cannot be identified with that, the spinulation of the feet, the structure of the 5th feet, the relative proportions of the abdominal segments alone being different. It cannot also be identified with *O. setigera* Dana, Giesb. (*loc. cit.*), the absence of the club-shaped bristles of the 2nd basals of the 2nd pair, and different proportions of thorax and abdomen, and the relative length of the segments of the latter, distinguishing it, though the marginal spines of the 1st and 2nd feet are the same in number. It must therefore be regarded as a new species.

See Pl. XCIX. figs. 44, 45, 46, 47, 48.

86. *Oithona robusta* (Giesbrecht, *F. u. Fl. Neap.* Vol. XIX. p. 538 *et seq.*).

♀ 1·5 mm., ♂ 1·2 mm. Forebody a little longer than the hindbody (16 : 14), twice as broad as long, produced in front into a strong pointed rostrum, visible from the dorsal surface and not ventrally directed.

The anterior antennæ are short and reach only just beyond the end of the thorax, in the ♂ a little shorter. The mouth parts resemble the figures given by Giesbrecht, the endopodite of the mandible with 4 bristles, the proximal much the largest, the distal three of unequal length: the endopodite of the maxilla with 2 bristles. The anterior and posterior foot-jaws are more equal in size than in other species. The marginal spines of the 1st to 3rd pairs of feet on the exopodites are 1 : 1 : 3, and in the 4th pair 1 : 1 : 2 only. The terminal saws of the feet are especially strongly toothed, there is no inner marginal bristle on the 2nd basal of the 1st pair, but a very short inner marginal on the exop. 1 of all the feet. The outer marginal spines of the 3rd and 4th pairs are particularly long.

The relative proportions of the abdominal segments are as 25 : 12 : 12 : 13, and the furca is 12 long and 3½ broad, its outer marginal bristle short and thin.

The head is apparently more pointed than in the figure of the species given by Giesbrecht, but in all other details the animal appears to agree very well with this writer's description, and there can be little doubt that it is identical.

The ♂ has the antennæ rather shorter than the ♀, the relative proportions of the abdominal segments 10 : 10 : 12 : 9 : 9 : 6; the furca 7 long and 4 broad. The joints of the anterior antennæ are much coalesced, the right one in the only male example found being unfortunately broken in the distal part, the left one is not a geniculated antenna. The mouth organs and feet resemble those of the female. Several females were found in this collection. Pl. XCIX. fig. 43.

87. *Oithona linearis* (Giesbrecht, *F. u. Fl. Neap.* Vol. XIX. p. 538 *et seq.*).

1·2 mm. long. The head rounded with no rostrum visible dorsally, the cephalothorax 3 times the breadth of the abdomen, and shorter than the latter (11 : 13). The segments of the posterior body proportionately 9 : 23 : 12 : 11 : 9, and the furca 6½ long and 3 broad.

The anterior antennæ have the joints apparently much coalesced and very difficult to determine, only 7 or 8 distinct segments being visible. The endopodite of the mandible has four bristles.

Feet:	1st	pair	with	1, 1, 3	marginal spines
	2nd	„	„	1, 1, 2	„ „
	3rd	„	„	1, 0, 1	„ „
	4th	„	„	0, 0, 1	„ „

The long narrow body, the hinder portion of which is longer than the anterior, and the spinulation of the feet, are characteristic points distinguishing this species. Several examples occurred in this collection. See Pl. XCIX. fig. 49.

Gen. *Thaumaleus* Kröyer.

88. *Thaumaleus tropicus*, nov.

One example occurred of a female, 2 mm. long, the proportions between the length of the antenna, the length of the body from extremity of head to mouth, and from mouth to the end of the first thoracic segment respectively as 5 : 5 : 23.

In the anterior antenna the 2nd segment was very much longer than the 3rd. The third exopodite joint of the first pair of feet carried three inner marginal hairs; the 5th pair had each a rudimentary endopodite, the inner bristle of the three at the distal end of the endopodite much thinner and shorter than the other two.

The long abdominal process ('eigabel') was twice as long only as the abdomen, and not much more than a third of the length of the whole body, and consisted of two distinctly independent processes, separated at the base and throughout the length.

The furca has on each side three setæ of equal thickness, but being broken the length cannot be determined.

The lateral eye-spots are large and the ventral eye especially strongly pigmented.

The anterior antennæ differ from those of *T. longispinosus*, also the body segments and abdominal process; the body proportions and 5th feet especially from *T. clarapedii*; the absence of reticulated appearance, the body proportions, abdominal process, and 5th feet differ from the same parts in *T. reticulatus*, the body proportions, abdominal process, and especially the size from *T. thompsonii*.

T. clarapedii, reticulatus, longispinosus are warm area species (41° N.—51° N.), *thompsonii* a northern cold area species.

The single Maldive specimen appears to differ so much in several particulars (enumerated above) as to necessitate the creation of a new species. Representations of this curious genus have not apparently been recorded from the tropical area.

Plate XCIX. figs. 31, 32, 33.

Gen. *Tortanus* Giesb.

89. *Tortanus gracilis*, Corynura. Brady, *Chall. Rep.*; Giesb. *F. u. Fl.*, *Tortanus*; Giesb. u. Schmeil, *Das Tierreich*, p. 157.

This species occurred several times in the Maldive collection, males being as frequent as females. It is recorded by Brady (*Chall. Rep.*) from the Philippines and by Cleve from the Malays, but not by Thompson and Scott from Ceylon, where it was apparently replaced by *T. forcipatus* Giesb. The latter species does not occur in this collection. Its identity is doubtful and Cleve has lately published reasons ("Plankton from the Indian Ocean," &c.) for the belief that *T. gracilis* and *forcipatus* are identical, the only essential difference being in the symmetry or asymmetry of the 5th feet. In *T. gracilis* these are never quite symmetrical, the left being constantly a little longer than the right foot. Cleve's measurements of size agree with my own inasmuch as both make the species smaller than Brady (viz. 1·6—1·8 mm. Brady 2·1 mm.).

Gen. *Corycæus* Dana.

90. *Corycæus ovalis* (Claus).

91. *Corycæus longistylis* (Dana in part = Dahl, *Verh. deutsch. Zool. Gesell.* 1894.

92. *Corycæus speciosus* (Brady).

93. *Corycæus venustus* (Dana).

94. *Corycæus obtusus* (Dana).

95. *Corycæus danæ* (Giesb. = *C. crassiusculus* (Dana), cf. Dahl, *loc. cit.*).

Of the forms of *Corycæus* with spoon-shaped prolongation of the thorax are included in Giesbrecht's work, *C. rostratus, carinatus, longicaudis, concinnus, gibbulus.* Dahl (*loc. cit.*) admitting *rostratus* (Claus), *gibbulus* (Giesb.), *concinnus* (Dana), *carinatus* (Giesb.), further includes *gracilis* Dana (= *pellucidus* Dana) and makes a new species *tenuicauda* (= *C. longicaudis* (Giesb.), *C. longicaudis* Dana = *C. speciosus juv.*).

Brady (*Chall. Rep.*) described *C. pellucidus* Dana (with which *C. megalops* (Willemoes-Suhn) appears in many respects to be undoubtedly identical), but of Brady's description and figures Giesbrecht (*F. u. Fl.* p. 662) remarks that he has confused two kinds and he regards Dana's species *pellucidus, gracilis, deplumatus,* and *productus* as very doubtful. Dahl however revives Dana's species *gracilis* (see above) as identical with *pellucidus* ♀ of Dana, and his synoptical diagnosis of those five kinds may be here referred to.

Bristles on basal joints of Post. Ant. feathered: the ♀ with a spoon-shaped thoracic ventral prolongation and one-jointed abdomen.

A. 4th feet without endopodite: furca very short: animal very small, = *C. rostratus* Claus.

B. 4th feet with endopodite with one bristle: furca longer.

I. External bristle of furca short and thick, = *C. gibbulus* Giesb.

II. Bristles of the furca thin.

1. Genital openings near the distal end of the abdomen, the upper and lower margins of which are parallel, = *C. concinnus* Dana.

2. Genital openings of ♀ set at end of abdomen.

α. The widened part of the ♀ abdomen as high as long in the upper margin.

i. Furca longer and thinner, the widened forepart of the ♀ abdomen with horizontal upper edge axially concave in the upper margin, = *C. gracilis* Dana (♀ = *pellucidus* Dana).

ii. Furca shorter and thicker, the widened part of the abdomen with swollen upper margin, = *C. carinatus* Giesb.

β. The widened part of the ♀ abdomen double as long as high, = *C. tenuicauda m.* (= *C. longicaudis* Giesb. and Dana = *C. speciosus juv.*).

The *Corycæus pellucidus* of the Maldive collection is I think identical with Willemoes-Suhn's *C. megalops,* and probably with Giesbrecht's *C. gibbulus.* As all specimens are females it is difficult to say whether the ♂ of *C. gibbulus* described by Cleve is identical.

96. *Corycæus pellucidus* (Dana. Brady, *Chall. Rep.*).

·85 mm. long (—·90). Head with a pair of prominent and comparatively large reddish-coloured lenses. Thorax with long downward directed ventral process; in some specimens can clearly be traced a connection between the corneal lenses and a gland from which a long yellow process extends into the thoracic process, exactly as in Willemoes-Suhn's figure (*Chall. Rep.*). The second thoracic segment has a strong dorsal hump. A trace of division of this segment anteriorly is present in all specimens, and at the distal end it is prolonged into long winged processes extending half the length of the abdomen. The latter of one segment only is in its upper margin produced at its forward end into a rounded and strongly haired process. Dorsally of irregular and swollen shapes, especially in the lower third, the genital openings are situated at the lower end of the segment with a mass of yellow brown pigmented matter, to which are, in all cases, attached two or three transparent oval spermatophores. Laterally viewed, the abdomen is oblong, and is nearly twice as long as broad in its broadest part, i.e. the lower third. The furcal segments are only half (or less) as long as the abdomen, and three to four times as long as broad. These propor-

tions however vary in different specimens, of which the following measurements of 6 specimens are examples ($\frac{7}{10}$ths = $\frac{6}{100}$ mm.).

Length of furca	Breadth of furca	Length of abdomen	Breadth of abdomen (in tenths)
8	$2\frac{1}{2}$	24	12
11	3	25	14
10	3	22	11
10	3	24	15
9	3	24	12
11	3	25	13

At the extremities, the furcal segments carry each on the inner side a long bristle half as long again as the furca, and at the outer margin a rather long unfeathered bristle, and one short and thick bristle, with a fourth external bristle situated a little distance from the distal margin. The exopodite of the 3rd pair of feet is the broadest and longest, the last segment as long as the first two, the endopodite only half its length. The last joint of the exopodite has only one marginal spine at the distal end.

The 4th feet have a short exopodite of 3 segments but no endopodite, though there is one bristle externally on the second basal.

The anterior antenna of 6 joints has the 4th joint nearly as long as the two last. The posterior antenna with 2 long basal joints and a short endopodite of three segments, the last modified into a claw, with stout hook bristles on the two first segments; the 2nd basal $3\frac{1}{2}$ times as long as broad, with the distal margin armed with four delicate long curved spines; the bristle of the 1st basal longer than that of the 2nd and both with marginal widely separated feathers. The posterior foot-jaw with broad claw-like 2nd joint with a stout spine at the distal extremity, the endopodite a basal joint and claw, with small inner bristle. See Pl. XCIX. figs. 4, 5, 6, 7, 8, 9, 10, 11.

This *Corycæus* closely agrees with Brady's and Willemoes-Suhn's *pellucidus* (=*megalops*), rather smaller than the former, the same size as the latter, differing from the former in the denticulation of the posterior antennal 2nd joint and apparently in the square-shaped abdomen with frontal knob. Probably Brady's description and figures embrace at least two different species, one of them agreeing with Willemoes-Suhn's specimens.

Very similar in many respects to Giesbrecht's *C. gibbulus*, it at once differs from this species in the proportions of the abdomen and furca (and shape of the former) and the basal joint of the posterior antenna but probably the species is variable.

As remarked by Willemoes-Suhn, the animal is distinguished by the large plum-jelly coloured eyes, and the amount of cobalt blue pigment scattered through the body and limbs. Not one of the very numerous specimens (in the Maldive collection) was observed without the bunch of clear, transparent (? spermatophore) processes attached to the genital openings. It is the commonest *Corycæus* in this collection.

Cleve has described[1] what he considers to be the ♂ of *C. gibbulus*, Giesb., and which presents certain differences in the shape of the abdomen and length of furcal segments (7 times as broad as long according to Cleve) and in the structure of the posterior antenna.

97. *Corycæus gibbulus*, Giesb.

[1] "Plankton from the Indian Ocean and Malay Archipelago," *Kong. Svenska Vetenskaps Akad. Handl.* B. xxxv. No. 5.

98. *Corycæus carinatus,* Giesb.

99. *Corycæus gracilicaudatus,* Giesb.

100. *Corycæus ?amazonicus,* Dahl, *loc. cit.* (vel nov.).

♀ 1 mm. long. Abdomen of two segments. Relative length of Ab. 1, ab. 2, furca, 7 : 8 : 9, with bristles on the genital segment. The lateral processes of Th. 3 and 4 are short, the endopodite of the 4th feet is a longer 'tap' joint than in other species, and carries two rather long feathered bristles, the 2nd basal behind the origin of the endopodite forming a sharp angular bend. All the endopodites of the feet are short, the 3rd joint of the exopodite of the 2nd foot long with long marginal setæ and a long spine at the apex, with the point bent inwards: in the other feet this spine is straight.

The bristle of the 2nd basal of the posterior antenna is not more than half the length of that of the 1st basal, and shorter than the distal hook. This Copepod has some resemblance to *C. tenuis* and *C. lubbockii*, the relative lengths of the abdominal segments and furca however are different:

	Ab. 1	Ab. 2	Furca
C. tenuis	7	4	8
C. lubbockii	9	4	11
C. amazon. (?)	7	8	9

In both of these species the furca is double or over the length of the anal segment, the latter only half the length of the genital. In this species the proportionate length of the three segments is more nearly equal. Under the diagnosis of *C. lubbockii* Dahl mentions a small hook on the female genital segment (genital openings) which is certainly absent in this species. Without figures, which are absent in Dahl's article, it is impossible to refer this Copepod to any of those of the group mentioned by him with certainty (*C. amazonicus, asiaticus, minimus, anglicus, tenuis, lubbockii*), but it agrees more with *amazonicus* than any other, in the short second antennal bristle, 2-segmented abdomen, endopodite of 4th feet with two bristles, anal segment longer than the genital. The proportions of genital and anal segments entirely exclude *C. asiaticus* and *minimus* (Dahl), and it probably should be regarded as a new species.

Gen. *Sapphirina* Thompson.

101. *Sapphirina ovatolanceolata* (Dana).

102. *Sapphirina nigromaculata* (Claus).

103. *Sapphirina opalina* (Dana).

104. *Sapphirina metallina* (Dana).

105. *Sapphirina intestinata* (Giesb.).

Gen. *Oncæa* Philippi.

106. *Oncæa conifera* (Giesb.).

107. *Oncæa media* (Giesb.).

108. *Oncæa mediterranea* (Claus).

109. *Oncæa venusta* (Philippi).

By far the commonest *Oncæa* in this collection is *O. venusta*, which occurs in nearly all samples. The other three are rare. These four forms are also recorded by Cleve from the Indian Ocean and Malay Archipelago.

Gen. *Lubbockia* Claus.

110. *Lubbockia squillimana* (Claus).

Gen. *Miracia* Dana.

111. *Miracia efferata* (Dana).

Gen. *Setella* Dana.

112. *Setella gracilis* (Dana).

Gen. *Copilia* Dana.

113. *Copilia mirabilis* (Dana) (= *Sapphirinella stylifera* of Brady).

Gen. *Clytemnestra* Dana.

114. *Clytemnestra scutellata* (Dana).

Gen. *Ectinosoma* Brady.

115. *Ectinosoma atlantica* (Brady).

Six examples only occurred of this widely distributed species. It is not mentioned among the Malay Copepods by Cleve, but occurs in the Antarctic region (Giesbrecht's report on the Belgica collection) as well as in the extreme north.

Gen. *Saphirella* T. Scott.

116. *Saphirella tropica* (nov. sp.), *S. abyssicola*. T. Scott, *Tr. Linn. Soc.* Vol. VI. Feb. 1893.

Under this name was described by Scott a strange Copepod from the Gulf of Guinea, taken at 260 fathoms, to which this author gave the name *S. abyssicola*.

One similar species was found in the Maldive collection, whole length 1·2 mm., greatest breadth of the cephalothorax ·3, and of the abdomen ·2 mm. The forebody is composed of 3 segments, the first pointed in front and three times as long as the next two segments, the second expanded laterally into strong wings like a *Corycæus*, the third narrower and with rounded margins bearing laterally a pair of simple 5th feet, and with 2 transverse chitin lines perhaps representing segmental division. The relative length of the three thoracic segments is 15 : 2 : 3. The first abdominal segment is longer than broad, and with pointed expansions at the distal lateral angles; the genital opening is in the middle of the segment, the latter forming a flap. The second abdominal segment long and comparatively narrow with straight and parallel lateral margins, is narrowed above where it joins the genital segment. A pair of very short furcal segments bear a very short lateral bristle and a pair of long stylet-shaped bristles longer than the second abdominal segment. The animal is remarkable in possessing in the thorax and abdomen altogether only 6 segments.

Anterior antennæ short and of 5 segments, comparatively

1	2	3	4	5
5	8	$4\frac{1}{2}$	$4\frac{1}{2}$	5

The third and fourth segments with long setæ, the 5th with 3 long and 4 short setæ.

The posterior antennæ each of 3 joints and one ramus only, the segments nearly equal in length, the 1st and 2nd with one marginal seta each, the last joint with outer and inner lobe, the inner margin denticulated, the outer with three short setæ, the lobes carrying respectively 5 (inner) and 4 (outer) bristles, especially broad and curved in the latter. The mandibles with strong conical tooth, under which is a stout broad plumose seta and internal to this two strong pointed plumose setæ. The posterior foot-jaw consists of two basal joints and a short and narrow endopodite of indistinctly two joints, the second basal much longer than the first, convex in the middle and with three setæ, short but stout; the first joint with three bristles at the distal end, two short and narrow, one longer with widely separated plumes. The short endopodite with 2 claw-like bristles, the innermost much longer than the other, the outer with a few lateral long spines.

The swimming feet are reduced to three pairs, only the anterior two pairs of which are freely adapted for swimming. Each biramous, composed of an outer and inner segment only, foliaceous, the exopodite with 5 broad lancet-shaped conspicuous spines, externally the two apical longer than the three marginal, and three long feathered setæ on the inner margin, the proximal part of this segment feathered on the inner side. The inner (endopodite) segment is nearly the same length and breadth as the exopodite, with seven simple long feathered setæ. (Scott describes the inner branch as a segment carrying dagger-shaped marginal spines like the outer segment. This is certainly not the case in the Maldive specimen, where the exopodite and endopodite segments had the usual structure, viz. marginal spines on the former, plain setæ on the latter.)

The 2nd pair of feet completely resemble the first. (Scott describes his species as having 'the three dagger-shaped spines on the inner branch replaced by plumose setæ.')

The 5th feet are represented by a short peduncle on each side carrying one external short simple bristle and one dagger-shaped spine of the same length internally, neither being longer than the first abdominal segment. Scott's specimen was apparently without any 5th pair. See Pl. XCIX. figs. 12, 13, 14, 15, 16, 17.

Clearly this Copepod is not identical with Scott's Gulf of Guinea species, though closely allied to it and of the same genus.

In Brady's monograph "The Marine Copepoda of N. Zealand" (*Trans. of the Linn. Soc. of London*, Vol. xv. Part II. No. 1, Aug. 1899) is described a new genus *Paurocopa*, in the description of which Brady remarks "the specimen described by Mr T. Scott under the generic name *Saphirella* seems to be, except as to the mouth organs, very similar to the present."

The shape of the body, the second thoracic segment and the abdomen and the mouth organs do not appear to be similar, and probably these two genera will be found to be different when more examples are submitted to examination. The Indian Ocean specimen certainly differs from both in the possession of 3 pairs of feet. Unfortunately only one specimen was found.

Gen. *Dactylopus* Claus.

117. *Dactylopus maldivensis*, nov.

♀, body of 11 segments, furca twice as broad as long, head with large broad spoon-like frontal process. ·9 mm. long.

Anterior antennæ of 9 segments, the basal four thick, the 4th with a long sensory process, the joints distally of this, small and narrow, the last one the largest.

Posterior antennæ with the large ramus of three joints, the second rather the largest, the last joint with a row of short marginal spines, two long distal marginal spines, and 5 apical broad bristles: exopodite slender, of 3 segments, the middle one very short, basal with one long distal marginal spine, last joint with 3 short terminal bristles.

Mandible palp of an ovoid basal much longer than broad and 2 rami, the inner rather longer than broad, square at the end, and with 6 + 2 bristles, the outer smaller and narrower, of two distinct joints, rather square, and with 5 terminal bristles; basal with 3 distal marginal bristles.

Masticatory plate with very strong teeth, outer trifid, next only little smaller and bifid, inner 4 smaller, innermost 3 rather pointed. One spine-like bristle and one rather long thick feathered bristle (below it) on inner margin.

Anterior foot-jaw with setigerous lobes, and one hook bristle on the 5th (?).

Posterior foot-jaw a claw, the middle joint with both margins convex, the inner armed with a row of fine teeth or spines and 2 rather long setæ, the end joint a strong claw bristle and two fine setæ internal to it.

The swimming feet except the 5th pair are biramous, each ramus with 3 joints; one foot of the 1st pair being however quite abnormal. The exopodite in this is of 4 distinct segments (as shown in the figure), the normal foot has the exopodite shorter than the 1st joint of the endopodite (seven-eights as long), the middle joint one-third longer than either the 1st or 3rd. Setæ 1, 1, 5, those of the last joint progressively longer from the outside inwards, and bearing strong claw-like bristles.

The 1st joint of the endopodite four times as long as broad, the inner margin with stiff hairs, the two end joints short, the proximal one with a long claw bristle and one inner marginal fine seta, and four spines at apex and inner margin, the distal with one strong claw bristle and two fine apical setæ.

2nd pair, with exop. 3, about twice as long as exop. 1 or 2, which are equal.

End. 1 < end. 2 < end. 3. End. 2 very broad, with distal margin ending on inner side in a short and on the outer side in a very long spine.

End. 1 with distal margins ending similarly but with outer spine longer than inner.

End. 3 square at end, with one marginal and 4 apical setæ, and one long rather broad spine at outer margin. Outer margins of end. 2 and 3 with short thick teeth. Exopodite with long and strong marginal spines, each with smaller spine internal to it. Inner distal margin of 2nd joint ending in stout spine, of 1st joint in short thick feathered seta. Spines of outer margins and apex, 1, 1, 4; apex and inner margin of last joint with 3 fine setæ.

Basal joints broad, 1st with strong thick short feathered bristle on the outer distal margin; 2nd ending in stout spine at the inner distal margin.

3rd pair of unequal size, on one side exop. and end. about equal length, on other exop. > end. In the former, exop. 3 is one-third longer than exop. 2 and has 2 marginal spines, one apical, and 3 inner marginal setæ; in the latter (unequal side) exop. 3 is twice as long as exop. 2, and has 3 outer marginal spines, one apical, and 3 inner marginal setæ. In the anomalous foot the marginal bristles of the inner side of the endopodite are 1, 1, 5.

The 4th foot is broken, but the inner marginal bristles of the endopodite are 1, 1, 4; the last joint with an apical spine at the outer margin.

5th pair, each of 2 foliaceous branches; inner ramus as broad as long, with 4 long and one fine apical and marginal setæ; the inner margin with stiff hairs, the outer upper marginal prolongation with one long seta; the outer ramus longer than broad, with 6 apical setæ.

The characters of the mandibles, the absence of marginal bristle on the end. 1 of the 1st feet (replaced by strong distal claw bristle), the 5th feet, and segmentation of the anterior antennæ are points of difference between this and any of the Ceylon species of *Dactylophusia*, and it seems to more nearly approach to *D. stromii* than to *D. tisboides* of European species. The very anomalous forms of the 1st and 2nd feet are probably accidental malformations.

See Pl. XCIX. figs. 34, 35, 36, 37, 38, 39, 40, 41.

Gen. *Peltidium* Philippi.

118. *Peltidium elegans*, nov. sp.

Whole length 1·1 mm., and in the broadest part ·6 mm. wide; head produced anteriorly into square ended process; body of six segments, the last on each side produced downwards and pointed. Furca not visible from the dorsal surface, only the long setæ, the segments quite hidden under the conical projection in the middle of the last segment. The chitin strongly reticulated in very regular manner. Furcal segments (from ventral aspect) twice as long as broad. Anterior antennæ short, with very thick basal joints, and of 9 joints, the basal three very large, the distal each successively smaller than the preceding, densely clothed with setæ, and with a long sensory process on the 4th segment. Posterior antennæ of two rami, inner of 4 segments, 2 short basals, long 1st and 2nd endopodite segments; outer ramus short and thin and of two segments only (see figure). Posterior foot-jaw claw shaped, 2nd basal with marginal row of fine teeth, end claw (endopodite) rather short but stout and with one thin basal bristle.

First pair of legs, with broad basals, exopodite of two segments, the 2nd longer than the 1st, and with 2 short strong claws; the endopodite of 2 segments, the first very broad and with marginal external process haired both sides and as long as the next joint, the last joint small, with 2 thick very short processes distally and 3 bristles.

2nd to 4th pairs of feet with 3-jointed exopodites and endopodites; marginal spines of the latter long and thin. Fifth pair quite hidden on the ventral surface of the chitinous integument, each of only one segment, with 3 long internal bristles, the distal one only feathered, 2 apical and one outer marginal bristle. See Pl. XCIX. figs. 21, 22, 23, 24, 25, 26, 27.

In comparing this specimen (the only one which could be found) with the 5 species mentioned and drawn in Thompson and Scott's monograph and with *Reticulina aurivillii* Cleve ("Plankton from the Indian Ocean and Malay Archipelago," p. 50), it is obviously not identical with any of those six species. In both Cleve's, and Scott and Thompson's, descriptions and figures, the outer ramus of the 1st feet is called the inner and *vice versâ*. The longer thinner foot ending in claws is the outer (or exopodite), and is figured correctly in Claus's

monograph (*Die Peltidien*) and in Brady's description of the genus *Peltidium* (*Cop. of the Brit. Isl.* p. 159).

In all the Ceylon species the anterior antenna is said to be 6 to 7 jointed, the same in Cleve's Malay species (*Reticulina aurivillii*). The 9 segments are distinct in the Maldive specimen, with a clear break in the chitin on each side of each segment, and the 9th or last segment though extremely small is probably present; thus it agrees with Philippi's original description of the genus as to segmentation of this organ.

For the three genera created by Claus[1], 1 *Alteutha*, 2 *Eupelte*, 3 *Oniscidium*, the number of segments of the anterior antenna is 8 or 9; the Ceylon species therefore differ greatly in this important particular from any known species of *Peltidium*. The Maldive specimen appears to agree more with Claus's subgenus *Oniscidium* than the others, and is characterised by the reticulation of the chitinous skeleton, the structure of the 1st feet, and the very short abdomen completely hidden in the dorsal aspect; and differs as before said in the segmentation of the antennæ from any of Thompson and Scott's species.

Gen. *Porcellidium* Claus.

119. *Porcellidium tuberculatum*, nov. sp.

Body rounded, seven-ninths as broad as long, whole length ·60 mm.; carapace dotted over with closely set tubercles, and the whole bright carmine colour.

Anterior antennæ 6-jointed.

1st pair of feet and mouth organs very like the same organs in *P. fimbriatum*.

5th feet long and rather narrow, ending in a blunt point with two apical short setæ, and a short spine about the middle of the external margin.

Abdomen very short, and furcal segments about $2\frac{1}{2}$ times as long as broad, pointed apically, with one apical seta and two setæ at the distal external margin. See Pl. XCIX. figs. 28, 29, 30.

Of Thompson and Scott's species this animal bears most superficial resemblance to *P. acuticaudatum*, so far as the furcal segments show; and of British species to *P. tenuicauda*, but the form of the body especially is very different to either.

Gen. *Euterpe* Claus.

120. *Euterpe acutifrons*.

Two or three specimens only occurred of this species, which appears to have a pretty wide distribution. Pl. XCIX. figs. 18, 19, 20.

[1] *Loc. cit.*

EXPLANATION OF PLATES.

PLATE XCVI.

FIG. 1. *Calanus robustior*, ♀. Whole animal.
FIG. 2. „ „ ♀. Abdomen and last thoracic segment: side view.
FIG. 3. „ „ ♀. 1st foot.
FIG. 4. „ „ ♀. 2nd foot.
FIG. 5. „ „ ♀. Posterior foot-jaw.
FIG. 6. „ „ ♀. Maxilla.
FIG. 7. *Paracalanus parvus*, ♀. Furcal segments and tail.
FIG. 8. „ „ ♀. 1st basal of 4th foot (specimen from the Faroe Channel).
FIG. 9. „ „ ♀. 5th feet.
FIG. 10. „ „ ♀. 4th foot (example from Maldives).
FIG. 11. „ „ ♀. Last 4 joints of the anterior antenna.
FIG. 12. „ *aculeatus*, ♀. Anterior antenna.
FIG. 13. „ „ ♀. 4th foot.
FIG. 14. „ „ ♀. 5th foot.
FIG. 15. „ „ ♀. Anal segment, furca and tail.
FIG. 16. „ *parvus*, ♂. 5th feet.
FIG. 17. *Euchirella bella*, ♀. Abdomen and tail.
FIG. 18. „ „ ♀. 4th foot, basal segment.
FIG. 19. „ „ ♀. Whole animal, side view.
FIG. 20. „ „ ♀. Posterior antenna.
FIG. 21. *Calanus vulgaris*, var. *plumosus*. One of the tail bristles.
FIG. 22. „ „ „ Abdomen, with branched tail bristles.
FIG. 23. *Paracalanus aculeatus*, var. *plumosus*.
FIG. 24. *Pleuromamma indica*, ♂. Abdomen.
FIG. 25. „ „ ♂. Portion of the anterior antenna.
FIG. 26. „ „ ♂. 5th feet.
FIG. 27. „ *xiphias*, ♀. 1st foot.
FIG. 28. „ *abdominalis*, ♀. Portion of the anterior antenna (specimen from Faroe).
FIG. 29. „ „ ♀. Head, dorsal view (specimen from Faroe).
FIG. 30. „ „ ♀. Head, lateral view „ „ „
FIG. 31. „ *indica*, ♂. Portion of anterior antenna.
FIG. 32. „ „ ♂. Head, dorsal.

FIG. 33. *Pleuromamma indica*, ♂. Head, lateral.
FIG. 34. „ *robusta*, ♀. Portion of the anterior antenna (specimen from Faroe Channel).
FIG. 35. „ „ ♀. Head, dorsal (specimen from Faroe Channel).
FIG. 36. „ „ ♀. Head, lateral „ „ „
FIG. 37. „ *xiphias*, ♀. Portion of anterior antenna.
FIG. 38. „ „ ♀. Head, dorsal.
FIG. 39. „ „ ♀. Head, lateral.
FIG. 40. *Candace tuberculata*, ♂. Last thoracic segment and abdomen.
FIG. 41. „ „ ♂. 5th feet.
FIG. 42. „ „ ♂. Portion of the 5th foot in lateral aspect.
FIG. 43. „ „ ♂. Whole animal.
FIG. 44. „ „ ♂. Last thoracic segment and ab. 1 and 2 (enlarged).
FIG. 45. *Haloptilus spiniceps*, ♂. Whole animal, dorsal.

PLATE XCVII.

FIG. 1. *Acrocalanus longicornis*, ♀. Cephalothorax, dorsal.
FIG. 2. „ *gracilis*, ♀. „ „
FIG. 3. „ *gibber*, ♀. „ „
FIG. 4. „ *monachus*, ♀. „ „
FIG. 5. „ *gardineri*, ♂. Side view.
FIG. 6. „ *longicornis*, ♀. „ „
FIG. 7. „ *gracilis*, ♀. „ „
FIG. 8. „ *gibber*, ♀. „ „
FIG. 9. „ *monachus*, ♀. „ „
FIG. 10. „ *gardineri*, ♂. 1st foot.
FIG. 11. „ *longicornis*, ♂. 1st foot.
FIG. 12. „ „ ♀. 2nd foot.
FIG. 13. „ „ ♀. 3rd foot.
FIG. 14. „ *gardineri*, ♂. 3rd foot.
FIG. 15. „ „ ♂. 2nd foot.
FIG. 16. „ „ ♂. 5th foot.
FIG. 17. „ „ ♂. Last exopodite segment of 4th foot.
FIG. 18. „ „ ♂. Mandible palp.
FIG. 19. „ „ ♂. Maxilla.
FIG. 20. „ „ ♂. Posterior antenna.
FIG. 21. „ „ ♂. Posterior foot-jaw.

FIG. 22. *Acrocalanus longicornis*, ♀. 4th foot.
FIG. 23. „ „ ♂. Side view.
FIG. 24. „ „ ♂. 5th foot.
FIG. 25. „ *gracilis*, ♂. Side view.
FIG. 26. „ „ ♂. 5th foot.
FIG. 27. „ *monachus*, ♂. Side view.
FIG. 28. „ „ ♂. 5th foot.
FIG. 29. *Calanus pauper*, ♂. 1st foot, basals enlarged.
FIG. 30. „ „ ♂. 5th foot, doubly flexed.
FIG. 31. „ „ ♂. Side view.
FIG. 32. „ „ ♂. 1st foot.
FIG. 33. „ „ ♂. 5th feet.
FIG. 34. „ „ ♂. Posterior foot-jaw.
FIG. 35. „ „ ♂. Abdomen.
FIG. 36. „ *minor*, ♂. 5th foot (right basal).
FIG. 37. „ „ ♂. 5th pair of feet.
FIG. 38. „ „ ♂. 5th foot of right side, basals and endopodite.
FIG. 39. „ *vulgaris*, ♂. 5th foot.
FIG. 40. „ *darwinii*, ♂. „
FIG. 41. „ *caroli*, ♂. „

PLATE XCVIII.

FIG. 1. *Centropages orsinii*, ♂. Side view.
FIG. 2. „ *elongatus*, ♀. 5th foot.
FIG. 3. „ „ ♀. Abdomen.
FIG. 4. „ *orsinii*, ♂. Anterior antenna.
FIG. 5. „ „ ♀. Lateral view.
FIG. 6. „ *calaninus*, ♀. Abdomen, ventral.
FIG. 7. „ *gracilis*, ♀. „ „
FIG. 8. „ *orsinii*, ♂. 2nd basal of 4th foot.
FIGS. 9, 10. „ *elongatus*, ♂. 5th feet.
FIGS. 11, 12. „ *orsinii*, ♂. „
FIG. 13. „ „ ♀. „
FIG. 14. „ *elongatus*, ♂. 5th foot enlarged and lateral aspect of exopodite.
FIG. 15. „ *calaninus*, ♀. Abdomen, lateral view.
FIG. 16. *Labidocera detruncata*, ♂. 5th feet.
FIG. 17. „ *wollastoni*, ♀. Abdomen, lateral.

FIG. 18. *Labidocera minuta*, ♀. Abdomen, lateral.
FIG. 19. „ *detruncata*, ♀. Abdomen, ventral.
FIG. 20. „ *laevidentata*, ♂. 5th feet.
FIG. 21. „ *detruncata*, ♀. Abdomen (? variety).
FIG. 22. „ *kröyeri*, ♀. Abdomen.
FIG. 23. „ „ ♀. Abdomen, dorsal.
FIG. 24. „ *minuta*, ♀. Abdomen, ventral.
FIG. 25. „ „ ♀. 5th feet.
FIG. 26. „ *laevidentata*, ♂. 5th feet.
FIG. 27. „ „ ♂. 5th feet, lateral view.
FIG. 28. „ „ ♂. Dorsal view.
FIG. 29. „ *minuta*, ♂. Last thoracic segment and abdomen, dorsal.
FIG. 30. „ *wollastoni*, ♀. 5th feet.
FIG. 31. „ „ ♂. „
FIG. 32. „ *minuta*, ♂. „
FIG. 33. „ *kröyeri*, ♀. „
FIG. 34. „ *detruncata*, ♀. „
FIG. 35. „ *wollastoni*, ♂. Anterior antenna.
FIG. 36. „ *detruncata*, ♂. „ „
FIG. 37. „ *minuta*, ♂. „ „
FIG. 38. „ *laevidentata*, ♂. „ „
FIG. 39. *Pontellopsis krämeri*, ♀. 5th feet.
FIG. 40. „ „ ♀. Abdomen.
FIG. 41. „ „ ♀. Posterior antenna.

PLATE XCIX.

FIG. 1. *Pontellopsis armata*, ♀. Whole animal, side view.
FIG. 2. „ „ ♀. Last thoracic segment and abdomen (ventral).
FIG. 3. „ „ ♀. 5th foot.
FIG. 4. *Corycæus pellucidus*, ♀. Whole animal, dorsal.
FIG. 5. „ „ ♀. Whole animal, side view.
FIG. 6. „ „ ♀. Posterior foot-jaw.
FIG. 7. „ „ ♀. Posterior antenna.
FIG. 8. „ „ ♀. 3rd foot.
FIG. 9. „ „ ♀. 4th foot.
FIG. 10. „ „ ♀. Cushion of the 1st abdominal segment.

FIG. 11. *Corycæus pellucidus*, ♀. Anterior antenna.
FIG. 12. *Saphirella tropica*, ♀. Portion of cephalothorax and abdomen.
FIG. 13. „ „ ♀. Posterior antenna.
FIG. 14. „ „ ♀. Anterior antenna.
FIG. 15. „ „ ♀. 1st foot.
FIG. 16. „ „ ♀. Mandible palp (?).
FIG. 17. „ „ ♀. Maxilla and ? anterior foot-jaw.
FIG. 18. *Euterpe acutifrons*, ♀. Dorsal view.
FIG. 19. „ „ ♀. Side view of head.
FIG. 20. „ „ ♀. 5th pair of feet.
FIG. 21. *Peltidium elegans*, ♀. Dorsal view.
FIG. 22. „ „ ♀. Last cephalothoracic segment and abdomen (ventral).
FIG. 23. „ „ ♀. 2nd foot.
FIG. 24. „ „ ♀. Posterior antenna.
FIG. 25. „ „ ♀. Anterior antenna.
FIG. 26. „ „ ♀. 1st foot.
FIG. 27. „ „ ♀. Posterior foot-jaw.
FIG. 28. *Porcellidium tuberculatum*, ♀. Whole animal (dorsal)
FIG. 29. „ „ ♀. 5th foot.
FIG. 30. „ „ ♀. 1st foot.
FIG. 31. *Thaumaleus tropicus*, ♀. 5th feet.
FIG. 32. „ „ ♀. Whole animal, side view.
FIG. 33. „ „ ♀. Abdomen (ventral).
FIG. 34. *Dactylopus maldivensis*, ♀. Abdomen.
FIG. 35. „ „ ♀. 1st foot.
FIG. 36. „ „ ♀. „
FIG. 37. „ „ ♀. 5th foot.
FIG. 38. „ „ ♀. Anterior antenna.
FIG. 39. „ „ ♀. Mandible and palp.
FIG. 40. „ „ ♀. Posterior antenna.
FIG. 41. „ „ ♀. 2nd foot.
FIG. 42. *Oithona rigida*, ♀. Dorsal view.
FIG. 43. „ *robusta*, ♀. „
FIG. 44. „ *tropica*, ♀. „
FIG. 45. „ „ ♀. 1st foot.
FIG. 46. „ „ ♀. 2nd foot.

FIG. 47. *Oithona tropica*, ♀. 3rd foot.

FIG. 48. „ „ ♀. 4th foot.

FIG. 49. „ *linearis*, ♀. Dorsal view.

PLATE C.

FIG. 1. *Euchaeta concinna*, ♀. Last cephalothoracic segment and abdomen.

FIG. 2. „ „ ♀. Genital segment, ventral.

FIG. 3. „ „ ♀. „ „ lateral, right side.

FIG. 4. „ „ ♀. 2nd foot.

FIG. 5. „ „ ♀. Genital segment, lateral, left side.

FIG. 6. „ „ ♀. Exopodite of 1st foot.

FIG. 7. „ *marina*, ♀. Whole animal, dorsal.

FIG. 8. „ „ ♀. Exopodite of 2nd foot.

FIG. 9. „ „ variety, ♀. Genital segment, ventral.

FIG. 10. „ „ ♀. 1st foot, exopodite.

FIG. 11. „ „ ♀. Genital segment, right side, lateral.

FIG. 12. „ *indica*, ♀. Genital segment, ventral.

FIG. 13. „ „ ♀. „ „ lateral, left side.

FIG. 14. „ „ ♀. „ „ „ right side.

FIG. 15. „ „ ♀. 1st foot, exopodite.

FIG. 16. „ „ ♀. 2nd foot, exopodite.

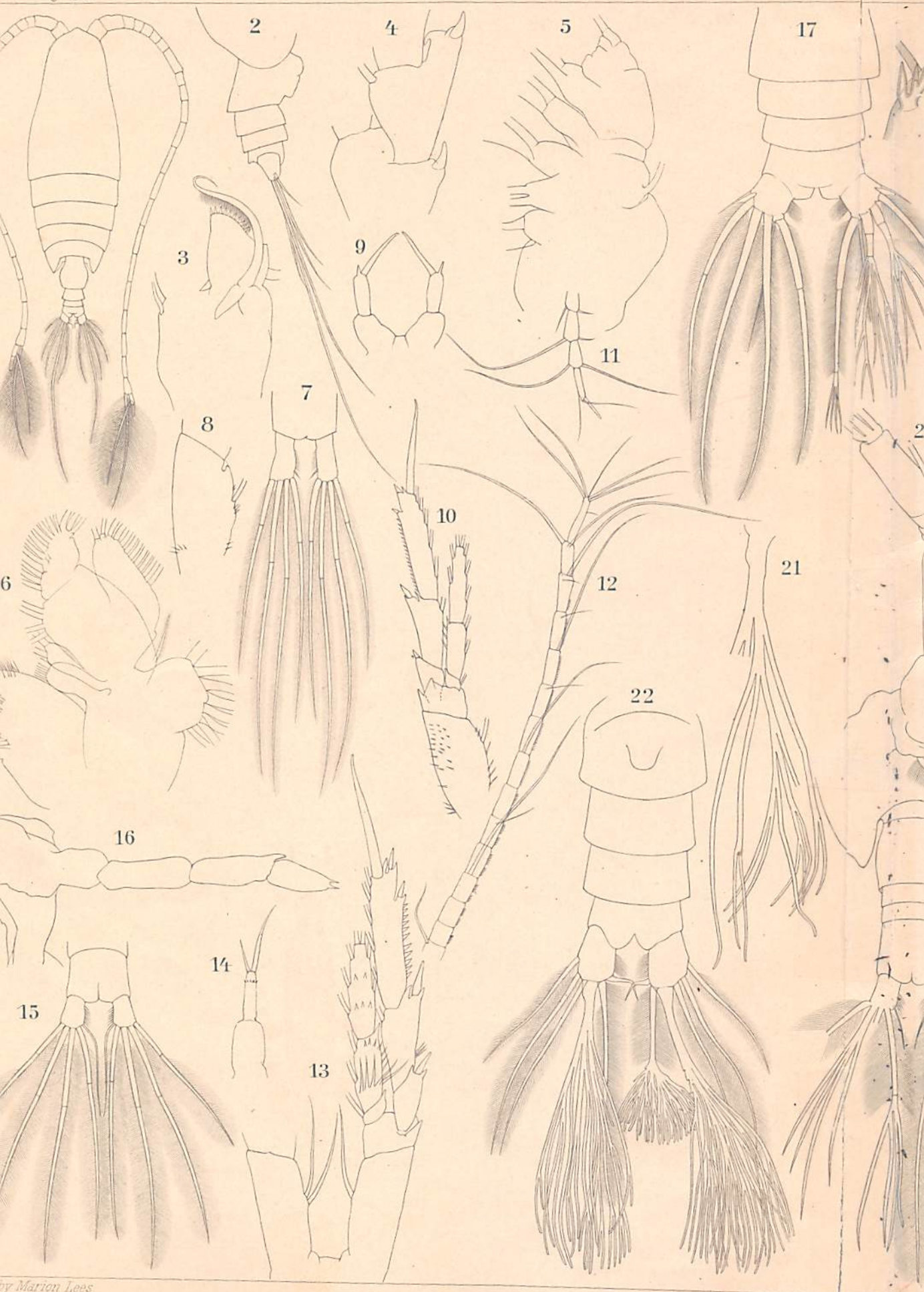
FIG. 17. „ *marina*, ♀. Genital segment, ventral.

FIG. 18. „ „ ♀. „ „ lateral, left side.

FIG. 19. „ „ ♂. 5th foot.

FIG. 20. „ „ ♂. „

FIG. 21. „ *norvegica*, dichotomous branching of tail setæ.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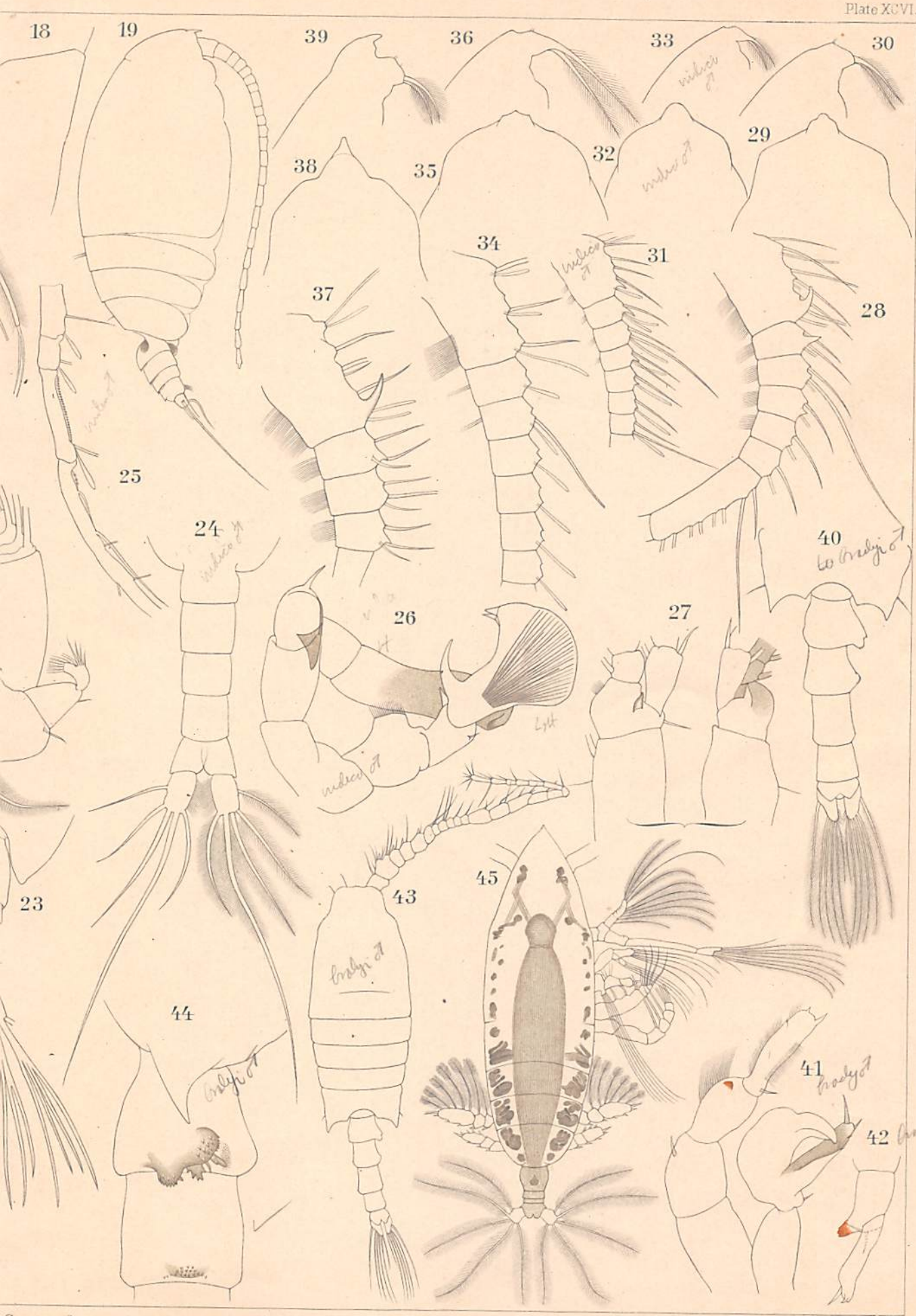

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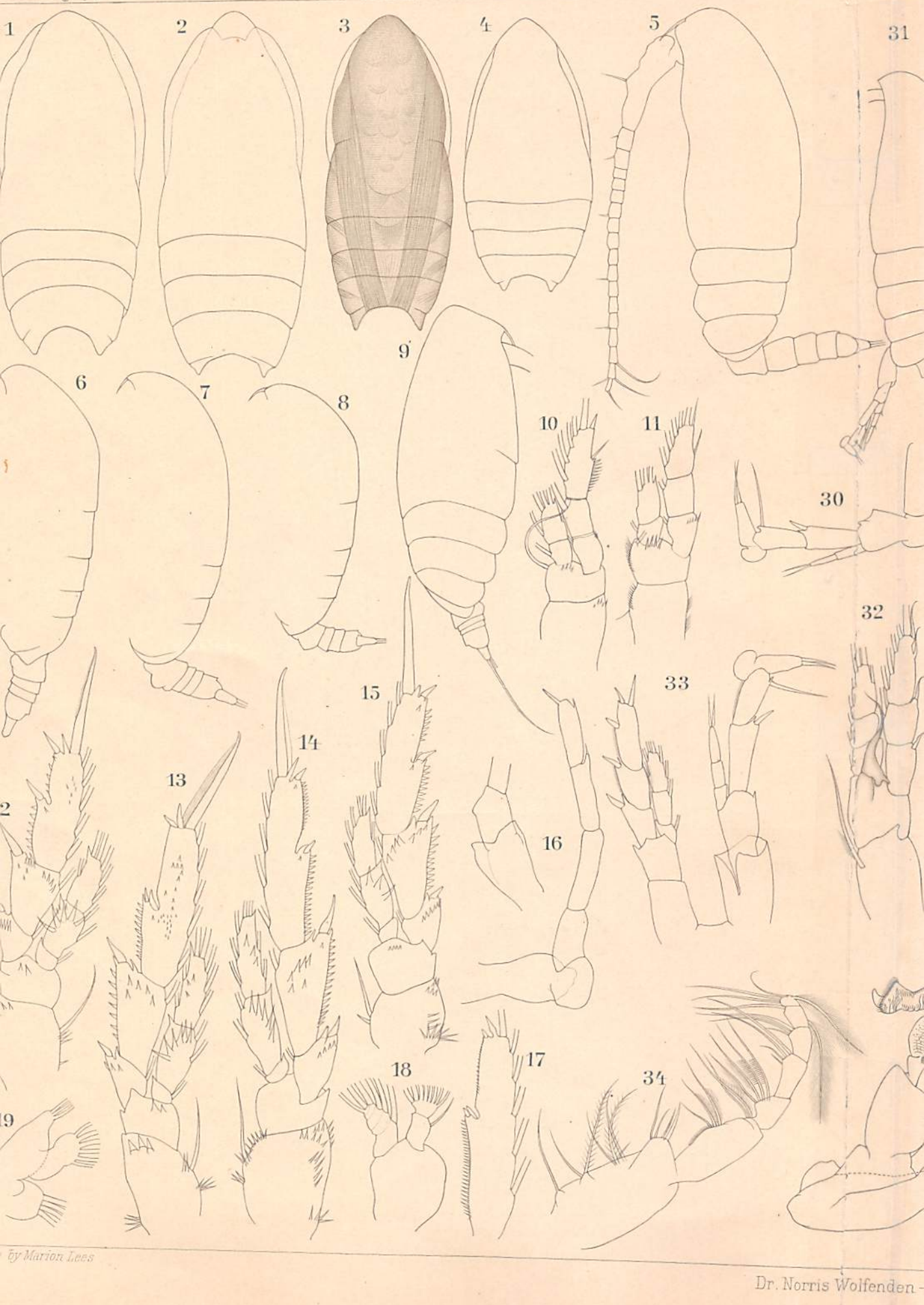

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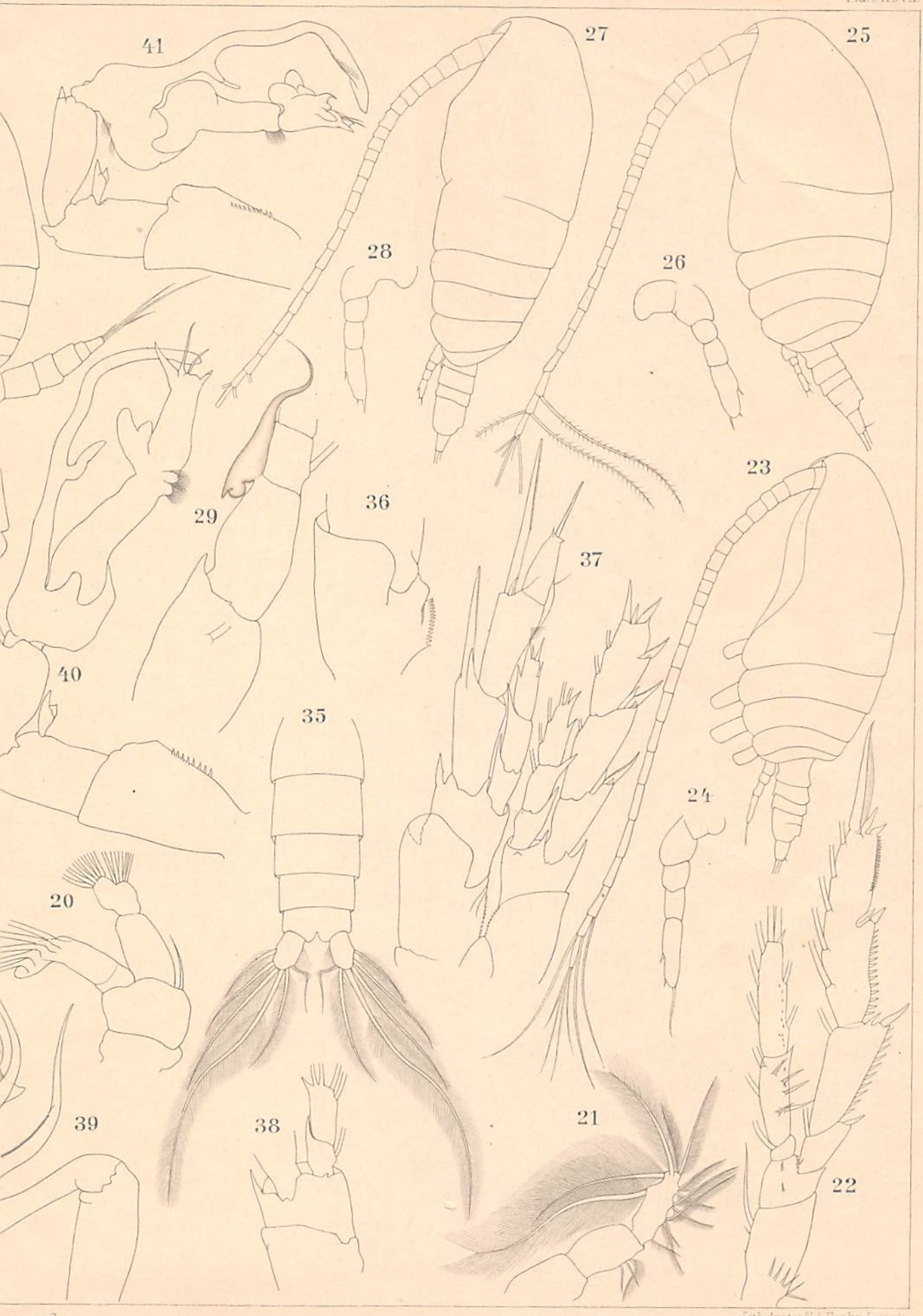

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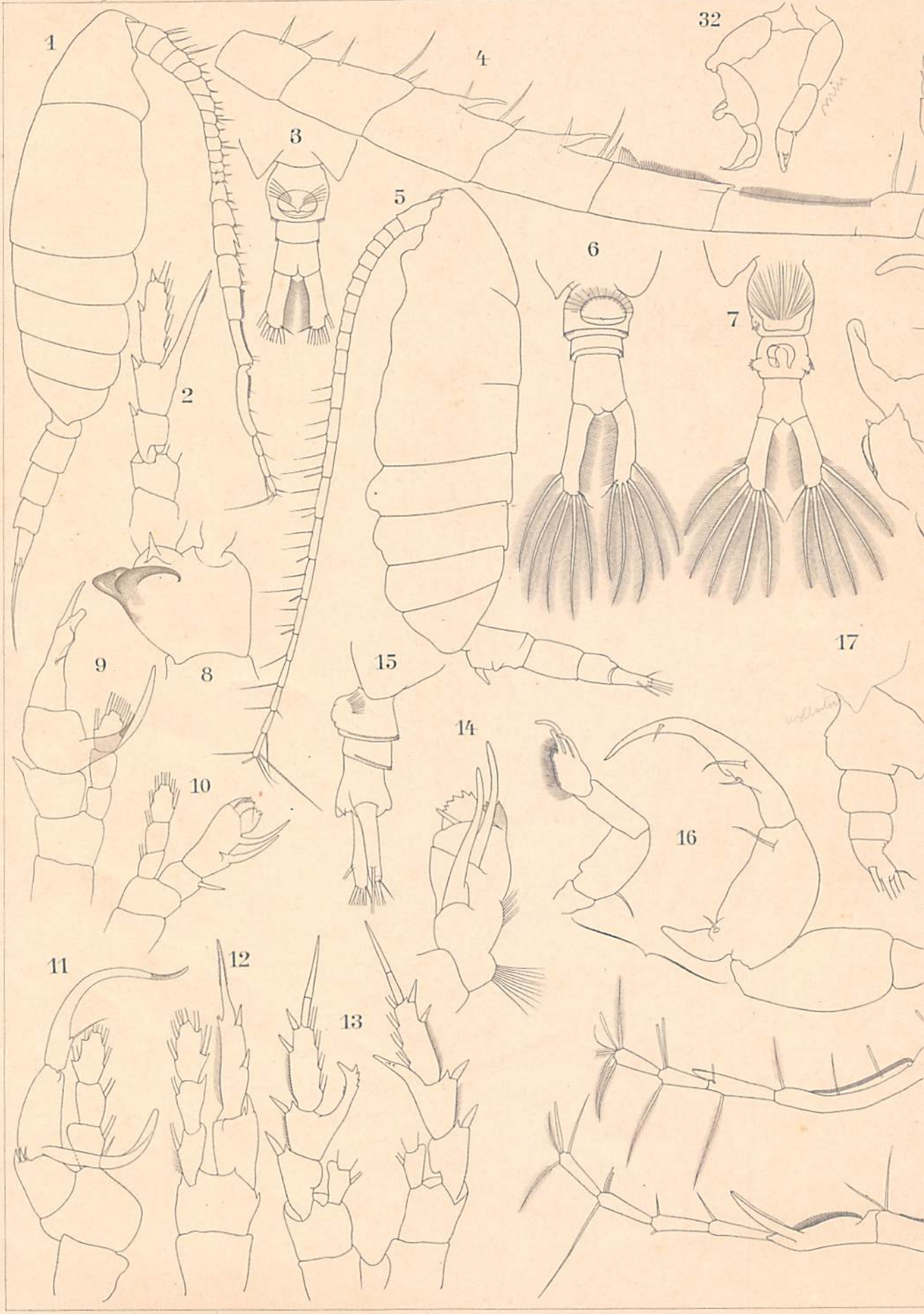

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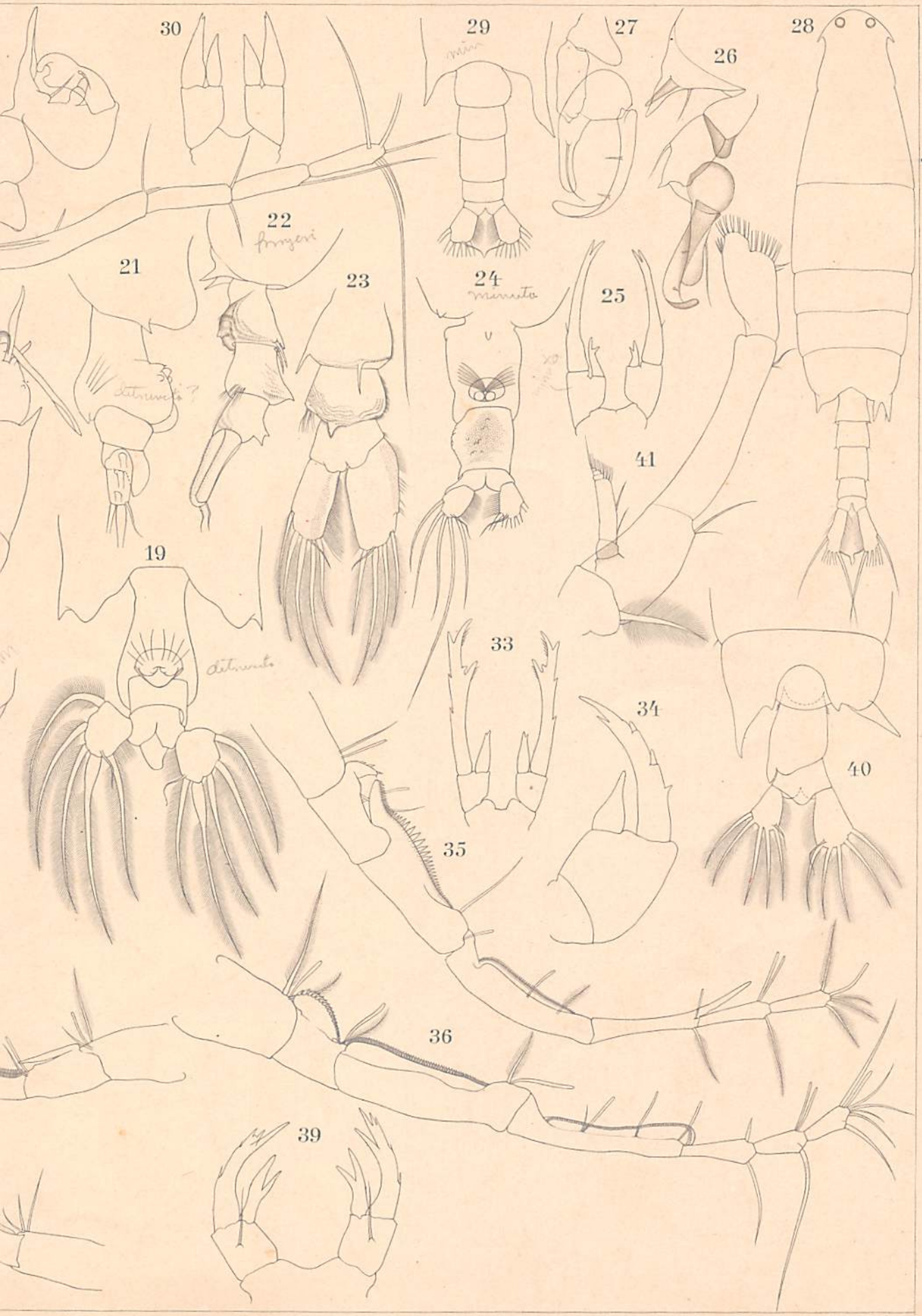

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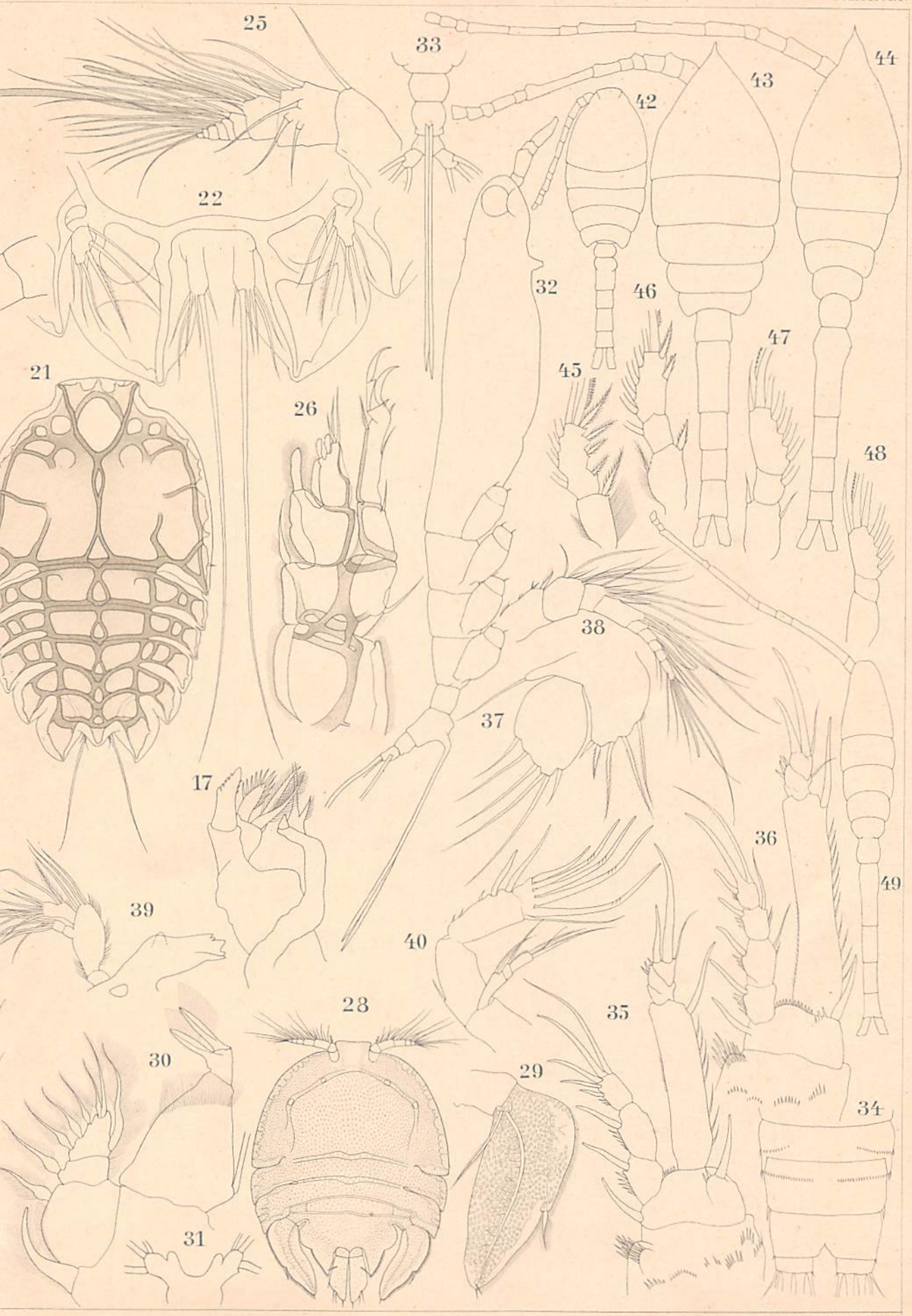

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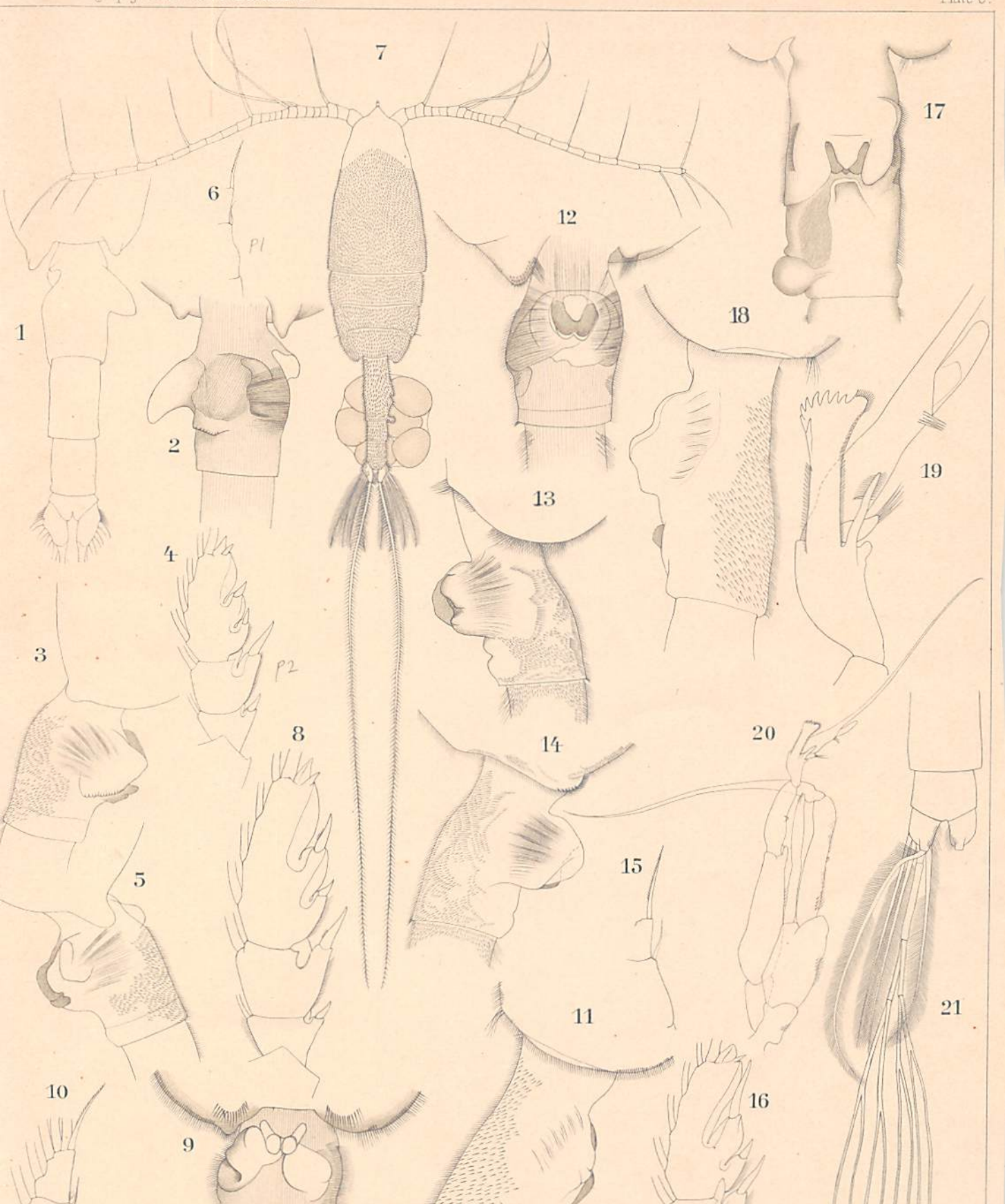
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