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XXIX. NOTES ON THE SURFACE-LIVING COPEPODA OF THE BAY OF BENGAL, I AND II.

By R. B. Seymour-Sewell, *B.A., Capt., I.M.S., Surgeon-Naturalist to the Marine Survey of India, and Offg. Professor of Biology, Calcutta Medical College.*

(Plates xiv—xxiv).

INTRODUCTION.

Up to the present time, our knowledge of the species and distribution of surface-living Copepoda in the Bay of Bengal is confined to a paper by the late Mr. I. C. Thompson, who worked out a collection made by Captain Wyse of the S. S. "Johannesburg" during a voyage from Delagoa Bay to Calcutta ("Report on two collections of Tropical and more northerly Plankton." I. C. Thompson, F.L.S., *Trans. Liverpool Biol. Soc.*, vol. xiv, 1899-1900). Several extensive collections have, however, been made in neighbouring waters and the results are contained in the following papers:—

(1) The Siboga collection, from the region between Borneo on the west and New Guinea on the east. The Copepoda of the "Siboga" Expedition. A. Scott. Leyden, 1909.

(2) The collection made by Professor Herdman around Ceylon and worked out by I. C. Thompson and A. Scott. The Ceylon Pearl Oyster Fisheries and Marine Biology, pt. i, 1903. London.

(3) The collection made by Professor S. Gardiner in the Maldive and Laccadive Archipelagoes and worked out by Dr Wolfenden. The Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. ii, 1903-1906. Cambridge.

In addition to these I must mention other minor collections described in the following papers:—

(4) Giesbrecht: Ueber pelagischen Copepoden des Rothen Meeres: Zoologische Jahrbucher, Syst. Abth., Band ix, 1897. Jena.

(5) Cleve: Planktonic organisms from the Indian Ocean and Malay Archipelago. Kong Sv. Vet. Akad. Handlingar, Bd. 35, No. 5, 1901-02. Stockholm.

(6) A. Scott: Some Red Sea and Indian Ocean Copepoda. Trans. Liverpool Biol. Soc., vol. xvi, 1902 Liverpool.

(7) Cleve: Record of a voyage made by Thorild Wulff to and from Bombay. Arkiv for Zoologi, Band i, 1903-04. Stockholm.

During the early months of 1911 and again in November of the same year the R.I.M.S. "Investigator" was carrying out a survey of the coast of Burma, and advantage was taken of the opportunity thus offered to make a collection of the free-living Copepoda that frequent the surface waters of this region.

There was also in the Indian Museum a large collection made some years previously by the "Investigator" in the region of the coast off Chittagong; these collections have been worked out and the results are embodied in the following paper.

For purposes of convenience I have divided the collections into two series, the first comprises those from the Chittagong region and the Rangoon River estuary, while the second deals with the collections made further south in the neighbourhood of the Moscos Islands and the mouth of Tavoy River.

I.—The Gymnoplea of the Chittagong and Rangoon River Estuaries; with notes on the application of "Brooks' Law" to the Copepoda and evidence of Dimorphism in this group of Crustacea.

As regards the collection from the Chittagong region there is unfortunately no indication of how the collection was made, and whether or not it is composed of the results from several surface trawls or only a single one, nor is there anything to indicate at what time of the year it was taken; it is probable however that the collection was made in 1903 during the months of January to March as that was, I believe, the last occasion on which the R.I.M.S. "Investigator" was surveying in that locality.

The collection from the Rangoon River estuary was made on three consecutive nights by means of a surface tow-net allowed to drift with the tide. The resulting catch was extremely copious, though subsequent examination showed that the actual number of species represented was small; but this lack of variety was amply compensated by the fact that out of a total of seven (or possibly eight) species five were new to science and as regards the *Labidocera euchaeta*, Giesbrecht, not only was the corresponding male, hitherto unknown present in large numbers, but a probably dimorphic form was also obtained. The main bulk of the collection consisted of large numbers of *Acrocalanus inermis*, sp nov. and *Labidocera euchaeta*, Giesbrecht, in various stages of development, and a study of these forms and the various changes that take place during the growth of these two species has led to results of very considerable interest. So many external factors such as temperature, salinity, or food supply, may possibly produce variation in the developmental changes that it is only in such cases as this, where a large number of stages can be obtained at the same time and place, that one is able with comparative ease to carry out investigations regarding the laws of development. The locality where the collection was made is situated at the mouth of the river close to the fairway buoy ("Investigator" station 394, 16° 16′ 00″ N., 96° 21′ 00″ E., 13-xi-1911), and hydrometer readings showed that the density of the water was very low, the average reading being 1002.

In the following table I have given a list of the Copepoda (Gymnoplea) present in the two collections, and a comparison of the two faunas indicates that the collection from Chittagong was probably made further out to sea, where there was greater admixture of the estuarine and truly marine forms than in the Rangoon River estuary.

RANGOON RIVER ESTUARY.	OFF CHITTAGONG.
Acartia spinicauda, Giesbrecht.	*Acartia spinicauda*, Giesbrecht.
Acartia tortaniformis, sp. nov.	*Acartia tortaniformis*, sp. nov.
Acrocalanus inermis, sp. nov.	*Acrocalanus gibber* (Giesbrecht).
Centropages alcocki, sp. nov.	*Acrocalanus inermis*, sp. nov.
Labidocera euchaeta, Giesbrecht.	*Canthocalanus pauper* (Giesbrecht).
Paracalanus dubia, sp. nov.	*Candacia bradyi*, Scott.
Pseudodiaptomus binghami, sp. nov.	*Centropages notoceras*, Cleve,[1] (? = *dorsispinatus*, Scott and Thompson).
	Centropages furcatus (Dana).
	Centropages orsinii, Giesbrecht.
	Centropages tenuiremis, Thompson and Scott.
	Eucalanus monachus, Giesbrecht.
	Euchaeta concinna, Dana.
	Labidocera acuta (Dana).
	Labidocera euchaeta, Giesbrecht.
	Labidocera kröyeri (G. Brady).
	Labidocera minuta, Giesbrecht.
	Paracalanus aculeatus, Giesbrecht.
	Paracalanus serratipes, sp. nov.
	Pontella andersoni, sp. nov.
	Pontellopsis regalis (Dana).
	Undinula vulgaris (Dana).

[1] I am somewhat doubtful about these species. Cleve apparently considered them synonymous, but both accounts differ in certain details and a consideration of the matter will be found below, in the second paper dealing with the Copepoda from the Moscos region.

I have embodied the results obtained in the following paper and for the sake of convenience I have divided it into two parts dealing respectively with the developmental changes in certain species and with a full description of the new forms obtained.

1. DEVELOPMENT.

From time to time results have been published showing that in certain members of the Crustacea the animal during the course of its development, as each succeeding growth-moult takes place, increases in size by a definite proportion.

W. K. Brooks (1886, p. 105) was the first to show that such a mathematical relationship existed between the successive larval stages of the Stomatopoda.

Hadley (1906) has shown that a similar condition of affairs is met with in the American lobster, *Homarus americanus*, Milne Edwards. Unfortunately I have not been able to see this paper, but Herrick (1911, p. 362), in his work on the natural history of this animal, has reprinted Hadley's results. In the table given he shows that during the earlier moults the growth-factor is 1·18 and that after the 17th moult this gradually diminishes.

Fowler (1909) has also shown that in all probability the same condition of affairs exists in the case of *Carcinus maenas*, but his chief contribution deals with a group of the Ostracoda, the Halocypridae. He has shown that here also, at each successive moult, there appears to be a definite increase in the size of the animal and he has formulated the following law which he proposes to call "Brooks' Law," that "during early growth each stage increases at each moult by a fixed percentage of its length, which is approximately constant for the species and sex." By applying this law, he has shown that as far as this group of the Ostracoda are concerned, it would appear highly probable that every species possesses two dimorphic forms corresponding to the two final sexually mature stages.

With a view to testing whether the Copepoda followed the same law, I carried out a number of measurements of the various stages in the species *Labidocera euchaeta*, Giesbrecht, *Acrocalanus inermis*, sp. nov., and *Pontella andersoni*, sp. nov. The measurement taken was the total length from the most anterior part of the head to the tip of the furcal rami, and the results were plotted out as shown in the following text-figures, the females being to the left and the males to the right of the middle line.

(*a*) **Labidocera euchaeta**, Giesbrecht.

In this species I have been able to obtain a fairly extensive series of measurements, covering six successive stages of growth in the female and four in the male. Of these stages, stage 2 and all below it undoubtedly were those of *Labidocera euchaeta*, but as regards stage 1, I was for some time of opinion that I was here dealing with a new species; but on measuring these examples and plotting the results obtained with those of the undoubted examples of *L. euchaeta*, I found that they formed a mathematically exact continuation of the series. As, in addition, these examples have only been obtained in association with large numbers of *L. euchaeta*, and a prolonged search has failed to reveal any immature forms other than those of *L. euchaeta* that could correspond with this type, I have come to the conclusion that we have here in the Copepoda an exactly similar state of affairs to that which has been shown by Fowler to exist among the Ostracoda (Halocypridae). The actual measurements of all the examples in each group are shown in text-figure I.

It is at once evident that the different measurements fall into a series of groups, each having a normal curve of variation, and although the extremes of variation of successive groups may to some extent overlap yet each shows a very definite mean.

Taking first the growth stages of the female, the mean length measurement at each successive moult is given below and for purposes of comparison I have also given the lengths calculated from the smallest stage by multiplying each stage by the growth-factor.

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 6	0·593	0·593	1·4
,, 5	0·844	0·830	1·4
,, 4	1·168	1·162	1·4
,, 3	1·620	1·627	1·27
,, 2	2·054	2·066	1·27
,, 1	2·639	2·624	

From the above it would appear that during the early moults the growth-factor is 1·4, whereas in the last two moults this factor falls to 1·27.

This drop in the factor is of some interest inasmuch as it has not been found to exist in the Ostracoda, though it undoubtedly is a feature in the growth stages of some of the higher Crustacea.

Turning now to the consideration of the males I found that, previous to stage 4, it was quite impossible to differentiate between the two sexes, and hence the growth moults can only be studied from that point.

The mean length-measurements of the various stages of the male are as follows, and here again I have given the calculated measurement for comparison.

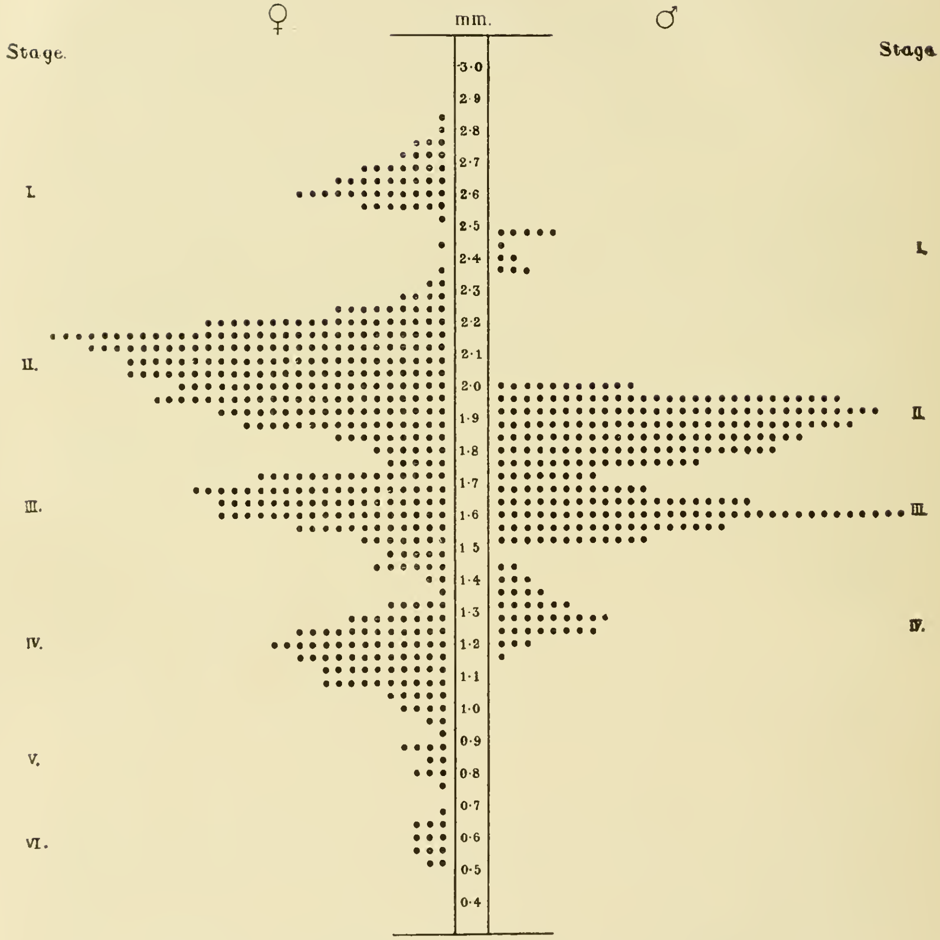

FIG. 1.—Measurements of 808 specimens (500 ♀ : 308 ♂) of *Labidocera euchaeta* from the Rangoon River Estuary.

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 5	0·844	0·844	1·5
,, 4	1·295	1·266	1·5 or 1·27
,, 3	1·611	1·608	1·5
.. 2	1·880	1·899	....
,, 1	2·429	2·412	....

At first sight the observed length measurements of the various stages did not appear to fit into "Brooks' Law," but a further study revealed the fact that at stage 4 we have a division taking place and an individual may go through one of two processes, either he may at once proceed to stage 2 becoming sexually mature in a single moult or he may have an extra immature moult, reaching stage 3, and then by a final moult attain to stage 1. The growth-factor between stages 5 and 4 is 1·5, and at the next moult some with the same growth-factor reach stage 2, others have an intermediate moult, the growth-factor of which is 1·27, (i.e. the same as that for the final two moults in the females) and then by a final moult having again a growth-factor of 1·5 he reaches stage 1. The number of examples of stage 1 was always considerably less than that of stage 2, and it is possible that these two forms may be seasonal dimorphic forms, the one a summer and the other a winter form.

As regards the structural characters of these various stages I have given a detailed description below; suffice it to say here that in both males and females, the last two stages only (stages 1 and 2), as in the Halocypridae, are sexually mature and in both cases there are, as I have already indicated, considerable differences in structure between the invididuals of the two groups, so much so that if only a few specimens had been met with I should without any hesitation have described them as different species. This difference was most marked in the case of the males, those of stage 2, which become sexually mature direct from stage 4, being totally different as regards their grasping antennae and 5th pair of legs from the individuals of stage 1, in which an intermediate moult is carried out.

In order to check the results, I carried out a further series of measurements on specimens obtained in a tow-netting taken off Chittagong (approximately 620 miles away) in which the same forms were present. I obtained exactly similar results, and the measurements found are shown in text-figure II.

In the table below I have again given the average length-measurements of the various stages, as found, and the calculated size for reference.

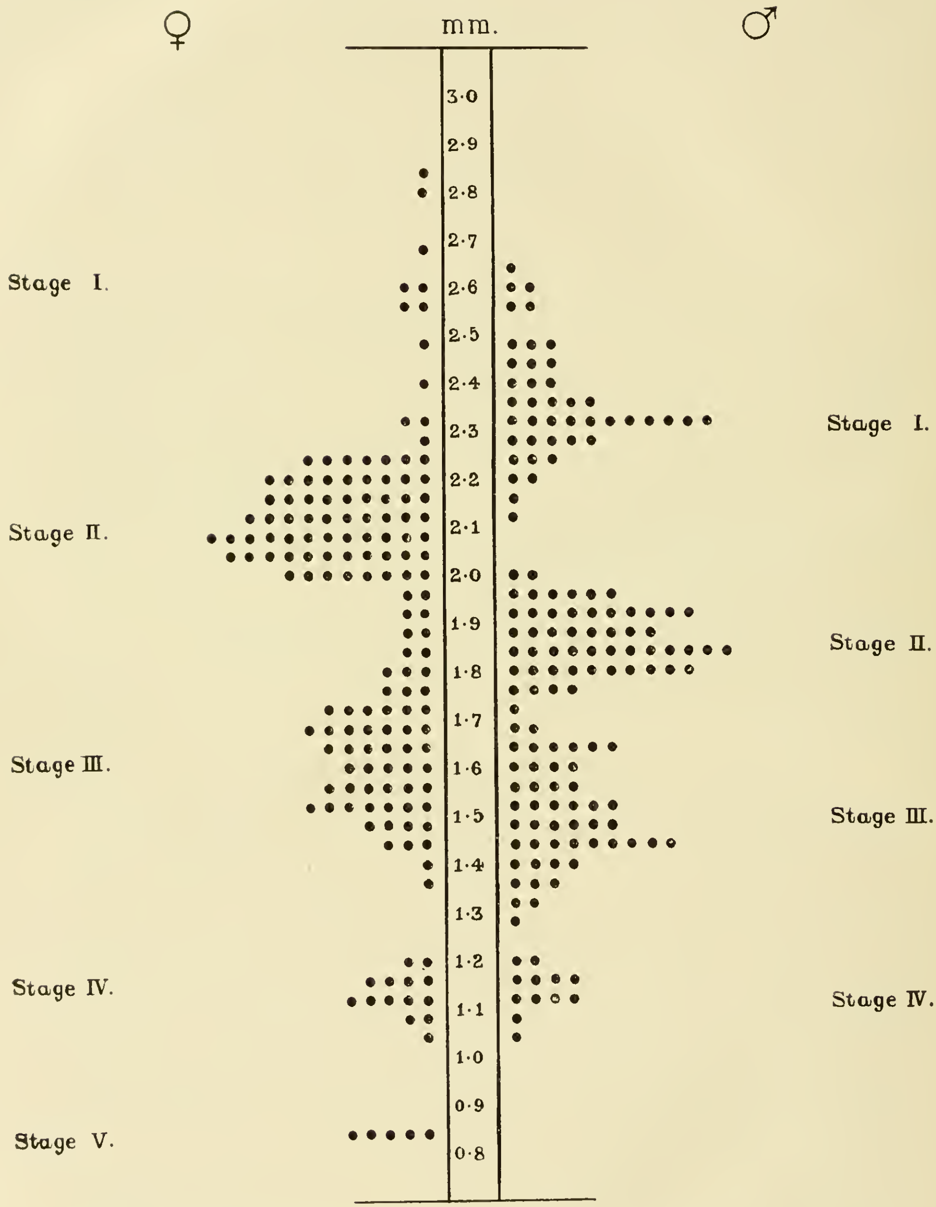

FIG. 2.—Measurements of 303 specimens (153 ♀ : 150 ♂) of *Labidocera euchaeta* from Chittagong.

♀

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 5	0·840	0·840	1·4
,, 4	1·131	1·176	1·4
,, 3	1·620	1·646	1·27
,, 2	2·114	2·090	1·27
,, 1	2·640	2·654	....

♂

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 5 .. .	0·84	0·84	1·5
,, 4	1·137	1·26	1·5 or 1·27
,, 3	1·502	1·60	1·5
,, 2	1·868	1·89	....
,, 1	2·342	2·40	....

Here again we find exactly the same growth factors and the same dimorphic condition in the males, and from this it would appear by no means improbable that the growth factors remain constant for a given species under altered conditions, variations in the food-supply, etc., merely causing changes in the number of moults carried out in any given period of time.

(*b*) **Acrocalanus inermis**, sp. nov.

A considerable number of examples (367) were measured and the results obtained were plotted out as before (text-figure III).

In this species I was only able to obtain a series of four growth stages in each sex and the final sexual stage, stage 1, was not represented; but so far as these moults go they confirm the results obtained in the previous species.

In the female the observed and calculated sizes for the various moults agree even more closely than in *Labidocera euchaeta*.

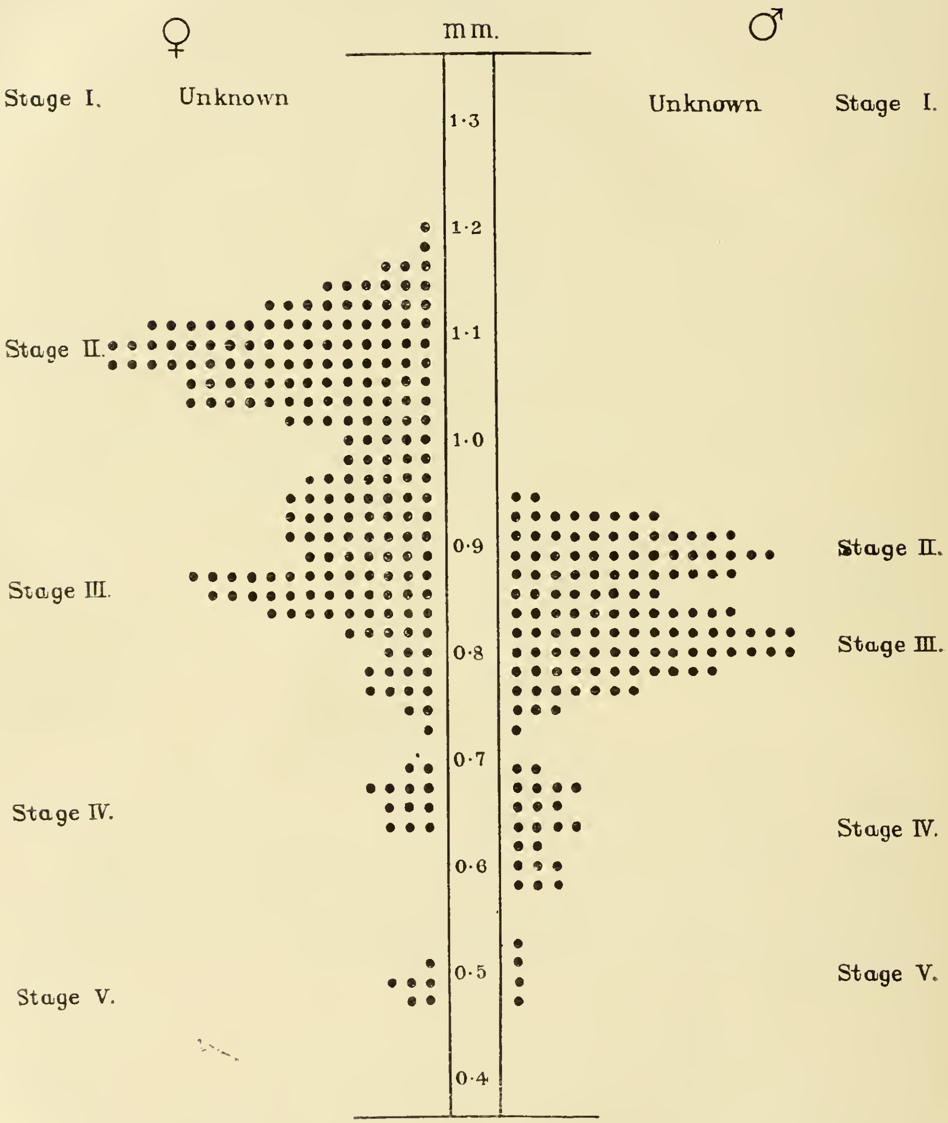

FIG. 3.—Measurements of 367 specimens (222 ♀ : 145 ♂) of *Acrocalanus inermis*, sp. nov.

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 5	0·49	0·49	1·355
,, 4	0·66	0·664	1·355
,, 3	0·90	0·900	1·208
,, 2	1·08	1·087	1·208
,, 1	Unknown	1·313	....

Here the growth-factors are 1·355 for the first two moults, while the last observed moult had a factor of 1·208 and in consequence the final sexual stage or stage 1, at present unknown, should have a length measurement of 1·313.

In the case of the male also the last sexual stage was missing, but the observed and calculated sizes for the preceding four stages are as follows :—

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 5	0·51	0·51	1·3
,, 4	0·63	0·66	1·3 or 1·208
,, 3	0·81	0·80	1·3
,, 2	0·86	0·86	....
,, 1	Unknown	1·04	....

The stage growths here follow exactly the same rule as in *Labidocera euchaeta.* At stage 4 we get a division taking place; some individuals becoming at once sexually mature and reaching stage 2, others having an extra moult to stage 3 before presumably doing so at stage 1. The characteristic growth-factor in this case is 1·3 with the single exception of the moult between stages 4 and 3, where it again is the same as in the final female moults, *viz.*, 1·208.

The text-figure does not show any very definite demarcation between stages 2 and 3, owing to the two curves of variation overlapping to a considerable extent; these two stages, however, can be easily recognized by their structural characters (*vide infra*).

(*c*) **Pontella andersoni**, sp. nov.

A fairly large number of individuals of this species were obtained from the tow-netting taken off Chittagong. I have, however, only been able to obtain three definite growth stages in either sex and although these follow "Brooks' Law" closely yet, as regards the female stages, this species differs in one respect from those of the other species measured.

The actual measurements are plotted out in text-figure IV, but owing to insufficient numbers the last stage of the female and the first of the male do not form very distinct groups.

The average sizes of each group, as found from the actual measurements and those calculated from the smallest stage obtained, are given below :—

♀

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 4	1·991	1·99	1·29
,, 3	2·575	2·57	1·29
,, 2	3·34	3·31	1·29
,, 1	Unknown	4·27	....

As in the case of the other species only specimens from stage 2 were sexually mature. A peculiarity of the growth of this species is that there is no diminution of the growth-factor for the last two moults.

In the case of all the other species that I have examined the growth-factor drops when stage 3 has been reached, and the last two sexual moults are characterized by a smaller increase in size, but here there is no indication of such a change.

In the case of the male also only the penultimate form was obtained. The table below shows the actual and calculated sizes of the various moult-stages.

♂

	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 4	1·825	1·825	1·29 or 1·57
,, 3	2·343	2·354	1·57
,, 2	2·859	2·865	....
,, 1 .. .	Unknown	3·696	....

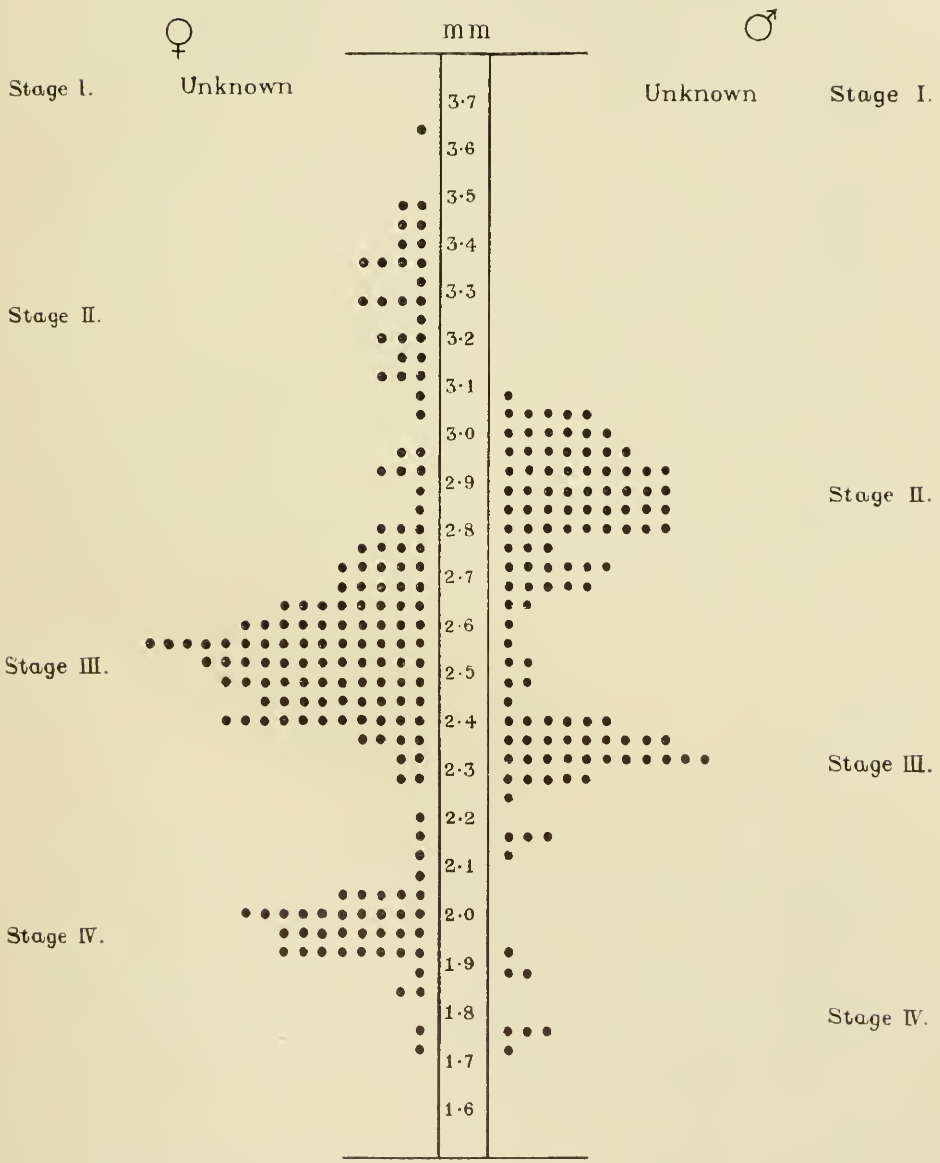

FIG. 4.—Measurements of 296 specimens (175 ♀ : 121 ♂) of *Pontella andersoni*, sp. nov.

As in the other cases we have two growth-factors for stage 4. Some individuals by a factor =1·57 attain sexual maturity direct and reach stage 2, the remainder have a growth factor =1·29 (the same as for the female) and thus reach stage 3, whence by a factor of 1·57 they should attain stage 1. Unfortunately no examples were obtained of this stage, but calculation shows that it should have a length of 3·69 mm., while the final stage of the female should be 4·2 mm. in length.

During the last few weeks a further series of tow-nettings has been received. These were taken in the region at the mouth of Tavoy River (*vide infra* plate xiv), and their chief interest and importance lies in the fact that they contain large numbers of *Paracalanus aculeatus*, Giesbrecht, among which are numerous examples of the hitherto unknown male, a detailed description of which will, I hope, be published shortly.

A series of measurements of individuals of both sexes has been carried out and the results are given in text-figure V.

In the case of the female only two stages have at present been obtained, and these apparently correspond to the last immature stage (stage 3), and the first sexually mature form (stage 2); the members of this latter group correspond exactly with the description of *P. aculeatus* both as regards size and structure.

As is shown in the accompanying table, the growth-factor between these two stages is 1·284.

Paracalanus aculeatus ♀.	Observed size.	Growth factor.
	mm.	
Stage 3 (?)	0·874	1·284.
,, 2 (?)	1·120	

The males fall into a series of four stages corresponding to stages 4 to 1. The individuals of stage 3 correspond exactly with the description given by Cleve (1901), so far as their structure is concerned, but are on the whole slightly smaller, measuring only 0·873 mm. as opposed to 1·1 mm. in his specimens.

Stage 2 corresponds exactly with the adult females, while stage 1 is slightly different, having a series of spines on the margin of the second joint of the exopod in the 2nd-4th pairs of legs.

The average measurements of these four stages are given below in the accompanying table.

Paracalanus aculeatus ♂.	Observed size.	Calculated size.	Growth-factor.
	mm.	mm.	
Stage 4	0·667	0·667	1·45 or 1·284
,, 3	0·873	0·856	1·45
,, 2	0·996	0·967	....
,, 1	1·238	1·241	....

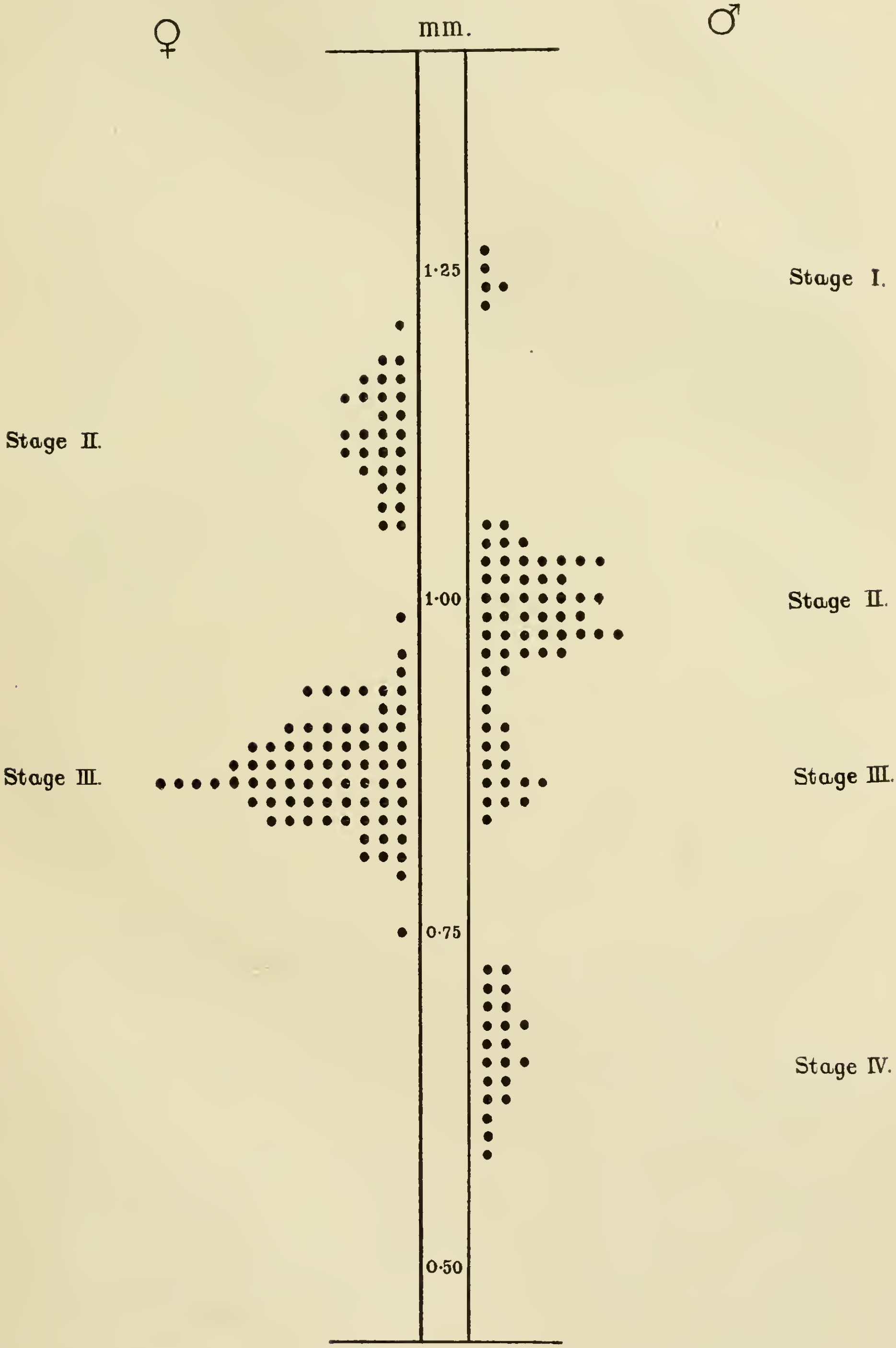

FIG. 5.—Measurements of 192 specimens (105 ♀ : 87 ♂) of *Paracalanus aculeatus* from Tavoy River Estuary.

Here again we see that from stage 4, an individual may either attain sexual maturity (stage 2) in a single moult having a growth-factor of 1·45, or may, by a moult with a growth the same as that of the female, *viz.*, 1·284, reach stage 3 and then become mature (stage 1) by a moult with the typical factor for the male =1·45.

From the above it would appear that under certain conditions we may get two dimorphic forms in any species of Copepod.

Dimorphism in certain groups of the Arthropoda and especially in the Insecta is comparatively common, and several instances have been reported from the Crustacea, among which I may make mention of the dimorphic males in *Pandalus montagui*. Leach (= *P. annulicornis*). This was first noted by Calman (1899) and has since been confirmed and explained by Wollebaek (1908).

In this case the dimorphism affects only the 1st pleopod of the male and is merely a breeding and non-breeding form, that is to say the dimorphism is seasonal and is of the "facultative" type.

Another example of facultative dimorphism in the Decapoda has been described by G. Smith (1906) in two species of *Inachus* (*I. scorpio* and *I. thoracicus*) in which the great chelae are affected.

The type of dimorphism which appears to be present in *Labidocera euchaeta*. *Paracalanus aculeatus*, and possibly in all the species of the Copepoda does not, however, follow either of the above cases, and we have apparently a "high" and a "low" form in both males and females.

As I have already mentioned in the case of *Labidocera euchaeta*, it would appear that in the females growth takes place by a series of moults which follow "Brooks' Law" and the last two stages are sexually mature, thus giving rise to a "high" and a "low" form, which differ from one another not only as regards size but also in respect to certain structural characters, which, however, as I shall subsequently show, are caused by a direct continuation of those changes which are undergone by the individual during the various moults from the later Copepodid stages to the "low" or 1st sexually-mature form. In this respect the dimorphism agrees exactly with that described by Fowler (*loc. cit.*) as occurring in the Ostracoda.

In the case of the males, however, the type of dimorphism is somewhat different and it would appear that the "low" sexually mature form (stage 2) does not directly give rise to the "high" form (stage 1). That is to say, the type of dimorphism is "definitive." Some factor, at present unknown but possibly seasonal, exercises an influence on a Copepodid form (stage 4) and determines which of the two forms shall be finally adopted by the individual.

It may possibly happen that when circumstances such as food supply, etc., are favourable, as in the summer season, the

Copepodid stage can become at once sexually mature and thus give rise to the "low" form (stage 2). Whereas, in unfavourable surroundings an extra Copepodid stage is passed before the individual attains to the "high" form (stage 1). At any rate, if any reliance can be placed on "Brooks' Law," it appears probable that stage 1 never develops direct from stage 2. A similar type of dimorphism has been described by G. Smith (1904) as occurring in a species of Isopod, *Gnathia maxillaris.* In this case, starting from a normal segmented larva, we may get the course of development passing through a small '*praniza*' (1—4 mm. in length) to a small adult (= the "low" form), or on the other hand we may get a larger '*praniza*' (= 5—8 mm. in length) which finally gives rise to a large adult (= "high" form), and in this case also it appears certain that the one form is never derived direct from the other.

In the only two species of Copepoda in which I have been able to investigate all the later stages of the life cycle, *viz.*, *Labidocera euchaeta* and *Paracalanus aculeatus*, the males follow an exactly similar course, and the results obtained in the case of the other species which I have investigated tend to show that this condition of affairs is universal.

We may summarize these changes in the male Copepod as follows:—

Stage IV (immature).

Stage III (immature).

Stage II
low form of ♂.

Stage I
high form of ♂.

In all cases where they have been obtained, examples of stage 1 were much less common than those of stage 2 or 3, and it appears probable that only a few individuals undergo this final moult.

Finally it would appear at least possible that in many instances so-called "species" of Copepoda, which are at present believed to be distinct, are in reality merely high and low forms of one and the same species, and further investigation may necessitate a linking of pairs of species, as is the case at present in the Ostracoda (Halocypridae).

One extraordinary feature in the above dimorphism of the males is the sudden assumption by certain individuals from stage 4 of the female growth-factor.

That the development of the external sexual characters in the Crustacea is largely, if not entirely, dependent on the development of the gonads cannot be denied and, in consequence, any circumstance that retards the full development of either ovary or testes will materially affect the assumption of the respective sexual characters. If from parasitisation or any other cause the sexual development of these organs is retarded we should expect to find that in the Copepoda, as in other groups of the Crustacea, there would be a corresponding modification in the development of the sexual characters; but in such a case we should further expect that if at a future date the animal recovered and developed its sexual functions the external characters of the sex would be less specialized than in the normal individual.

In the present cases the exact reverse is found, for the individuals of stage 1 (the "high" form), in the development of which the female growth-factor makes its appearance, are, besides being altogether larger and finer specimens, also more highly developed as regards their sexual appendages, to wit the grasping antenna and the 5th pair of legs, than is the case with examples of stage 2, the "low" form, in whose development the growth-factor is of the male type throughout. Consequently it would appear highly improbable that we are dealing here with the result of infection by a parasite.

Wollebaek (1909) has recently published observations tending to show that in certain deep-sea Decapoda the individuals are normally hermaphrodite but, in the absence of any observations on the development and structure of the gonads in these various growth-stages, any speculation with regard to the possibility of a similar condition occurring among Copepoda cannot be attempted.

2. SYSTEMATIC.

Family *CALANIDAE*.

Genus **Paracalanus**.

Paracalanus dubia, sp. nov.

Pl. xv, figs. 1—5.

Numerous specimens of a female of a species of *Paracalanus* were present, and at first sight I was inclined to regard them as examples of *P. crassirostris* (Dahl), but a further examination has revealed several differences and I have been forced to conclude that I was dealing with a new form. I have, therefore, given it the name *P. dubia*.

Total length 0·74 mm.

The head and 1st thoracic segment are fused together; the forehead presents a well-developed rounded bulge anteriorly and terminates in a bifid rostrum, composed of two short, stout, blunt processes.

The thorax presents only three free segments as, in addition to the 1st, the 4th and 5th segments are fused together.

The abdomen consists of four segments of which the 2nd and 3rd are quite short, closely resembling those of *P. crassirostris*. The 1st segment is symmetrical and presents a well-marked genital swelling ventrally. The furcal rami are symmetrical, twice as long as broad, and terminate in four setae of nearly equal length. The proportions of the segments and furca are 15 : 5 : 5 : 10 : 8.

The *1st antennae* reach to the middle of the abdomen; they are composed of 24 free joints having the following relative proportions:—

Segments—

1-2	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
20.	5.	4.	4.	4.	4.	4	4·5.	5.	5·5.	6.	6.	6.	6.	6.	6.	7.	8·5.	8·5.	8·5.	9.	10.	9.	10.

There is a transverse row of minute spines present on the posterior aspect of segments 2 to 9 inclusive.

The *2nd antennae and mouth parts* are similar to those of other members of the genus.

The *1st pair of legs*. The 1st basal segment bears several scattered delicate spines on its anterior surface. The 2nd basal bears an internal marginal seta. The exopodite consists of three segments, of which the 1st bears a small spine distally on its external margin. The 2nd is devoid of spines and the 3rd has the usual two marginal spines, and an end spine, which is extremely long and delicate and is equal in length to the whole exopodite. The endopodite consists of two segments, both devoid of spines.

The *2nd pair of legs*. The 1st basal carries an inner marginal seta and has delicate spines scattered over its anterior surface. The 2nd basal has no seta or spines. The 1st segment of the exopodite bears a corona of spines on its distal external border. The 2nd segment bears no spines in addition to the usual marginal one. The 3rd segment has a row of fine spinules, six to eight in number, on the proximal part of the margin and a corona of fine spines near the distal end; the terminal spine is nearly half as long again as the end segment. The endopodite is three-jointed and has a group of four long slender spines on the posterior aspect of the 2nd joint.

The *3rd and 4th pairs of legs*. In both there is a row of spinules on the proximal part of the margin of exopod 3, and a few on exopod 2, and the 2nd joint of the endopodite has a group of four spines on its posterior surface. The 3rd leg differs from the 4th, however, in that the 1st basal bears a few scattered spines on its anterior surface which are absent on the 4th leg.

The *5th pair of legs*. These are composed of two joints, the terminal joint bears two end spines, one long and the other quite short. The longer spine bears to the end joint the proportional lengths of 7 : 10, and the margin is serrated so that in reality it is a saw rather than a spine. In addition there is a corona of spinules on the posterior aspect of the 2nd segment near the distal border.

As will be seen the points in which the present specimens differ from *P. crassirostris* are:—

1. The absence of spines on the margin of exopod 2 of the 2nd leg.
2. The absence of spines on the posterior aspect of exopod 3 of the 3rd and 4th legs.
3. The serrated saw on the 5th pair of legs.
4. The shorter terminal joint of the 1st antennae.

No corresponding males were found in the collection.

Paracalanus serratipes, sp. nov.

Pl. xv, figs. 6–10.

Several specimens were obtained off Chittagong associated with numerous specimens of the preceding species which they fairly closely resemble, especially as regards the proportions of the body and the 5th pair of legs; they differ, however, both as regards size and in the spinulation of the swimming legs.

As I have already pointed out, it would seem probable that for every species proper we have two forms, a first and a second sexual stage such as have been shown to exist among the Ostracoda, and I am inclined to think that this form may be the later sexual stage of *P. dubia*, but this is only a matter of opinion and I have therefore given it the above "specific" name.

♀ Total length 1·1 mm.

The body and abdomen were similar to *P. dubia* and the relative proportions of the latter were 22: 12: 11: 18: 10.

The 1*st antennae* reach to the middle of the abdomen and consist of 23 free joints, the 1st and 2nd and the 8th and 9th segments being fused; the relative proportions of these joints are as follows:—

Segments—

1-2.	3.	4.	5.	6.	7.	8-9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
35.	11.	11.	12.	12.	12.	14.	8.	8.	10.	11.	12.	12.	12.	12.	12.	13.	13.	13.	15.	13.	15.	15.

Segments 2 to 9 inclusive all bear a transverse row of fine spines on their posterior surfaces close to the distal border, and on segments 10 to 24 there are longitudinal rows of spines as in *P. aculeatus*.

Practically the only difference between these two species, as regards the 1st antenna, is in the length of the end segment.

The 2*nd antennae and mouth-parts* are as in other members of the genus.

The 1*st pair of legs*. The 1st basal segment bears a few spines on its anterior surface. The exopodite is three-jointed and the 1st joint bears a small transverse row of spines on its distal external margin, and the 2nd joint is devoid of spines. The endopodite is two-jointed and bears no spines; the last segment bears 5 setae.

The *2nd pair of legs.* There are no spines on the basal joints. The segments of the exopodite have the usual marginal and end spines, and in addition the 1st segment of the exopod bears a transverse row of spines on its outer and posterior aspect. The 2nd segment bears a slightly oblique row of 4 spines posteriorly and the 3rd segment bears a corona of spines on its posterior surface.

The *3rd and 4th pairs of legs* are almost exactly similar. There are no spines on the basal joints. The 1st segment of the exopod bears a row of spines on the outer and posterior surface distally in the 3rd leg; this is absent in the 4th. The 2nd joint has a row of 4 spines posteriorly, and the 3rd joint has a corona of fine spines in addition to the marginal row. The 2nd joint of the endopodite has a row of spines on its posterior aspect and a transverse corona of spines on its outer and anterior surface.

In the 2nd—4th legs the endopod bears 2 setae on its 2nd and 7 on its terminal joint.

The *5th pair of legs* is the same as in *P. dubia*, but in a few specimens a third small segment was intercalated between the usual two.

♂ Total length 1·1 mm.

The cephalo-thorax is the same as that of the female. The abdomen consists of five segments and its length is contained 2·5 times in that of the cephalo-thorax. The proportional lengths of abdominal segments and furca are 10 : 20 : 16 : 16 : 12 : 10.

The rostrum consists of two short stout spines.

The *1st antennae* reach a point a short distance behind the posterior border of the 5th thoracic segment. As usual in adult males of this genus the basal segments are fused together, so that there are only twenty joints present. The relative lengths are as follows :—

Segments—

1-2.	3-6.	7-8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21	22.	23.	24.	25.
33.	45.	21.	5.	6.	7.	8.	8.	10.	9.	11.	11.	11	10.	11.	10.	11.	11.	11.	8.

The *2nd antennae* resemble those of the male of *P. parvus*, and the exopodite terminates in a nipple-like projection.

The *1st pair of legs.* There appear to be no spines on the 1st basal joint; basal 2 as usual bears an internal seta. The 1st joint of the exopodite has no marginal spine, the 2nd carries a transverse row of small spines and the 3rd has a row of delicate spines on the proximal part of the external margin. The terminal spine is long and slender, being longer than the whole exopodite.

The *2nd—4th pairs of legs* are the same as in the female.

The *5th pair of legs.* As usual that of the left side is considerably the larger and possesses four segments in addition to the enlarged basal portion. The proportional lengths of these segments are 15: 18: 16: 12. The penultimate joint bears a distal spinous process and the last joint terminates in two processes of unequal length. The right leg has only three segments and terminates in two short processes.

These specimens very closely resemble *P. aculeatus*, especially as regards the spinulation of the legs, but they differ markedly in the length of the antennae and the structure of the 5th legs, and I conclude that they are a new species.

NOTE.—Since the above was written, other examples of this species have been obtained at the mouth of the Tavoy River, and it would appear probable that it is a regular inhabitant of estuarine waters in this region.

Genus **Acrocalanus**.

Acrocalanus inermis, sp. nov.

Pl. xvi, figs. 1—9.

As already mentioned a large number of specimens in various stages of development were obtained. As regards their general structure and appearance they agree very closely with other members of this genus; they have all five segments of the thorax separate; the 5th pair of legs is practically absent in the female and only the left one present in the male. They differ, however, in having no spines on the margins of the exopodite of any leg. I do not consider that this is sufficient ground for creating a new genus and propose to include this species under the name of *A. inermis*.

Stage 1. Unknown.

Stage 2.

♀ Total length 1·08 mm.

The head is separate from the 1st thoracic segment and terminates anteriorly, its bifid rostrum consisting of two sharply-pointed processes. The 4th and 5th thoracic segments are also separate and the posterior margin of the thorax is rounded and bears a row of small spines.

The abdomen consists of four segments and is contained 3 times in the length of the cephalo-thorax; the furcal rami are symmetrical and bear four terminal setae. The proportional lengths of the abdominal segments and furca are 24 : 14 : 11 : 18 : 12.

The 1st *antennae* reach to the end of the furcal rami and consist of 23 separate joints; the 1st and 2nd segments are completely and the 8th and 9th partially fused together. The relative proportions are as follows :—

Segments—

1-2.	3.	4.	5.	6.	7.	8-9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25
35.	9.	9.	9.	9.	10.	15.	8.	8.	9.	10.	11.	11.	11.	11.	11	12.	12.	12.	10·5.	12.	11.	12

Each of the 1st six segments bears a transverse row of very small delicate spines.

In *the 2nd antenna* the endopodite and exopodite are of nearly equal length, the former consists of seven segments and the whole closely approximates to the condition found in *Paracalanus parvus.*

The *mandible* is armed with a row of powerful teeth; they are not quite symmetrical, that of the left side having a small extra cusp on the large 1st tooth.

The *maxilliped* resembles that of *A. pediger*, Claus (*vide* Cleve, 1901, pl. i, fig. 9).

The *1st pair of legs* consists of the usual 3-jointed exopod and 2-jointed endopod; the 1st segment of the exopod has no large marginal spine, but its place is taken by a short transverse row of small spinules; the 2nd joint is also devoid of spines but its outer border is fringed with long hairs; the 3rd joint has two marginal and a long terminal spine, this last being twice as long as the segment. The 1st basal joint bears no inner seta and is beset with short stiff hairs. The 2nd basal bears a long inner seta.

The *2nd pair of legs.* Both endopodite and exopodite are 3-jointed. The 1st joint of the exopod has a transverse row of short spines near its distal extremity and a well-marked marginal spine. The 2nd joint has a well-developed marginal spine and an oblique row of 4 long spines on its posterior aspect, but no spinules on its margin. The 3rd joint has 2 outer spines and a terminal spine but no marginal spinules, it also has a transverse row of delicate spinules distally. The 2nd joint of the endopod has a row of small spinules on its anterior surface and an oblique row of long delicate spines posteriorly.

The *3rd and 4th pairs of legs* resemble each other and are devoid of the marginal spinules that are present in other members of the genus.

The *5th pair of legs* is practically absent, being only represented by short rounded unsegmented processes.

♂ Total length 0·86 mm.

The abdomen consists of 5 segments having, together with the furcal rami, the following proportional lengths 5 : 8 : 6 : 6 : 6 : 5, the last three abdominal segments being of equal length.

The *1st antennae* resemble those of *A. gibber* and *A. gardineri* in that the first six segments are fused together to form a solid mass, separated by a constriction from the remainder of the segments. Segments 7 and 8 are also fused and the relative proportions of the joints are as follows:—

Segments—

1-6	7-8.	9.	10.	11.	12.	13.	14.	15.	16.	17	18.	19.	20.	21.	22.	23.	24.	25.
52.	14.	4·5.	5·5.	6.	6·5.	7·5.	7·5.	8.	9.	9.	9.	9·5.	10.	10.	9·5.	10·5.	10.	6.

The *2nd antennae* differ from those of the female in that the last segment of the exopodite ends in a stump devoid of bristles.

A *5th leg* is only present on the left side and resembles that of *A. gardineri* in that it is composed of a basal portion and four joints. The last joint bears two terminal processes, one long and the other short, and the penultimate joint also bears a terminal spine.

Immature forms :—

In the younger stages of development we find that the males and females closely resemble one another, practically the only difference being the presence of the 5th leg; neither of the antennae showing, as yet, distinctive male features.

Stage 3. In both sexes the abdomen consists of four segments having, together with the furcal rami, the following proportional lengths :—4 : 6 : 5 : 9 : 5.

The 1*st and* 2*nd antennae* are of the female type and with the exception of the 5th leg in the male all the other mouth parts and appendages are as in the adult.

The 5*th leg* of the male is short, reaching only to the 2nd basal joint of the 4th leg and consisting of a basal portion and three joints having the proportional lengths 6 : 5 : 13. The last joint bears 3 spines, two terminally and one midway along the margin, at which point it also shows a slight constriction. From its appearance it is evident that at the next moult it will divide into two, to form the last two segments of the adult leg.

There is a very close relationship between the two genera *Acrocalanus* and *Paracalanus* and, from the study of these immature forms of the present species and examples of so-called adults of other members of these genera, it would appear that in mature males we get certain sexual characters in both 1st and 2nd antennae as well as in the 5th leg.

In *Paracalanus parvus*, *Acrocalanus pediger*, and *A. gardineri*, as well as in the present species, in sexually mature males we find that (1) the 1st antenna has a marked tendency towards the coalescence of the basal segments, (2) the distal part of the end segment of the exopodite of the 2nd antenna is rounded and nipple-like and is devoid of setae, (3) the abdomen consists of five fully-separate segments, and (4) the left leg consists of a basal portion and 4 segments, of which the terminal bears two and the penultimate a single spinous process.

Males have also been described in the case of *A. longicornis*, *monachus* and *gracilis* and *Paracalanus aculeatus*, but in all cases they present only four completely-separate abdominal segments; the antennae are of the female type and the 5th leg has only three separate joints apart from the basal portion and the terminal joint bears three spines. I therefore entirely agree with Wolfenden (1906, p. 1002) that in these instances the males were immature and a comparison of these forms with stage 3 of the above species shows that they are of corresponding ages.

Both Wolfenden (1906) and Cleve (1901) have described forms which they took to be females in which a small 5th leg was present belonging to the following species, *Acrocalanus longicornis*. *A. gracilis*, and *A. gibber* (by Wolfenden) and *Acrocalanus pediger* (by Cleve), but I am inclined to regard most, if not all, of these examples as immature males corresponding to stages 3 and 4 as described above.

NOTE.—Since the above was written Grandori (1912) has published a description of a new genus and new species of Copepod (*Piezocalanus lagunaris*) This is very closely related to *Paracalanus* and *Acrocalanus* and it is interesting to note that in this form also the mature males present the above characters.

Family *CENTROPAGIDAE*.

Genus **Pseudodiaptomus**.

Pseudodiaptomus binghami, sp. nov.

Pl. xvii, figs. 8—11.

A single specimen of a female was found which, while undoubtedly belonging to this genus, yet presents certain characters which indicate that it belongs to a species hitherto undescribed.

♀ Total length 1·3 mm.

The head was fused with the 1st thoracic segment, and thoracic segments 4 and 5 were also fused together. The posterior border of the thorax is rounded and bears a small spine near the dorsal surface. Anteriorly the head terminates in a small bifid rostrum.

The abdomen consists of four segments of which the 1st is considerably the longest; their relative proportions together with the furcal rami being 45 : 25 : 30 : 12 : 28. The 1st segment has two transverse rows of minute spines on its dorsal surface and a row of spines round the dorsal half of its posterior border; there is also a small blunt projection on the ventral aspect, behind the genital opening. The 2nd and 3rd segments also have a row of spines on the dorsal part of the posterior margin. The furcal rami are symmetrical and bear 5 short setae, of which the third is considerably wider than the others and is spear-shaped.

The 1*st antennae* unfortunately have their terminal segments missing, only 18 being present; the relative lengths of these are as follows :—

Segments—

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
17.	10.	5.	6.	6.	9.	5	5.	7.	10.	11.	12.	13.	14.	14.	14.	12.	14.

The 2*nd antennae and mouth parts* are of the usual type, but the terminal joint of the endopod of the 2nd antenna bears a row of sharp spines.

The exopodite and endopodite of the 1*st*—4*th pairs of legs* are 3-jointed and only bear two spines on the external margin of the last segment of the exopodite. There is no spine on the 2nd joint of the exopodite of the 1st leg.

The 5*th pair of legs* is symmetrical, each consists of three segments; the 2nd bears a spine at its outer distal angle and the third segment terminates in four spines, three of which are short, but the fourth is very long and curved, being longer than the combined length of the last two segments. All the spines have serrated margins.

At first sight this specimen appeared to be an example of *Pseudodiaptomus lobipes*, Gurney (1907, p. 27, pl. 1, figs. 3—5), but a closer comparison revealed several differences as regards the serration of the spines on the 5th pair of legs and the spinulation of the 1st abdominal segment, and the furcal setae are entirely different.

Unfortunately Gurney's type specimens appear to have been lost by him and have never been deposited in the Indian Museum, but I have examined other specimens from the original locality and have come to the conclusion that the specimen is not identical. I therefore propose to give it the above name after Lt. A. Bingham, R.I.M., who for many years has been 1st Lieutenant on the R.I.M.S. "Investigator" and has personally assisted in the collection of much valuable marine material.

Genus Centropages.

Centropages alcocki, sp. nov.

Pl. xvii, figs. 1—7.

Numerous examples of both males and females were present.

♀ Total length 1·2 mm.

The head and 1st thoracic segment are separate as also are the last two thoracic segments. The posterior border of the last segment is rounded and near the ventral border presents a short backwardly directed spinous process. The head is rounded anteriorly and terminates in a small bifid rostrum.

The abdomen possesses three segments and is symmetrical, the proportional lengths of segments and furca being 35 : 22 : 20 : 15. The 1st segment bears on each side a clump of small needle-shaped spines. The furcal setae are 5 in number and of these the 2nd is about twice the length of the others.

The 1*st antennae* are short and do not reach to the end of the thorax; the proportional lengths of the segments are as follows:—

Segments—

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
15.	9.	3.	4.	4.	4.	4.	5.	5.	6.	6.	9.	13	14.	15.	16.	16.	17.	15.	11.	11.	7.	7.	12.

There are no spines on any of the proximal segments.

The *2nd antennae and mouth-parts* closely resemble those of *C. typicus*.

The 1*st*—4*th pairs of legs* in their general structure resemble those of other members of the genus, but the terminal spines of the exopods differ from those of other species in that the armature of the saw is composed of a series of coarse teeth separated by comparatively wide intervals, more nearly resembling the condition found in *Temora*. The spine on the 2nd joint of the exopod of the *5th pair of legs* is simple and resembles that present in *C. typicus.*

♂ Total length 1·1 mm.

The head and thorax are as in the female; the abdomen consists of four segments and the furcal rami are symmetrical as in the female.

The *grasping antenna* has the knee-joint, as usual, between the 18th and 19th segments and the proportional lengths of the distal joints are as follows :—

13.	14.	15.	16.	17.	18.	19-21	22.	23.	24.
13.	15.	20.	20.	20.	32.	22.	20.	16.	12.

The 10th, 11th and 12th segments all bear a curved spine-like process on the anterior surface. The 17th segment bears a toothed-plate which is somewhat longer than the segment itself and is prolonged over the proximal part of the 18th segment. The toothed-plate on the 18th segment extends the whole length of the joint, that of the 19th segment bears teeth the whole length of the segment and is then produced as a spinous process beyond the distal extremity.

The *5th pair of legs* is as figured.

The shape of the last thoracic segment and the coarse saw on the exopodites of the legs serve to distinguish it from other members of the genus.

I have much pleasure in dedicating this species to Lt.-Col. A. Alcock, who for many years was Surgeon Naturalist and subsequently became the Superintendent of the Indian Museum.

Genus **Labidocera.**

Labidocera euchaeta, Giesbrecht.

Stage 1, Dimorph. 1, nov.

Pl. xviii, figs. 1—9.

♀ Total length 2·64 mm.

The head is separate from the 1st thoracic segment and is subdivided into two regions, an anterior and a posterior, by a deep groove that runs transversely across the dorsum, separating the part that carries the two antennae from that which bears the mouth-parts. The 4th and 5th thoracic segments are fused, and the posterior thoracic border is produced backwards in an angular process as in *L. wollastoni*. Anteriorly the head forms a prominent bulge terminating below in a pair of long retrorse rostral spines. There is no rostral lens but a ventral lens is present. Although well marked this forward bulge of the forehead is not so distinct as in the earlier stage (stage 2). Side hooks are absent.

The abdomen is composed of two joints only, the 2nd or posterior of which is very short. The furcal rami are symmetrical and the furcal setae are of practically equal length.

The 1*st antennae* comprise 21 joints, the 7th and 8th segments being completely and the 10th and 11th partially fused. When fully extended they reach nearly to the end of the abdomen. The proportional lengths of the joints are as follows:—

Segments—

1.	2.	3.	4.	5.	6.	7-8.	9.	10-11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23
51.	52.	11.	8.	7.	18.	30.	17.	37.	24.	25.	28.	38.	38.	45.	45.	30.	28.	28.	25.	25

The distal part of segment 2 and segments 3 to 14 are fringed posteriorly with long hair.

The *2nd antenna, mandible and maxillae* are of the usual type.

The *maxilliped* resembles that of other members of the genus, but is armed with a row of fine teeth down the margin of the 2nd basal joint.

The 1*st pair of legs* is as figured. All the segments of the exopodite are fringed with fine hair and the terminal saw is long and slender, being over $1\frac{1}{2}$ times the length of the last segment.

The 5*th pair of legs* very closely resembles those of the preceding stage as described by Giesbrecht. In both cases there is no endopodite present; it differs, however, in having five spines on the margin of the exopodite instead of four. As we shall see later this increase in the number of spines appears to be connected with the progressive stages of development, the young immature forms only having three spines present.

♂ Total length 2·43 mm.

The general structure of the cephalo-thorax is the same as in the female, but the cephalic groove, described above, appears to be usually somewhat better marked. The rostrum resembles that of the female and has no lenses. A well-developed ventral lens is present.

The abdomen consists of 5 segments, of which the 5th is very small. The furcal rami are symmetrical, as in the female, and the proportional lengths of segments and furca are 5 : 6 : 6 : 4 : 1 : 6.

The *left* 1*st antenna* resembles that of the female, the proportional lengths of the joints being as follows:—

Segments—

1.	2.	3.	4.	5.	6.	7-8.	9.	10-11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
45.	46.	9.	6·5.	7.	16.	27.	15.	35.	23.	23.	26.	38.	38.	45.	44.	30.	27.	27.	24.	24.

The *right* 1*st antenna*, as usual, forms a grasping organ, and the exact determination of the limits of the various segments in the proximal portion is a matter of considerable difficulty; as regards the distal segments the knee-joint is situated between segments 18 and 19 and the 19th to 21st segments are fused together.

The proportional lengths of the last 9 joints are as follows:—

14.	15.	16.	17.	18.	19-21.	22.	23.	24.
31.	30.	45.	38.	78.	78.	32·5.	23.	23.

The 17th segment bears a prominent crest, which terminates distally in a sharp point; the 18th segment is armed with a toothed-plate, which is not produced proximally as in the earlier stage; the teeth are lancet shaped and are larger in the centre than at the two ends. The 19th—21st segments bear a toothed plate, which extends nearly the whole length of the joint, and the 22nd segment is produced distally in a sharp process which extends nearly the whole length of the succeeding segment.

The *5th pair of legs.* The right forms a grasping organ; the proximal part of the claw is produced in a slender curved process and near the base of this is a single rounded tooth. The distal part of the claw is slender and has no teeth. The left leg has a short terminal joint, which bears a spine on its external margin and has three terminal processes; its inner border is thickly fringed with hair. The penultimate joint also bears a terminal spine at its distal external angle.

L. euchaeta. Stage 2, Dimorph. 2.

Pl. xix, figs. 1—3.

Giesbrecht, 1892, p. 446, pl. 23, fig. 31, and pl. 41, figs. 7-36.
Giesbrecht and Schmeil, 1898, p. 135.

The female of this stage was first described by Giesbrecht (1889). I have not been able to see his original description, but the specimens obtained by me agree almost exactly with the description and figures given by him in his work on the Copepoda of the Gulf of Naples (1892), and by Giesbrecht and Schmeil in the "Das Tierreich" (1898). It is therefore unnecessary for me to give a detailed description.

The head and 1st thoracic segment are separate and a faint groove indicates the division into the two parts of the cranial region, and the 5th thoracic segment is fused with the 4th and terminates posteriorly in an angular process; a point in which my specimens differ from the description is in the sharp forward bulge of the forehead. The rostral spines are long and slender. No rostral lenses are present but there is a small ventral lens.

The abdomen has three segments and the furcal rami are asymmetrical, the left being smaller than the right, and the 2nd furcal seta is much longer than the others, more than three times their length and nearly $2\frac{1}{2}$ times as long as the combined abdomen and furca.

The 1st *antenna* is composed of 23 segments; their relative lengths are given below—

Segments—

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
32.	38.	6.	5.	6.	9.	6.	19.	15.	12.	26.	24.	23.	30.	39.	36.	42.	41.	27.	27.	31.	31.	25.

It reaches back nearly to the posterior end of the furca.

The *5th pair of legs* has no separate endopodite, and the exopodite has a row of spines on its external margin and distal end.

♂ Total length 1·88 mm.

Numerous examples of males were obtained and they correspond very closely with the females as regards their general structure.

The cephalo thorax is the same as in the female.

The abdomen consists of 5 segments, of which the 3rd is the longest and the 5th very short; the relative proportions of abdominal segments and furca are 22 : 20 : 30 : 15 : 7 : 22. The furcal rami in this sex are symmetrical.

The *grasping antenna* has the knee-joint between the 18th and 19th segments : the proportional lengths of the distal-joints are as follows :—

13-14.	15.	16.	17.	18.	19-21.	22.	23.	24-25.
23.	25.	45.	27.	47.	60.	38.	30.	23.

The 17th segment bears a spine very like that of *L. minuta*, and the toothed-plate of the 18th is longer than the segment itself and is produced proximally over the 17th. The 19th segment bears a row of six angular teeth which increase in size distally.

The *5th pair of legs* is as figured. The spine on the proximal segment of the claw in the right leg is short, and there is a small angular tooth near its base; the distal segment is broad and terminates in two setae. The left leg bears a terminal group of curved spine-like processes and is clothed in hair on its inner margin; the penultimate joint also has a distal spine.

L. euchaeta. Stage 3.

Pl. xix, figs. 4—7.

♀ As regards their general structure, the individuals of this stage do not show any very great differences from stage 2. The abdomen possesses the same three segments, but the furcal rami are symmetrical. The *antennae and mouth parts* are identical with those of the adult.

The *5th pair of legs* is short, only reaching to the end of the 1st basal joint of the 4th pair of legs; they are very similar in structure to those of stage 2.

♂ In the case of the male the cephalo-thorax is the same as in the adult. The abdomen, however, only possesses four segments; of these the 3rd is the longest as in the case of subsequent stages.

The *5th pair of legs* contains only two joints and presents a superficial resemblance to those of the female of the same stage; they are however considerably longer, reaching to the 2nd basal joint of the 4th leg, and are not quite symmetrical, that of the right side being the larger. The main difference in length from that of the female is due to the greater size of the distal joint; four spines are present, one about the middle of the external margin and a group of three distally; on a level with the single marginal spine there is a distinct constriction showing where, at the next moult, the division into two segments will occur.

L. euchaeta. Stage 4.

Pl. xix, figs. 8 and 9.

This is the earliest stage in which any definite difference between the two sexes could be made out, and here the only apparent sexual indication lay in the proportional length of the 5th legs; in the female they were short, reaching only to a point half-way or a trifle more along the 2nd abdominal segment, whereas in the male they reach well beyond the 2nd segment and in some cases half-way along the 3rd.

In both sexes the form of the legs were the same and consisted of two joints, the distal having only three spines, and in both sexes also the abdomen consists of three segments, of which the third is the longest.

From the above descriptions, it is seen that the two final stages (1 and 2) differ very considerably as regards certain characters; especially is this the case in the males, where the grasping antennae and the 5th pair of legs are entirely different.

In the females the differences are less marked, yet a study of the two sexes in these stages must, I think, convince anyone that they actually belong to each other and that we are not dealing with the female of one species and the male of another. For the purpose of reference I have tabulated below some of the main characters following the changes through the four final growth-moults.

	No. of joints in abdomen.		Head lenses.	1st antenna ♀.	5th leg ♀ exopod.
	♀	♂			
Stage 4 ..	3	3	No lenses ..	23 free segments	3 spines.
,, 3 ..	3	4	No lenses ..	23 free segments	4 spines.
,, 2 ..	3	5	No rostral lenses, small ventral lens.	23 free segments	4 spines.
,, 1 ..	2	5	No rostral lenses, ventral lens.	21 joints, segments 7 and 8, and 10 and 11 fused.	5 spines.

It is at once obvious that these differences are due to a progressive development through the various growth-moults. In all the above-mentioned instances there is a regular gradation such as could not be merely due to coincidence. There is no greater difference between stages 1 and 2 than there is between stage 2 and the sexually immature forms, stages 3 and 4, and I consider that this fact, combined with a study of the developmental moults, justifies me in concluding that these are dimorphic forms and not distinct species or varieties. Incidentally it is interesting to note that in the female we get a fusion of the abdominal segments taking place, whereas in the male we have the exact reverse, the segments gradually increasing in number owing to division taking place.

Genus **Pontella**, G. Brady.

Pontella andersoni, sp. nov.

Pl. xx, figs. 1—6.

Numerous examples of both males and females were obtained; they differ from all previously described species, and I have given them the above name after Lt.-Col. A. R. S. Anderson, who was for many years Surgeon-Naturalist and is now Civil Surgeon at Chittagong, where the specimens were obtained.

♀ Total length 3·34 mm.

The head and 1st thoracic segment are separate, as are also the 4th and 5th thoracic segments. The posterior thoracic margin terminates in a sharp lateral spine. The forehead is rounded anteriorly and terminates in a strong bifid rostrum. There are no rostral lenses present. The back of the head is crossed by a strongly marked groove. Side hooks are present.

The abdomen consists of two segments, the 2nd of which is small and terminates in symmetrical furca. The 2nd pair of furcal setae are much longer than the others, about twice the length. The relative lengths of the segments and furca are 20 : 6 : 11. The 1st segment is barrrel-shaped and quite symmetrical.

The 1st *antennae* do not reach to the end of the thorax. The segments have the following proportional lengths :—

Segments—

1.	2.	3.	4.	5.	6.	7.	8.	9	10.	11-12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
50.	38.	11.	9.	13.	14.	12.	12.	20.	14.	39.	24.	28.	32.	41.	37.	43.	45.	34.	31.	32.	23.	28.

The 11th and 12th segments are partially fused and the posterior border of the proximal segments is fringed with hair.

The *2nd antennae, mandibles, and maxillae* are of the usual type. The *maxillipeds* show the usual seven joints and the 2nd joint is armed with a row of spines down the margin.

The *1st pair of legs* has the usual 3-jointed exopodite and endopodite, and the whole of the external margin of the former is fringed with hair. The spine on exopod 2 is long, reaching well beyond the base of the 1st spine on exopod 3. The terminal saw is longer than the combined lengths of the two end segments of the exopodite.

The *2nd—4th pairs of legs* are as usual.

The *5th pair of legs* consists of a single jointed exopodite and endopodite, the former being about twice the length of the latter. The exopodite bears five spines, a single one near the middle of the outer border and four close together at the distal end. The endopodite is bifid, the external process being the longer of the two.

♂ Total length 2·86 mm.

The head and thorax resemble those of the female, with the exception that small rostral lenses are present.

The abdomen consists of five segments, of which the 3rd is the longest, the furcal rami are symmetrical and the proportional length of the segments and furca are 7 : 5 : 10 : 5 : 5 : 15.

The *left* 1st *antenna* resembles that of the female. The *right* forms the usual grasping apparatus. The knee-joint is between the 18th and 19th segments. The 17th segment is produced on its anterior surface as a low crest, terminating in a short spine distally. The 18th segment carries a toothed-plate, which is prolonged proximally for a short distance over the 17th segment, and is armed with a double row of fine teeth. The 19th segment bears two tooth-plates each armed with fine teeth, and is prolonged distally as a sharp spine. The proportional lengths of the end segments are as follows :—

13-14.	15.	16.	17.	18.	19-21.	22-25.
8.	8.	12.	5.	23.	20.	26.

The 9th—12th segments each carries a seta-like spine on the anterior border.

The *5th pair of legs* is as figured. Instead of a single process on the proximal segment of the claw, it bears two spines, and proximal to the spines are a pair of small knot-like projections on the margin. The distal segment is broad and ends in a blunt club-like protuberance. The left leg terminates in a long segment, bearing the usual spine and two processes terminally, and about two-thirds of the distance along its posterior surface arises a serrated spine.

P. andersoni. Stage 3.

Pl. xx, figs. 7—9.

♀ At this period of its existence the animal is as mentioned before, sexually immature, and in consequence we find that the abdomen consists of 3 segments, one more than in the mature female. As regards the appendages, these are for the most part the same as in the adult, and even in the case of the 5th pair of legs there is no very marked difference ; the endopod is, however, a trifle shorter and its two terminal processes have not yet assumed their final delicate shape

♂ In the male, as was pointed out in the case of *Labidocera euchaeta*, there are very considerable differences between this stage and the next.

The abdomen consists of 4 segments only, of which the third is the longest.

The *left* 1st *antenna* exactly resembles that of the female ; the *right*, though quite unlike that of the adult, yet has begun to alter in character and has assumed the form described by Brady (1883, p. 95, pl. xlv, fig. 11) in his *Pontella inermis.* The segments 12—16 form a spindle-shaped swelling, but the distal segments have not yet fused completely together, though segments 19—21 show signs of so doing, and there is no distinct knee-joint present. Segment 14 bears a long spinous process, and from the distal end of segment 19 a spinous process arises and extends to the end of segment 2 . , this is the future toothed-plate.

The *5th pair of legs* is symmetrical and consists of two segments only, the distal of which closely resembles the exopod of the femal leg ; there is no endopodite present. They reach to the end of the 2nd basal joint of the 4th leg and, as in the immature *Labidocera euchaeta*, are slightly constricted at the level of the first marginal spine, thus indicating where the division into two segments will occur at the next moult.

It is interesting to note that in stage 2, that is, in the first sexually mature stage of the males of both *Labidocera euchaeta* and *Pontella andersoni*, the terminal part of the claw of the 5th right leg is broad and stout and comparatively short, and it may be that this is one of the characteristics of this stage of development, the slender spinous-type of joint being developed only in stage 1.

Genus **Acartia.**

Acartia tortaniformis, sp. nov.

Pl. xxi, figs. 1—10.

Several examples of both sexes were obtained.

♀ Total length 1·4 mm.

The head and 1st thoracic segment are separate. Thoracic segments 4 and 5 are fused together and have a rounded posterior margin. Anteriorly the rostrum is absent, and the line of the forehead is continued round to the ventral surface, where it terminates in a hair-bearing ridge.

The abdomen is long and is contained $1\frac{1}{2}$ times in the length of the cephalo-thorax ; it contains 3 segments and a pair of furcal rami which are long, the proportions being 9 : 7 : 5 : 10. The 1st segment bears a row of spines transversely across its dorsal surface and scattered spines on the anterior half of its dorsal aspect. The furcal rami are symmetrical and terminate in four setae, the fifth arising from the external margin ; the 2nd is longer than the others and is somewhat stouter at its base : this latter feature is however much more marked in the males. An accessory seta also arises from the dorsal surface.

The *1st antennae* reach to the beginning of the furcal rami ; as usual it is difficult to determine the boundaries of the various segments in the proximal part ; the proportional lengths of the segments are as follows :—

Segments—

1.	2-6.	7.	8.	9	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
10.	36.	12.	15.	3.	11.	11.	8.	19.	12.	12.	14.	21.	21.	25.	19.	19.	15.	20.	15.	5.

There are three groups of small triangular spines on the posterior surface of the proximal joints, and with the exception of the distal three segments, all the others bear transverse rows of spines posteriorly.

The *2nd antenna* is of a somewhat unusual type. The basal portion consists of the usual two segments; the 1st basal bears a single and the 2nd basal two setae, and the margins are fringed with hair. The endopodite appears to be fused with the second basal joint and bears a crown of seven setae. The exopodite consists of a single joint and bears 9 setae.

The *mandible* is furnished with four teeth, of which the 1st is separated from the remainder by a wide interval.

The *2nd maxilla* resembles that of other members of the genus.

The *maxilliped* presents a resemblance to that of other members of the genus *Acartia*; the 3rd joint bears four sharp spinous processes and the 2nd joint carries a row of 4 triangular teeth on the margin.

The *1st pair of legs.* The exopodite consists of three segments. There is no marginal spine on exopod 2; both exopod 1 and 2 carry a single seta on their inner margins and exopod 3 has a row of five. The terminal spine is long and slender and is not serrated for some distance along the shaft; the proportional lengths of the spine and the terminal segment are as 46 : 16. The endopodite has two joints, of which the proximal bears a pair and the distal six setae.

The *2nd—4th pairs of legs.* Each consists of a 3-jointed exopod and 2-jointed endopod. Each joint of the exopod bears a single marginal spine, and the end saw is very long and slender resembling that of the 1st leg. The 1st joint of the endopod bears 3 and the 2nd 6 setae.

The *5th pair of legs* is symmetrical and possesses a basal portion carrying a marginal bristle and a single-jointed exopodite and endopodite, of which the former is about twice the length of the latter and each is serrated.

♂ Total length 1·45 mm.

The cephalo-thorax resembles that of the female. The abdomen is composed of four segments.

The *right antenna* is modified to form a grasping organ. The knee-joint is situated between segments 18 and 19. The 17th segment bears a toothed-plate which is prolonged distally over the 18th segment, which bears a toothed-plate carrying numerous needle-like teeth, and distally has a pair of sharp fang-like teeth. The 19th segment bears two long spine-like tooth-plates armed with fine teeth on their anterior margins.

The *left antenna* resembles that of the female.

The *th pair of legs.* The left leg consists of three segments and the right of four, as in other members of the genus; arising from the basal joint of the right leg is a well-developed process, the endopodite.

This species is of considerable interest as it shows marked affinities on the one hand to the genus *Acartia* and on the other to the genus *Tortanus*; it forms, as it were, a distinct connection between these two genera, though on the whole, its structure is nearer that of *Acartia.* I propose therefore to give it the name *Acartia tortaniformis.*

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II.—The Gymnoplea of the S. Burma Coast and Moscos Island.

The regions of the coast of Burma in which the collections were made comprise (1) Hinzé Basin (lat. 14° 41′ 95″ N., long. 97° 53′ 00″ E.) and its neighbouring waters, and (2) the region extending from the Middle Moscos South Island (lat. 14° 15′ 95″ N.) on the north to the entrance of Tavoy River (lat. 13° 31′ 45″ N.) on the south, and from the coast line on the east to about latitude 97° 40′ 00″ on the west. Over the whole area the plankton was found to be abundant, especially during the later part of the season, *i.e.* March and early April, and the following diatoms were identified:—

Amphilonche belonoides.
Asterionella glacialis.
Asterionella challengerensis.
Asteromphalus hookeri.
Bacteriastrum delicatulum.
Bacteriastrum spirillum.
Bacteriastrum varians.
Chaetoceras criophilum.
Chaetoceras coarctatum.
Chaetoceras compressum.
Chaetoceras densum.
Chaetoceras dichaeta.
Chaetoceras didymum.
Chaetoceras diversum.
Chaetoceras furca.
Chaetoceras lorenzianum.
Climacodium biconcavum.
Climacodium frauenfeldianum.
Coscinodiscus centralis.
Coscinodiscus excentricus.
Coscinodiscus lineatus.
Eucampia zoodiacus.
Guinardia flaccida.
Hemiaulus hauckii.
Melosira borreri.
Nitzschia closterium.
Nitzschia lineola.
Nitzschia migrans.
Planktoniclla sol.
Pyrocystis lunula.
Rhizosolenia alata.
Rhizosolenia arafurensis.
Rhizosolenia calcar avis.
Rhizosolenia robusta.
Rhizosolenia setigera.
Rhizosolenia shrubsolei.
Rhizosolenia stolterfothii.
Rhizosolenia styliformis.
Skeletonema costatum.
Thalassiosira antarctica.
Thalassiosira aurivillii.
Thalassiosira longissima.

It was soon seen, however, that although in the main the same diatoms were present in all the different parts of this region, in certain very definite areas the proportional distribution was extremely different, and this appeared to be constant during the whole of the two months in which the investigations were carried out. So striking were the differences that one could tell at a glance from which particular area the collection of plankton had been made. I was thus able to divide the region, from the Middle Moscos Islands to Tavoy River, into four areas, each differing from the other in their surface plankton, and in the accompanying map (pl. xiv) I have indicated, as nearly as possible, the limits of these areas.

Area I extends from the mainland to some distance west of the Middle Moscos Islands, and from there is continued southward along the coast in a narrow band. The diatom flora of this area was composed, in the main, of large quantities of *Coscinodiscus* and *Thallasiosira*. In this respect it resembled the flora of the waters off Hinzé Basin, some 25 miles further to the north; but I am unable to state whether these areas were confluent as no observations were made in intermediate waters. The flora of Hinzé Basin itself agreed with that of area III and the estuary of Tavoy River.

Area II extends from the south point of the Middle Moscos South Island to the north of the South Moscos group and then splits into two; one band passes down on the west side of the Islands, but the main area is continued to the south, in a gradually decreasing band, as far as the coast. In this area the tow-nettings were extremely large and of a dark green colour and consisted very largely of a thread-like alga of the genus *Trichodesmium*; there were also present, in fairly large numbers, several species of the genus *Ceratium*, principally *C. tripos*, which occurred not only as single individuals but also in the chain form.

Area III extends in a band from the east of the South Moscos Islands down to the entrance to Tavoy River, where it becomes continuous with the estuarine plankton. Here again the tow-nettings were very copious and of a dark green colour. Diatoms were exceedingly abundant, the commonest forms being *Rhizosolenia* and *Chaetoceras*.

Area IV extends over the whole of the region lying to the west of the 20-fathom line. The tow-nettings were of a pale pink colour, thereby being in marked contrast to those obtained from the two preceding areas. In some respects the plankton here was very similar to that of area II in that it contained quantities of the alga *Trichodesmium*, but it differed very materially in the large number of *Radiolaria* that were present. As I have already mentioned, its eastern boundary corresponds fairly closely with the 20-fathom line, and it is possible that we are in reality dealing here with a continuation of area II, the differences being due solely to the increased depth of the water; but as, in addition to the differences above mentioned, it was found that there were certain differences in the Copepod fauna present in these two areas I have preferred to keep them separate.

One cannot help being struck by the manner in which these areas are arranged, in roughly parallel bands running approximately from north north-west to south south-east Along this part of the coast, the main trend of the ebb and flood tides is in this same direction, but it does not appear to me to be probable that tide alone could cause such a definite banded arrangement, and a much more likely explanation would be that we are here dealing with a slow though definite current of water moving down the coast from the north and carrying the plankton with it, and this view receives further support from a study of the physical conditions of the coast-line, where we see that the sand-banks at the mouth of Hinzé Basin and in Maungmagan Bay have a well-marked southerly trend, and at the south end of the

South Moscos South Island there is a very definite scouring out of the sea bed, the depth here suddenly increasing to over 20 fathoms. Such a current coming down from the more northerly region of the Bay of Bengal would also account for the presence in area II of the serial form of *Ceratium tripos*, a form which, it is generally stated, is only found well out to sea and remote from any land.

On the other hand, however, area III would appear to run in a direction exactly opposed to such a current, for this area is directly continuous with the region at the mouth of Tavoy River. There is no doubt that this area is largely influenced by tides, for on two occasions the ship while carrying out a line of soundings passed right across this region, and although the net was down the whole time, the type of plankton obtained was typically that of area II; on both occasions, however, the tide was on the ebb, and this would appear to indicate that during the flood tide this area is carried up from the south from the region of Tavoy River to the east of the South Moscos Islands, and on the ebb tide it again recedes, its place being taken by water from area II.

The variations in the tow-nettings of these four areas were, however, not confined merely to the diatom flora; marked differences were found to exist regarding the occurrence of various species of Copepoda. This was particularly well marked in the case of area I as compared with the remaining three areas, and in the following table I have endeavoured to indicate these differences as fully as possible, the frequency or the reverse of several species being shown in percentages of the total Copepod catch.

	Area I (5 localities).	Areas II and III (8 localities).	Area IV (2 localities).
CALANIDAE.			
Canthocalanus pauper	12·33% in one locality; less than 4% in all others.	From 6 to 29·5% in 5 of the 8 localities.	From 6 to 8%.
Undinula caroli ..	Less than 1% in all localities.	From 3 to 16% in five localities.	Less than 1%.
Eucalanus subcrassus	6·6% and 13·2% in two localities: less than 2·5% in all others.	From 8 to 22% in seven localities.	11% in both localities.
Acrocalanus longicornis.	Less than 1% ..	From 5 to 29·5% in six localities.	2% in both localities.
PONTELLIDAE.			
Labidocera acuta ..	From 19·8 to 59% in all localities.	From 5·4 to 8% in three localities: less than 3% in all others.	Less than 4%.

	Area I (5 localities).	Areas II and III (8 localities).	Area IV (2 localities).
Labidocera minuta ..	From 4·1 to 10·1% in two localities: less than 4% in others.	Less than 1% or absent.	1% or less.
Pontella spinipes ..	From 5·5 to 21·5% in three localities.	Absent ..	Less than 1% or absent.
Tortanus gracilis ..	Less than 1% or absent.	Less than 4% or absent.	From 6 to 9%.

In addition to the above, area IV differed from all the other areas in the presence—though only in very small numbers—of *Eucalanus attenuatus*, *Rhincalanus cornutus* and *Candacia truncata*, *C. aethiopica* and *C. pachydactyla*.

The Copepod fauna of this region of the Burma coast, considered as a whole, seems in many respects to be intermediate between that of the Arabian Sea and Ceylon on the one hand and the Malay Archipelago and its neighbouring waters on the other; thus we find present such species as *Centropages dorsispinatus*, *Centropages tenuiremis* and *Labidocera pectinata*, and such variations as *Pontella danae* var. *ceylonica*, *Labidocera kroyeri* var. *stylifera* and the "*plumulosus*" variety of *Undinula vulgaris* and allied species, all of which have so far only been recorded from the west, and *Candacia discaudata*, *Calanopia thompsoni*, *Tortanus barbatus*, *Pontella princeps* and *Labidocera euchaeta*, which link the fauna of this region with that of the Malay Archipelago and Pacific Ocean on the east. In several instances the specimens obtained furnish interesting examples of "continuous" variation, being intermediate between specimens already known from regions on both sides or a further development of previously-described variations from Ceylon and the Arabian Sea; a more detailed account of these will be given under the different species.

In the following systematic notes I have dealt solely with the Gymnoplea. Of these 73 different species and varieties were obtained, two of the former being new to science, *Pseudodiaptomus hickmani* and *Pontella investigatoris*. In the table below I have given a list of these species and varieties and have indicated in the succeeding columns their presence or absence, so far as is at present known, from the neighbouring areas that have already been investigated.

		Red Sea (Giesbrecht, Cleve, A. Scott).	Arabian Sea (Cleve, A. Scott).	Maldive and Laccadive Archipelagoes (Wolfenden).	Around Ceylon (Thompson & Scott).	Malay Archipelago (Cleve).	Between Borneo and New Guinea (A. Scott).
1	*Calanus minor*		×	×	×	×	×
2	*Canthocalanus pauper*	×	×	×	×	×	×
3	,, ,, var. *plumulosus*, nov.						
4	*Undinula vulgaris*	×	×	×	×	×	×
5	,, ,, var. *plumulosus* ..			×			
6	,, *darwini*		×	×	×	×	×
7	,, *caroli*			×			×
8	,, ,, var. *plumulosus*, nov. ..						
9	*Eucalanus attenuatus*		×	×	×	×	
10	,, *crassus*	×	×	×	×	×	
11	,, *monachus*		×	×	×	×	×
12	,, *pileatus*			×	×		×
13	,, *subcrassus*	×	×	×	×	×	×
14	,, *subtenuis*	×	×	×	×	×	×
15	*Rhincalanus cornutus*	×	×	×	×	×	×
16	*Paracalanus aculeatus*	×	×	×		×	×
17	,, ,, var. *plumulosus* ..			×			
18	,, *parvus*	×	×	×	×	×	×
19	*Acrocalanus gardineri*			×			
20	,, *gibber*	×	×	×	×	×	×
21	,, *gracilis*	×	×	×	×	×	×
22	,, *inermis*						
23	,, *monachus*			×			×
24	,, *longicornis*		×	×	×	×	×
25	,, ,, var. *plumulosus*, nov.						
26	*Calocalanus pavo*	×	×	×	×	×	×
27	,, *plumulosus*	×	×	×	×	×	×
28	*Clausocalanus arcuicornis*		×	×	×	×	×
29	*Euchaeta concinna*			×	×	×	×
30	,, *marina*	×	×	×	×	×	×
31	*Scolecithrix danae*		×	×	×	×	×
32	*Centropages notoceras*		×		×		
33	,, *furcatus*	×	×	×	×	×	×
34	,, *orsinii*	×	×	×	×	×	×
35	,, *tenuiremis*		×		×		
36	*Pseudodiaptomus aurivillii*		×		×	×	×
37	,, *hickmani*, sp. nov. ..						
38	*Temora discaudata*	×	×	×	×	×	×
39	,, *stylifera*	×	×	×	×	×	
40	,, *turbinata*				×		×
41	*Lucicutia flavicornis*	×	×	×	×	×	×
42	*Candacia æthiopica*		×		×		×
43	,, *bradyi*	×	×	×			×
44	,, *catula*	×	×	×	×	×	×
45	,, *discaudata*						×
46	,, *pachydactyla*		×	×	×	×	×
47	,, *truncata*	×	×	×	×		×
48	*Calanopia elliptica*	×	×	×	×	×	×
49	,, *minor*	×	×	×	×		×
50	,, *thompsoni*						×
51	*Labidocera acuta*	×	×	×	×	×	×
52	,, *euchaeta*						
53	,, *kroyeri*		×		×	×	×
54	,, ,, var. *bidens*, nov. ..						
55	,, ,, var. *burmanica*, nov. ..						

		Red Sea (Giesbrecht, Cleve, A. Scott).	Arabian Sea (Cleve, A. Scott).	Maldive and Laccadive Archipelagoes (Wolfenden).	Around Ceylon (Thompson & Scott).	Malay Archipelago (Cleve).	Between Borneo and New Guinea (A. Scott).
56	*Labidocera kroyeri* var. *stylifera* ..				×		
57	,, *minuta*	×	×	×	×	×	×
58	,, *pectinata*		×		×		
59	*Pontella andersoni*						
60	,, *danae* var. *ceylonica*				×		
61	,, *investigatoris*, sp. nov. ..						
62	,, *princeps*				×		×
63	,, *securifer*			×	×		×
64	,, *spinipes*			×			
65	*Pontellopsis herdmani*				×		× (?)
66	,, *krämeri*	×		×			×
67	,, *regalis*		×			×	×
68	*Pontellina plumata*	×	×	×	×	×	×
69	*Acartia danae*			×			×
70	,, *erythraea*	×	×	×	×	×	×
71	,, *spinicauda*		×				×
72	*Tortanus barbatus*						× ?
73	,, *gracilis*	×	×	×	× (?)	×	×

Family *CALANIDAE*.

Genus **Calanus**, Leach.

1. **Calanus minor** (Claus).

Occurrence: Localities B, E, F, K, N, P.[1]

On the whole, this species was comparatively rare; in only a single locality (F) was it present in comparative abundance. The specimens obtained are, with one exception, typical, and in size correspond to the measurement, as given by Scott, 1·7 mm. in length.

As regards colouration, the females usually showed a uniform faint red pigmentation, whereas the males were as a rule colourless.

In one specimen, a female, the 3rd and 4th legs of the left side were abnormal; instead of the usual three-jointed exopodite and endopodite, it consisted of a single paddle-shaped segment, bearing on its free margin a number of setae, 10 in the 3rd and 11

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[1] These letters afford reference to the list of localities given at the end of the paper. All of them, with the exception of Q (Hinzé Basin), are also shown on the map.

in the 4th leg, in the latter the basipodite also presented at its distal external angle a short process carrying four teeth. Probably this abnormality was the result of some previous injury.

Genus **Canthocalanus**, Scott.

1. **Canthocalanus pauper** (Giesbrecht).

Calanus pauper, Giesbrecht and Schmeil, Das Tierreich, Lief. 6, p. 16, 1898.

Occurrence: Localities A. B, C, D, E, G, H, J, K, L, N, O, P, Q.

This species was almost invariably present all over the area of investigation, its maximum frequency of occurrence being obtained to the E. and S. E. of South Moscos South Island.

In point of size it agrees very closely with the figures given by Giesbrecht and Schmeil (*loc. cit*).

In this species also a single specimen, again a female, possessed an abnormal 4th leg right side. The endopodite was normal but the exopodite was composed of only two segments: the distal segment was paddle-shaped and carried one external marginal spine and six setae, the proximal segment carried a single seta but no spine.

2. **Canthocalanus pauper** (Giesbrecht) var. **plumulosus,** nov.

Occurrence: Localities H, K, M.

Seven specimens were obtained which presented, in varying degree, the plumose variation of the furcal setae. So far as I am aware the only previous record of this type of variation was given by Dr. Wolfenden, who found it in several closely allied species: in *Undinula* (*Calanus*) *vulgaris*, *Paracalanus aculeatus* and *Calocalanus pavo* bilaterally, and in *Euchirella bella* var. *indica* and *Euchaeta norvegica* [1] unilaterally, all his examples being obtained from the Maldive and Laccadive Archipelagoes.

As he points out, the variation is extremely irregular, only two, of the seven specimens obtained, being identical; the absence of feathering on the side branches of the plumose setae also agrees with his description of the variation as he found it in *Undinula vulgaris*.

It would appear that this type of variation is extremely local in its occurrence, for as will be seen later, almost all specimens showing it were obtained in the region round the South Moscos South Island.

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[1] Dr. Wolfenden gives a figure of the variation in this species (the Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. ii, plate C, fig. 21), but I can find no mention of it in the text.

Genus **Undinula**, Scott.

Undina, Brady, *nom. præocc.*

1. **Undinula vulgaris** (Dana).

Occurrence: Localities B, D, E, F, G, H, K, L, M, O, P.

Although widely distributed over the whole of the Middle and South Moscos regions, it was much more abundant over the region to the S. and E. of the South Moscos South Island.

In size it was as a rule rather below the average as given by Giesbrecht and Schmeil (*l.c.*, p. 17), varying from 1·9 to 2·3 mm. in length. A few specimens were obtained having the double spine on the left side of the last thoracic segment as figured by Giesbrecht (*Calanus vulgaris*: F. u. Fl. Gulf. Neap., xix, pl. 7, fig. 28).

2. **Undinula vulgaris** (Dana) var. **plumulosus** (Wolfenden).

Calanus vulgaris, Wolfenden, Notes on the Collection of Copepoda. *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii, p. 994, pl. xcvi, figs. 21 and 22.

Occurrence: Localities K, L, Q.

This variety appears to be of comparatively infrequent occurrence, only four specimens being obtained. These, with a single exception from Hinzé Basin, were obtained in the same locality as *Canthocalanus pauper* var. *plumulosus*. They show the same irregularity in the number and arrangement of the plumose setae.

3. **Undinula darwini** (Lubbock).

Occurrence: Localities O and P.

This species appears to be very rare in the different areas investigated and very few specimens were obtained; all those examined were, with one exception, females.

4. **Undinula caroli** (Giesbrecht).

Calanus caroli, Giesbrecht, Atti. Acc. Lincei Rend., ser. 4, vol. 4, Sem. 2, p. 331 (1892).—F. u. Fl. Neapel, vol. 19, p. 91, t. viii, f. 36.

Calanus caroli, Wolfenden, Notes on the Collection of Copepoda. *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii, p. 994.

Occurrence: Localities B, C, E, F, G, H, K, L, M, P, Q.

A large number of females were obtained, which agree in every particular with the description of the specimens obtained by Wolfenden in the Maldive and Laccadive Archipelagoes; that is to say, they have no teeth on the external margin of the last segments of the 2nd or 3rd legs, and in addition, the fine denticulation on the proximal segment of the basipodite of the 5th legs and the spines on the margin of the 1st and 2nd abdominal segments, which are met with in *U. darwini*, are absent in these specimens.

I agree with Wolfenden in thinking that these are probably the female *Undinula caroli*. No males were obtained.

5. **Undinula caroli** (Giesbrecht) var. **plumulosus**, nov.

Two specimens showing the plumose variation of the furcal setae were found in locality K.

Genus **Eucalanus**, Dana.

1. **Eucalanus attenuatus** (Dana).

A few specimens only were taken in localities O, P. They all differed slightly from the description given by Giesbrecht, in possessing a more pointed forehead. In this respect they much more nearly resembled *Eucalanus elongatus*.

2. **Eucalanus crassus**, Giesbrecht.

Occurrence: Localities D, E, L, M, O, P, Q.

A considerable variation in colouration was found to be present; in a few specimens the pigmentation was well marked and closely resembled the figure in Giesbrecht, the setae on the exopodite of the mandible being bright crimson; in the majority, however, all trace of pigmentation was absent.

The females were covered all over the posterior part of the cephalo-thorax and the 1st abdominal segment with short close-set hairs. In the males, however, this was not the case.

In one male specimen the 5th leg was found to terminate in two apical hairs, the distal end of the last segment being slightly bifid, and a specimen of a female was found in which a rudimentary 5th left leg was present; in structure this extra leg closely resembled that normally present in the male, though slightly smaller in size.

3. **Eucalanus monachus**, Giesbrecht.

Occurrence: Localities E, G, H, O, P.

This species was comparatively rare especially in locality H, in which only three specimens were obtained.

4. **Eucalanus pileatus**, Giesbrecht.

Occurrence: Localities J, L, M, P, Q.

This species also was not common, except in locality J where it formed 6% of the whole catch.

5. **Eucalanus subcrassus**, Giesbrecht.

Occurrence : Localities A, B, C, D, E, F, H, J, L, M, N, O, P, Q.

This species was one of the commonest ; it was widely distributed over the whole area of investigation and was usually present in large numbers ; in one locality (Q) it formed very nearly half the total catch.

6. **Eucalanus subtenuis**, Giesbrecht.

Occurrence : Locality Q.

The species was apparently absent over the whole of the Moscos Archipelago ; a few specimens were obtained further north in Hinzé Basin (locality Q).

Genus **Rhincalanus**, Dana.

1. **Rhincalanus cornutus** (Dana).

This species appears to be extremely rare in this region, only two specimens were obtained from locality O and one from P.

Genus **Paracalanus**, Boeck.

1. **Paracalanus aculeatus**, Giesbrecht.

Occurrence : Localities A, D, E, G, J, K, L, N, O.

Although by no means common, this species of *Paracalanus* was fairly widely distributed.

2. **Paracalanus aculeatus**, Giesbrecht, var. **plumulosus**, Wolfenden.

Two specimens were obtained showing the plumose arrangement of the furcal setae, one each in localities G and P ; in other respects they were identical with *P. aculeatus*.

3. **Paracalanus parvus** (Claus).

A few specimens were obtained in localities A, J and Q, but in all other localities this species appears to be absent.

Genus **Acrocalanus**, Giesbrecht.

1. **Acrocalanus longicornis**, Giesbrecht.

Occurrence : Localities A, F, G, H, K, L, M, N, O, P.

This species was fairly widely distributed and in certain regions (G, K, L, M) was exceedingly common.

In one specimen an unusual condition was present in the 4th right leg ; the proximal "aussenranddorne" was missing on the

3rd joint of the exopodite and the coarse teeth on the proximal part gradually diminished in size and finally blended with the finer denticulations on the distal part of the margin, forming a continuous series.

2. **Acrocalanus longicornis**, Giesbrecht, var. **plumulosus**, nov.

A single specimen was obtained from locality G, which showed a slight form of variation of this type, the 2nd seta of the left furcal appendage showing a single dichotomous branching.

3. **Acrocalanus gardineri**, Wolfenden.

A. gardineri, Wolfenden, Notes on the Collection of Copepoda. *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii, p. 1004, pl. xcvii, figs. 5, 10, 14-21.

Occurrence: Localities M, N, Q.

Examples of this species were rare. Those that were obtained were all males and tallied with Wolfenden's description, with the exception that the 2nd basal segment of the 5th leg was in all cases much shorter than the 1st, not longer, as he describes it.

4. **Acrocalanus gibber**, Giesbrecht.

Occurrence: Localities D, E, H, J, K, L, N, O, P.

This species was fairly widely distributed, and in certain localities, notably D, H, K, was quite common.

5. **Acrocalanus gracilis**, Giesbrecht.

Occurrence: Localities C, G, H, J, M, N.

With the exception of localities H, N, in which it formed 10—11% of the total catch, it occurred only in comparatively small numbers. It was also less widely distributed than the preceding species.

6. **Acrocalanus monachus**, Giesbrecht.

Only a single specimen was obtained from locality G.

Genus **Calocalanus**, Giesbrecht.

1. **Calocalanus pavo** (Dana).

Occurrence: Localities D, E, O

With the exception of a single specimen found in D, all those obtained came from E and O, where the species was comparatively common.

2. **Calocalanus plumulosus** (Claus).

A single female was obtained in locality O.

Genus **Clausocalanus**, Giesbrecht.

1. **Clausocalanus arcuicornis** (Dana).

Occurrence : Localities J, O, P.

Only a few specimens were obtained in each of the above localities and the species was apparently absent in all others.

Genus **Euchaeta**, Philippi.

1. **Euchaeta concinna**, Dana.

Occurrence : Localities B, J, O, P, Q.

This species seems to be extraordinarily local in its distribution, and, if present at all, is so in comparatively large numbers.

2. **Euchaeta marina** (Prestand).

This species appeared to be comparatively rare; a few specimens were found in Hinzé Basin (Q).

Genus **Scolecithrix**, Brady.

1. **Scolecithrix danae** (Lubbock).

A single male specimen was obtained from locality O.

Family *CENTROPAGIDAE*.

Genus **Centropages**, Kröyer.

1. **Centropages furcatus** (Dana).

Occurrence : Localities A, B, C, D, E, G, J, L, N, O, P.

This species was of almost universal distribution and in certain localities, especially C and N, was exceedingly common, large numbers of both sexes being obtained.

2. **Centropages notoceras**, Cleve.

C. notoceras, Cleve, Report on Plankton collected by Mr. Thorild Wulff during a voyage to and from Bombay. *Archiv för Zoologi*, vol. i, p. 373, pl. 17, figs. 2-10; pl. 18, fig. 1, 1903-4.

? *C. dorsispinatus*, Thompson and Scott, Report on the Copepoda. *Ceylon Pearl Oyster Fisheries and Marine Biology*, (Suppl. Rept. vii), vol. 1, p. 247, pl. i, figs. 19—25.

Occurrence: Localities B and Q.

Numerous examples of this species were obtained, both males and females, and they agree very closely with the description given by Cleve (*loc. cit.*) of his specimens from the Arabian Sea. As, however, they differ in a few details I append a full description below.

♀ Length from 1·2 to 1·4 mm.

The forehead, when viewed in profile, has a rounded outline, terminating anteriorly in a bifid, backwardly directed rostrum; behind the forehead is a well-marked dorsal hump. A little anterior to the posterior border of the head region, in the middle line, is a large backwardly-curved spine, which terminates in a pair of small antrorse hooks.

The head and 1st thoracic segments are separate. The last thoracic segment is armed on each side with a sharp backwardly-directed spine.

The abdomen is composed of three segments, of which the 1st is markedly swollen and bears on each side ventrally a row of sharp spines. The 2nd segment is longer than the anal and bears on its right side two short rows of spines, of which the proximal is the more ventrally situated. The furcal joints are three times as long as broad and the 5th seta is much shorter and stouter than the others, and arises at the junction of the middle and distal thirds.

The 1*st antennae* are composed of 21 free joints, the first or basal joint being formed by the fusion of 1st to 4th segments, though in a few specimens traces of separation could be made out between the 3rd and 4th. The proportional lengths are as follows :—

1-4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
42.	7.	10.	10.	10.	14.	14.	14.	17.	23.	25.	28.	30.	30.	31.	29.	21.	19.	14.	14.	14.

The fused basal joint carries three spines, on its anterior border a small proximal and a large distal, and on its posterior border a small spine opposite the small proximal one on the anterior surface.

The 1*st leg* closely resembles that of *C. typicus* (Kröyer), in having serrated spines on the 1st and 2nd segments of the exopodite, but differs in the possession of a small spine on the inner border of the 2nd basal segment near the joint for the endopodite.

The 5*th pair of legs* corresponds exactly with Cleve's description and figures.

♂ Length 1·2 mm.

Abdomen 5-jointed, the last segment being very short.

The *anterior antennae* are, as usual, asymmetrical; that of the left side is identical with the female type; the right grasping antenna has the first four segments separate, not fused as in the female and left male antenna, and the 19th to 21st and 22nd and 23rd segments are respectively fused together. The proportional lengths are as follows :—

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19-21.	22-23.	24.
11.	15.	7.	6.	7.	5.	8.	8.	7.	10.	10.	8.	15.	17.	25.	30.	27.	35.	50.	27.	15.

The knee-joint occurs between the 18th and 19th segments, and the 17th, 18th and proximal half of the 19—21st segments are all armed with rows of delicate teeth. The 2nd, 5th and 19—21st segments all bear spines, that on the 5th being large and well-marked.

The *5th leg* is exactly similar to that of *C. dorsispinatus*.

There can, I think, be no doubt that these examples, obtained by me in Hinzé Basin, are identical with those described by Cleve under the name of *C. notoceras* from the Arabian Sea. But there seems to be certain discrepancies between them and *C. dorsispinatus*.

Cleve himself, after seeing Thompson and Scott's paper, came to the conclusion that his examples were identical, but on comparing the two descriptions certain differences are apparent and I have tabulated these as far as possible :—

	C. notoceras, Cleve, and present specimens.	*C. dorsispinatus*, Thompson and Scott.
1	Abdomen ♀ 3-jointed.	Abdomen ♀ 4 (?) jointed (three only are shown in the fig., but in the text it is stated that four are present).
2	Spines on genital (1st) segment of abdomen ♀ on both sides.	Spines only on left side.
3	Rostrum, bifid.	Rostrum broad and triangular.
4	Antennal joints 1-4 fused (in female and left male).	Antennal joints all separate.
5	Well-marked spine on 5th joint right antenna ♂.	No spine present. (They make no mention of it in the text but figure it as absent).

Were it not that Cleve himself was convinced of the identity of his specimens with those from Ceylon, I should have had no hesitation in describing my examples as representatives of *C. notoceras* and distinct from, though closely allied to, *C. dorsispinatus*. Under these circumstances, however, I have left the matter open.

3. **Centropages orsinii**, Giesbrecht.

Occurrence: Localities B, C, D, F, G, H, K, M, N, O, P.

This species was quite common, especially in localities G and H.

4. **Centropages tenuiremis**, Thompson and Scott. Pl. xxiv, figs. 6—7.

C. tenuiremis, Thompson and Scott, Report on the Copepoda. *Ceylon Pearl Oyster Fisheries and Marine Biology*, (Suppl. Rept. vii), vol. 1, p. 247, pl. i, figs. 14—18, 1903.

C. arabicus, Cleve, Report on Plankton collected by Mr. Thorild Wulff during a voyage to and from Bombay, *Arkiv for Zoologi*, vol. i, p. 371, pl. 16, figs. 1—9; pl. 17, fig. 1, 1903-4.

Occurrence: Localities C and E.

Numerous specimens were obtained in the above localities and agree very well with the descriptions of Cleve, and Thompson and Scott. The latter, however, state that in their examples the abdomen of the female possesses four segments (they only figure it with three). As Cleve (*loc. cit.*) points out, the 1st and 2nd segments of the exopod of the right 5th leg of the female are fused together, a point apparently overlooked by Thompson and Scott. Both authors figure the spine as arising from the 1st segment. I have examined a large number of specimens, but can find no evidence whatever in favour of this view; on the contrary, where any trace of separation can be made out, it invariably runs on the proximal side of the spine, which therefore arises, as one would have expected, from the distal portion of the fused segment (vide pl. xxiv, fig. 6). A second point in which my examples appear to differ is in the length of the endopodite which reaches to the end of the spine, whereas both the previous authors show it as falling considerably short of this. Possibly this latter is a local variation, as Cleve figures it much shorter in his examples than in those from Ceylon.

Another point in which my specimens differ is in the 4th pair of legs of the male. Thompson and Scott state that in their specimens this appendage resembled that of *C. typicus*, that is to say the marginal spine of the 2nd joint of the exopodite of the 3rd and 4th legs of the right side is increased in length in comparison with its fellow of the opposite side. In all the specimens that I have examined, however, the 3rd pair of legs is symmetrical and the 4th leg of the right side bears enlarged spines on both exopod 1 and 2.

Genus **Pseudodiaptomus**, Herrick.

1. **Pseudodiaptomus aurivillii**, Cleve.

A few specimens were obtained in locality Q; they were, without exception, females and agreed with Cleve's description.

2. Pseudodiaptomus hickmani, sp. nov.

Pl. xxii, figs. 1—7.

Occurrence : Locality Q.

Several specimens were obtained, both males and females; they appear to differ from any previously described species, and I have much pleasure in naming it after Commander C. S. Hickman, R.I.M., Officer in charge, Marine Survey of India.

♀ Total length 1·37 mm.

The abdomen and furca are contained twice in the length of the cephalo-thorax. The head is separate from the 1st thoracic segment and terminates anteriorly in a bifid rostrum with long and delicate spines. The 5th thoracic segment is armed laterally with a sharp spine, directed backwards and slightly outwards. The abdomen is composed of four segments, the first three of which are armed posteriorly with a row of triangular teeth extending across the dorsal surface. The relative lengths of these segments and the furcal rami are 10 : 4 : 6 : 4 : 7. The latter are three times as long as wide.

The genital segment has a well-marked ventral swelling, and the genital operculum is produced posteriorly in a single spine on the right side. On the right side of the segment is a blunt spinous process and anterior to the genital orifice is a curved row of needle-shaped spines, which terminates laterally in the above mentioned process. Dorsally the segment is armed on each side with an elongated group of very fine spines.

The 1st *antennae* are composed of 21 joints having the following relative proportions:—

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
15.	8.	4.	8.	7.	9·5.	6.	7.	12.	13.	14.	15.	14.	14.	15.	13.	10.	11.	11.	11.	13.

The 2*nd antennae* have the usual characters as in the other members of the genus, but differ from the others in possessing a row of fine spine-like processes on the margin of the last segment of the endopodite.

In the 1*st pair of legs* the endopodite and exopodite are of nearly the same length. The 1st joint of the exopodite bears a long slender serrated external margin spine and the 3rd joint has two short non-serrated external spines and a terminal spine, whose length is almost equal to the combined length of the last two segments; the 2nd joint is without a spine. The 1st joint of the basiopodite bears two rows of delicate spines on its antero-external surface, one at its distal margin and the second, in which the spines are somewhat longer, about the middle of its length.

The 2*nd*-4*th pairs of legs* are of the usual type, but the 2nd pair differs in having three series of very delicate spines on the 1st joint of the basiopodite; two of these are similar to those of the 1st leg, the third is a delicate row of spines proximal to the origin of the seta on the inner border.

The *5th pair of legs* very closely resembles those of *P. serricaudatus* (Th. and Scott). The outer claw bears an inner toothed lamella and is slightly longer than the inner claw.

♂ Total length 1·3 mm.

Cephalo-thorax as in the female.

The abdomen consists of 5 segments, of which the 2nd, 3rd and 4th are armed posteriorly with a complete ring of triangular teeth; the relative lengths of the segments and furca are 2 : 5 : 5 : 5 : 3 : 5.

The *grasping antenna* consists of 21 free joints, of which the 13th-17th are swollen; the knee joint occurs between the 18th and 19th segments. The "endabschnitt" comprises three segments. Sickle-shaped spines are articulated with the anterior border of segments 10-13.

The *1st to 4th legs* are the same as in the female.

The *5th pair of legs*. On the right side, the 2nd basal segment carries on its inner aspect a Y-shaped spinous process, the endopodite. The exopodite is three-jointed; the 1st segment is produced externally in a Y-shaped spinous process, and the posterior border of the articulation with the 2nd segment is armed with a row of teeth. The 2nd segment bears on its outer surface distally a short thick spine with serrated margins, and the 3rd segment is sickle-shaped and its inner margin is finely denticulate. On the left side the endopodite is represented by a fringed unjointed process. The exopodite is two-jointed and the 2nd segment consists of a thin plate bearing a spine at each corner of the distal extremity, the margin between being finely denticulate; the outer border bears a blunt process which projects at a right angle.

It is not improbable that many of the records of the occurrence of *P. serricaudatus* in Indian waters really refer to this species.

Family *TEMORIDAE.*

Genus **Temora**, W. Baird.

1. **Temora discaudata**, Giesbrecht.

Pl. xxii, figs. 8 and 9.

Occurrence: Localities A, B, D, E, F, G, J, L, M, N, O, P.

This species was of almost universal distribution; its maximum frequency was obtained in A and B. A considerable degree of variation was found to exist in the structure of the 5th pair of legs of the female. In the majority of cases the condition was that usually described, the inner spine arising close to the end of the terminal segment, but in others it arose from the inner border some distance from the extremity, at about the junction of the middle and distal thirds; in all cases it appeared to retain the same relative position to the external margin spine, thus indicating that it was the terminal post-spinal portion of the segment that had increased in length.

2. **Temora turbinata** (Dana).

Occurrence: Localities A, B, C, D, E, F, G, H, J, K, L, M, N, O, P.

This species was usually present in large numbers and was much the commonest representative of the genus.

3. **Temora stylifera** (Dana).

Occurrence: Localities E, J, L.

This species appeared to be comparatively rare; only a few specimens being obtained.

Family *LUCICUTIIDAE.*

Genus **Lucicutia**, Giesbrecht, 1898.

1. **Lucicutia flavicornis** (Claus).

Occurrence: Localities F, J, N, O, P.

This species was comparatively rare, only a few specimens being obtained in each of the above localities.

Family *CANDACIIDAE.*

Genus **Candacia**, Dana.

1. **Candacia aethiopica**, Dana.

Only a single specimen, a female, was found in locality O. While agreeing with the description as regards structure, it differed in that it was only slightly pigmented, the spots most pigmented being not the back but the bases of the maxillae and the ends of the swimming feet.

2. **Candacia bradyi**, Scott.

Pl. xxiii, figs. 6 and 7.

C. bradyi, Scott, Some Red Sea and Indian Ocean Copepoda. *Trans. L. B. S.*, vol. xvi, p. 406, pl. 1, figs. 9—12.

C. tuberculata, Wolfenden, Notes on the collection of Copepoda. *The Fauna and Geography of the Maldive and Laccadive Archipelagoes*, vol. ii, p. 1015, pl. xcvi, figs. 40—44.

C. bradyi, Scott, The Copepoda of the Siboga Expedition, pt. 1, p. 156, pl. xlvii, figs. 1—9.

A large number of specimens were obtained in localities J, N, O. Associated with these were several females, which I take to be the hitherto undescribed female of this species.

♀ Length 1·8 mm.

The last thoracic segment terminates in a short spine.

The abdomen is contained $2\frac{1}{2}$ times in the length of the cephalothorax. The 1st segment viewed from above is symmetrical and somewhat globular in shape, ventrally there is a well-marked genital swelling. The 2nd segment is produced ventrally in the middle line in a short spine, its length is about half that of the genital segment.

The furcal joints are about twice as long as broad; they are slightly asymmetrical, that on the right side being broader than the left.

The 1*st antennae* consist of 23 joints. The proportional lengths of the joints are as follows:—

1.	2.	3.	4.	5.	6.	7.	8	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
16.	21.	7.	12.	16.	13.	7.	8.	8.	8.	14.	19.	19.	25.	26.	30.	29.	34.	23.	18.	12.	21.	24.

In the male the proportional lengths of the joints of the left antenna are:—

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
16.	21.	7.	15.	17.	10.	8.	8.	9.	9.	13.	20.	20.	27.	27.	33.	32.	37.	24.	16.	13.	19.	21.

The 2nd segment of the 2*nd maxilla* bears three spines and the proximal spine of the 3rd segment is longer and much stouter than the distal.

The 1*st leg* resembles that of the male in having a single jointed endopodite and in the absence of any hair on the basiopodite.

The terminal spine on the exopodite of the 3*rd leg* is, as in the male, two-thirds the length of the last segment.

In the 5*th legs* the terminal segments are almost symmetrical, are slightly curved inwards and bear on their inner margin two setae. The outer border carries three spines, the first about the middle of its length and the other two close together near the tip, which ends in a single stout spine. These external spines on the left side are blunt and pigmented, and on the right are sharp and devoid of pigment.

3. Candacia catula (Giesbrecht).

This species appears to be very rare in this region, only a single male specimen was obtained in locality O and one female in locality P.

4. Candacia discaudata, A. Scott.

Occurrence: Localities B, D, E, F, J, K, L, M, N, O, P.

A considerable number of specimens, both males and females, were obtained, especially in localities F, L, M. They were all quite typical, agreeing exactly with the description given by Scott (Siboga Expedition. Copepoda, pt. 1, p. 157, pl. xlvii, figs. 10—20, 1909).

5. **Candacia pachydactyla**, Dana.

Occurrence : Localities O and P.

A few specimens were obtained in the above localities, but on the whole this species was conspicuous by its absence. The examples obtained were quite typical.

6. **Candacia truncata**, Dana.

Occurrence : Localities O and P.

Several specimens, both males and females, were obtained.

Family *PONTELLIDAE.*

Genus **Calanopia**, Dana.

1. **Calanopia elliptica** (Dana).

Occurrence : Localities E, F, J, M, N, O, P.

This species was most abundant in localities F and J.

2. **Calanopia minor**, A. Scott.

Occurrence : Localities F, J, O, P.

As in the preceding species, this was most abundant in F and J ; in other localities, however, it was rare or entirely absent.

3. **Calanopia thompsoni**, A. Scott.

C. thompsoni, A. Scott, The Copepoda of the Siboga Expedition, pt. i, p. 178, pl. xlix, figs. 1—8, 1909.

A single specimen, a female, was obtained in locality E. The specimen was somewhat immature, measuring only 1·6 mm., but from the barbed rostrum, the small 3rd segment of the antenna and the lateral spines on the head, I have no doubt that it belongs to this species.

Genus **Labidocera**, Lubbock.

1. **Labidocera acuta** (Dana).

Occurrence : Localities A, B, C, D, E, F, G, H, K, L, M, O, P, Q.

In localities A, B, C, D and E this species was extremely common, forming from 20% to 60% of the total catch, whereas in the remaining localities it was comparatively rare.

The males differ slightly from the Mediterranean form in that the "reibleistes" of the grasping antennae were somewhat longer on both joints of the knee-joint than as shown in Giesbrecht's figure (F. u. Fl. des Golfes von Neapel, vol. xix, plate 23, fig. 15), especially on the distal segment.

In several cases, in young specimens, it was found that the 3 central furcal setae were deeply pigmented at their bases with a purple-blue pigment; this appears to grow fainter and is finally lost during the later development.

2. **Labidocera euchaeta**, Giesbrecht.

Occurrence: Locality Q.

Several specimens of both sexes were obtained.

3. **Labidocera kroyeri** (G. Brady).

Occurrence: Localities B, E, O, P, Q.

On the whole this species was comparatively rare, occurring only in small numbers in the localities given above. The females were all typical in their structure, but all the corresponding males showed some form of variation.

4. **Labidocera kroyeri** (Brady) var. **stylifera**, Th. and Scott.

Several specimens were obtained showing this variation.

5. **Labidocera kroyeri** (Brady) var. **burmanica**, nov.

Pl. xxiii, figs. 4 and 5.

In this form the right side of the 5th thoracic segment terminates in a branched arrangement of 5 spines. Three of these spines are large and conspicuous and two smaller ones project respectively from the inner and outer surface of the lower border of the projection. In general structure the 5th natatory legs closely resemble those of the variety "*gallensis*" (Thompson and Scott)[1] from Ceylon; it differs, however, in possessing an extra process on the terminal segment of the left leg; this process arises from the inner border and is bluntly rounded.

This variety, like "*gallensis*," has the spine on the right basal corner of the first abdominal segment.

6. **Labidocera kroyeri** (Brady) var. **bidens**, nov.

Plate xxiv, fig. 8.

A single female, obtained in locality O, presented a variation from the normal in the structure of the 5th pair of legs.

As usually figured and described, the normal exopods of the 5th pair of legs have no spines on their outer margins, but in this case a single spine was present near the termination, and on the left side gave a bifid appearance to the exopodite. The endopodites were normal in structure. In all other respects the structure was perfectly normal.

[1] "Ceylon Pearl Oyster Fisheries and Marine Biology," pt. 1, p. 251, pl. ii, figs. 6 and 7, 1903.

7. **Labidocera minuta**, Giesbrecht.

Occurrence : Localities A, B, C, D, E, G, L, N, O, P.

This species, like *L. acuta*, was common in localities A to E ; in the remaining ones, however, it was comparatively rare.

8. **Labidocera pectinata**, Thompson and Scott.

Pl. xxiii, figs. 8, 9.

L. pectinata, Thompson and Scott, *Ceylon Pearl Oyster Fisheries.* (Suppl. Report vii), vol. i, p. 252, pl. ii, figs. 10—14, 1903.

L. similis, Cleve, Report on Plankton collected by Mr. Th. Wulff. *Arkiv för Zoologi*, vol. i, p. 378, pl. 19, figs. 4—6, 1903-04.

♀ A single specimen was obtained in locality Q. This species was first described by Thompson and Scott from the Pamban Pass, Ceylon : almost simultaneously another account was published by P. T. Cleve, who had found it in the plankton off Karachi. These two descriptions, while agreeing in all main essentials, differ slightly in certain details. Cleve's specimens presented a symmetrical furca, and on the genital segment a large dorsal apophysis and a single lateral spine, whereas in the specimens from Ceylon the furca is slightly asymmetrical and the genital segment has two lateral spines and is without the apophysis. Another point of difference, judging from the figures given, is in the number of spines on the endopodites of the 5th pair of legs. These are more numerous in the specimens from Ceylon. In the single specimen that I obtained in Hinzé Basin this feature was still more marked, though in all other respects it exactly corresponded with the Ceylon specimens. It would appear that we have here an example of continuous variation, the further to the east the locality in which the species is obtained, the more numerous become the spines of the endopodites of the 5th pair of legs.

Genus **Pontella**, G. Brady.

1. **Pontella andersoni**, Sewell.

Vide *Ante.*

A single male and a single damaged female were obtained in locality D.

2. **Pontella danae**, Giesbrecht, var. **ceylonica**, Thompson and Scott.

P. danae var. *ceylonica*, Thompson and Scott, Report on the Copepoda. *Ceylon Pearl Oyster Fisheries and Marine Biology* (Suppl. Report vii), vol. i, p. 252, pl. ii, figs. 1—5.

P. danae, A. Scott, The Copepoda of the Siboga Expedition, pt. i, p. 159.

A few specimens were obtained in locality Q.

These all agreed exactly with the description given by Thompson and Scott of the variety found by them round Ceylon.

A. Scott also describes a form of *P. danae* found by him in the "Siboga" collection, in which the 5th pair of legs are the same as in var. *ceylonica*, but the furca agrees with Giesbrecht's original specimens. This form is of interest in supplying the intermediate stage of variation.

3. **Pontella investigatoris**, sp. nov.

Pl. xxiii, figs. 1—3.

Three males were obtained in localities A and E.

These specimens appear to differ from any previously described species. No corresponding females were found.

♂ Total length 2·9 mm.

The cephalo-thorax is robust; the head is furnished with side hooks and terminates anteriorly in a well-developed rostrum, provided with well-marked rostral lenses; there is also a well-developed ventral lens. The 4th and 5th thoracic segments are separate and the latter terminates laterally in a triangular plate, which is slightly asymmetrical, being more sharply pointed on the right side.

The abdomen is contained $3\frac{1}{2}$ times in the length of the cephalo-thorax, it consists of 5 segments, of which the relative lengths are 7 : 4 : 6 : 2 : 4. The furcal rami are slightly asymmetrical, the right being a little stouter than the left; they are $2\frac{1}{2}$ times as long as broad and are equal in length to the preceding three segments. The 2nd furcal seta is about twice the length of the others.

The 1*st antennae* are as usual asymmetrical and the relative proportions of the joints of the left antenna are as follows :—

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
50.	33.	8.	8.	10.	12.	10.	9.	15.	12.	10.	20.	18.	19.	24.	32.	33.	37.	40.	30.	29.	29.	29.	25.

The 10th and 11th joints are partially fused together.

In the right *grasping antenna* the middle joints are much swollen. The proximal segment of the knee-joint bears on its upper margin a toothed-plate somewhat longer than the joint itself, and produced proximally over the preceding segment, and bears a series of sharply-pointed teeth that diminish in size distally. The distal segment bears two toothed-plates, each armed with a series of fine needle-shaped teeth, and has a sharp spine at its distal extremity. The proportional lengths of the three terminal joints are 21 : 18 : 23.

In the 5*th pair of legs* that of the right side somewhat resembles *P. atlantica* (M.E.); the proximal segment of the claw has a well-marked proximal process and bears on its margin a single trilobed tooth, from the base of which a single seta arises. The distal segment is somewhat sharply curved about the middle of its length, and bears on its proximal half two setae but no tooth-like process. In the left leg the terminal segment is short and bears on its external border a short spine; terminally it is provided with a long curved spine and two shorter and more delicate processes, one of which is ribbed; the inner surface is clothed with hair. The penultimate segment carries a short spine at its distal external angle.

The remaining appendages resembled those of the other members of the genus.

4. **Pontella princeps**, Dana.

A single specimen, a male, was obtained in locality A.

5. **Pontella securifer**, G. Brady.

Pontella securifer, Brady, Rep. Voy. Challenger, Copepoda, vol. viii, p. 96, pl. 45, 1883.

Pontella securifer, Claus, Ueber die entwicklung und das system der Pontelliden. *Arb. Zool. Inst. Wien*, vol. x, p. 233, pl. v, fig. 6, 1892-93.

Pontella securifer, Giesbrecht, F. u. Fl. Neap., vol. xix.

Pontella spinipes ♂, Wolfenden, The Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. ii, p. 1020, 1903-4.

Occurrence: Localities A, B, E.

This species was comparatively rare in this region. Several typical examples of the female were obtained and associated with them were a few males.

From previous descriptions it would appear that the male of this species is somewhat variable as regards the grasping antenna. Brady's original description is of the briefest character and his figure of this antenna is very poor. Claus figures it as having on the proximal end of the 19th segment a rounded elevation bearing three pointed teeth. Giesbrecht, however, represents this portion as consisting of a plate bearing a number of lamellar teeth.

In the males obtained by me the right antenna agrees exactly with Claus's figure, and differs from that given by Giesbrecht.

The 5*th legs* of my specimens agree with Giesbrecht. Wolfenden has described a male *Pontella*, which he takes to be the male of *P. spinipes*; in this, the right grasping antenna has on the 19th segment a "rounded projection with three arrow-shaped teeth." Other points of difference are that in his specimens the teeth on the 19th segment are smaller and the toothed plate on the 18th segment is also smaller than in *P. securifer.* With regard to these last two points, it would appear not improbable that they may be merely a variety, and as I shall show in the next species, a considerable degree of variation is met with in specimens of undoubtedly the same species.

In the few specimens that I obtained the relative lengths of the two limbs of the knee-joint were 47 : 43, thus agreeing with Wolfenden's measurements of his supposed *P. spinipes* ♂.

The only difference that would appear to be constant between Wolfenden's *P. spinipes* ♂ and *P. securifer* ♂ is the absence of the large triangular tooth on the proximal limb of the claw of the 5th leg. I have, therefore, come to the conclusion that he was in reality dealing with a variation, either local or seasonal, of *Pontella securifer.*

6. **Pontella spinipes**, Giesbrecht.

Pl. xxiv, figs. 1—4.

Occurrence: Localities A, C, D, E, O.

A considerable number of typical females were obtained in the above localities and associated with them were several males that I believe to be the true male of this species.

♂ In these specimens the total length is 3·15—3·5 mm. The head is furnished with side hooks and the rostral lens is large and well-developed.

The last thoracic segment and abdomen are like *P. securifer.* The length of the abdomen and furca is contained nearly 3½ times in that of the cephalo-thorax.

1*st antennae.* The left antenna very closely resembles that of the female, the proportionate lengths of the segments in the two sexes are given below :—

♀

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
50.	35.	10	7.	10.	11.	11.	12.	16.	15.	14.	27.	25.	30.	31.	41.	37.	44.	46.	34.	30.	30.	23.	25.

♂

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23	24.
50.	37.	9.	7.	10.	11.	11.	11.	13.	14.	15.	17.	24.	22.	25.	33.	33.	40.	45.	31·5.	31.	33.	23.	25.

In both sexes the 11th and 12th segments are partially fused together.

In general appearance the grasping antenna very closely resembles that of *P. securifer*; there are slight differences in the toothed plate of the 18th segment, which is shorter apparently than in *P. securifer* and has fewer teeth; the teeth are long and sharp and set fairly widely apart, diminishing gradually in size towards the distal end. The number present varies from 25 to 30.

The toothed-plate is invariably shorter than the segment itself; an average of 8 measurements gave the relative proportions of segment and "reibleiste" as 27·5 : 24·5, whereas in *P. securifer*, Giesbrecht figures the reibleiste as much longer than the segment, and in my specimens the average was 20 : 24. The distal segment of the knee-joint bears two toothed-plates, the proximal being the smaller and having from 8 to 11 arrow-shaped teeth. These two segments appear to vary very considerably in their relative proportions; in some the proximal is the longer, while in others it is very distinctly shorter than the distal joint. Below I give the measurements in ten different individuals:—

(1)	22 : 21	(6)	21 : 19
(2)	23 : 21	(7)	20 : 21
(3)	21 : 21·5	(8)	20 : 21·5
(4)	22 : 21·5	(9)	24 : 22
(5)	22 : 22	(10)	22 : 22.

From the above it will be noted that it is in the smaller specimens, with a measurement of 20 or 21 for the proximal joint, that the distal exceeds the proximal in length, the condition becoming reversed in the larger specimens.

It appears possible that we are here dealing with a depauperized condition, the small size of the animal and the alteration in the proportions of the segments forming the knee-joint being correlated with one another. In any case, the relative proportions of these joints, in the absence of any other measurements, would seem to be of doubtful specific value.

It is in the 5*th pair of legs* that these males present their greatest difference from *P. securifer*. The proximal segment of the claw has a well-marked simple process proximally and bears on its margin three teeth; the first is stout and triangular in shape, the other two are thin and more delicate and are respectively rounded and sharply pointed; between these two latter a single seta arises. The distal segment also bears on its margin three rounded teeth. The left leg has a short terminal joint, bearing a stout curved spine and two more delicate processes at its distal extremity and a short spine on its external border, and the inner surface is covered with hair. The penultimate joint has a short spine at its distal external border.

As I have shown (*vide P. securifer*, above), the male described by Wolfenden as the male of *P. spinipes* is in all probability merely a variation of the male of *P. securifer*, and not the hitherto-unknown male of *P. spinipes*. The above males are unlike anything previously described, though fairly closely resembling *P. securifer* in certain respects; they were associated in all the catches with undoubted females of *P. spinipes* and are, in my opinion, the hitherto-unknown male.

Genus **Pontellopsis**, G. Brady.

1. **Pontellopsis herdmani**, Thompson and Scott.

Pl. xxiv, fig. 5.

Pontellopsis herdmani, Thompson and Scott, Ceylon Pearl Oyster Fisheries (Suppl. Report vii), vol. i, p. 253, pl. ii, figs. 15—17 (1903).

Pontellopsis macronyx, A. Scott, The Copepoda of the Siboga Expedition, pt. i, p. 137, pl. liv, figs. 1—10 (1909).

Occurrence: Localities A, B, C, D, E, F, L, O, P.

A large number of specimens, both males and females, were obtained. The males correspond exactly with the description of *Pontellopsis macronyx*, A. Scott, from the "Siboga" collection. The females however present certain differences and are exactly intermediate between *Pontellopsis macronyx* and *Pontellopsis herdmani*, which was described by Thompson and Scott from Ceylon and to which no corresponding male was obtained.

Considering the differences between the two forms obtained from Ceylon and the waters to the east of Borneo, Scott was quite justified in making them different species, but the discovery of a third and intermediate form from the Burma coast indicates that in reality we are dealing with a single very variable species, and I propose to combine the three under the name of *P. herdmani*.

In the following table I have given the main characters of the three forms:—

	P. herdmani.	*P. macronyx.*	Intermediate form.
Total length	1·9 mm.	1·97 mm.	1·64 mm.
Length of abdomen and furca.	Contained twice in cephalothorax.	Contained 2½ times.	As *P. macronyx.*
Abdomen ..	Composed of 2 joints, 1st segment twice as large as 2nd, two thorn-like projections on right side	2 joints. Genital segment long, two spines on each side.	2 joints. Genital segment long. Spines variable from 2 to 4.
Furca	Rami twice as long as broad, fine hairs on inner surface, 5 short non-plumose setae.	Furcal joints short, 5 short setae.	As *P. herdmani.*
Rostrum ..	Long, narrow and bifid.	Rami long and slender.	Ditto ditto.
Antenna ..	16 jointed (judging from the fig segments 3 and 4 are each composed of 3 segments fused together), extend to end of thorax. Relative lengths as follows: $\frac{1.\ 2.\ 3.\ 4.\ 5.\ 6.}{6.\ 7.\ 5.\ 8.\ 3.\ 5.}$	20 jointed, extend to end of thorax.	As *P. herdmani.* Segments 3 and 4 each composed of 3 partially fused segments. Relative lengths as in *P. herdmani.*

	P. herdmani.	*P. macronyx.*	Intermediate form.
5th pair of legs	Symmetrical. Each 2 branched. Each branch bifid.	Asymmetrical. Inner margin of right exopodite produced into a strong spine. The spine on the inner margin of the left leg has become suppressed.	As *P. macronyx.*

In a few cases the abdomen, instead of being almost symmetrical, is produced on the left side into a long spine-like process, this being apparently an exaggerated phase of the condition normally found in which a rod-like spine is present at this point (plate xxiv, fig. 5).

From the above it would appear that we are here dealing with another example of continuous variation, apparently affecting only the females of the species, for as the habitat extends to the westward we meet with a tendency for a reduction of the number of spines on the genital segment of the abdomen, a fusion of certain joints at the base of the antennae, and the formation of a second spine on the left 5th leg.

2. **Pontellopsis krämeri**, Giesbrecht.

♀ A single specimen was obtained in each locality A and J and two in locality P.

The asymmetry of the furcal joints was well-marked and corresponded with Giesbrecht's original figures. The spines on the 5th pair of legs also resembled those in Giesbrecht's specimens. In both these points the specimens differed from Wolfenden's description of the specimens obtained by him in the Maldive and Laccadive Archipelagoes.

3. **Pontellopsis regalis** (Dana).

Occurrence: Localities A, C, D, E, K.

A few specimens were obtained in each of the above localities, but on the whole the species was comparatively rare.

Genus **Acartia**, Dana.

1. **Acartia danae**, Giesbrecht.

A single specimen, a female, was obtained in locality F.

2. Acartia erythraea, Giesbrecht.

Occurrence: Localities C, E, G, J, L.

Only a few specimens were obtained in the above localities, with the exception of locality E, where it was quite common.

3. Acartia spinicauda, Giesbrecht.

Occurrence: Localities A, C, K, N, O, P.

Genus Tortanus, Giesbrecht.

1. Tortanus barbatus (Brady).

Corynura barbata, Brady, Rep. Voy. Challenger, vol. 8, p. 71, plate 31, figs. 11-12, 1883.
Corynura barbata, Giesbrecht, F. u. Fl. Neapel, vol. 19, p. 525, 1892.
Tortanus barbatus, Giesbrecht and Schmeil, Das Tierreich, pt. 6. Copepoda, p. 158.
Tortanus barbatus, Scott, The Copepoda of the Siboga Expedition, pt. 1, p. 189, pl. lv, figs. 16—18.

Several specimens were obtained in localities E and Q.

A. Scott considers that *T. denticulatus* and *T. barbatus* are in reality the same species, but the present specimens differ in several particulars from the specimens that he describes as *T. barbatus* in the "Siboga" material. In my specimens the teeth on the left 5th leg all have whip-like ends, the outer hair of the furca is long and reaches to the end of the furcal joint, and in the mid-dorsal line there arises from the anal segment of the abdomen a spine-like projection. Brady in his original illustration figures a rounded projection.

The length of the specimens were 1·43 mm.

I consider that it is advisable to retain the distinction between these two species and the above would appear to be typical specimens of *Tortanus barbatus*, while Scott's specimens were in all probability *Tortanus denticulatus.*

2. Tortanus gracilis (Brady).

Tortanus gracilis, Cleve, Plankton from the Indian Ocean and Malay Archipelago. *Kongl. Svens. Vet. Akad. Handl.*, Bd. 35, No. 5, p. 51, pl. vii, figs. 11—15, 1901-02.

Occurrence: Localities B, E, F, G, J, N, O, P.

Considerable variation was met with in the degree of asymmetry of the 5th legs of the females. I am inclined to agree with Cleve that *T. forcipatus* and *T. gracilis* are in reality the same species, the difference in the 5th leg being due to age.

List of Localities showing species of Copepoda (Gymnoplea) taken.

LOCALITY A { 14°8 to 14°10 N. / 97°42¾ to 97°46½ E. } 17 species.

Acartia spinicauda.
Acrocalanus longicornis.
Canthocalanus pauper.
Centropages furcatus.
Eucalanus subcrassus.
Labidocera acuta.
Labidocera minuta.
Paracalanus parvus.
Pontella investigatoris, sp. nov.
Pontella princeps.
Pontella securifer.
Pontella spinipes.
Pontellopsis krämeri.
Pontellopsis herdmani.
Pontellopsis regalis.
Temora discaudata.
Temora longicornis.

LOCALITY B { 14°6 to 14°15½ N. / 97°49 to 97°58½ E. } 19 species.

Calanus minor.
Candacia discaudata.
Canthocalanus pauper.
Centropages notoceras.
Centropages furcatus.
Centropages orsinii.
Eucalanus subcrassus.
Euchaeta concinna.
Labidocera acuta.
Labidocera kroyeri.
Labidocera kroyeri var. *stylifera.*
Labidocera minuta.
Pontella securifer.
Pontellina plumata.
Pontellopsis herdmani.
Temora discaudata.
Temora turbinata.
Tortanus gracilis.
Undinula caroli.
Undinula vulgaris.

LOCALITY C { 14°5 to 14°6½ N. / 98°1¾ to 98°5 E. } 16 species.

Acartia erythraea.
Acartia spinicauda.
Acrocalanus gracilis.
Canthocalanus pauper.
Centropages furcatus.
Centropages orsinii.
Centropages tenuiremis.
Eucalanus subcrassus.
Labidocera acuta.
Labidocera minuta.
Pontella danae.
Pontella spinipes.
Pontellopsis herdmani.
Pontellopsis regalis.
Temora turbinata.
Undinula caroli.

LOCALITY D { 14°2¼ to 14°5 N. / 98°2½ to 98°5 E. } 19 species.

Acrocalanus gibber.
Calocalanus pavo.
Candacia discaudata.
Canthocalanus pauper.
Centropages furcatus.
Centropages orsinii.
Eucalanus crassus.
Eucalanus subcrassus.
Labidocera acuta.
Labidocera minuta.
Paracalanus aculeatus.
Pontella andersoni.
Pontella spinipes.
Pontellina plumata.

Pontellopsis herdmani.
Pontellopsis regalis.
Temora discaudata.
Temora turbinata.
Undinula vulgaris.

Locality E { 13°47¼ to 13°52½ N. / 98°3½ to 98°4¾ E. } 31 species and varieties.

Acartia erythraea.
Acrocalanus gibber.
Calanus minor.
Calanopia elliptica.
Calanopia thompsoni.
Calocalanus pavo.
Candacia discaudata.
Canthocalanus pauper.
Centropages furcatus.
Centropages tenuiremis.
Eucalanus crassus.
Eucalanus monachus.
Eucalanus subcrassus.
Labidocera acuta.
Labidocera minuta.
Labidocera kroyeri.
Labidocera kroyeri var. *stylifera.*
Paracalanus aculeatus.
Pontella investigatoris, sp. nov.
Pontella danae var. *ceylonica.*
Pontella securifer.
Pontella spinipes.
Pontellopsis herdmani.
Pontellopsis regalis.
Temora discaudata.
Temora stylifera.
Temora turbinata.
Tortanus barbatus.
Tortanus gracilis
Undinula caroli.
Undinula vulgaris.

Locality F { 13°59½ to 14°4½ N. / 97°51½ to 98°0 E. } 20 species.

Acartia danae.
Acrocalanus longicornis.
Calanopia aurivillii.
Calanopia elliptica.
Calanopia minor.
Calanus minor.
Candacia discaudata.
Canthocalanus pauper.
Centropages orsinii.
Eucalanus subcrassus.
Labidocera acuta.
Lucicutia flavicornis.
Pontellina plumata.
Pontellopsis herdmani.
Temora discaudata.
Temora turbinata.
Tortanus gracilis.
Undinula caroli.
Undinula vulgaris.
Undinula darwini.

Locality G (13. 49¼ N. : 97.58½ E.) 16 species and varieties.

Acartia erythraea.
Acrocalanus gracilis.
Acrocalanus longicornis.
Acrocalanus longicornis var. *plumulosus.*
Acrocalanus monachus.
Canthocalanus pauper.
Centropages furcatus.
Centropages orsinii.
Labidocera acuta.
Labidocera minuta.
Paracalanus aculeatus.
Paracalanus aculeatus var. *plumulosus.*
Temora discaudata.
Temora turbinata.
Undinula caroli.
Undinula vulgaris.

LOCALITY H $\left\{\begin{array}{l} 13^{\cdot}51\frac{1}{2} \text{ to } 13^{\cdot}55\frac{1}{2} \text{ N.} \\ 97^{\cdot}57\frac{1}{2} \text{ to } 98^{\cdot}2 \text{ E.} \end{array}\right\}$ 11 species.

Acrocalanus gibber.
Acrocalanus gracilis.
Acrocalanus longicornis.
Canthocalanus pauper.
Centropages orsinii.
Eucalanus monachus.
Eucalanus subcrassus.
Labidocera acuta.
Temora turbinata.
Undinula caroli.
Undinula vulgaris.

LOCALITY J $\left\{\begin{array}{l} 13^{\cdot}41 \text{ to } 13^{\cdot}95 \text{ N.} \\ 97^{\cdot}55 \text{ to } 98^{\cdot}0 \text{ E.} \end{array}\right\}$ 22 species.

Acartia erythraea.
Acrocalanus gibber.
Acrocalanus gracilis.
Acrocalanus longicornis.
Calanopia elliptica.
Calanopia minor.
Candacia bradyi.
Candacia discaudata.
Canthocalanus pauper.
Centropages furcatus.
Clausocalanus arcuicornis.
Eucalanus subcrassus.
Eucalanus pileatus.
Euchaeta concinna.
Lucicutia flavicornis.
Paracalanus aculeatus.
Paracalanus parvus.
Pontellopsis krämeri.
Temora discaudata.
Temora stylifera.
Temora turbinata.
Tortanus gracilis.

LOCALITY K $\left\{\begin{array}{l} 13^{\cdot}50 \text{ to } 13^{\cdot}45 \text{ N.} \\ 97^{\cdot}59\frac{1}{2} \text{ to } 97^{\cdot}55 \text{ E.} \end{array}\right\}$ 14 species and varieties.

Acartia spinicauda.
Acrocalanus gibber.
Calanus minor.
Candacia discaudata.
Canthocalanus pauper.
Centropages orsinii.
Eucalanus subcrassus.
Labidocera acuta.
Paracalanus aculeatus.
Temora turbinata.
Undinula caroli.
Undinula caroli var. *plumulosus.*
Undinula vulgaris.
Undinula vulgaris var. *plumulosus.*

LOCALITY L (13·50 N. : 97·56 E.) 20 species and varieties.

Acartia erythraea.
Acrocalanus gibber.
Acrocalanus longicornis.
Candacia discaudata.
Canthocalanus pauper.
Centropages furcatus.
Eucalanus crassus.
Eucalanus pileatus.
Eucalanus subcrassus.
Labidocera acuta.
Labidocera minuta.
Paracalanus aculeatus.
Pontellopsis herdmani.
Temora discaudata.
Temora stylifera.
Temora turbinata.
Tortanus gracilis.
Undinula caroli.
Undinula vulgaris.
Undinula vulgaris var. *plumulosus.*

LOCALITY M (13·44½ N. : 98·0½ E.) 14 species.

Acrocalanus gardineri.
Acrocalanus gracilis.
Acrocalanus longicornis.
Calanopia elliptica.
Candacia discaudata.
Centropages orsinii.
Eucalanus crassus.
Eucalanus pileatus.
Eucalanus subcrassus.
Labidocera acuta.
Temora discaudata.
Temora turbinata.
Undinula caroli.
Undinula vulgaris.

LOCALITY N { Byikhwaaw Bay. 13·33 N. : 98·8½ E. } 21 species.

Acartia spinicauda.
Acrocalanus gardineri.
Acrocalanus gibber.
Acrocalanus gracilis.
Acrocalanus longicornis.
Calanopia elliptica.
Calanus minor.
Candacia bradyi.
Candacia catula.
Candacia discaudata.
Canthocalanus pauper.
Centropages furcatus.
Centropages orsinii.
Eucalanus subcrassus.
Labidocera minuta.
Lucicutia flavicornis.
Paracalanus aculeatus.
Pontellopsis regalis.
Temora discaudata.
Temora turbinata.
Tortanus gracilis.

LOCALITY O { 13·32 to 13·40 : N. 97·40 to 97·55 : E. } 35 species and varieties.

Acartia spinicauda.
Acrocalanus gibber.
Acrocalanus longicornis.
Calanopia elliptica.
Calanopia minor.
Calocalanus pavo.
Calocalanus plumulosus.
Candacia aethiopica.
Candacia bradyi.
Candacia discaudata.
Candacia truncata.
Canthocalanus pauper.
Centropages furcatus.
Centropages orsinii.
Clausocalanus arcuicornis.
Eucalanus attenuatus.
Eucalanus crassus.
Eucalanus monachus.
Eucalanus subcrassus.
Euchaeta concinna.
Labidocera acuta.
Labidocera minuta.
Labidocera kroyeri.
Labidocera kroyeri var. *stylifera.*
Labidocera kroyeri var. *bidens.*
Lucicutia flavicornis.
Paracalanus aculeatus.
Pontella spinipes.
Pontellopsis herdmani.
Rhincalanus cornutus.
Scolecithrix danae.
Temora discaudata.
Temora turbinata.
Tortanus gracilis.
Undinula vulgaris.

LOCALITY P { 13·40 to 14·5½ N. 97·40 to 97·50 E. } 32 species and varieties.

Acartia spinicauda.
Acrocalanus gibber.
Acrocalanus longicornis.
Calanopia elliptica.

Calanopia minor.
Calanus minor.
Candacia catula.
Candacia discaudata.
Candacia truncata.
Canthocalanus pauper.
Centropages furcatus.
Centropages orsinii
Clausocalanus arcuicornis.
Eucalanus attenuatus.
Eucalanus crassus.
Eucalanus monachus.
Eucalanus pileatus.
Eucalanus subcrassus.
Euchaeta concinna.
Labidocera acuta.
Labidocera kroyeri.
Labidocera minuta.
Lucicutia flavicornis.
Paracalanus aculeatus var. *plumulosus.*
Pontellopsis herdmani.
Rhincalanus cornutus.
Temora discaudata.
Temora turbinata.
Tortanus gracilis.
Undinula caroli.
Undinula vulgaris.
Undinula vulgaris var. *plumulosus.*

LOCALITY Q { Hinzé Basin. 14·41½ N. : 97·53 E. } 21 species and varieties.

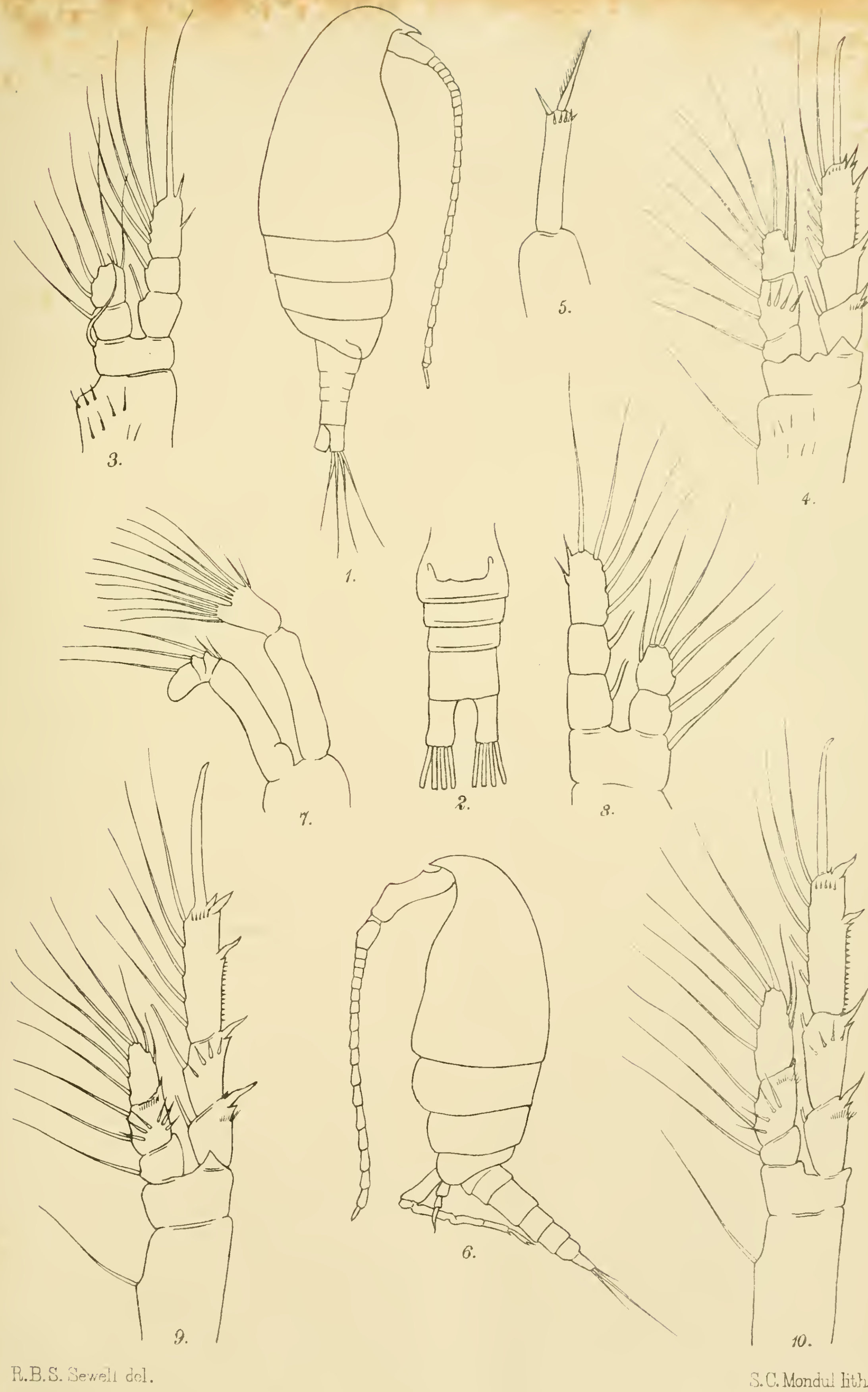
Acrocalanus gardineri.
Canthocalanus pauper.
Centropages notoceras.
Eucalanus crassus.
Eucalanus pileatus.
Eucalanus subcrassus.
Eucalanus subtenuis.
Euchaeta concinna.
Euchaeta marina.
Labidocera acuta.
Labidocera euchaeta.
Labidocera kroyeri.
Labidocera kroyeri var. *burmanica*, nov.
Labidocera pectinata.
Paracalanus parvus.
Pontella danae var. *ceylonica.*
Pseudodiaptomus aurivillii.
Pseudodiaptomus hickmani, sp. nov.
Tortanus barbatus.
Undinula darwini.
Undinula vulgaris var. *plumulosus.*

A. C. Chowdhary, del.

Photo.-Engraved & printed at the Offices of the Survey of India, Calcutta, 1913.

EXPLANATION OF PLATE XV.

1.—*Paracalanus dubia*, sp. nov.	♀	Lateral view.
2.— ,, ,, ,, ,,	♀	Abdomen, ventral view
3.— ,, ,, ,, ,,	♀	1st Leg.
4.— ,, ,, ,, ,,	♀	2nd Leg.
5.— ,, ,, ,, ,,	♀	5th Leg.
6.—*Paracalanus serratipes*, sp. nov.	♂	Lateral view.
7.— ,, ,, ,, ,,	♂	2nd Antenna.
8.— ,, ,, ,, ,,	♂	1st Leg.
9.— ,, ,, ,, ,,	♀	2nd Leg.
10.— ,, ,, ,, ,,	♀	3rd Leg.



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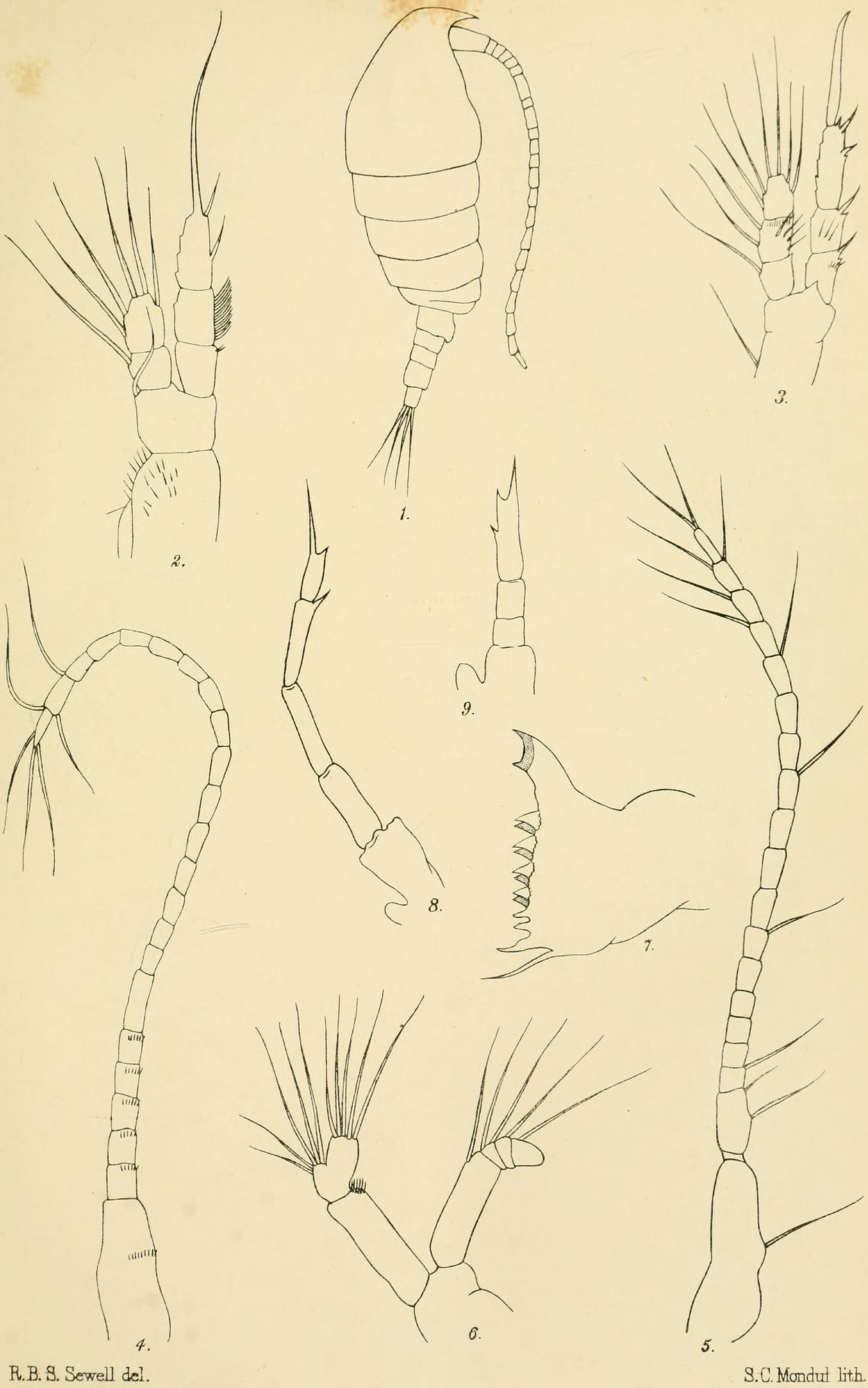
EXPLANATION OF PLATE XVI.

1.—*Acrocalanus inermis*, sp. nov.					♀	Lateral view.
2.—	,,	,,	,,	,,	♀	1st Leg.
3.—	,,	,,	,,	,,	♀	2nd Leg.
4.—	,,	,,	,,	,,	♀	1st Antenna.
5.—	,,	,,	,,	,,	♂	1st Antenna.
6.—	,,	,,	,,	,,	♂	2nd Antenna.
7.—	,,	,,	,,	,,	♂	Mandible.
8.—	,,	,,	,,	,,	♂	5th Leg, adult.
9.—	,,	,,	,,	,,	♂	5th Leg, immature.



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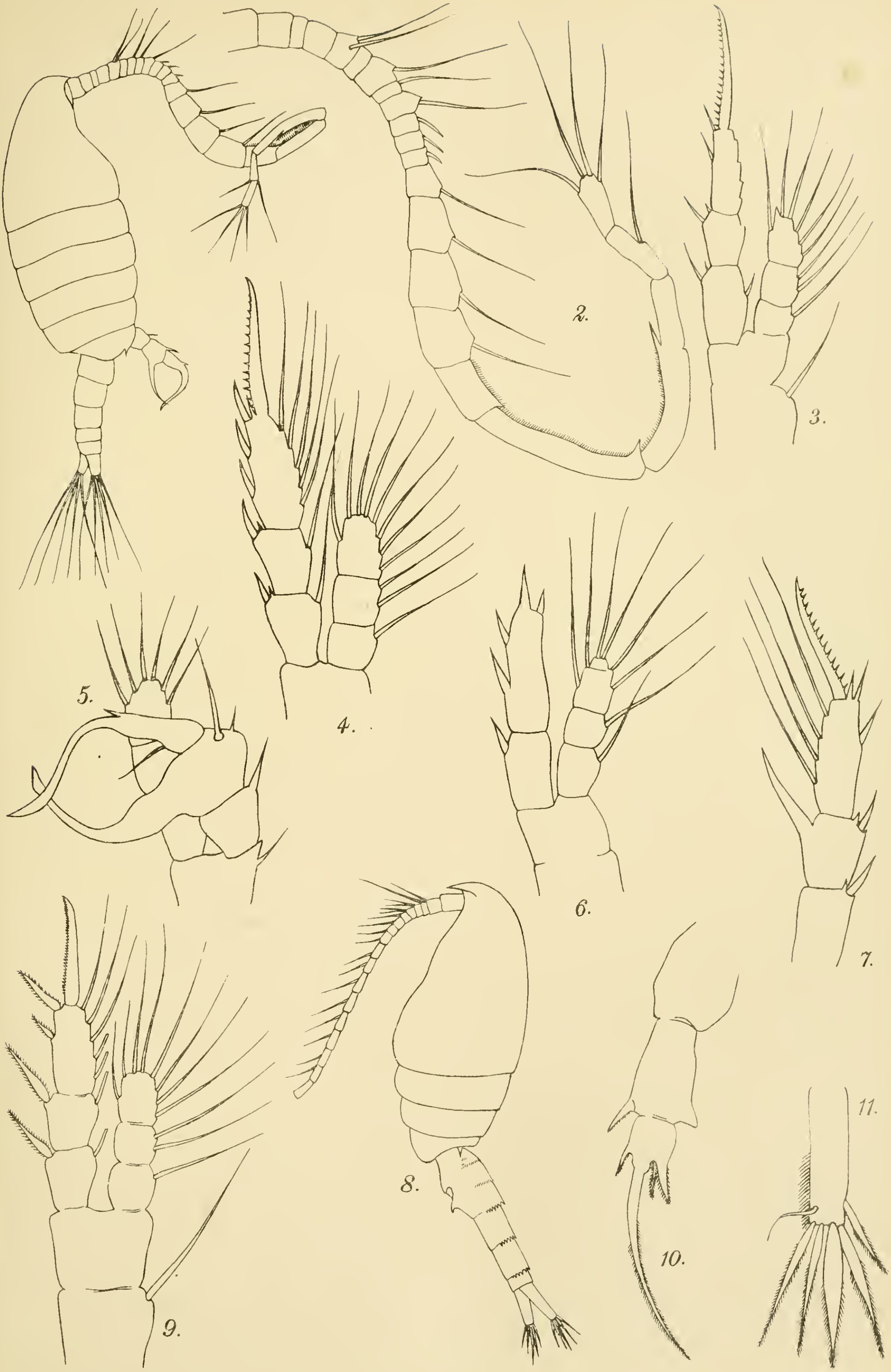
EXPLANATION OF PLATE XVII.

1.—	*Centropages alcocki*, sp. nov.	♂	Lateral view.
2.—	,, ,, ,, ,,	♂	1st Antenna.
3.—	,, ,, ,, ,,	♂	1st Leg.
4.—	,, ,, ,, ,,	♂	2nd Leg.
5.—	,, ,, ,, ,,	♂	5th Leg, right side.
6.—	,, ,, ,, ,,	♂	5th Leg, left side.
7.—	,, ,, ,, ,,	♀	5th Leg.
8.—	*Pseudodiaptomus binghami*, sp. nov.	♀	Lateral view.
9.—	,, ,, ,, ,,	♀	2nd Leg.
10.—	,, ,, ,, ,,	♀	5th Leg.
11.—	,, ,, ,, ,,	♀	Furcal ramus and setae.



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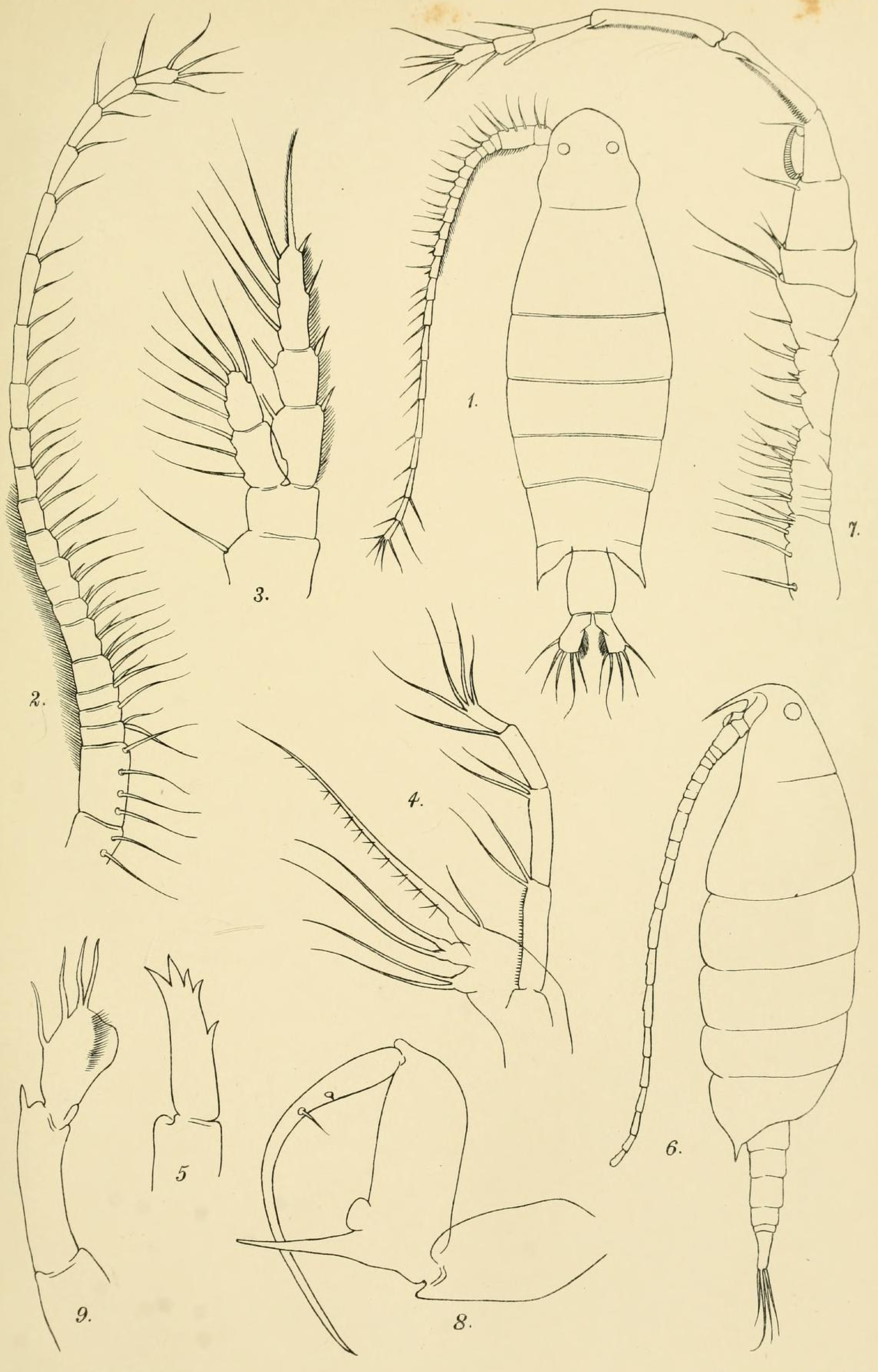
EXPLANATION OF PLATE XVIII.

1.—*Labidocera euchaeta,*	stage	1,	nov.		♀	Dorsal view.
2.—	,,	,,	,,	,,	,,	♀	1st Antenna.
3.—	,,	,,	,,	,,	,,	♀	1st Leg.
4.—	,,	,,	,,	,,	,,	♀	Maxilliped.
5.—	,,	,,	,,	,,	,,	♀	5th Leg.
6.—	,,	,,	,,	,,	,,	♂	Lateral view.
7.—	,,	,,	,,	,,	,,	♂	1st Antenna.
8.—	,,	,,	,,	,,	,,	♂	5th Leg, right side.
9.—	,,	,,	,,	,,	,,	♂	5th Leg, left side.



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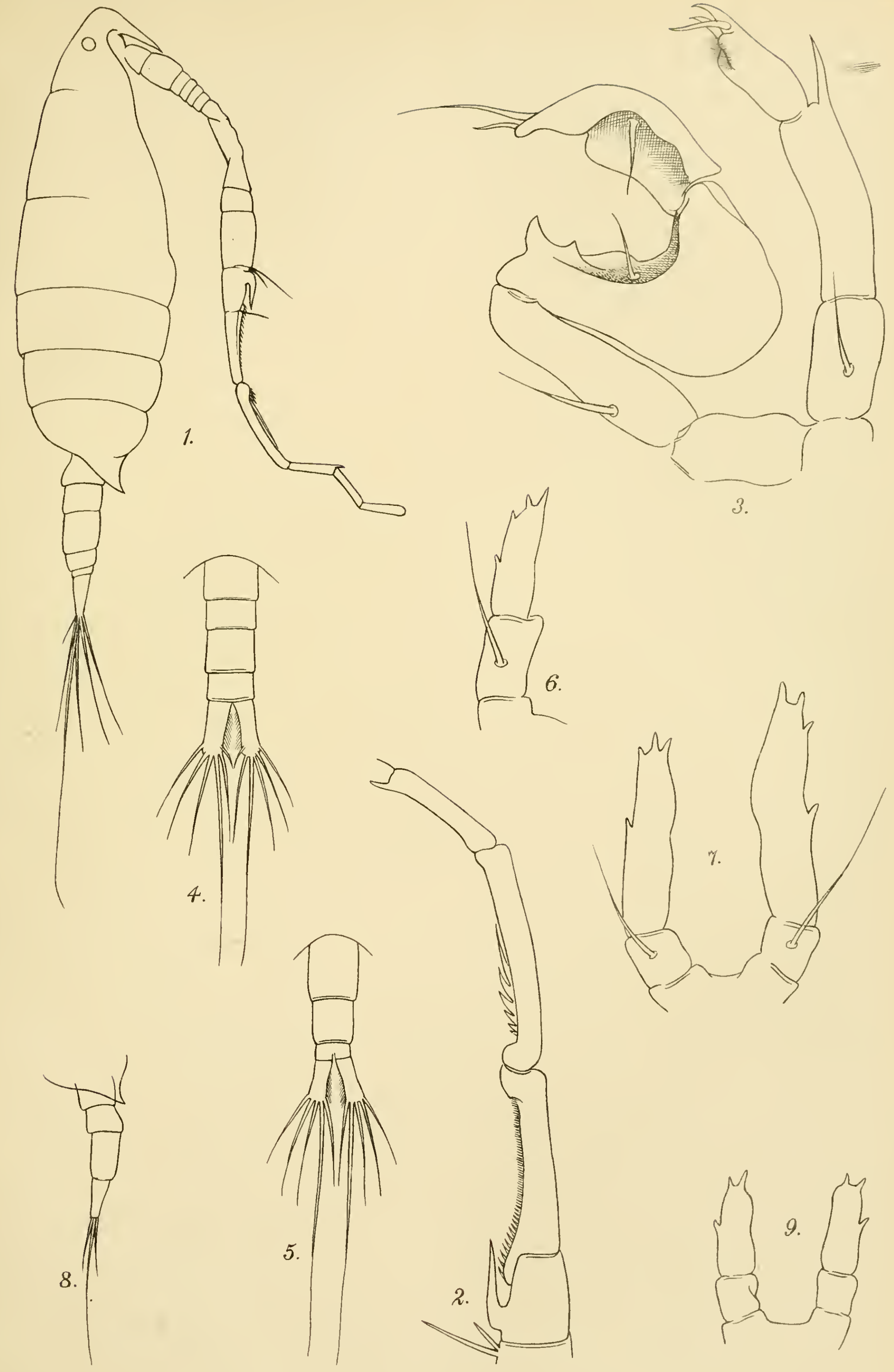
EXPLANATION OF PLATE XIX.

1.—	*Labidocera*	*euchaeta*,	Giesbrecht,	stage II.		♂	Lateral view.
2.—	,,	,,	,,	,,	,,	♂	1st Antenna.
3.—	,,	,,	,,	,,	,,	♂	5th pair of legs.
4.—	,,	,,	,,	stage III.		♂	Abdomen, dorsal view.
5.—	,,	,,	,,	,,	,,	♀	Abdomen, dorsal view.
6.—	,,	,,	,,	,,	,,	♀	5th Leg.
7.—	,,	,,	,,	,,	,,	♂	5th pair of legs.
8.—	,,	,,	,,	stage IV.			Abdomen.
9.—	,,	,,	,,	,,	,,		5th pair of legs.



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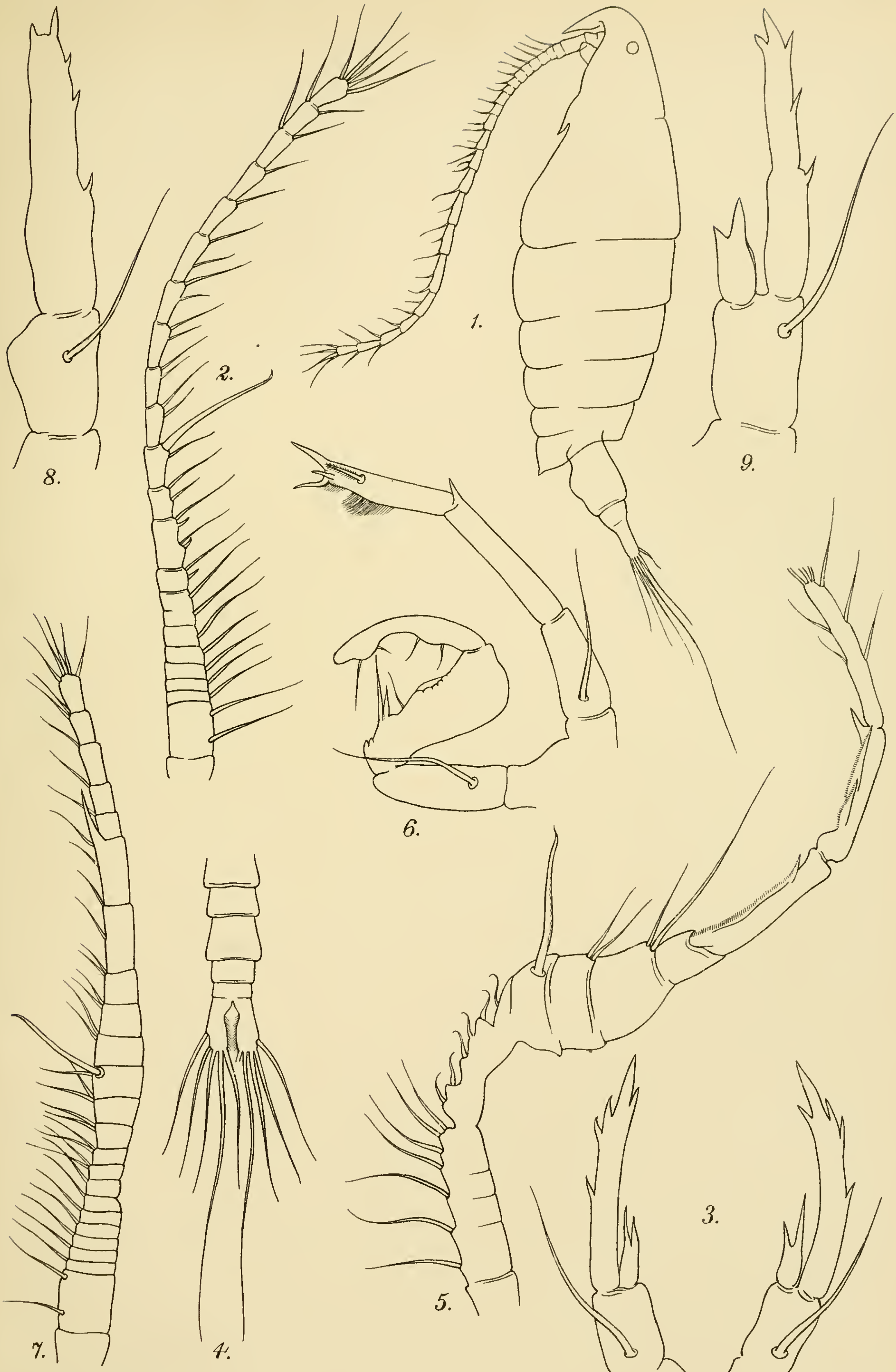
EXPLANATION OF PLATE XX.

1.—*Pontella andersoni*, sp. nov.	♀	Lateral view.
2.— ,, ,, ,, ,,	♀	1st Antenna.
3.— ,, ,, ,, ,,	♀	5th pair of legs.
4.— ,, ,, ,, ,,	♂	Abdomen.
5.— ,, ,, ,, ,,	♂	1st Antenna.
6.— ,, ,, ,, ,,	♂	5th pair of legs.
7.— ,, ,, ,, ,,	♂	1st Antenna, immature.
8.— ,, ,, ,, ,,	♂	5th Leg ,,
9.— ,, ,, ,, ,,	♀	5th Leg ,,



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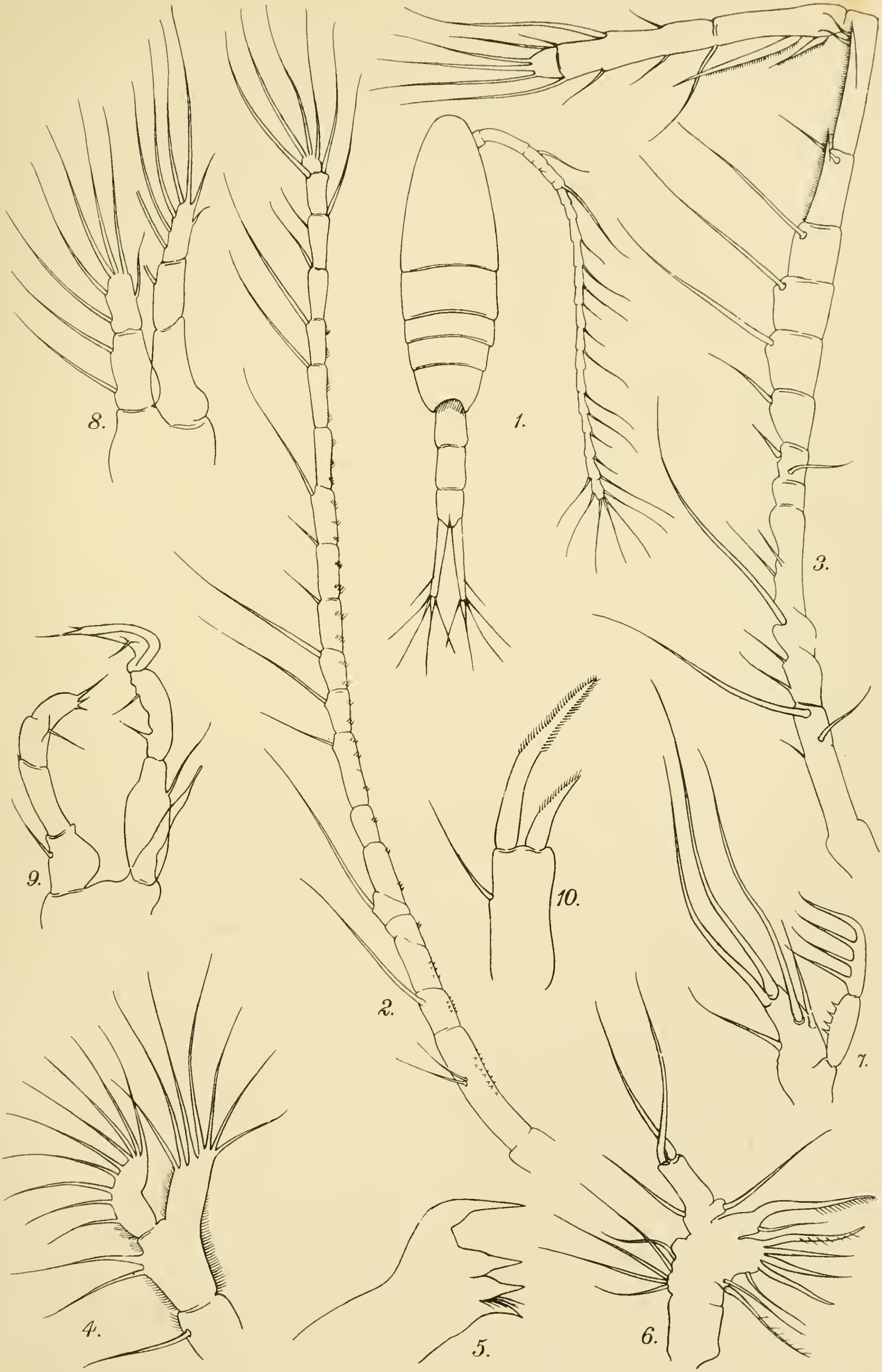
EXPLANATION OF PLATE XXI.

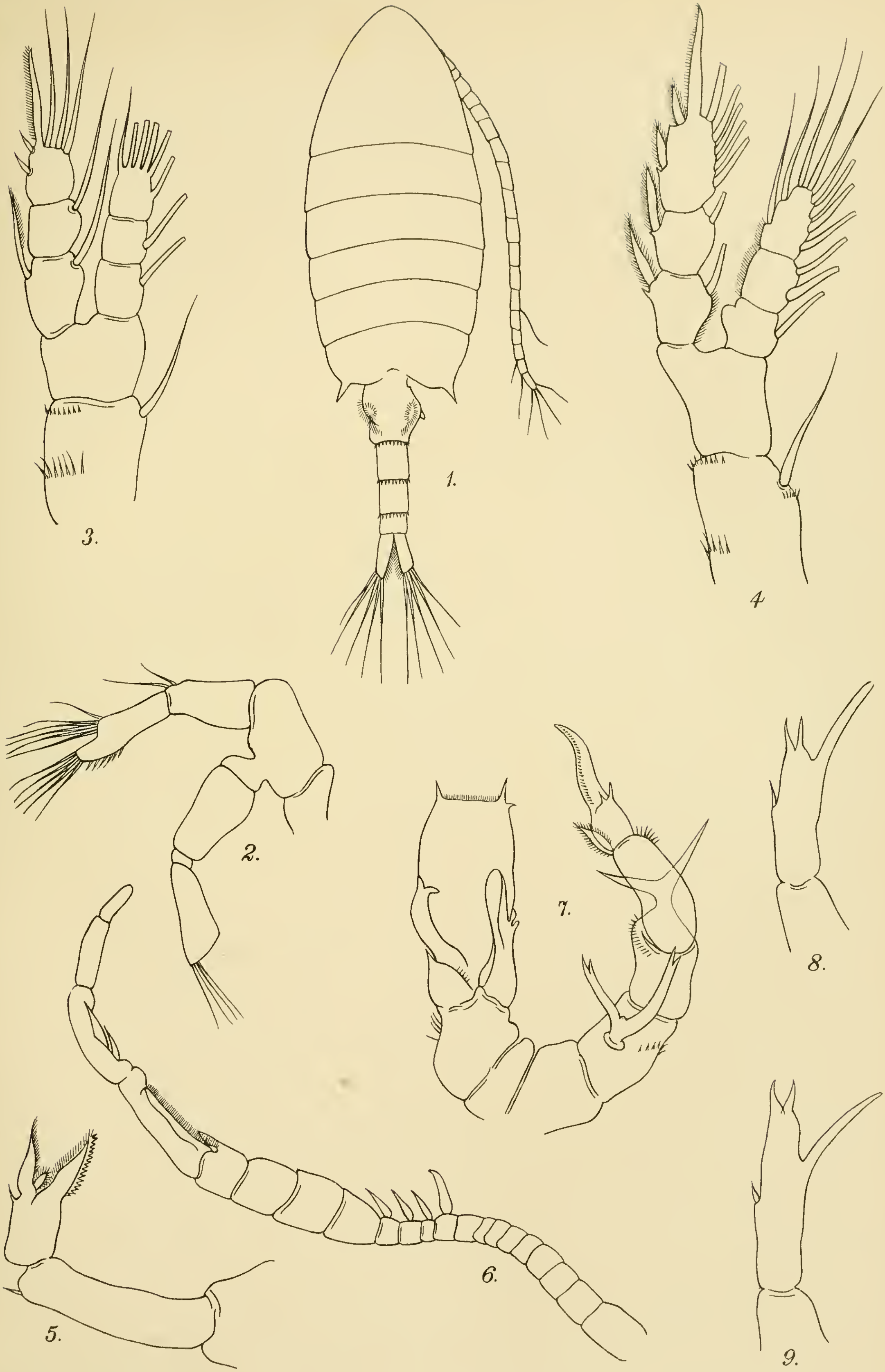
1.—*Acartia tortaniformis*, sp. nov.					♀	Dorsal view.
2.—	,,	,,	,,	,,	♀	1st Antenna.
3.—	,,	,,	,,	,,	♂	1st Antenna.
4.—	,,	,,	,,	,,	♀	2nd Antenna.
5.—	,,	,,	,,	,,	♀	Mandible.
6.—	,,	,,	,,	,,	♀	1st Maxilla.
7.—	,,	,,	,,	,,	♀	Maxilliped.
8.—	,,	,,	,,	,,	♂	1st Leg.
9.—	,,	,,	,,	,,	♂	5th pair of legs.
10.—	,,	,,	,,	,,	♀	5th pair of legs.



R. B. S. Sewell del. S. C. Mondul lith.

EXPLANATION OF PLATE XXII.

1.—*Pseudodiaptomus hickmani*, sp. nov.	♀	Dorsal view.
2.— ,, ,, ,, ,,	♀	2nd Antenna.
3.— ,, ,, ,, ,,	♀	1st Leg.
4.— ,, ,, ,, ,,	♀	2nd Leg.
5.— ,, ,, ,, ,,	♀	5th Leg.
6.— ,, ,, ,, ,,	♂	1st Antenna.
7.— ,, ,, ,, ,,	♂	5th pair of legs.
8.—*Temora discaudata*, Giesbrecht.	♀	5th Leg, normal.
9.— ,, ,, ,,	♀	5th Leg, variety.



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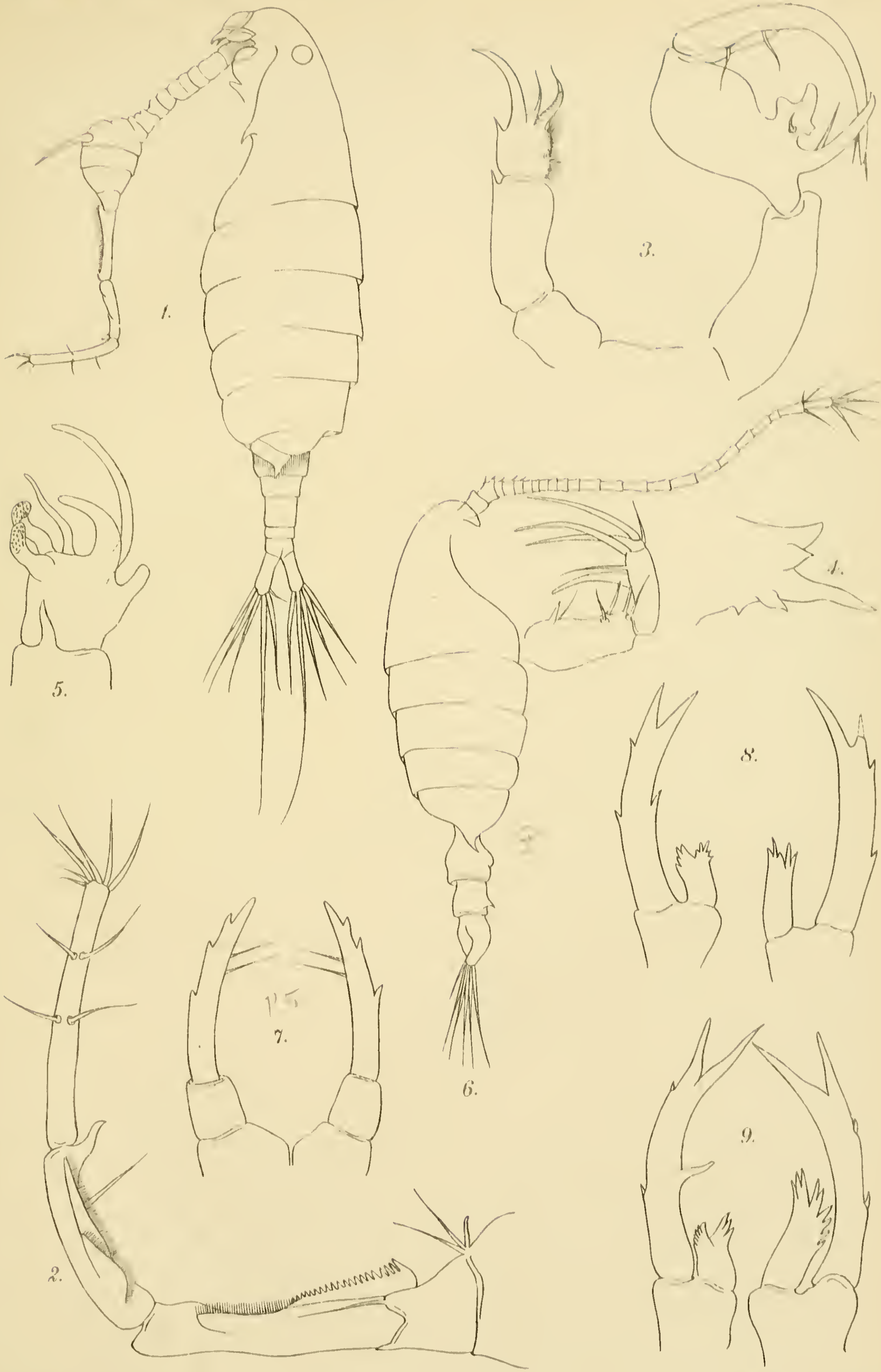
EXPLANATION OF PLATE XXIII.

1.—*Pontella investigatoris*, sp. nov. ♂ Lateral view.
2.— ,, ,, ,, ,, ♂ 1st Antenna, right side.
3.— ,, ,, ,, ,, ♂ 5th pair of legs.
4.—*Labidocera kröyeri* (Brady) var. *burmanica*, nov., lateral thoracic angle.
5.— ,, ,, ,, ,, ,, ,, ♂ 5th left leg, terminal segment.
6.—*Candacia bradyi*, A Scott. ♀ Lateral view.
7.— ,, ,, ,, ,, ♀ 5th pair of legs.
8.—*Labidocera pectinata*, Thomp. and Scott. ♀ 5th pair of legs (after Cleve).
9.— ,, ,, ,, ,, ,, ♀ 5th pair of legs (from Burma).



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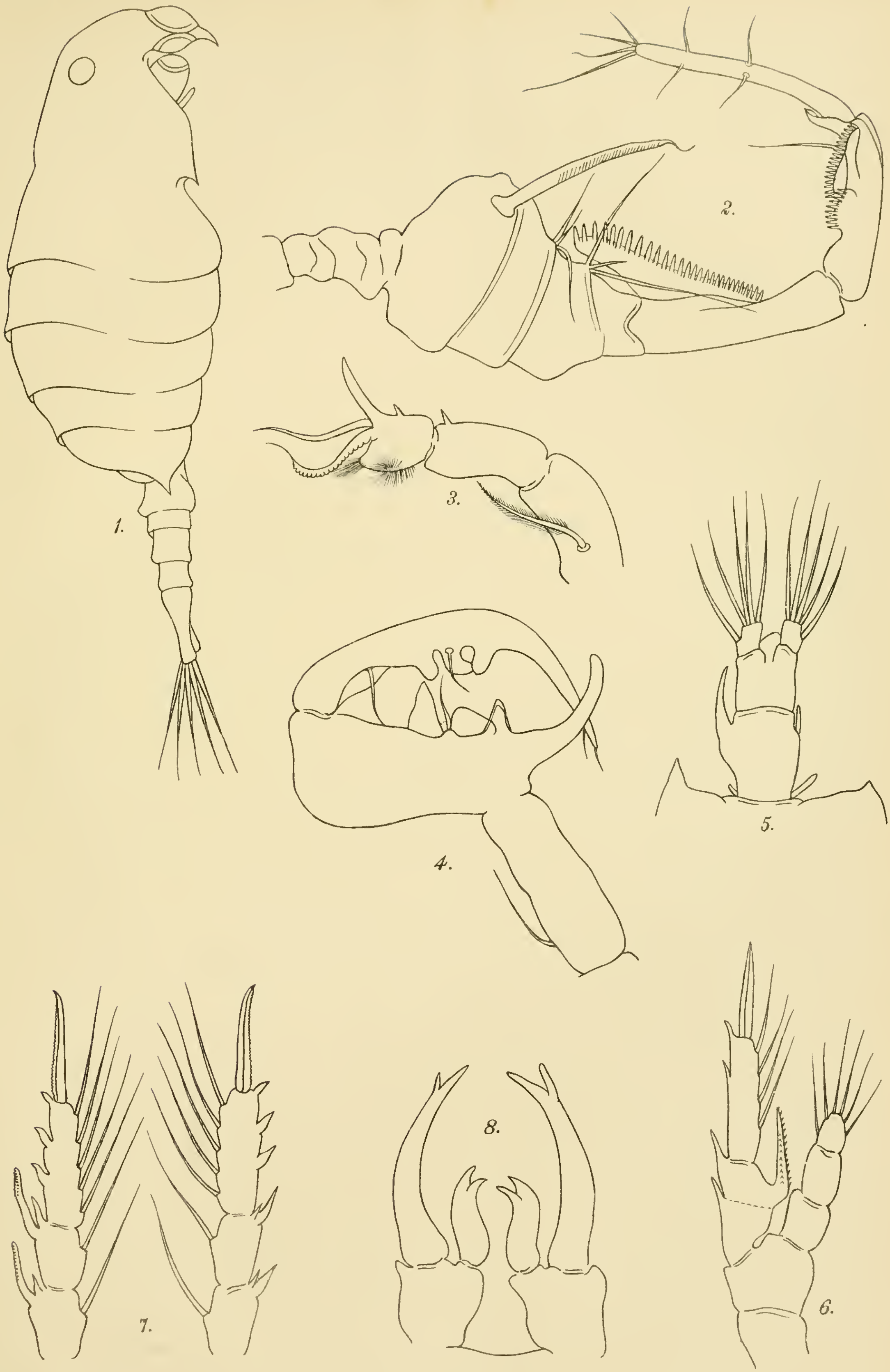
EXPLANATION OF PLATE XXIV.

1.—*Pontella spinipes*, Giesbrecht.	♂	Lateral view.
2.— ,, ,, ,,	♂	1st Antenna, right side.
3.— ,, ,, ,,	♂	5th left leg.
4.— ,, ,, ,,	♂	5th right leg.
5.—*Pontellopsis herdmani*, Thomp. and Scott.	♀	Abdomen with abnormal spine.
6.—*Centropages tenuiremis*, Thomp. and Scott.	♀	5th right leg.
7.— ,, ,, ,, ,, ,,	♂	Exopodites, 4th pair of legs.
8.—*Labidocera kröyeri* (Brady) var. *bidens*, nov.	♀	5th pair of legs.



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