Notes on Some Decapod Larvae

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R. RAGHU PRASAD AND P. R. SADASIVAN TAMPI

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(*Central Marine Fisheries Research Station, Mandapam Camp.*)

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Introduction

A wide variety of decapod larvae is characteristic of the inshore plankton of Mandapam (*q. v.*, Prasad, 1954) but the specific identity of many of these larvae is still unknown. Our present knowledge of the decapod larvae of Indian waters is mostly based on the pioneering work of Menon (1933, 1937 and 1940) who, however, could not determine the species in many cases because of the inadequacy of material in some cases and the difficulty he experienced in getting the earliest larval stages hatched in the laboratory. He remarks that: "This difficulty in getting the earliest stage from the eggs renders the identification of the plankton specimens a very difficult task." Amongst some of the other contributions dealing with particular species mention may be made of those by Nayar (1947) on *Periclimenes* (*Ancylocaris*) *brevicarpalis* (Schenkel), Menon (1949 and 1951) on *Periclimenes* (*Periclimenes*) *indicus* Kemp and *Metapenaeus dobsoni* Miers, Raja Bai Naidu (1951 and 1955) on *Scylla serrata* (Forskal) De Haan, *Neptunus sanguinolentus* (Herbst) and *Ocypoda platytarsis* Milne-Edwards; Prasad and Tampi (1953) on *Neptunus pelagicus* (Linnaeus) and *Thalamita crenata* Latreille, and the same authors (1957) on *Panulirus ornatus* (Fabricius) *Thenus orientalis* (Rumph.) and *Scyllarus* (?) *orientalis* (Spence Bate).

In order to facilitate the specific determination of the larvae that usually occur in the local plankton, ovigerous specimens of a few of the common species of decapods were collected and kept in the aquarium until the eggs hatched so that the characters of the first larvae could be studied, which, in the majority of cases, would help in recognising the subsequent larval stages. Attempts to rear these larvae through later stages proved unsuccessful. The following account, therefore, deals only with the first larval stages of *Pinnotheres ridgewayi*, *Menippe rumphii*, *Pilumnus longicornis*, *Chlorodius niger*, *Eucrete crenate*, *Elamena sindensis*, *Alpheus rapacida*, *Alpheus strenuus*, *Leander semmelinki* and *Anchistus inermis*.

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Descriptions of Larvae

Pinnotheres ridgewayi Southwell[1]

The zoea (Fig. 1*a*) measures 0.95 mm in length when the abdomen is held straight. The abdomen is curled in under the body when the zoea is at rest and in this position it appears like a ball. The carapace is without the dorsal and lateral spines but two small protuberances are seen on the carapace as shown in Fig. 1*a*, of which one is at the position where the dorsal spine is normally inserted. There are several large stellate chromatophores on the carapace and some of the appendages. Similar chromatophores are present on the abdomen and the telson.

Antennule (Fig. 1*b*) has an unsegmented peduncle with two aesthetes of almost equal length.

Antenna. The antennae are not clearly visible at this stage. In all species of pinnotheridae the antennae are minute and are represented only by a rudimentary stump (Lebour, 1928 and Hyman, 1924 as quoted by Lebour).

Mandible could not be traced.

First maxilla (Fig. 1*c*). Of the two endites of the protopodite the proximal one (coxopodite) bears five setae and the distal (basipodite) has six setae of which only one is hirsute. The endopodite seems to be a single piece with three setae.

Second maxilla (Fig. 1*d*). The coxo and basipodite, the endopodite and the scaphognathite have fine hairs on their margin. The coxopodite has three short setae and the basipodite has eight short setae in two groups of five and three respectively. The endopodite is unsegmented bearing three short setae each separated by a notch. The scaphognathite is narrow, tapers to a point and has five plumose setae.

First maxillipede (Fig. 1*e*) has three chromatophores on the basipodite which bears four setae. The exopodite is unsegmented and has four terminal natatory setae. The endopodite is five segmented and has one seta each on the proximal and second segments. The third segment bears no seta, the fourth has two and the terminal or the fifth segment has five setae of which four are terminal and much longer than the other.

Second maxillipede (Fig. 1*f*). There are two chromatophores on the basipodite which bears no seta. The exopodite has four terminal natatory setae. The endopodite is small and two segmented bearing four short setae on the terminal segment.

1. The adults of *Pinnotheres ridgewayi* are generally found in *Pinna aequilatera* Martens and the ovigerous specimens collected in the present instance are from the mantle cavity of *P. aequilatera*. Orton (1920) pointed out that the females of *P. pisum* are frequently found alone in a mollusc and that males are scarce. Kemp (1922) observed the same phenomenon in *Pinnotheres* and other genera of Pinnotherid crabs in India. In the present instance too the authors did not find any males in the *Pinna*. According to Stauber (1945) males and females of *P. ostreum* are found in the American oyster, *Ostrea* (*Gryphaea*) *virginica*.

Telson (Fig. 1g). The telson of many species of *Pinnotheres* has a somewhat characteristic shape (Lebour, 1928; Menon, 1937 and Sandoz and Hopkins, 1947) with three lobes, two lateral ones and a middle one which is longer than the lateral lobes. *P. ridgewayi* also has a similar telson. The outer margins of the lateral lobes are crenulated. There are two large, branching chromatophores on the telson. The middle lobe ends in a point. Between the lateral and median lobes there are four setae on each side, three of which are placed very close to the median lobe and the single, relatively short seta is inserted almost at the corner of the lateral lobes. On the outer side of these setae there is a short spine of the lateral lobe. All the setae have fine hairs on them.

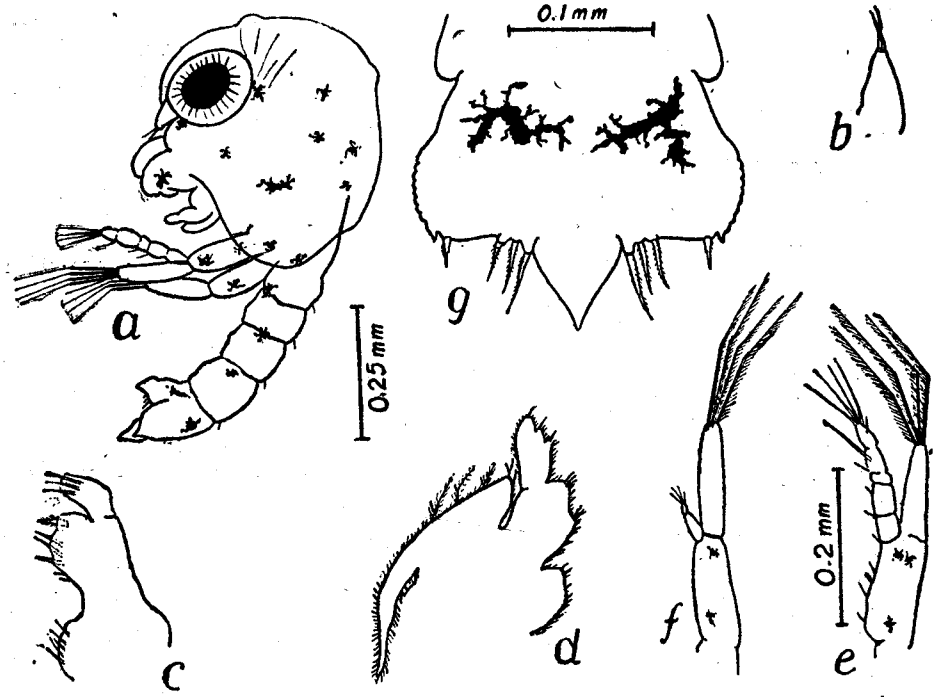

Fig. 1. *Pinnotheres ridgewayi*. (*a*) zoea; (*b*) antennule; (*c*) first maxilla; (*d*) second maxilla (*e*) first maxillipede ; (*f*) second maxillipede; (*g*) telson. Magnification of figures (*b*), (*c*) and (*d*) is the same as that of (*g*) and (*f*) as that of (*e*).

The zoea of *P. ridgewayi* resembles in its general shape, telson, etc., the corresponding stage of *P. ostreum* described by Sandoz and Hopkins (1947) but in many details it shows differences. Lebour (1928). has remarked that the larval forms of Pinnotheridae may differ to a large extent and even within the species *Pinnotheres* there will be variations as to the number of spines on the carapace and the form of telson. However, there are certain important characters which they have in common such as the rudimentary antennae, form of telson and abdomen which show that they must be closely related. The characteristic form of telson, where the forks of telson are reduced so that the telson becomes a more or less flat plate with the long spines shortened, is believed to be of advantage as an aid to curling up the

body. She considers the ordinary forked telson as perhaps the more primitive type from which the peculiar forms are probably derived (Lebour, 1928). The zoea of *P. ridgewayi* too has the habit of curling in the abdomen under the body so as to form a ball and this habit, according to Lebour, seems to be of advantage in keeping itself down below.

Menippe rumphii (Fabricius)

The zoea (Fig. 2*a*) measures 1.5 mm. in length and 1.35 mm. from tip of the rostral spine to the tip of the dorsal spine. The dorsal spine is slightly curved and is longer than the rostral spine. The carapace has also the lateral spines. There are a few chromatophores on the carapace and the dorsal spine. Each abdominal segment has a pair of chromatophores on the ventral side. The second, third, and fourth segments each carry on the dorsal side a pair of short hairs. The second and third segments each have a pair of curved lateral spines as found in most of the xanthid zoeae; those of the second segment being curved upwards, whereas those of the third are curved downwards. The postero-lateral margin of the fifth segment is produced into slightly curved spines which run almost parallel to the forks of the telson.

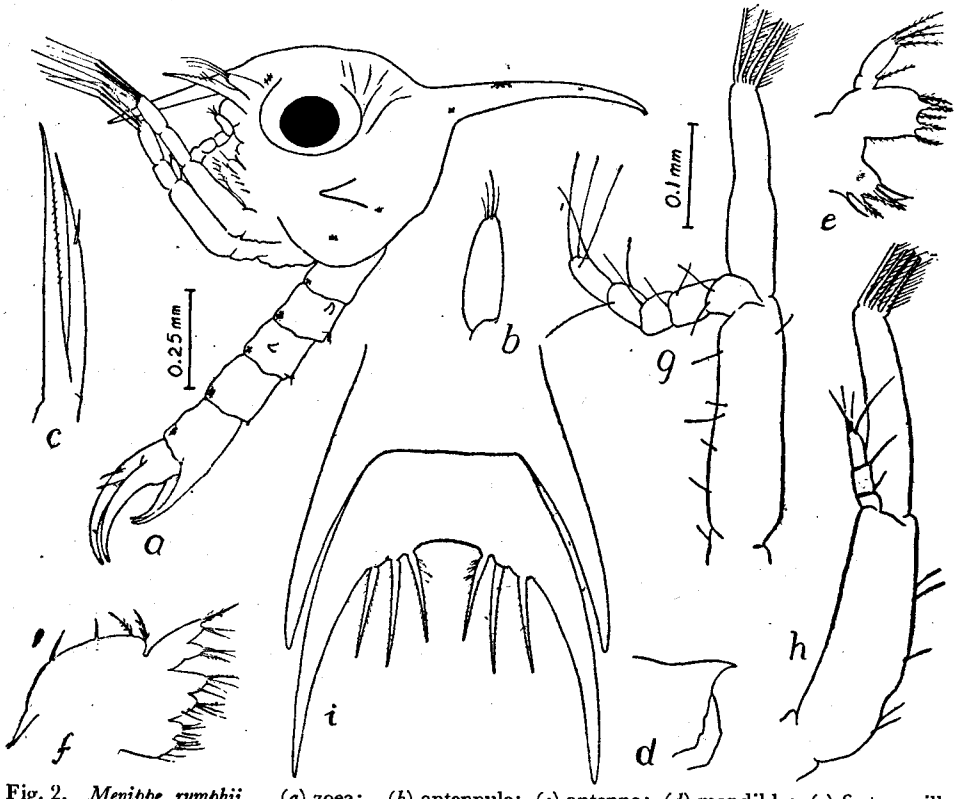

Fig. 2. *Menippe rumphii*. (*a*) zoea; (*b*) antennule; (*c*) antenna; (*d*) mandible; (*e*) first maxilla; (*f*) second maxilla; (*g*) first maxillipede; (*h*) second maxillipede; (*i*) telson. Magnifications of figures (*b*), (*c*), (*d*), (*e*), (*f*), (*h*) and (*i*) same as that of (*g*).

Antennule (Fig. 2*b*) has an unsegmented peduncle with four terminal aesthetes of unequal length.

Antenna (Fig. 2*c*). The spiniform process (endopodite) and the exopodite, which has a single spine, are of nearly equal length as is usual in the Menippinae. The endopodite, on the other hand, has a series of small spines.

Mandible (Fig. 2*d*) has no palp. The cutting edge is finely serrated. The top corner is produced into a beak-like structure.

First maxilla (Fig. 2*e*). The coxopodite has six setae of which two are stouter and hairy. The basipodite has five setae all of which are hirsute but two are relatively stouter. Fine hairs in a row are present on the lower margin of the basipodite. The endopodite is two segmented. The proximal segment is short with one seta and the distal segment has four hirsute setae.

Second maxilla (Fig. 2*f*). The coxo-, basi- and endo-podites are bifid. There are five and four setae respectively on the coxopodite and a similar number of setae on the two segments of the basipodite. On the basipodite three setae are hirsute, two in the lower segment and one in the upper. The endopodite has three setae in each segment and of these one in each group is hirsute. The scaphognathite has four plumose setae and posteriorly it tapers to a point and the margin of this is covered with hairs so much so that the posterior part appears like a large plumose seta.

First maxillipede (Fig. 2*g*). The coxopodite is small and has a single seta. The larger basipodite has five setae on the inner margin and one on the outer margin. The exopodite has four terminal natatory setae. The endopodite is five segmented; the first, second and fourth segments carry two setae each, the third segment one seta and the fifth segment has four long terminal setae.

Second maxillipede (Fig. 2*h*). The basipodite is large and has few setae. The exopodite has four terminal natatory setae. The endopodite is three segmented. The terminal segment has four setae and the middle segment two.

Telson (Fig. 2*i*) is deeply forked with the two forks wide apart. Three pairs of setose spines are present between the forks. Running almost parallel to the fork of the telson are the spines of the fifth abdominal segment as already mentioned.

Pilumnus longicornis Hilgendorf

The zoea (Fig. 3*a*) measures 1.4 mm in length. The carapace is armed with the rostral and posterior spines. A large branching chromatophore is present at the point where the posterior spine originates from the carapace. Similar chromatophores are seen on the dorsal aspect at the junction of the first and second abdominal segments and also one each on the ventral side of the fourth and fifth segments. The length of the rostral spine is less than that of the second antennae. Short lateral spines are also present on the carapace. The five abdominal segments, excluding telson, are more or less of uniform size and have one or two dorsal hairs on the second, third and fourth segments. The second and third segments each

possesses a pair of short lateral spines characteristic of xanthid zoea. Those on the second segment are directed upwards while the other pair is directed downwards. The third, fourth and fifth segments each bears a pair of downwardly pointed spines from the postero-lateral border as shown in Fig. 3*a*. These zoeae somewhat resemble those of *Lobopilumnus agassizii* Milne-Edwards described by Lebour (1950).

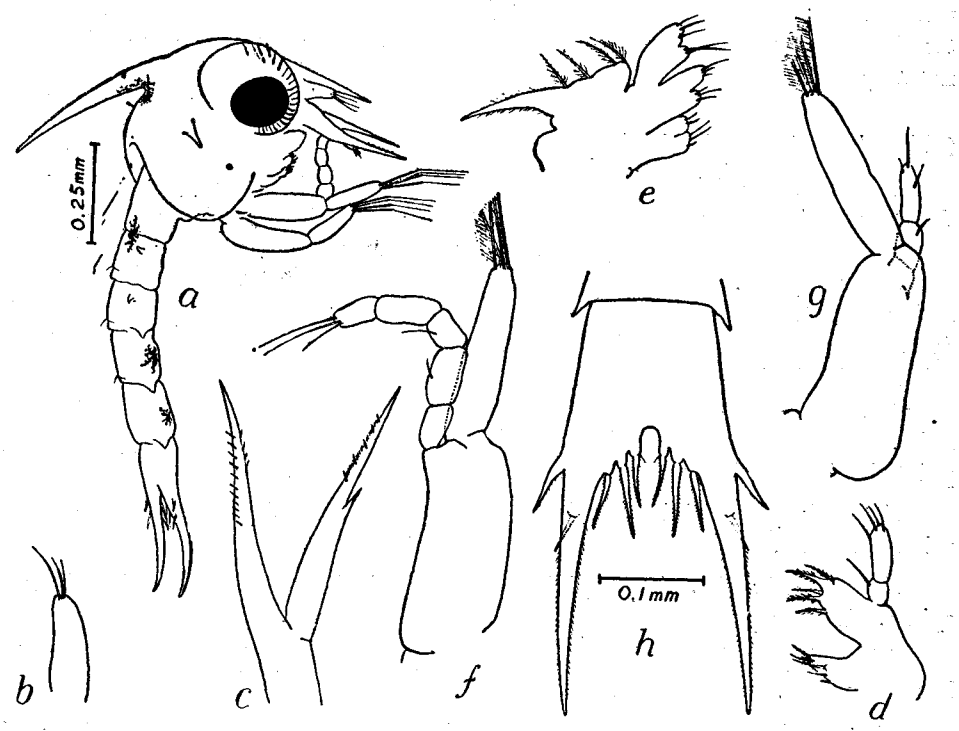

Fig. 3. *Pilumnus longicornis*. (*a*) zoea; (*b*) antennule; (*c*) antenna; (*d*) first maxilla; (*e*) second maxilla; (*f*) first maxillipede; (*g*) second maxillepede; (*h*) telson. Magnification of figures (*b*) to (*g*) same as that of (*h*).

Antennule (Fig. 3*b*) consists of a single piece with three terminal aesthetes.

Antenna (Fig. 3*c*). The antenna is of the usual type found in Menippinae with both the exopodite and the spiniform process of nearly equal length. The exopodite bears four spines and hairs along its inner border and a fairly large spine at about the middle of its length. The endopodite also possesses spines along its inner and outer borders, the number of spines on the outer border being greater.

Mandible. It has not been possible to separate the mandible even after several attempts.

First maxilla (Fig. 3*d*). The two endites of the protopodite have five hirsute setae on each of them. The endopodite is two jointed. The shorter proximal one has one seta while the distal longer segment bears four setae.

Second maxilla (Fig. 3*e*). The coxo-, basi- and endo-podites are bifid and they bear five, six and five setae respectively. The scaphognathite is small and the end is prolonged into a spinous process. The four marginal setae and the border of the scaphognathite are provided with fine hairs.

First maxillipede (Fig. 3*f*). The basipodite is, as usual, longer than the coxopodite and does not possess any setae. The endopodite consists of five, somewhat unequal segments; the second and third segments each has one seta and the terminal segment has three setae. The exopodite is a large single piece with four natatory setae.

Chlorodius niger (Forskal)

The zoea (Fig. 4*a*) measures 1.16 mm. in length and 1.05 mm. from the tip of the rostral spine to the end of the dorsal spine. The dorsal spine, which is longer than the rostral, has the tip slightly curved downwards. The carapace has two short lateral spines. There are a few chromatophores in each abdominal segment. A few chromatophores are also seen on some of the appendages. As is common in most of the known xanthid zoea there are small lateral spines on the second and third abdominal segments; those on the second directed upwards and the others directed downwards. Abdominal segments two to five have a pair of short dorsal hairs. The third, fourth and fifth abdominal segments have a pair of downwardly pointed spines originating from the postero-lateral margin.

Antennule (Fig. 4*b*) is prominent and the unsegmented peduncle has three terminal aesthetes.

Antenna (Fig. 4*c*). The spiniform process is long and has a series of small spines. The exopodite is reduced to a bract-like structure.

Mandible (Fig. 4*d*) consists of a single piece without a palp. The cutting edge has a few teeth.

First maxilla (Fig. 4*e*). The coxopodite bears seven setae of which one is relatively very short and without hairs. The basipodite has five setae of almost equal length but two of these are relatively stouter and four amongst these are hirsute. The endopodite is two segmented, the proximal one being the smaller. The distal segment bears five setae in two groups of three and two.

Second maxilla (Fig. 4*f*). The coxo-, basi- and endo-podites are all bifid. The coxopodite has three and two setae, the basipodite has two and two of which the upper two are hirsute and the endopodite has two and five setae. Of the seven setae on the endopodite only one is hirsute, and two setae on the upper segment are relatively short. The scaphognathite is narrow with three marginal plumose setae and the tip of the scaphognathite is pointed and hairy.

First maxillipede (Fig. 4*g*). The exopodite seems to be unsegmented and has four terminal natatory setae. The endopodite is five segmented; first, second and third segments each has a pair of setae; fourth has a single seta and the fifth has four terminal setae.

Second maxillipede (Fig. 4*h*.) The basipodite has a single seta and has a chromatophore almost at the junction of the exopodite and basipodite. The exopodite bears four natatory setae. The endopodite is three segmented and the terminal segment bears four setae of which one is relatively short.

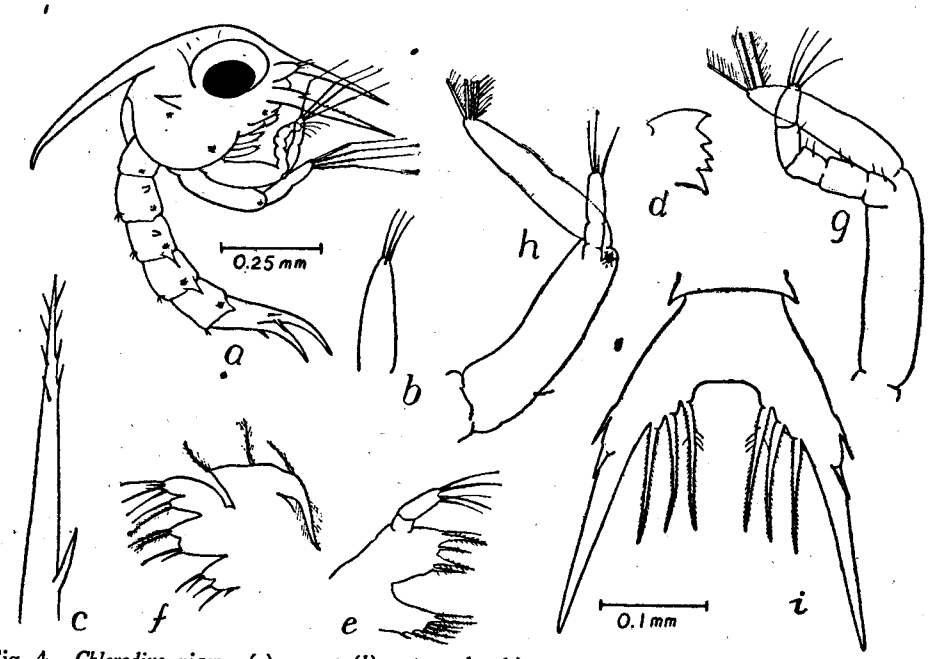

Fig. 4. *Chlorodius niger*. (*a*) zoea; (*b*) antennule (*c*) antenna; (*d*) mandible; (*e*) first maxilla; (*f*) second maxilla; (*g*) first maxillipede; (*h*) second maxillipede; (*i*) telson. Magnification of figures (*b*) to (*h*) same as that of (*i*).

Telson (Fig. 4*i*) is deeply forked with the forks slightly diverging. There is a lateral and a dorsal spine on each fork. Between the forks there are three pairs of setose spines.

Eucrete crenate De Man

The zoea measures 1.5 mm in length. The backwardly directed spine of the carapace is somewhat longer than the rostral spine. Rostral spine extends beyond the tip of the antennae. The carapace also possesses a short lateral spine on either side. The abdominal segments are more or less of the same size and these are unarmed (Fig. 5*a*).

Antennule (Fig. 5*b*) has an unsegmented peduncle with three aesthetes at its tip.

Antenna (Fig. 5*c*.). The antenna has a well developed exopodite which is about three-fourths the length of the spiniform process. Almost at the middle of the exopodite there is a long spine and towards the tip there are numerous pinules.

Mandible (Fig. 5*d*) consists of a single piece and no palp. The cutting edge has only very blunt serrations.

First maxilla (Fig. 5*e*). Of the two endites of the protopodite, the proximal one has six hairy setae while the distal one has five spines and also provided with stiff hairs. The endopodite seems to be three jointed and the terminal segment bears four setae.

Second maxilla (Fig. 5*f*). The protopodite endites are four in number and each bears four, three, five and four setae respectively. The endopodite is bifid with

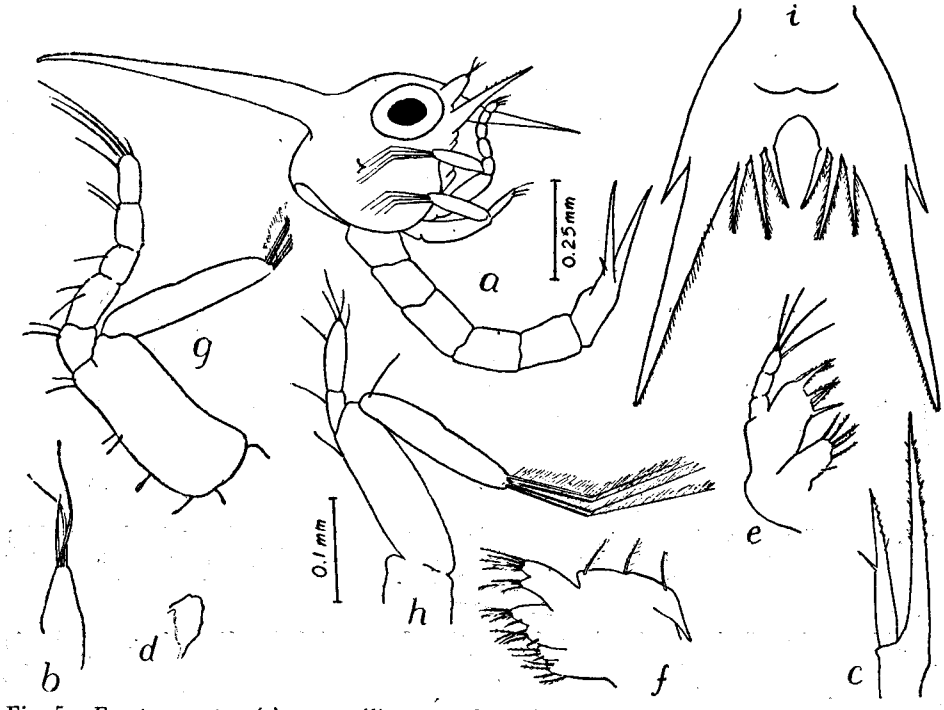

Fig. 5. *Eucrete crenate.* (*a*) zoea; (*b*) antennule; (*c*) antenna; (*d*) mandible; (*e*) first maxilla; (*f*) second maxilla; (*g*) first maxillipede; (*h*) second maxillipede; (*i*) telson. Magnification of figures *b* to *i* as shown in figure *h*.

three setae on the inner border and five at the tip. All the setae are hairy. The scaphognathite is narrow and tapers to a point. There are three marginal setae.

First maxillipede (Fig. 5*g*). The basipodite is considerably larger than the coxopodite, and has six setae. Endopodite is five jointed, each of the first two and the fourth of which has two setae on their inner border while the third segment bears only one seta. The terminal segment has five setae of which three are relatively longer than the rest. Exopodite seems to be a single piece with four natatory setae.

Second maxillipede (Fig. 5*h*). The large basipodite has only one seta. Endopodite is small and two jointed, the proximal segment has a single seta while the distal

one has five. The exopodite is a single piece with a seta near its base and four terminal, natatory setae.

Telson (Fig. 5*i*) is deeply forked. The two long spines bear hairs along the inner border and on the outer margin on each side of the fork there is a small lateral spine. Three pairs of setae are present within the fork, the middle pair is without hairs along the inner border of the setae.

Elamena sindensis Alcock

The zoea is relatively small and measures 0.96 in length (Fig. 6*a*). There are a few chromatophores on the carapace, some of the appendages and the abdomen. The abdomen shows only four segments and the telson. The last segment has the posterior margin formed into lateral projections as shown in Fig. 6*i*. There is a chromatophore each placed dorsally and one each located ventrally on the third and fourth abdominal segments. A pair of short spines are also present on the second, third and fourth abdominal segments. The carapace has no lateral or dorsal spines but there is a short, blunt, rostral spine. The zoeae have the habit of curling up into balls.

Gurney (1924) in his report on the decapod larvae of the "Terra Nova" expedition describes a similar larva. He remarks: "At stations 133 and 135 a peculiar Brachyuran Zoea was taken in some numbers, which is of interest although it is impossible even approximately to identify it." He adds that: "The nearest to it is one described by Claus (1876, Taf. XIV, Figs. 1-4). This zoea has, however, lateral spines, but the form of the sixth somite is the same and the structure of the telson somewhat similar."

Antennule (Fig. 6*b*) has a short peduncle with two terminal aesthetes and one short seta.

Antenna is reduced to a simple, unsegmented structure just below the antennule as shown in Fig. 6*a*.

Mandible (Fig. 6*c*) is without palp. The cutting edge has a few blunt teeth.

First maxilla (Fig. 6*d*). The coxopodite bears two setae and the basipodite has five of which four are with hairs. Of these four, three are stouter. The endopodite is two jointed; the basal segment has one seta and the distal has four of which two are terminal.

Second maxilla (Fig. 6*e*). The coxopodite is small and has a single hirsute seta. The basipodite bears seven hirsute setae. The endopodite is slightly bifid, the inner segment has two and the outer three setae. The scaphognathite is narrow, tapers to a point and has marginal hairs. There are three plumose marginal setae.

First maxillipede (Fig. 6*f*). The basipodite has five marginal setae and the exopodite bears four long, natatory setae. The endopodite is five segmented and the first, second and fourth segments each has a pair of setae; the third has one and the fifth has four terminal setae.

Second maxillipede (Fig. 6*g*). The basipodite has two setae and the exopodite bears four long natatory setae. The endopodite is relatively small and four segmented. The second and third segments have one and three setae respectively. The fourth has three terminal setae.

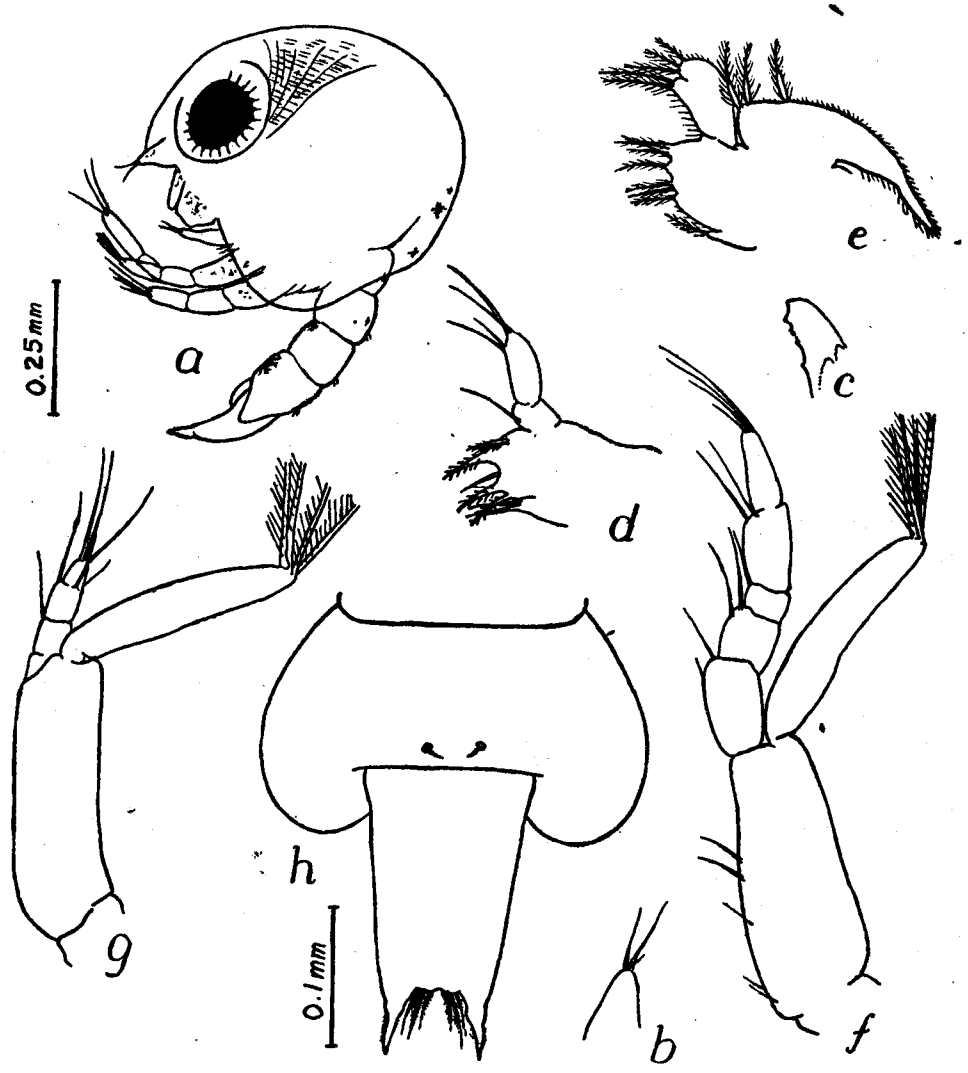

Fig. 6. *Elamena sindensis*, (*a*) zoea; (*b*) antennule; (*c*) mandible; (*d*) first maxilla; (*e*) second maxilla; (*f*) first maxillipede; (*g*) second maxillipede; (*h*) telson and the last abdominal segment showing the lateral projections. Magnification of figures *b* to *g* as shown in *h*.

Telson (Fig. 6*h*) is a long plate-like structure with the corners produced into short forks which have small hairs on them. Between the forks there are three pairs of setose spines. As already mentioned the lateral projections of the last abdominal segment form two wing-like structures on either side of the telson.

Alpheus rapacida De Man

Length of the entire larva (Fig. 7*a*) is 2.3 mm. The rostral spine is broad and short thus revealing the large stalked eyes.

Antennule (Fig. 7*b*) is a long peduncle with a knob-like inner flagellum provided with a single seta and an outer flagellum with two terminal aesthetes.

Antenna (Fig. 7*c*). The peduncle bears a prominent spine at the base of the scale and a short one at the base of the flagellum. The scale is segmented anteriorly showing six or seven segments. There are three short outer setae and eight setae along the inner margin of which only the basal one is short. The flagellum has a small spine at its tip and a long terminal seta.

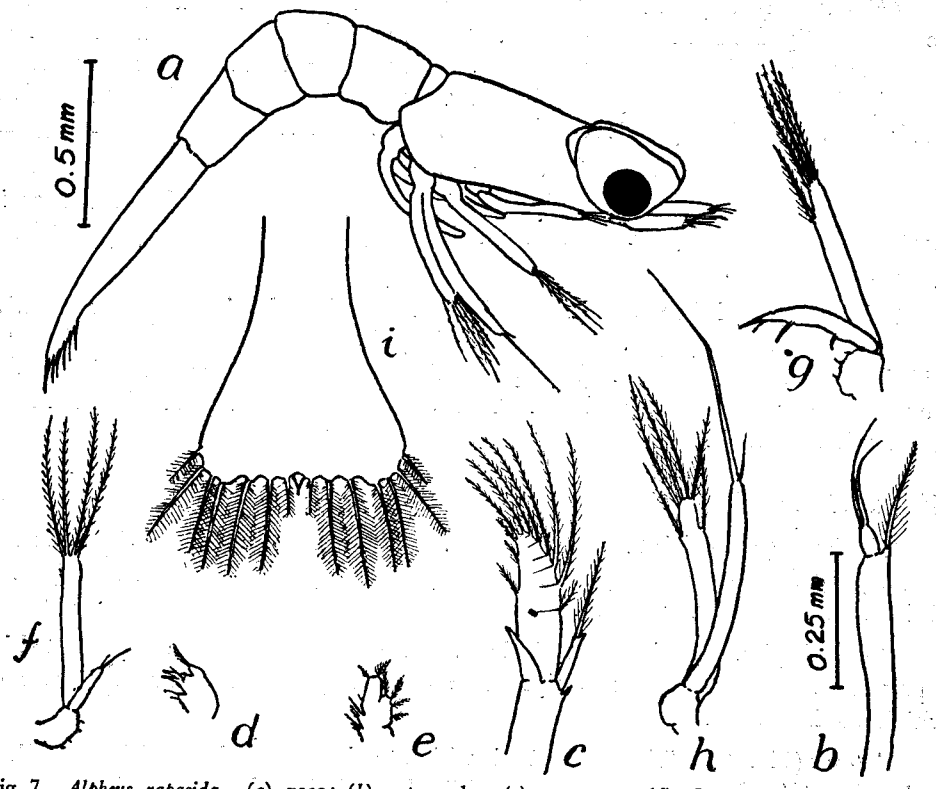

Fig. 7. *Alpheus rapacida.* (*a*) zoea; (*b*) antennule; (*c*) antenna; (*d*) first maxilla; (*e*) second maxilla (*f*) first maxillipede; (*g*) second maxillipede; (*h*) third maxillipede; (*i*) telson. Magnification of figures (*b*) to (*i*) as shown in figure (*b*).

First maxilla (Fig. 7*d*). The two endites of the protopodite have two and three setae respectively and the endopodite has a single apical seta.

Second maxilla (Fig. 7*e*). Only two endites are distinguishable in the protopodite with three setae each. The one small spine-like seta at the base of the endopodite may represent the other endite which is perhaps fused with the

endopodite. Endopodite is with two setae. The scale, which is small, has four marginal setae.

First maxillipede (Fig. 7*f*). The basal segments are together represented by one segment which possesses four spine-like setae. The endopodite is short, unsegmented and has two terminal setae. The exopodite is also unsegmented but bears four long setae.

Second maxillipede (Fig. 7*g*). The basal segment is single and is similar to that of the first maxillipede. The endopodite which is unsegmented terminates in a spine and besides possesses three setae along the inner side. The exopodite is also unsegmented but has five long setae.

Third maxillipede (Fig. 7*h*). The basal segment is similar to that of the first and second maxillipedes but is without setae. The exo and endo-podites are almost of the same length. The exopodite bears six hairy setae similar to that in the other maxillipedes, but the endopodite has a very long terminal seta besides another smaller one. In this respect it resembles somewhat the third maxillipede of stage II of *Alpheus* sp., described by Menon (1940).

Two pairs of rudimentary thoracic legs are present of which the first one is shorter than the second pair. Both are uniramous, unsegmented and partly hidden by the maxillipedes.

Telson (Fig. 7*i*) is broad and triangular but not as broad as in *Leander semmelinki*, described later in this paper. There are eight pairs of marginal setae of which the middle pair is the smallest. The pair of setae immediately next to this and the outermost pair are slightly bigger. The others are the longest and these are of about uniform length.

Alpheus strenuus Dana

The larva (Fig. 8*a*) is 2.3 mm in length. The rostral spine is small and is not seen beyond the level of the eyes. Posteriorly the carapace leaves much of the first abdominal segment uncovered.

Antennule (Fig. 8*b*). Peduncle is long. The inner flagellum is represented by a protuberance with a seta at its tip. The outer flagellum has two aesthetes of which one is often short.

Antenna (Fig. 8*c*). The peduncle is without spines at the base of the flagellum and scale. The flagellum has one seta while the scale has eleven of which two are on the outer margin.

First maxilla (Fig. 8*d*). The two endites of the protopodite have two and one seta respectively while the endopodite has two.

Second maxilla (Fig. 8*e*) The three endites of the protopodite are very much reduced and are represented by the setae, one, one and two in each. Endopodite has two setae and the scaphognathite is provided with five marginal setae.

First maxillipede (Fig. 8*f*). The basal segments are reduced. The endopodite is a small piece with two short terminal setae. Exopodite is unsegmented and possesses four long setae.

Second maxillipede (Fig. 8*g*). The endopodite shows indistinct segmentation into two and possesses three setae. The exopodite also shows the same kind of segmentation and has five setae.

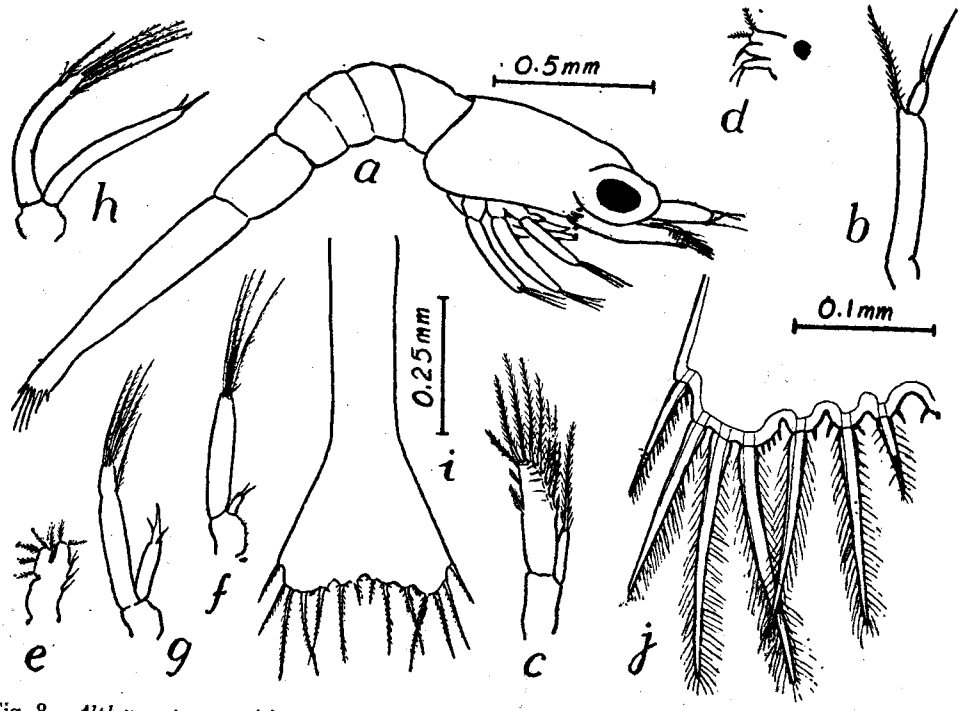

Fig. 8. *Alpheus stenuus*. (*a*) zoea; (*b*) antennule; (*c*) antenna; (*d*) first maxilla; (*e*) second maxilla; (*f*) first maxillipede; (*g*) second maxillipede; (*h*) third maxillipede; (*i*) telson; (*j*) part of telson enlarged showing the details. Magnification of figures (*b*) to (*h*) same as that of (*i*).

Third maxillipede (Fig 8*h*). The endopodite is slightly longer than the exopodite. Both seem to be unsegmented. The former bears two short setae, whereas the latter is provided with six long setae.

Telson (Fig. 8*i*) in its general shape resembles that of *Alpheus rapacida*. It possesses seven pairs of setae and has a few marginal spines, four between the fourth and fifth, two between the fifth and sixth, and one between the sixth and seventh setae and two in the middle as shown in Fig. 8*j*. This arrangement, however, is apparently not very constant and slight differences have been noticed. All except the outermost pair of setae, which have hairs only on the inner margin, have hairs on both sides.

Leander semmelinki De Man

The larvae (Fig. 9*a*) measure 2.6 mm. in length including the rostral spine. The carapace hides the base of the eyes when viewed from the dorsal side and projects beyond the eyes nearly up to the level of the antennule.

Antennule (Fig. 9*b*). The peduncle is long and shows indications of a basal segment. The outer flagellum has four terminal aesthetes. The inner flagellum is not developed but a long seta is present in its place.

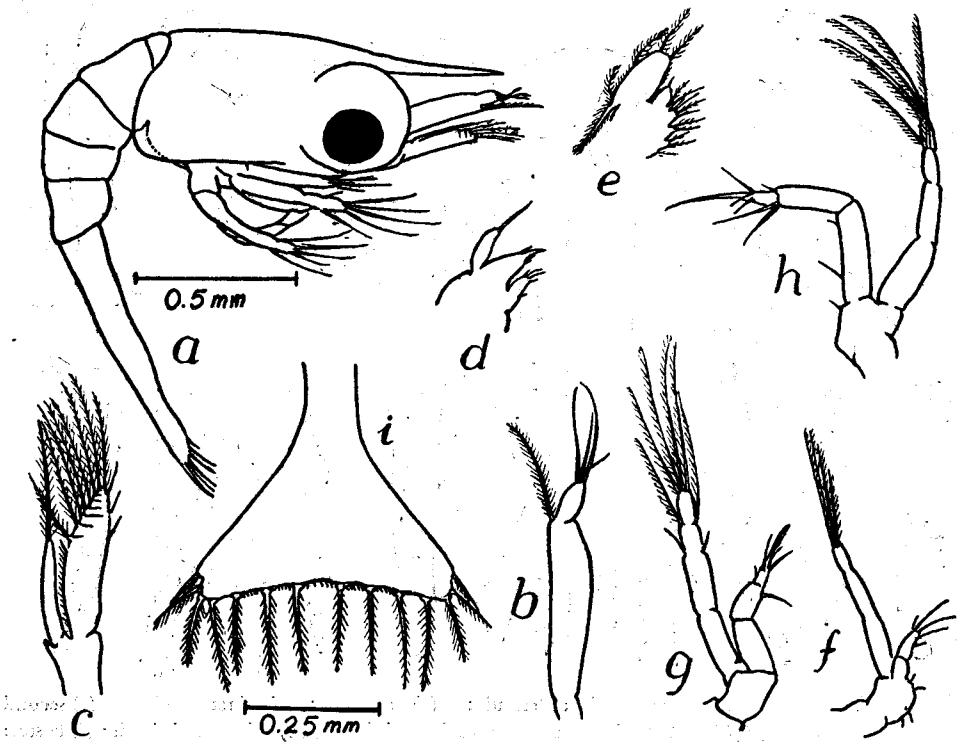

Fig. 9. *Leander semmelinki*. (*a*) Zoea; (*b*) antennule; (*c*) antenna; (*d*) first maxilla; (*e*) second maxilla; (*f*) first maxillipede, (*g*) second maxillipede; (*h*) third maxillipede; (*i*) telson. Magnification of all appendages same as that of telson.

Antenna (Fig. 9*c*). The peduncle has a short spine at the base of the flagellum. The flagellum itself is unsegmented and is provided with a long terminal seta. The scale shows six or seven segments anteriorly with eight or nine hairy setae on the inner margin and three simple setae on its outer border.

First maxilla (Fig. 9*d*) has two protopoditic endites and an endopodite. The coxopodite has five setae, the basipodite has a spinous tip surrounded by three setae and the endopodite has a relatively long single seta.

Second maxilla (Fig. 9*e*). There are three small endites on the protopodite. The setae on these are well developed; three, two and four respectively on each of

them. The unsegmented endopodite has two or three setae. The scaphognathite has five marginal setae of which the last one is the most prominent.

First maxillipede (Fig. 9*f*). The basal poditic segments are united into one bearing four spine-like setae. The endopodite is two segmented, the distal segment possessing five setae. The exopodite is much longer and shows faint indications of three segments with four long setae at the tip.

Second maxillipede (Fig. 9*g*). The basal segments are represented by a single piece devoid of setae. The endopodite is three jointed, the penultimate joint with one and the terminal segment with three or four setae. The exopodite is longer and shows faint segmentation into four. Of these, the terminal segment possesses four long setae and the next two have two setae each.

Third maxillipede (Fig. 9*h*). The basal segment is as in the second maxillipede but possesses one small spine-like seta. Endopodite is three segmented. The proximal segment has two setae, the penultimate one has three and the last one has four setae. The exopodite shows four segments of which the last, which is the smallest, bears four setae while the penultimate has two setae.

Two pairs of rudimentary legs are present and both are biramous. However, these are completely hidden from view by the maxillipedes.

Telson (Fig. 9*i*). The five abdominal segments are followed by a long telson which is nearly as long as the whole abdomen. The stalk region is narrow and the triangular portion has a broad base which is slightly curved inwards. There are seven pairs of setae. The two setae inserted at the corner of the triangle have hairs only along the inner side while the rest are plumose. The setae are more or less of the same length. The margin of the telson between the middle six setae shows short spines.

Anchistus inermis (Miers)[1]

The larvae (Fig. 10*a*) are relatively small and are 1.81 mm. in length. The rostral spine is absent. The third abdominal segment is unusually larger than the rest and the body is bent at the third abdominal segment as is usually found in the larvae of *Periclimenes* and some of the other closely related genera.

Antennule (Fig. 10*b*). The peduncle is unsegmented and long. The inner flagellum is represented by a plumose seta. The outer has five aesthetes and a terminal plumose seta.

Antenna (Fig. 10*c*). The peduncle is unsegmented with the flagellum having a long unsegmented base and a terminal plumose seta. The scale shows indications of two or three segments at the tip and has eleven setae of which ten are hirsute and the ones on the inner margin are longer.

First maxilla (Fig. 10*d*). The coxopodite has four setae and the basipodite has four of which two are stout and with short hairs. The endopodite has a peculiar shape as shown in the figure. It is flat, leaf-like and without any spines or setae.

Second maxilla (Fig. 10*e*). The protopodite is divided into three endites. The first probably represents the exopodite with three setae and the second and third

[1] The adults of this species were obtained from the mantle cavity of *Pinna aequilateria* Martens.

lobes may constitute the basipodite which has four setae. The endopodite has a terminal plumose seta. The scaphognathite is small and has four plumose setae.

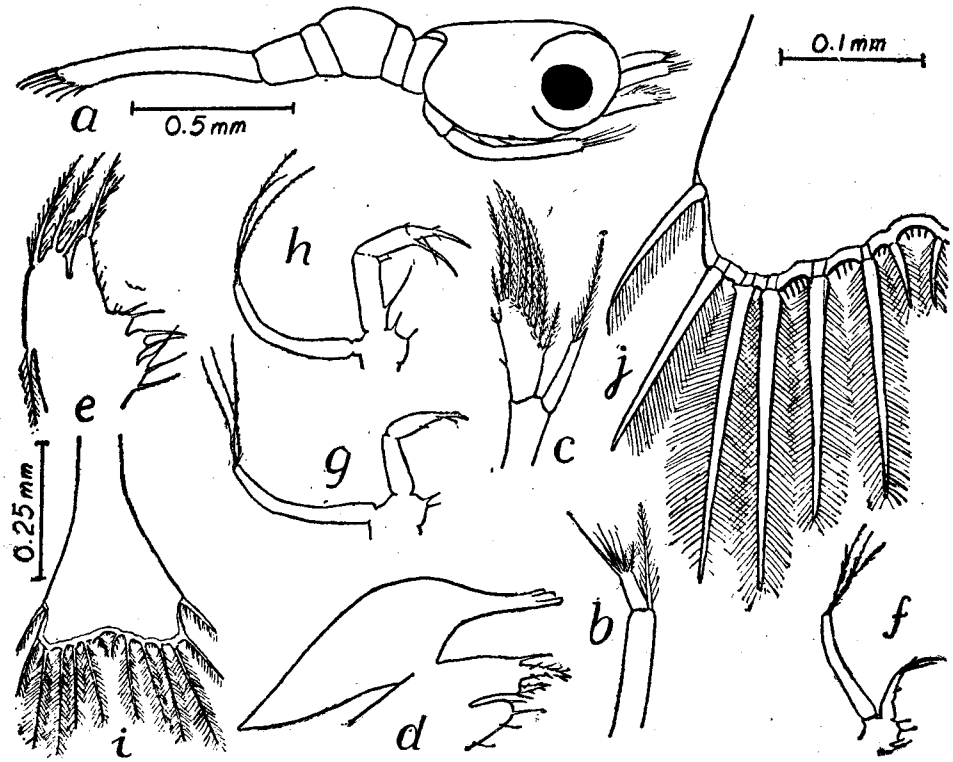

Fig. 10. *Anchistus inerms.* (*a*) zoea; (*b*) antennule; (*c*) antenna; (*d*) First maxilla; (*e*) second maxilla; (*f*) first maxillipede; (*g*) second maxillipede; (*h*) third maxillipede; (*i*) telson; (*j*) a portion of the telson enlarged to show the details. Magnification of figures (*b*), (*c*), (*f*), (*g*) and (*h*) same as that of (*i*) and that of (*d*) and (*e*) same as that of (*j*).

First maxillipede (Fig. 10*f*). The protopodite is represented by a single segment having four setae. The exopodite is long with three terminal setae. The endopodite appears to be two segmented although the segmentation is not very distinct and the distal segment has four setae of which three are terminal.

Second maxillipede (Fig. 10*g*). As in the first maxillipede the basal segment is a single piece but with only two setae. The exopodite resembles that of the first maxillipede except that it is longer in this. The endopodite is two segmented; the terminal segment tapers to a point and the tip of this prolongation is slightly serrated. This terminal segment also carries two setae.

Third maxillipede (Fig. 10*h*). The basal segment is united as in the other two maxillipedes. The exopodite is long with three long terminal setae. The endopodite is three jointed. The distal segment tapers to a point and has three setae. The first and second segment each has two setae.

Telson (Fig. 10*i*). The shape of the telson, in general, resembles that of *Alpheus strenuus* except that the outermost pair of setae are placed relatively far above the corner of the telson. There are seven pairs of setae, the pair located at the middle of the telson being the shortest. The outer two pairs have hairs only on the inner margin while the rest have hairs on both sides. Between the fourth and fifth, fifth and sixth and sixth and seventh there are four, three and two short marginal spines respectively. Between the seventh pair, *i.e.*, in the middle of the telson, there are four marginal spines (Fig. 10*j*).

Summary

Ovigerous specimens of *Pinnotheres ridgewayi*, *Menippe rumphii*, *Pilumnus longicornis Chlorodius niger*, *Eucrete crenate*, *Elamena sindensis*, *Alpheus rapacida*, *A. strenuus*, *Leander semmelinki* and *Anchistus inermis* were kept in the aquarium until the eggs hatched The first larval stages of these species are described in detail.

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