

STUDY ON LARVAE OF THE FAMILY XANTHIDAE (PILUMNUS) HATCHED IN THE LABORATORY (DECAPODA: BRACHYURA)

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Prezoea, first, second and third zoeae of *Pilumnus vespertilio* (Fabricius) and first zoea of *Pilumnus longicornis* (Hilgendorf) have been obtained by rearing from ovigerous female crabs in the laboratory. They are figured and described. A list of discrepancies noted in the previous studies^{1,4} on these species has been included.

Two species of the sub-family Pilumninae are reared in the laboratory. First zoea of *Pilumnus vespertilio* (Fabricius) has been described by Aikawa¹ and the first zoea of *Pilumnus longicornis* (Hilgendorf) by Prasad and Tampi.⁴ However the description of the second and third zoeal stages of *Pilumnus vespertilio* (Fabricius) is new to science.

Materials and Method

Collections of ovigerous female crabs were made from Manora Island and Native Jetty, Karachi during 1964-65. Rearing methods were used as described by Costlow and Bookhout.² *Artemia* nauplii were fed to the larvae. Temperature and salinity were maintained at 28°C and 35 p.p.t. respectively during the rearing. Larvae were preserved in 5% Formalin for further study, and lactic acid used as clearing agent.³ Drawings were made with the help of camera lucida. Measurements were made with the help of an ocular micrometer. Total length was measured from the base of the rostrum to the tip of the telson.

Moulting Periods

The eggs of *Pilumnus vespertilio* (Fabricius) hatched into prezoea which moulted after four hours into the first zoea. First zoea moulted after four days into the second zoeal stage which remained active for five days and moulted into the third zoeal stage. The third zoeae were not active and remained at the bottom and died after 6 hr and none were reared beyond this stage. The eggs of *Pilumnus longicornis* (Hilgendorf) hatched into the first zoea which died after 2 days.

Descriptions

1. *Pilumnus vespertilio* (Fabricius)

Prezoea: It is 2741 μ in length; spines of the cephalothorax are not fully developed; rudimentary dorsal, rostral and lateral spines are

however present; buds of the thoracic appendages have appeared.

Abdomen: A pair of thick lateral knobs on the second segment and a pair of hooks on the third segment; telson fork depth is more than its body length (235 and 220 μ respectively) sharp projecting points of the prong are finely serrated; a long spine emerge on the lateral side of the prong.

Antennule: (264 μ) bears four aesthetes.

Antenna: Protopodite (294 μ) is much longer than the rostral spine of the cephalothorax; bears teeth on distal spine; exopodite bears four setae.

Mandible: bears three large and several small teeth.

Maxillule: bears six plumose setae on the coxal endites; five setose spines on the basal endite; six plumose setae on the terminal and one on the basal segment of the endopodite.

Maxilla: bears eight (5+3) plumose setae on coxal endites; seven (4+3) setae on the basal endites; eight (3+5) setae on the endopodite; four thick plumose setae on the margin of the scaphognathite which terminates as a thick plumose seta.

First maxilliped: has no seta on the basis; four setae emerge on the exopodite; setation on the five segmented endopodite is still enclosed.

Second maxilliped: has no seta on the basis; four setae emerge on the exopodite; three segmented endopodite has imperfectly developed setation.

First zoea: (Fig. 1-3): It is 2867 μ in length; the dorsal spine is more than seven times as long as the rostral spine of the cephalothorax (Fig. 3g) (514 and 73 μ respectively); a pair of small lateral spines present on the cephalothorax (Fig. 1a) there are blunt teeth on the dorsal spine; postero-

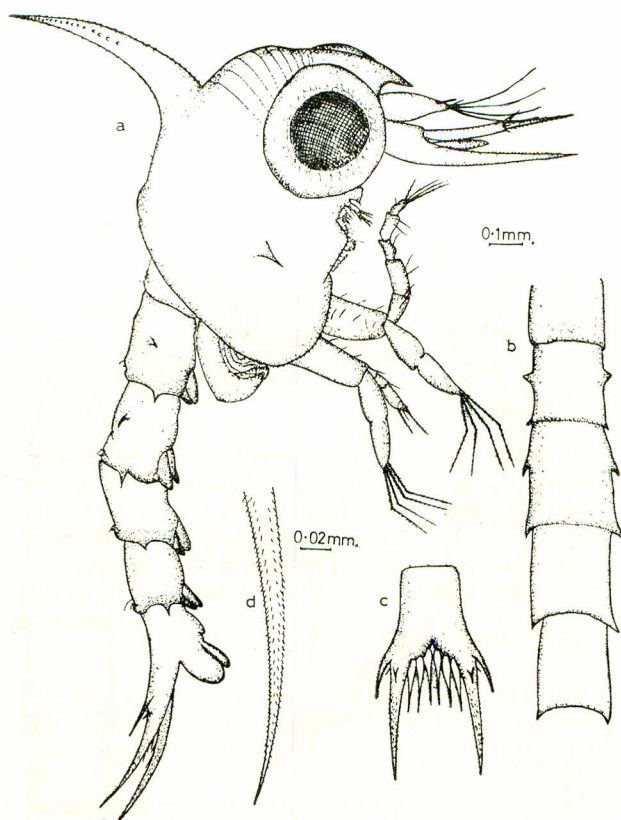


Fig. 1. First zoeal stage of *Pilumnus vespertilio* (Fabricius). (a) Side view of first zoea; (b) abdomen; (c) telson; (d) prong of telson.

lateral border of the cephalothorax dentate; eyes are sessile; buds of thoracic appendages (Fig. 3d and e) present.

Abdomen (Fig. 1b): A pair of knobs on the second segment and a pair of hooks on the third segment; postero-lateral margins of segments two to five, extend as small spines, overlapping the next segment; bud of pleopods have appeared; telson (Fig. 1c) fork depth is more than its body length (411 and 250 μ respectively); a pair of large and small spines on the lateral sides and a pair of large spines on the dorsal sides of the telson; fine spinnules on the sharp projecting points of the prong (Fig. 1d).

Antennule (Fig. 2a) (276 μ): bears four long aesthetes (220 μ) and two small setae.

Antenna (Fig. 2b): Protopodite (676 μ) is more than nine times as long as the rostral spine of the cephalothorax; bears long teeth on either side of the distal half; exopodite (500 μ) is very long, reaching the tip of the protopodite; bears small



Fig. 2.—Limbs and mouth parts of first zoeal stage of *Pilumnus vespertilio* (Fabricius). (a) antennule; (b) antenna; (c) exopodite of antenna; (d) flagellum of antenna; (e) mandible; (f) maxillule; (g) first maxilliped; (h) endopodite of first maxilliped.

teeth on either side of the distal half; three large teeth in the middle (Fig. 2c); flagellum (endopodite) has made its appearance and it is unjointed (Fig. 2d).

Mandible (Fig. 2e): bears three large and several small teeth.

Maxillule (Fig. 2f): bears six (2+4) setae on the coxal endites; five setae on the basal endite; four terminal and two subterminal setae on the terminal segment and one seta on the basal segment of the endopodite.

Maxilla (Fig. 3a): bears ten (6+4) plumose setae on the coxal endites; eight (5+3) setae on the basal endites; five terminal and three subterminal long plumose setae on the unsegmented endopodite; four long thick plumose setae on the margin of scaphognathite which terminates as a thick spine with long hair.



Fig. 3.—Mouth parts of thoracic appendages of first zoeal stage of *Pilumnus vespertilio* (Fabricius). (a) maxilla; (b) second maxilliped; (c) endopodite of second maxilliped; (d) & (e) thoracic appendages; (f) third maxilliped; (g) rostral spine.

First maxilliped (Fig. 2g and h): has nine small bristles on the basis; four swimming setae on the exopodite; setation on the five segmented endopodite is 3, 2, 1, 3, 4+1.

Second maxilliped (Fig. 3b and c): has four small bristles on the basis; four swimming setae on the exopodite; three segmented endopodite has 1, 1, 6 setae respectively.

Third maxilliped (Fig. 3f): buds have appeared.

Second zoea (Fig. 4 and 5): It is 3015μ in length; the dorsal spine is longer than the rostral spine of the cephalothorax (544 and 147μ respectively); lateral spine (130μ) (Fig. 4a) is at right angles to the cephalothorax; denture of the postero-lateral border of the cephalothorax is prominent; eyes are stalked.

Postero-lateral spines of abdominal segments three to five are longer; small buds of pleopod

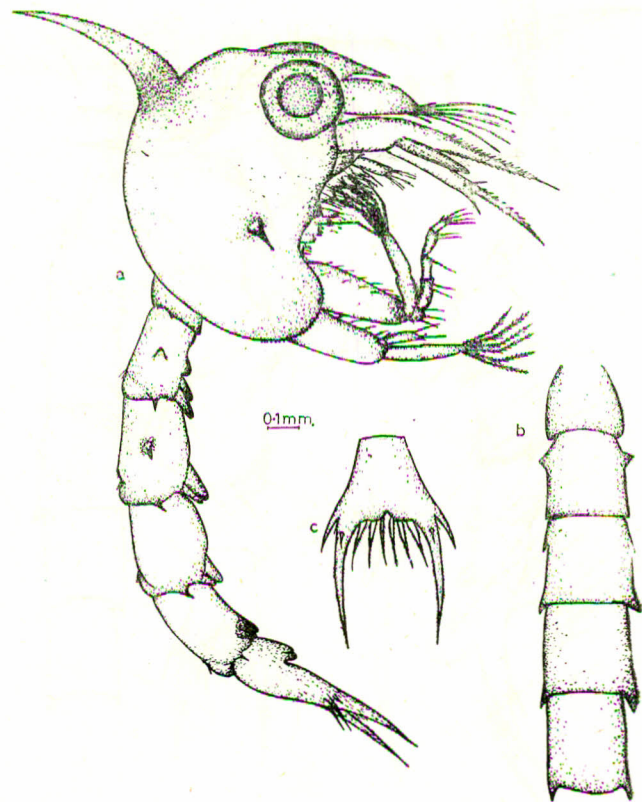


Fig. 4.—Second zoeal stage of *Pilumnus vespertilio* (Fabricius). (a) Side view of second zoea; (b) abdomen; (c) telson.

appeared; no change in the armature of the telson (Fig. 4b and c).

Antennule (Fig. 5a): has five aesthetes and one seta terminal and one thick seta subterminal.

Antenna (Fig. 5b): has a well developed flagellum.

Mandible (Fig. 5c): bears five large and several small teeth.

Maxillule (Fig. 5d): bears six plumose setae on the coxal endites; seven setose spines on the basal endite.

Maxilla (Fig. 5e): has eleven (7+4) plumose setae on the coxal endites; nine (5+4) setae on the basal endites; eight setae on the endopodite; six thick setae on the margin of the scaphognathite.

First maxilliped (Fig. 5f): has six swimming setae on the exopodite.

Second maxilliped (Fig. 5g): has also six setae on the exopodite.



Fig. 5.—Limbs and mouth parts of second zoeal stage of *Pilumnus vespertile* (Fabricius). (a) antennule; (b) antenna; (c) mandible; (d) maxillule; (e) maxilla; (f) first maxilliped; (g) second maxilliped.

Third maxilliped: buds are well developed.

Third zoea (Fig. 6 and 7): It is 3015μ in length; the dorsal spine is relatively smaller than in the previous stage; rostral spine of the cephalothorax is much shorter than the dorsal spine (147 and 514μ respectively); eyes are conspicuously stalked (Fig. 6a).

Small buds of the thoracic appendages appeared beneath the cephalothorax; abdomen is six segmented; buds of the pleopods are well developed (Fig. 6b).

Antennule (Fig. 6a): has five aesthetes and one terminal and two subterminal setae.

Antenna (Fig. 6b): has well developed flagellum now.

Mandible (Fig. 7c and d): bears a small palp.

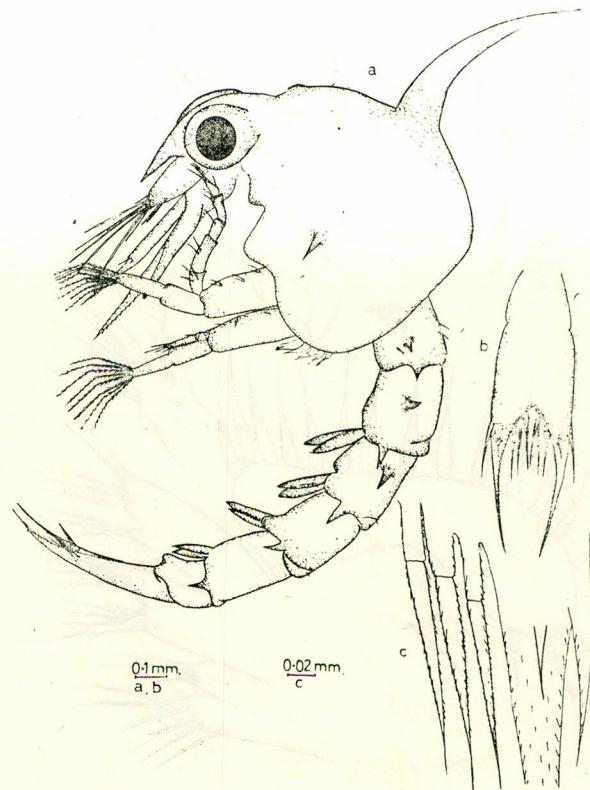


Fig. 6.—Third zoeal stage of *Pilumnus vespertile* (Fabricius). (a) Side view of third zoea; (b) telson and sixth abdominal segment; (c) prong of telson.

Maxillule (Fig. 7e): bears nine plumose setae on the coxal endites; eight setose spines on the basal endite; epipodital seta has also appeared.

Maxilla (Fig. 7f): bears eighteen long setae on the margin of the scaphognathite.

First and second maxilliped have eight swimming setae on the exopodite.

Third maxilliped: buds are segmented now.

2. *Pilumnus longicornis* (Hilgendorf). (Figs. 8-10).

First zoea: It is 3162μ in length; the rostral spine is less than a quarter the length of the dorsal spine (117 and 500μ respectively); there is a pair of lateral spines (88μ) on the cephalothorax (Fig. 8a.) the dorsal spine stands very erect and its borders are notched (Fig. 8a) buds of the thoracic appendages have appeared (Fig. 10d).

Abdomen (Fig. 8b): postero-lateral margins of segments three to five terminate as small spines, overlapping the next segment; there are teeth on

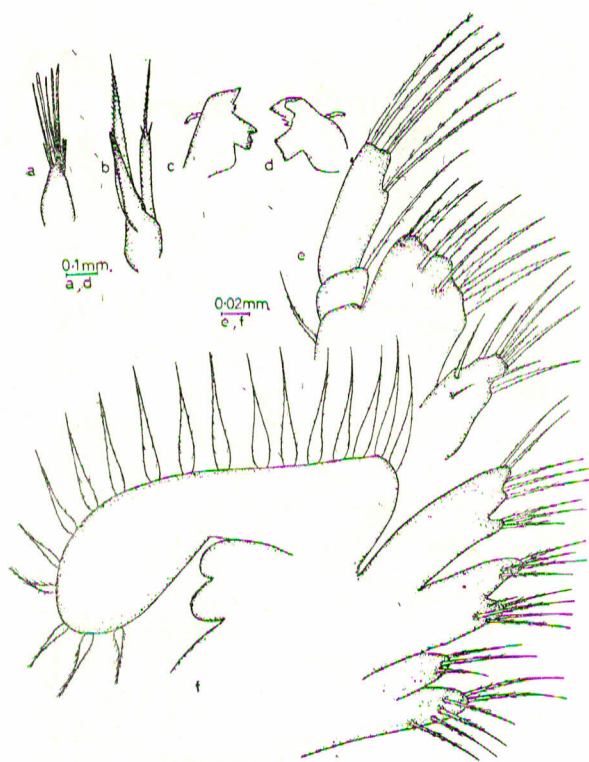


Fig. 7.—Limbs and mouth parts of third zoeal stage of *Pilumnus vespertilio* (Fabricius). (a) antennule; (b) antenna; (c) & (d) mandibles; (e) maxillule; (f) maxilla.

the dorsal side of each segment); telson fork depth is more than its body length (441 and 264 μ respectively); one large and one small spine outside and one large spine on the dorsal side of the prong.

Antennule (Fig. 9a) (147 μ): bears three terminal and one subterminal long aesthetes (205 μ) and one small seta.

Antenna (Fig. 7b and c): Protopodite (705 μ) is more than six times as long as the rostral spine of the cephalothorax; bears long teeth on either side of the distal half; exopodite (455 μ) is very long and exceeds the protopodite; bears small and large teeth on outside and large teeth on the dorsal side (Fig. 9d and e) two large setae are in the middle.

Mandible (Fig. 9f): bears three large and several small teeth.

Maxillule (Fig. 9g): bears seven (2+5) plumose setae on the coxal endites; five setose spines on the basal endite; four terminal and two sub-terminal long plumose setae on the terminal segment and one seta on the basal segment of the endopodite.

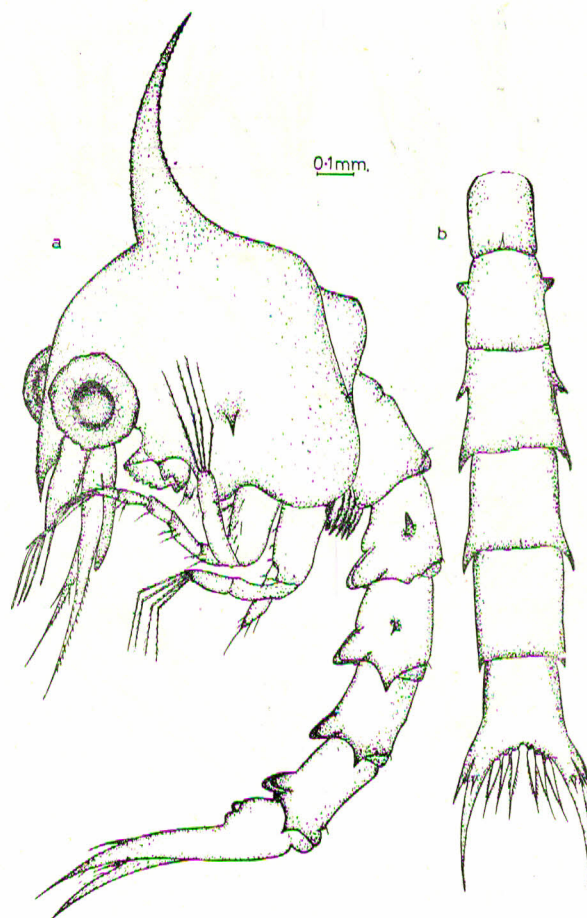


Fig. 8.—First zoeal stage of *Pilumnus longicornis* (Hilgendorf). (a) Side view of first zoea; (b) abdomen plus telson.

Maxilla (Fig. 10a): bears ten (6+4) plumose setae on the coxal endites; nine (5+4) setae on the basal endites; five (3+2) terminal and three sub-terminal long plumose setae on the unsegmented endopodite; four long thick plumose setae on the margin of the scaphognathite which terminates as a long spine with hair.

First maxilliped (Fig. 10b and c): has ten small bristles on the basis; plumose setae on the exopodite; setation on the five segmented endopodite is 3, 2, 1, 2, 4+1.

Second maxilliped: has six small bristles on the basis; four swimming setae on the exopodite; three segmented endopodite bears 1, 1, 6 setae respectively.

Discussion

First zoea of *Pilumnus vespertilio* (Fabricius) has been described by Aikawa.¹ He figured only

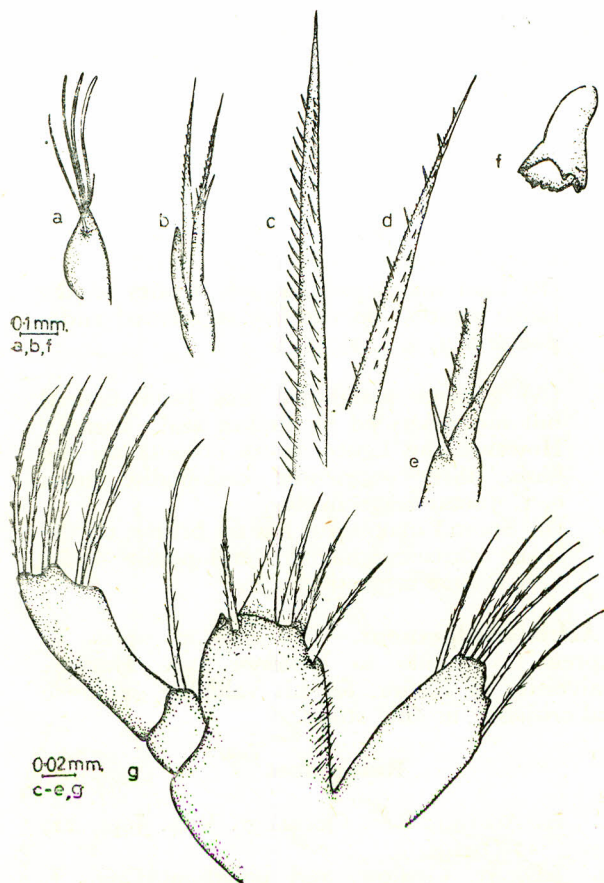


Fig. 9I.—Limbs and mouth parts of first zoeal stage of *Pilumnus ongicornis* (Hilgendorf). (a) antennule; (b) antenna; (c) tapered process formed by the protopodite of antenna (d) & (e) exopodite of antenna; (f) mandible; (g) maxillule.

the lateral view of the first zoea which seems to be of a prezoaea rather than a first zoea. The discrepancies noted are however listed below. Observations of Aikawa¹ being designated as (A) and those found in this study as (B).

1. (A) Rostral spine 0.67 mm; dorsal spine 0.67 mm; second antenna 0.52 mm (id not give the total length).
(B) Total length 2867 μ ; rostral spine 73 μ ; dorsal spine 514 μ ; protopodite of the antenna 676 μ .
2. (A) Dorsal and rostral spines are very long.
(B) The dorsal spine is more than seven times as long as the rostral spine of the cephalothorax; there are blunt teeth on the dorsal spine.
3. (A) No dentition shown on the postero-lateral border of the cephalothorax in his figure.

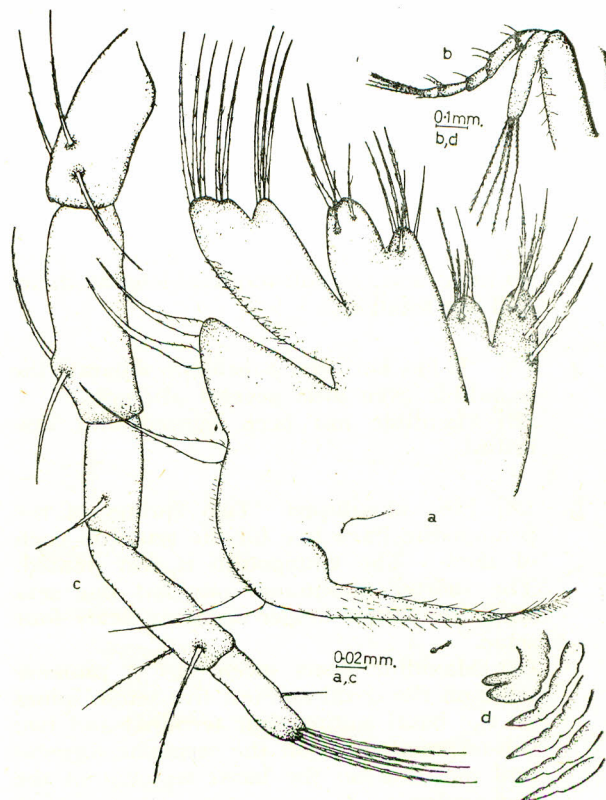


Fig. 10.—Mouth parts and thoracic appendages of first zoeal stage of *Pilumnus longicornis* (Hilgendorf). (a) maxilla; (b) first maxilliped; (c) thoracic appendages.

(B) The postero-lateral border of the cephalothorax is dentate.

4. (A) "Maxillae of usual type; setae on each podite and hairs on protopodite of maxillipeds could not be counted as the larvae seemed to be just after moulting from the protozoaea".
(B) Aikawa (1929) did not figure or describe the mouth parts but mentioned about it as quoted above.
5. (A) "An outer tooth and a hair present on the side of the telson fork".
(B) A pair of large and a pair of small spines on the lateral sides and a pair of large spines on the dorsal side of the telson.

First zoea of *Pilumnus longicornis* (Hilgendorf) has been figured and described by Prasad and Tampi.⁴ The discrepancies noted are listed below. Observations of Prasad and Tampi being designated as (A) and those found in this study as (B).

1. (A) Zoea measured 1.4 mm in length.
(B) Total length of the first zoea 3162 μ .
2. Measurements of the dorsal, rostral and lateral spines of the cephalothorax are not given by Prasad and Tampi.
3. (A) Antennule consists of a single piece with three terminal aesthetes.
(B) Antennule is uniramous and bears three terminal and one sub-terminal long aesthetes and one small seta.
4. (A) "It has not been possible to separate the mandible even after several attempts.
(B) Mandible has been figured and described.
5. (A) First maxilliped "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."
(B) Maxillule bears seven (2+5) plumose setae on the coxal endites; five setose spines on the basal endite; four terminal and two sub-terminal setae on the terminal segment and one seta on the basal segment of the endopodite.
6. (A) "Second maxilla "The coxo-basi- and endopodite are bifid and they bear five, six and five setae respectively. The four marginal (figured three) setae and the border of the scaphognathite are provided with fine hairs."
(B) Maxilla bears ten setae on the coxal endites; nine setae on the basal endites; five terminal and three sub-terminal setae on the unsegmented endopodite.
7. (A) "First maxilliped does not possess any setae on the basipodite; the endopodite consists of five unequal segments; the second and third segment each has one seta and the terminal segment has three setae."
(B) First maxilliped has ten bristles on the basis; setation on the five segmented endopodite is 3, 2, 1, 2, 4+1.
8. (A) Second maxilliped has been figured but not described by Prasad and Tampi.⁹ However the figure shows no seta on the basis; three segmented endopodite bears 0, 1, 3 setae respectively.
(B) Second maxilliped has six bristles on the basis; three segmented endopodite bears 1, 1, 6 setae respectively.

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References

1. H. Aikawa, Rec. Oceanogr. Wks. Jap., **11**, 17 (1929).
2. J.D. Jr. Costlow, and Bookhout C.G., J. Elisha Mitchell Sci. Soc., **77**, 33 (1961).
3. A.G. Humes and R.U. Gooding, Crustaceana., **62**, 238 (1964).
4. R.R. Prasa and, R.S. Tamp, J. Zool. Soc. India, **9**, 22 (1957).