

THE BRACHYURAN LARVAE OF W. PAKISTAN HATCHED IN THE LABORATORY

Part II.—Portunidae: *Charybdis* (Decapoda: Crustacea)

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Prezoea and first zoea of four species of swimming crabs (family Portunidae) of sub-family Lupinae are obtained by rearing the female in the laboratory. They are described here.

Introduction

The larvae of crabs within the family Portunidae have received more attention than larvae from any other single group, but many species have been described only in part. Most of the commercially important crabs belong to this family and studies on their life history have been in progress for the last hundred years.

Among the 19 species of swimming crabs, that have been recorded from Karachi, ¹⁻² the larvae of *Neptunus* (*Neptunus*) *pelagicus*, ³⁻⁵ *Neptunus* (*Neptunus*) *sanguinolentus*, ⁵⁻⁶ *Charybdis* (*Goniosoma*) *orientalis*⁵ and *Thalamita crenata* have been described.⁴⁻⁵ In the present paper prezoea and first zoea of four species of *Charybdis* (*Goniosoma*) are described. The descriptions of the larvae of *Charybdis* (*Goniosoma*) *lucifera* (Fabricius), *Charybdis* (*Goniosoma*) *annulata* (Fabricius) and *Charybdis* (*Goniosoma*) *callianassa* (Herbst) are new to science.

Materials and Method

Ovigerous females of four species of *Charybdis* were collected from Buleji rocks, Manora island and Korangi creek, Karachi during June to September 1965. They were brought into the laboratory and maintained separately at 28°C and 35 ppt salinity and fed fresh shrimps. Methods of rearing, preservation and drawings were the same as employed in earlier paper.

Moulting Periods

Eggs of all the four species of *Charybdis* hatched into prezoea and after about 4-8 hr changed into first zoea by shedding the embryonic cuticle. First zoea lived for 4-5 days and then died without moulting.

Description of Larvae

1. *Charybdis* (*Goniosoma*) *lucifera* (Fabricius).—Prezoea: It is 1937 μ length; the dorsal and

rostral spines are equal in length (19 μ); a pair of lateral spines (58 μ) also emerge on cephalothorax.

Abdomen: Pair of lateral knobs of second segment are pointed upwards and of third segment pointed downwards; postero-lateral spines of segment three to five, overlapping the next segment; telson: fork depth is more than the body length (132 and 73 μ respectively).

Antennule is short (88 μ) and bears two aesthetes and two small setae.

Antenna: Protopodite (156 μ) is smaller than the rostral spines of the cephalothorax; bears small teeth on its distal half; exopodite (58 μ) bears two setae.

Mandible bears three large teeth.

Maxillule bear six (2+4) plumose setae on coxal endite; five setose spines on basal endite; six plumose setae on terminal and one on basal segment of the endopodite.

Maxilla bears five (2+3) plumose setae on coxal endites; eight (4+4) on basal endites; six on endopodite; three thick plumose setae emerge on the margin of the scaphognathite which terminates as a seta with hair.

First maxilliped has eight setae on the basis; four swimming setae emerge on the exopodite; five segmented endopodite bearing 3, 2, 0, 2, 4+1 setae respectively.

Second maxilliped has four setae on the basis; four swimming setae on the exopodite; three segmented endopodite bearing 1, 1, 3 setae respectively.

First zoea: (Figs 1 and 2). It is 1544 μ in length; the dorsal spine is much longer than the rostral spine of the cephalothorax (411 and 294 μ respectively); a pair of lateral spines (100 μ) (Fig. 1 a and b) there are five to eight small sharp teeth

on the postero-lateral margin (Fig. 1 g); there is a pair of setae on either side of the dorsal spine (Fig. 1 b and c).

Abdomen (Fig. 1 d and f): Pair of knobs of the second segment are pointed upwards and of third segment pointed downwards; posterolateral spines of the segments three and four are long and of segment five small; telson (Fig. 1 e): fork depth is more than the body length (191 and 88 μ respectively); one large and one small lateral spine and one large curved dorsal spine present on the prong.

Antennule (100 μ) bears two long aesthetes (147 μ) and two small setae (Fig. 2 a).

Antenna (Fig. 2 b): Protopodite (279 μ) is smaller than the rostral spine of the cephalothorax; bears short teeth on distal half; exopodite (100 μ) bears one long and one short seta.

Mandible (Fig. 2 c) bears four large teeth.

Maxillule (Fig. 2d) bears six (2+4) plumose setae on coxal endites; five setose spines on basal endite; six long plumose setae on terminal and one small seta on basal segment of the endopodite.

Maxilla (Fig. 2e) bears five (2+3) plumose setae on coxal endites; seven (4+3) on basal endites; four terminal and two subterminal plumose setae on the unsegmented endopodite; three thick plumose setae on the margin of scaphognathite which terminates as a setose spine.

First maxilliped (Fig. 2f and g) has eight plumose setae on the basis; swimming setae on the exopodite; five segmented endopodite bearing 3, 2, 0, 2, 4+1 setae respectively.

Second maxilliped (Fig. 2h and i) has four plumose setae on the basis; four swimming setae on the exopodite; three segmented endopodite bears 1, 1, 5 setae respectively.

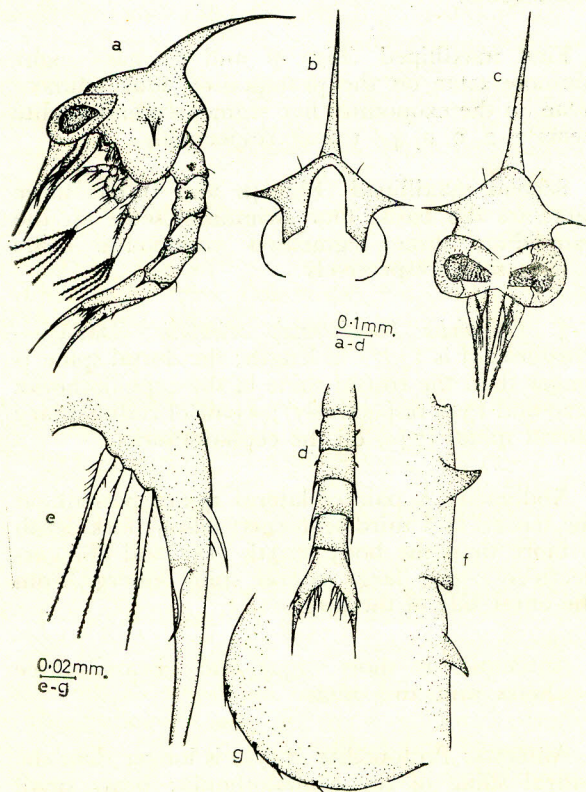


Fig. 1.—First zoeal stage of *Charybdis (Gonisoma) lucifera* (Fabricius). (a) Side view of first zoea; (b) back view of cephalothorax; (c) front view of cephalothorax; (d) abdomen plus telson; (e) prong of telson; (f) lateral margin of second and third abdominal segments; (g) lateral margin of cephalothorax.

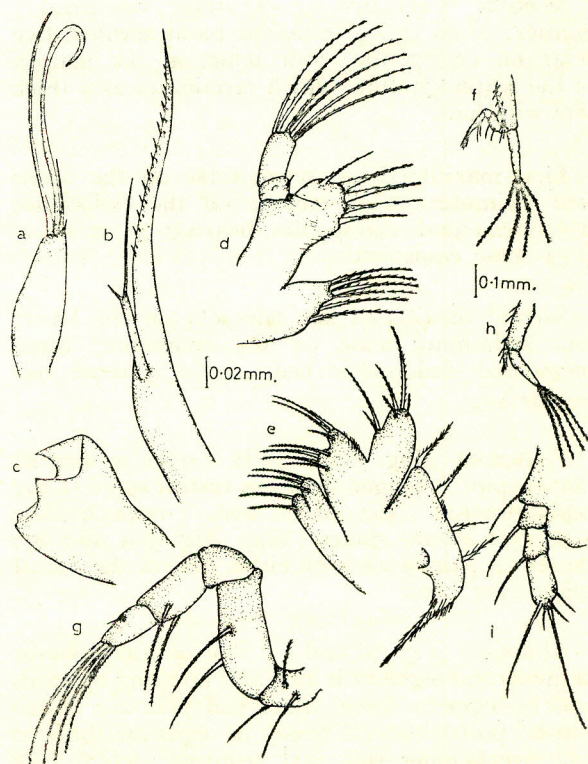


Fig. 2.—Limbs and mouth parts of first zoeal stage of *Charybdis (Gonisoma) lucifera* (Fabricius). (a) Antennule; (b) antenna; (c) mandible; (d) maxillule; (e) maxilla; (f) first maxilliped; (g) endopodite of first maxilliped; (h) second maxilliped; (i) endopodite of second maxilliped.

2. *Charybdis (Goniosoma) annulata* (Fabricius).—
Pre-zoea: It is 895μ in length; the dorsal spine is longer than the rostral spine (147 and 117μ respectively); a pair of rudimentary lateral spines (58μ).

Abdomen: Pair of lateral knobs of second segment are pointed upwards and of third segment, pointing downwards; telson fork depth is more than its body length (132 and 88μ respectively).

Antennule is short (88μ), bears two aesthetes and one small seta.

Antenna: Protopodite (117μ) is as long as the rostral spine of the cephalothorax; bears small teeth on the distal spine; exopodite is small.

Mandible bears three large and one small teeth.

Maxillule bears six plumose setae on coxal endite; four setose spines on basal endite; five plumose setae on the terminal segment of endopodite.

Maxilla bears five ($3+2$) setae on coxal endites; seven ($3+4$) setae on basal endites; five setae on endopodite; four setae on the margin of the scaphognathite which terminates as a thick seta with hair.

First maxilliped has seven setae on the basis; four swimming setae emerge on the exopodite; five segmented endopodite bearing 3, 2, 0, 2, $4+1$ setae respectively.

Second maxilliped has one seta on the basis; four swimming setae on the exopodite; three segmented endopodite bears 1, 1, 5 setae respectively.

First zoea: (Fig. 3 and 4) It is 955μ in length; dorsal spine is longer than the rostral spine of the cephalothorax (367 and 220μ respectively); a pair of lateral spines (88μ) (Fig. 3 a and b); there is a pair of setae on either side of the dorsal spine (Fig. 3e).

Abdomen (Fig. 3d and f): Pair of lateral knobs of the second segment is long and pointing upwards and of segment three, short and pointing downwards; postero-lateral spines of segments three to five overlapping the next segment; telson fork well-developed and its depth is more than its body length. (191 and 73μ respectively); one large posterolateral, one small lateral and one large dorsal spine are present on the prong; three pairs of long setose spines inside the fork (Fig. 3e).

Antennule (Fig. 4a) (88μ) bears two long aesthetes (147μ) and one small seta.

Antenna (Fig. 4b): Protopodite (250μ) is longer than the rostral spine of the cephalothorax (Fig. 6b); bears large and sharp teeth on either side of the distal half; spiniform process (100μ) bears 1 long and one short seta.

Mandible (Fig. 4c) bears four large and several small teeth.

Maxillule (Fig. 4d) bears six ($2+4$) plumose setae on coxal endites; five setose spines on basal endite; six long plumose setae on terminal and one small seta on basal segment of the endopodite.

Maxilla (Fig. 4e) bears five ($3+2$) plumose setae on coxal endites; nine ($5+4$) on basal endites; three terminal and two subterminal plumose setae on the unsegmented endopodite; four long and thick plumose setae on the margin of scaphognathite which terminates as a long setose spine.

First maxilliped (Fig. 4f and g) has eight plumose setae on the protopodite; four plumose setae on the exopodite; five segmented endopodite bears 2, 2, 0, 2, $4+1$ setae respectively.

Second maxilliped (Fig. 4h and i) has three setae on the basis; four swimming setae on the exopodite; three segmented endopodite bears 1, 1, 5 setae respectively.

3. *Charybdis (Goniosoma) orientalis* (Dana).—
Pre-zoea: It is 1397μ in length; the dorsal spine is longer than the rostral spine of the cephalothorax (220 and 132μ respectively); a pair of rudimentary lateral spines (73μ) on the cephalothorax.

Abdomen: A pair of lateral spines present on the second and third segments; telson: fork depth is more than the body length (132 and 88μ respectively); one large lateral spine emerge from the outer side of the fork.

Antennule is short (73μ) and bears three aesthetes and two setae.

Antenna: Protopodite (147μ) is longer than the rostral spine of the cephalothorax; bears small teeth on either side of the spine; exopodite (73μ) bears two setae.

Mandible bears three large and several small teeth.

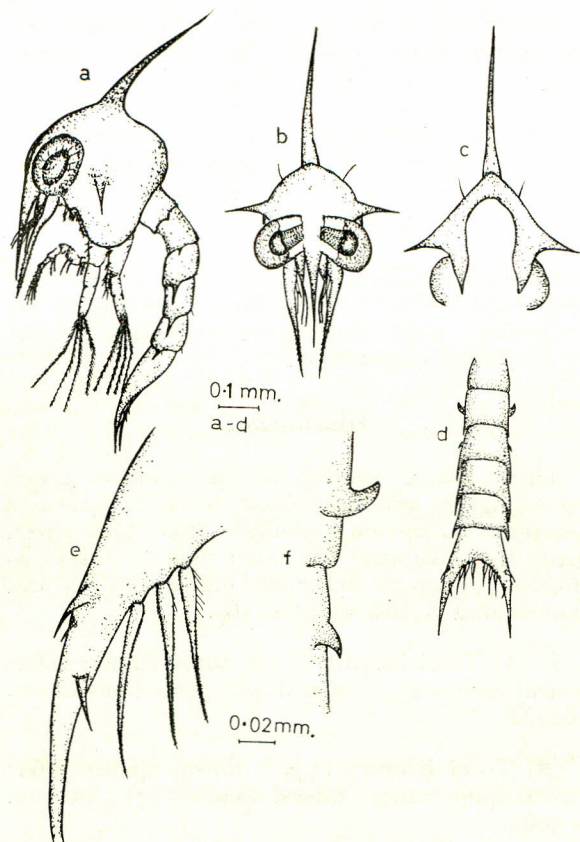


Fig. 3.—First zoeal stage of *Charybdis (Goniosoma) annulata* (Fabricius). (a) Side view of first zoea; (b) front view of cephalothorax; (c) back view of cephalothorax; (d) abdomen plus telson; (e) prong of telson; (f) lateral margin of second and third abdominal segments.

Maxillule bears five (2+3) plumose setae on coxal endites; five setose spines on basal endites; six long plumose setae on terminal and one seta on basal segment of the endopodite.

Maxilla bears four (2+2) setae on coxal endites; seven setae on basal endites; five on endopodite; four emerge on the margin of the scaphognathite which terminates as a thick setose spine.

First maxilliped has no seta on the basis; four swimming setae emerge on the exopodite; five segmented endopodite bears 3, 2, 0, 2, 5 setae respectively.

Second maxilliped has two setae on the basis; four swimming setae on the exopodite; three segmented endopodite has 1, 1, 3 setae respectively.

First zoea: (Fig. 5 and 6) It is 1544 μ in length; the dorsal spine is longer than the rostral spine of the cephalothorax (376 and 294 μ respectively);

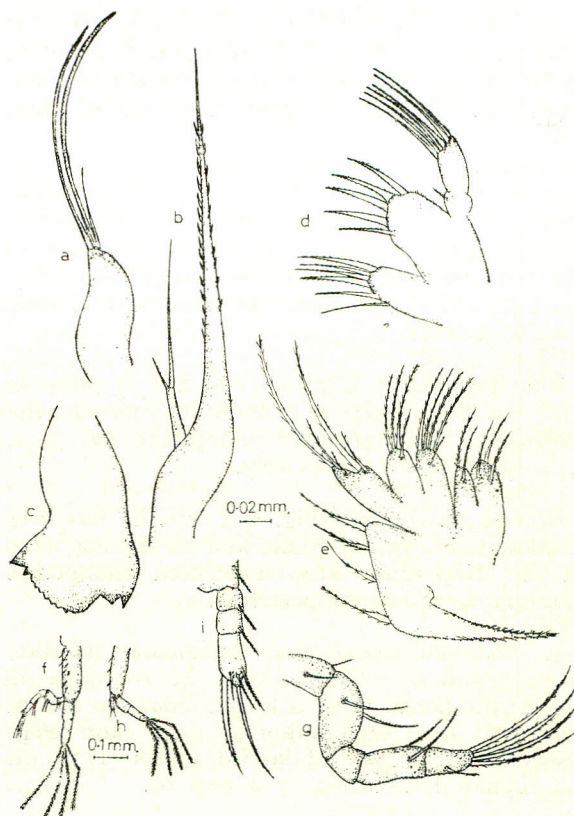


Fig. 4.—Limbs and mouth parts of first zoeal stage of *Charybdis (Goniosoma) annulata* (Fabricius). (a) Antennule; (b) antenna; (c) mandible; (d) maxillule; (e) maxilla; (f) first maxilliped; (g) endopodite of first maxilliped; (h) second maxilliped; (i) endopodite of second maxilliped.

a pair of lateral spines (117 μ) on the cephalothorax (Fig. 5 a, b and c); eyes are stalked.

Abdomen (Fig. 5d): Pair of lateral knobs of the second segment are blunt, pointing outwards and of segment three pointed and bent downwards; postero-lateral spines of segments three to five are small; telson (Fig. 5f): fork depth is more than the body length (220 and 132 μ respectively); one small lateral and one large dorsal spine present on the prong.

Antennule (Fig. 6a) (117 μ) bears two long aesthetes (176 μ) and two long and one small setae.

Antenna (Fig. 6b); Protopodite (308 μ) is longer than the rostral spine of the cephalothorax; bears sharp teeth on either side of the distal half; exopodite (132 μ) bears two setae.

Mandible (Fig. 6c) bears three large and one small dorsal and several small ventral teeth.

Maxillule (Fig. 6d) bears six (2+4) plumose setae on coxal endites; five setose spines on basal endite; six long plumose setae on terminal and one small seta on basal segment of the endopodite.

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

First maxilliped (Fig. 6 f, 9e) has 12 plumose setae on the basis; four plumose setae on the exopodite; five segmented endopodite has 3, 2, 0, 2, 4+1 setae respectively.

Second maxilliped (Fig. 6 g and h) has four plumose setae on the basis; four swimming setae on the exopodite; three segmented endopodite bears 1, 1, 5 setae respectively.

4. *Charybdis (Goniosoma) callianassa* (Herbst) (Figs. 7 and 8).—First zoea: It is 1098 μ in length; the dorsal spine is longer than the rostral spine of the cephalothorax (352 and 264 μ respectively); a pair of lateral spines (117 μ) on the cephalothorax (Fig. 7 a and b).

Abdomen (Fig. 7 c, e and f): Pair of knobs of second segment are blunt, pointing outwards and of third segment are pointed and bent downwards; postero-lateral spines of segments three and four are long and segment five short, overlapping the next segment; telson (Fig. 7d): fork depth is more than the body length of the telson (235 and 88 μ respectively); one large and one small lateral spines and one large dorsal spine are on the prong.

Antennule (Fig. 8a) (100 μ) bears two long aesthetes (147 μ) and one short seta.

Antenna (Fig. 8b and c): Protopodite (264 μ) is as long as the rostral spine of the cephalothorax; bears teeth on either side of the distal half; exopodite (88 μ) bears two setae.

Mandible (Fig. 8d) bears three large and several small teeth on dorsal and ventral side.

Maxillule (Fig. 8e) bears five (2+3) plumose setae on coxal endites; five setose spines on basal endite; six long plumose setae on terminal and one small seta on basal segment of the endopodite.

Maxilla (Fig. 8f) bears five (3+2) plumose setae on coxal endites; eight (4+4) setae on basal endites; six setae (4+2) on the unsegmented

endopodite; four long and thick plumose setae on the margin of the scaphognathite which terminates as a thick spine with long hair.

First maxilliped (Fig. 8 g and h) has six plumose setae on the basis; four swimming setae on the exopodite; five segmented endopodite bearing 2, 2, 1, 2, 4+1 setae respectively.

Second maxilliped (Fig. 8 i and j) has four setae on the basis; for long swimming setae on the exopodite; three segmented endopodite bears 1, 1, 5 setae respectively.

Discussion

There are a number of discrepancies noted in the figures and description of the first zoea of *Charybdis (Goniosoma) orientalis* that have been given by Chhapgar⁵ are listed below. Observations of Chhapgar being designated as (A) and those found in this study as (B).

1. (A) Total length=733 μ ; dorsal spine=288 μ ; rostral spine=233 μ ; lateral spine=66 μ ; antenna=166 μ .

(B) Total length=1544 μ ; dorsal spine=376 μ ; rostral spine=294 μ ; lateral spine=117 μ ; antenna=308 μ .

2. (A) The antennule is a short unjointed pigmented process with a single aesthete.

(B) Antennule is a uniramous and short process; bears two long aesthetes and two long and one small setae.

3. (A) The antenna consists of a well-developed spiniform process which is nearly as long as the rostrum and a small exopodite bearing a seta.

(B) Antenna bears a protopodite which is longer than the rostral spine of the cephalothorax; bears teeth on either side of the distal half; exopodite bears two setae.

4. (A) The first maxilliped has five jointed endopodite with four setae at the tip.

(B) First maxilliped has 12 setae on the basis; five segmented endopodite has 3, 2, 0, 2, 4+1 setae respectively.

5. (A) In the second maxilliped, the endopodite consists of three joints (Figured as having one setae on the middle segment and four on the terminal segment, but not described in the text).

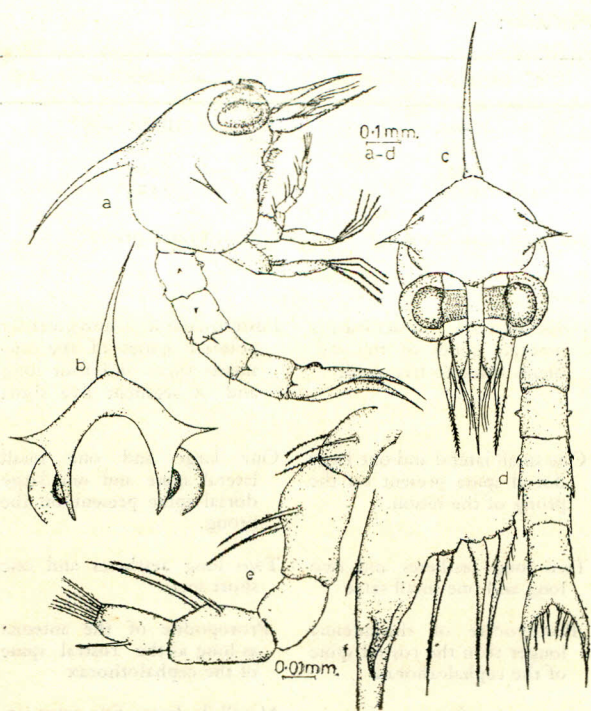


Fig. 5.—First zoeal stage of *Charybdis (Goniosoma) lis orientalis* (Dana). (a) Side view of first zoea; (b) back view of cephalothorax; (c) front view of cephalothorax; (d) abdomen plus telson; (e) endopodite of first maxilliped; (f) prong of telson.

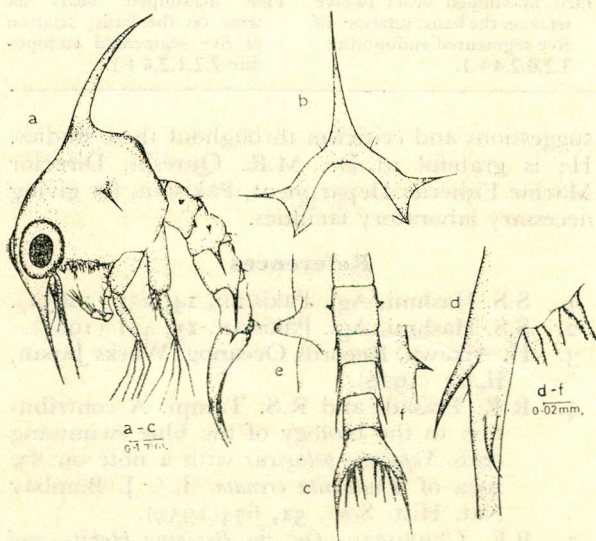


Fig. 7.—First zoeal stage of *Charybdis (Goniosoma) callianassa* (Herbst). (a) Side view of first zoea; (b) back view of cephalothorax; (c) abdomen plus telson; (d) prong of telson; (e) (f) lateral margins of second and third abdominal segments.

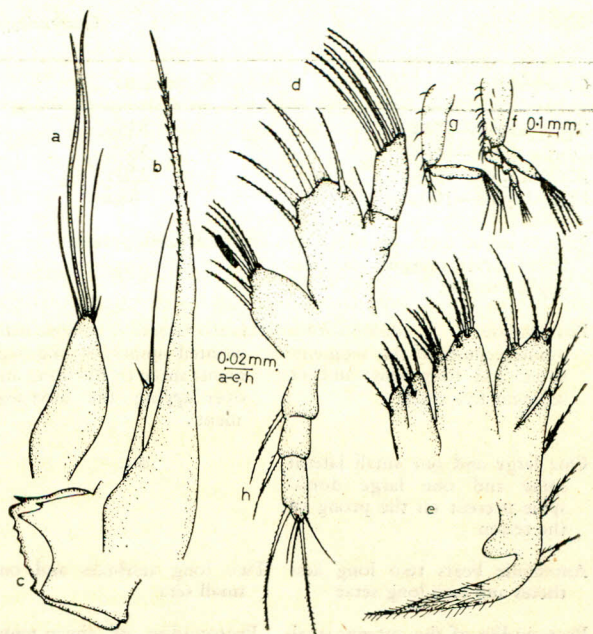


Fig. 6.—Limbs and mouth arts of first zoeal stage of *Charybdis (Goniosoma) orientalis* (Dana). (a) Antennule; (b) antenna; (c) mandible; (d) maxillule; (e) maxilla; (f) first maxilliped; (g) second maxilliped; (h) endopodite of second maxilliped.

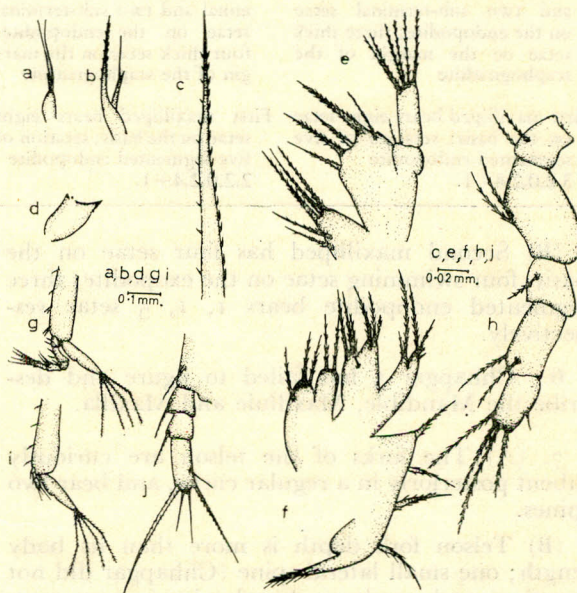


Fig. 8.—Limbs and mouth parts of first zoeal stage of *Charybdis (Goniosoma) callianassa* (Herbst). (a) Antennule; (b) antenna; (c) tapered process formed by the protopodite of antenna; (d) mandible; (e) maxillule; (f) maxilla; (g) first maxilliped; (h) endopodite of first maxilliped; (i) second maxilliped; (j) endopodite of second maxilliped.

Comparison of First Zoea:

<i>C. lucifera</i>	<i>C. annulata</i>	<i>C. orientalis</i>	<i>C. callianassa</i>
Total length—1544 μ	955 μ	1544 μ	1098 μ
Dorsal spine—411 μ	367 μ	376 μ	352 μ
Rostral spine—294 μ	220 μ	294 μ	264 μ
Lateral spine—100 μ	88 μ	117 μ	117 μ
Five to eight teeth on the postero-lateral margin of the cephalothorax	No such teeth present	No such teeth present	No such teeth present
Postero-lateral downwardly pointed spines of the segments three and four long and of segment five small	Postero-lateral downwardly pointed spines of the segments three to five long and overlapping the next segment	Postero-lateral downwardly pointed spines of the segments three to five small	Postero-lateral downwardly pointed spines of the segments three and four long and of segment five short
One large and one small lateral spine and one large dorsal spine present on the prong of the telson	do.	One small lateral and one large dorsal spine present on the prong of the telson.	One large and one small lateral spine and one large dorsal spine present on the prong.
Antennule bears two long aesthetes and two long setae	Two long aesthetes and one small seta	Two long aesthetes and two long and one small setae	Two long aesthetes and one short seta
Protopodite of the antenna smaller than the rostral spine of the cephalothorax	Protopodite of the antenna longer than the rostral spine of the cephalothorax	Protopodite of the antenna longer than the rostral spine of the cephalothorax	Protopodite of the antenna as long as the rostral spine of the cephalothorax
Maxillule bears six setae on the coxal endites	do.	do.	Maxillule bears five setae on the coxal endites
Maxilla bears five setae on the coxal endites; seven setae on the basal endites; four terminal and two sub-terminal setae on the endopodite; three thick setae on the margin of the scaphognathite	Maxilla bears five setae on the coxal endites; nine setae on the basal endites; three terminal and two sub-terminal setae on the endopodite; four thick setae on the margin of the scaphognathite	Maxilla bears six setae on the coxal endites; nine setae on the basal endites; three terminal and two sub-terminal setae on the endopodite; four thick setae on the margin of the scaphognathite	Maxilla bears five setae on the coxal endites; eight setae on the basal endites; six setae (4 2) on the endopodite; four thick setae on the margin of the scaphognathite
First maxilliped bears eight setae on the basis; setation of five segmented endopodite 3.2.0.2.4+1.	First maxilliped bears eight setae on the basis; setation of five segmented endopodite 2.2.0.2.4+1.	First maxilliped bears twelve setae on the basis; setation of five segmented endopodite 3.2.0.2.4+1.	First maxilliped bears six setae on the basis; setation of five segmented endopodite 2.2.1.2.4+1.

(B) Second maxilliped has four setae on the basis; four swimming setae on the exopodite; three segmented endopodite bears 1, 1, 5 setae respectively.

6. Chhapgar 5 has failed to figure and describe the Mandible, Maxillule and Maxilla.

7. (A) The forks of the telson are curiously inbent posteriorly in a regular curve, and bear two spines.

(B) Telson fork depth is more than its body length; one small lateral spine (Chhapgar did not mention) and one large dorsal spine is present on each prong of the telson; the sharp projecting points of the telson are straight.

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