

LARVAL DEVELOPMENT OF THE MANGROVE CRAB *SESARMA*
BIDENS (DE HAAN, 1853) IN THE LABORATORY (BRACHYURA:
GRAPSIDAE : SESARMINAE)

T. KRISHNAN AND T. KANNUPANDI

Centre of Advanced Study in Marine Biology, Annamalai University,
Parangipettai - 608 502.

ABSTRACT

Larvae of *Sesarma bidens* (de Haan) were reared in the laboratory upto megalopa stage under the culture conditions of salinity $25 \pm 1\text{‰}$ and temperature $28 \pm 1^\circ\text{C}$. First zoea reached megalopa stage in four moults after a minimum period of 10 days. Four zoeal and a megalopal stages are described and compared with other known larvae of *Sesarma* spp.

Key-words: *Sesarma bidens*, decapod larvae.

INTRODUCTION

Though 17 species in the brachyuran crab family Grapsidae have been reported from the Indian waters of the genus *Sesarma* (Alcock, 1900), studies on its larval development are meagre. Rajabai (1961) described the first zoea of *Sesarma tetragonum*. Description of larval development comprising 4 zoeal and a megalopa stages is available in *S. lanatum* (Kakati and Sankolli, 1975), *S. andersoni* (Vijayakumar and Kannupandi, 1986) and *S. brockii* (Vijayakumar and Kannupandi, 1987). The present study describes the larval stages of the mangrove crab, *S. bidens* from hatching to megalopa stage and detailed comparison is made with larvae of other known Indian *Sesarma* spp.

MATERIALS AND METHODS

Ovigerous females of *S. bidens* were collected from Pitchavaram mangrove ($11^\circ 29' \text{N}$; $79^\circ 47' \text{E}$) on 10 September 1985 and maintained in plastic troughs containing filtered estuarine water of salinity $25 \pm 1\text{‰}$ and temperature $28 \pm 1^\circ\text{C}$ until hatching occurred on 18 September 1985 which took about 1hr. Larvae were reared in groups of 10 per glass bowl containing 50ml filtered estuarine water and fed with newly hatched Brazilian strain of *Artemia* nauplii. Other methods in larval rearing were same as reported by Krishnan and Kannupandi (1987).

RESULTS AND DISCUSSION

Four zoeal and a megalopal stages appeared in the complete larval development of *S. bidens*. Second, third, fourth zoeae and megalopal stage appeared

on 3rd, 5th, 7th and 10th day respectively. Only one megalopa after a period of 26 days moulted to first crab stage. Thus the minimum period for complete metamorphosis was 36 days. The first crab survived for 41 days without moulting.

Description of stages

In description setal formulae progress distally. After describing the first zoea in details, only morphological changes are described for subsequent stages.

The abbreviations used are. A1-antennule; A2-antenna; Md-mandible; Max 1-maxillule; Max 2-maxilla; Mxp 1-3-maxillipeds 1-3; P 1-5 — pereopods 1-5; Pl 1-4 pleopods 1-4; Ab-abdomen; T-telson and U-uropod.

First Zoea (Fig. 1)

Carapace length 0.42 mm; dorsal spine length 0.17 mm; rostral spine length 0.13 mm; abdomen length 0.75 mm.

Carapace (Fig. 1a) smooth, globose, dorsal spine short, curving posteriorly, rostral spine stout, directed ventrally, no lateral spines in any zoeal stage; paired setae posterolaterally at the base of dorsal spine in all stages; posterodorsal and posterolateral margins without any setae; eyes sessile. Ab (Fig. 1b): Five somites, first naked, second and third with paired lateral knobs directed anteriorly and laterally respectively; pair of posterodorsal setae on somites 2-5 in all stages. T (Fig. 1b): Broadly forked, furcae covered with fine setae; posterior margin of telson with 6 equal processes, each armed with rows of spinules. A1 (Fig. 1c): Smooth and conical, 4 equal aesthetascs + 1 seta. A2 (Fig. 1d): Biramous; protopodite armed with 2 rows of spinules; exopodite about 1/3 length of protopodite with 1 long + 1 short terminal setae. Md (Fig. 1e): Asymmetrical, dentate with well divided incisor and molar processes. Max 1 (Fig. 1f): Coxal endite with 4 setae; basal endite with 5 setae; endopodite 2-segmented with setal formula 1,5. Outer seta representing exopod well developed. Max 2 (Fig. 1g): Coxal endite unilobate, with 7 setae; basal endite bilobed having 5, 5 setae; endopodite partially bilobed, 2, 3 setae; scaphognathite with 4 setae on outer margin, large dte with setal formula 2,2,2,3; endopodite 5-segmented bearing 1,1,1,2, 4+1 setae; exopodite partially 2-segmented with 4 terminal plumose natatory setae. Mxp 2 (Fig. 1i): Coxopodite naked; basipodite with 4 setae as 1,1,1,1; endopodite 3-segmented, 0,0,5 setae; exopodite with 4 terminal plumose natatory setae. Colour: Eye reddish brown. Whole larva orange coloured. Red chromatophores at the base of dorsal spine.

Second Zoea (Fig. 2)

Carapace length 0.60 mm; dorsal spine length 0.22 mm; rostral spine length 0.20 mm; abdomen length 0.92 mm. Carapace (Fig. 2a) enlarged; posterolateral margin with 1 long plumose seta; eyes stalked Ab (Fig. 2b): Five somi-

tes; first somite with 1 long seta. *A1* (Fig. 2c): With 5 aesthetascs + 1 seta. *Md* (Fig. 2e): Incisor of right and left mandibles with 2,4 teeth respectively. *Max 1* (Fig. 2f): Coxal endite now with 5 setae; basal endite bilobed, with 7 setae, 1 long plumose seta on basal margin. *Max 2* (Fig. 2g): Coxal endite with 6 setae; basal endite, 4,4 setae; scaphognathite with 4 setae on outer margin, 3 stout, short setae distally. *Mxp 1* (Fig. 2h): Basipodite setation 3,3,2,2 setae,

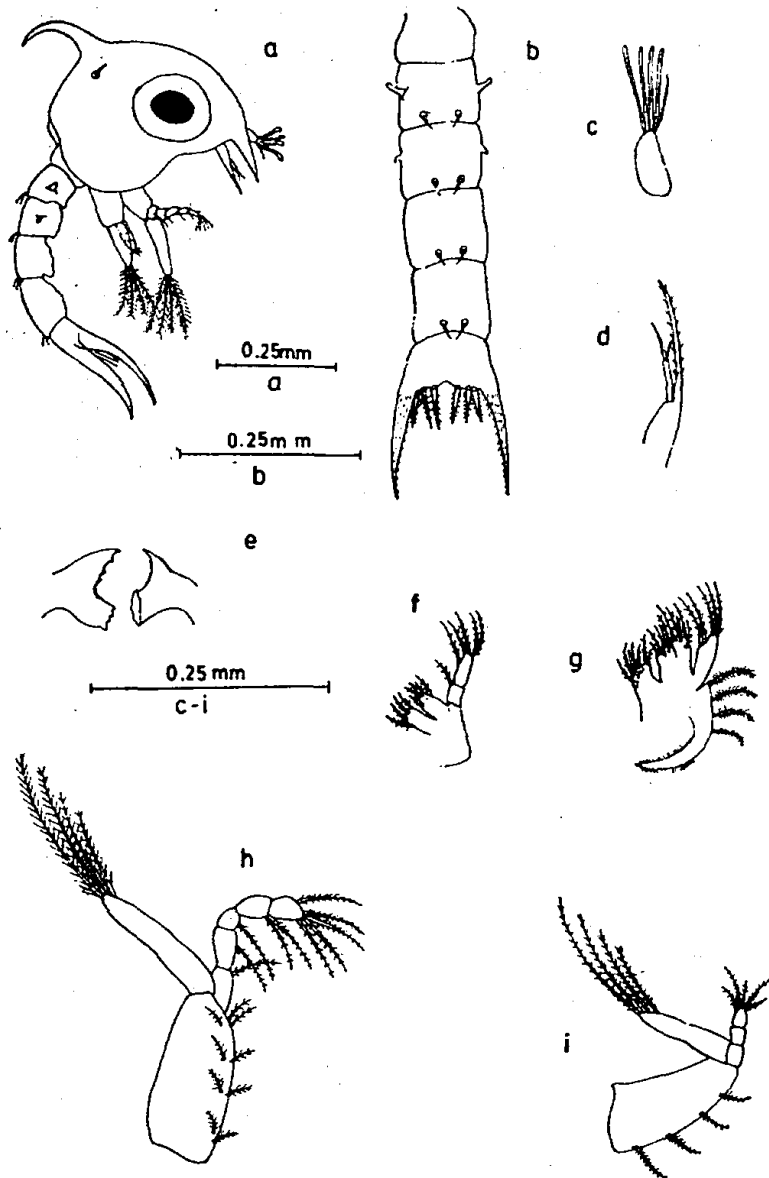


Fig. 1. First Zoea of *Sesarma bidens*. (a) entire larva-lateral view; (b) abdomen and telson (in dorsal view); (c) antennule; (d) antenna; (e) mandible; (f) maxillule; (g) maxilla; (h) maxilliped 1; (i) maxilliped 2.

endopodite setal formula, 1,2 (1 outer +1 inner seta), 1,2, 4+1; exopodite with 6 terminal plumose natatory setae. *Mxp* 2 (Fig. 2i): Endopodite with setation 0,0,6; exopodite with 6 terminal plumose natatory setae.

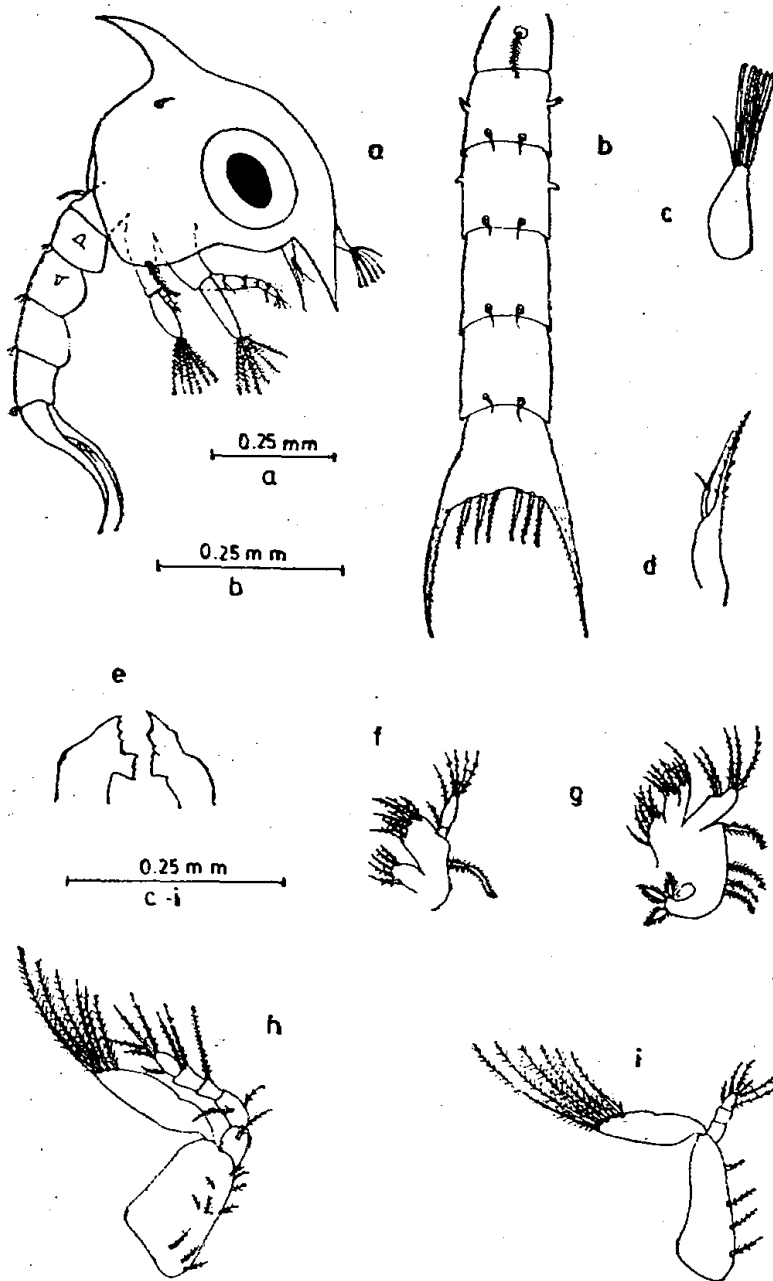


Fig. 2. Second Zoea of *Sesarma bidens*. (a) entire larva-lateral view; (b) abdomen and telson (in dorsal view); (c) antennule; (d) antenna; (e) mandible; (f) maxillule; (g) maxilla; (h) maxilliped 1; (i) maxilliped 2.

Third Zoea (Fig. 3)

Carpace length 0.67 mm; dorsal spine length 0.25 mm, rostral spine length 0.25 mm; abdomen length 1.17 mm.

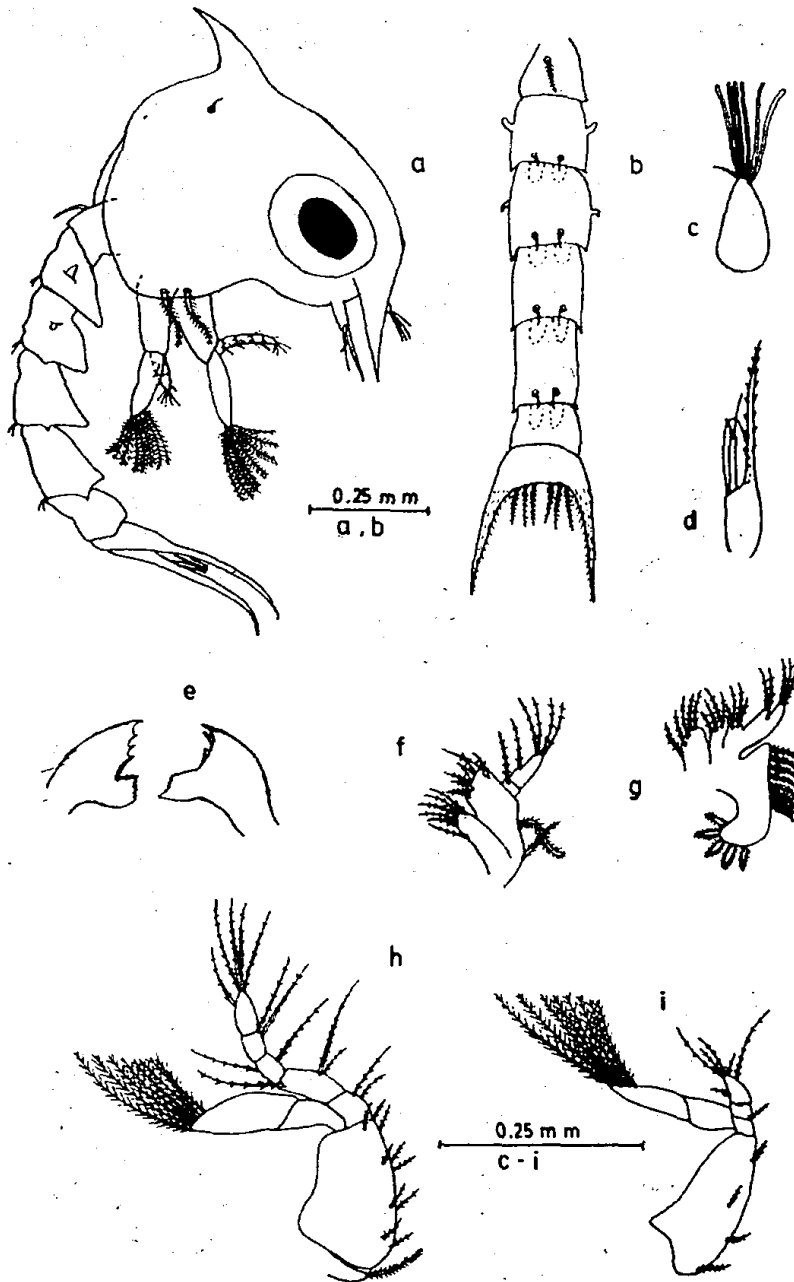


Fig. 3. Third Zoea of *Sesarma bidens*. (a) entire larva-lateral view; (b) abdomen and telson (in dorsal view); (c) antennule; (d) antenna; (e) mandible; (f) maxillule; (g) maxilla; (h) maxilliped 1, (i) maxilliped 2.

Carapace (Fig. 3a): Posterolateral margin now with 2 setae. *Ab* (Fig. 3b): Six somites; somites 2-5 with pleopod buds. *A1* (Fig. 3c): With 6 aesthetascs + 1 seta. *A2* (Fig. 3d): Endopodite bud appears. *Md* (Fig. 3e): Incisor of right and left mandibles with 3,4 pointed teeth respectively. *Max 1* (Fig. 3f): Coxal endite with 6 setae; basal endite bearing 6 setae, 2 basal marginal setae. *Max 2* (Fig. 3g): Coxal endite with 5 setae; scaphognathite with 8 marginal, 5 stout

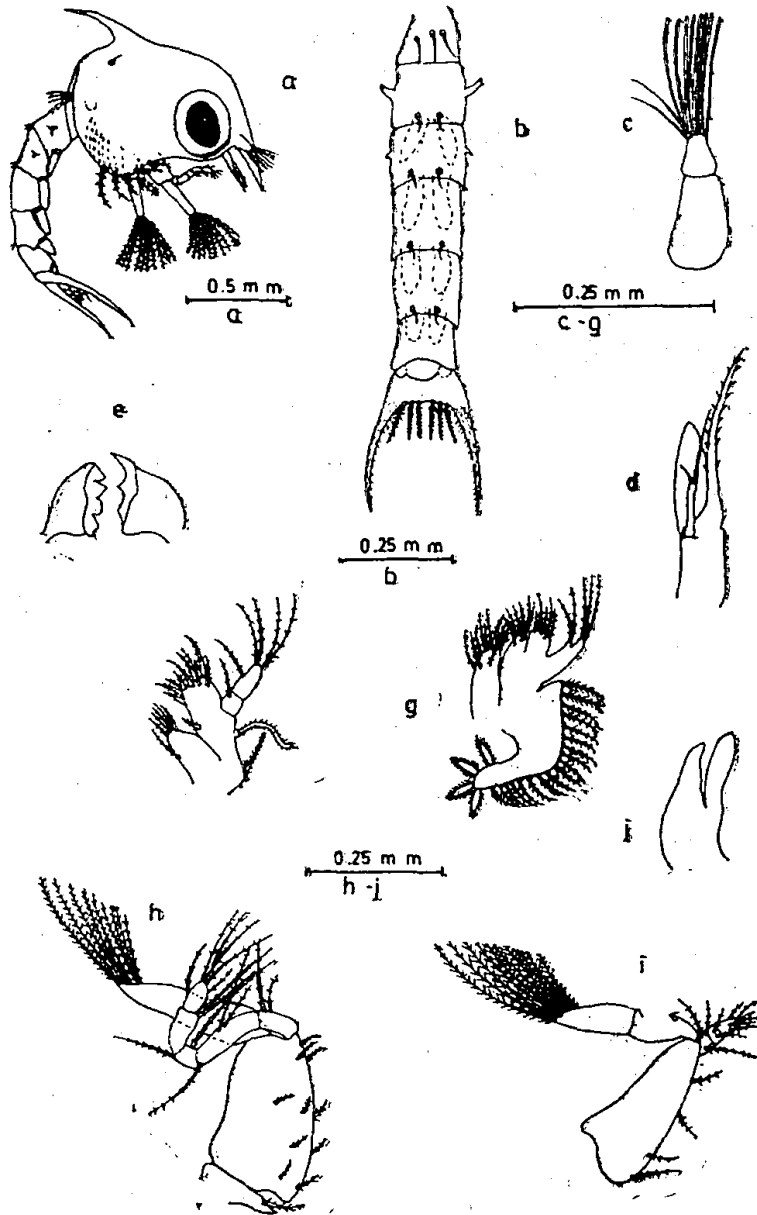


Fig. 4. Fourth Zoea of *Sesarma bidens*. (a) entire larva-lateral view; (b) abdomen and telson (in dorsal view); (c) antennule; (d) antenna; (e) mandible; (f) maxillule; (g) maxilla; (h) maxilliped 1; (i) maxilliped 2; (j) maxilliped 3.

distal setae. *Mxp 1* (Fig. 3h): Coxopodite with 1 plumose seta; basipodite setation 2,2,3,3; endopodite with setal formula 2,3 (1 outer + 2 inner setae), 2 (1 outer + 1 inner seta), 2, 4 + 1; exopodite 2-segmented, 8 plumose natatory setae terminally. *Mxp 2* (Fig. 3i): Endopodite with 1,0,6 setae; exopodite 2-segmented, 8 plumose natatory setae terminally. *Mxp 3*: Appears as rudimentary bud. P 1-5: Rudimentary buds.

Fourth Zoea (Fig. 4)

Carapace length 0.83 mm; dorsal spine length 0.33 mm; rostral spine length 0.33 mm abdomen length 1.41 mm.

Carapace (Fig. 4a) much enlarged; posterolateral margin now bears 5 setae. *Ab* (Fig. 4b): Six somites. First somite now with 3 setae. Pl buds 1-4 elongated. *U*: Somite 6 with small uropod buds. *A1* (Fig. 4c): 2-segmented, 8 aesthetascs + 2 setae terminally. *A2* (Fig. 4d): Endopodite longer than exopodite. *Md* (Fig. 4e): Left mandible with 4 stout teeth, right with 2 stout teeth. *Max 1* (Fig. 4f): Basal endite with 11 setae, 2 basal marginal setae. *Max 2* (Fig. 4g): Coxal endite with 10 setae; basal endite with 6.5 setae; scaphognathite with 18 plumose setae on outer margin, 4 stout plumose setae distally. *Mxp 1* (Fig. 4h): Endopodite with setal formula 2,3 (1 outer + 2 inner setae), 2 (1 outer + 1 inner seta), 2, 5 + 1; exopodite with 9 setae. *Mxp 2* (Fig. 4i): Endopodite with setal formula 3,2,6; exopodite with 10 setae. *Mxp 3* (Fig. 4j): Elongated biramous bud. P 1-5: Long uniramous buds.

Megalopu (Figs. 5,6)

Carapace length (including rostrum) 0.92 mm; carapace width 0.67 mm; rostrum length 0.22 mm; abdomen length 0.83 mm.

Carapace (Fig. 5a) subquadrate, laterally inflated, covered with minute setae; rostrum ventrally deflexed with V-shaped median cleft dorsally; anterolateral margins of carapace produced into 2 rounded lobes; eyes large, projecting laterally. *Ab* (Fig. 5b): Six somites, all somites except fifth with bluntly rounded posterolateral margins; somite 5 with long posterolateral spines; setation as illustrated. *Pl 1-4* (Fig. 5h): Well developed with exopodal setation 12,12,13,8; all endopodites with 3 hooks terminally. *U* (Fig. 5i): With 7 exopodal plus 1 protopodal seta. *T* (Fig. 5b): Semicircular, with 1 seta each on either lateral margins. *A1* (Fig. 6a): Peduncle 3-segmented, enlarged basal segment with 2 setae, middle and distal segments with 1 seta each; flagellum 1-segmented with 12 aesthetascs plus 1 seta. *A2* (Fig. 6b): Peduncle 3-segmented, 0,1,2 setae; flagellum 4-segmented with setation 0,3,1,4. *Md* (Fig. 6c): With smooth, thin cutting edge distally; palp 2-segmented with 0,4 setae. *Max 1* (Fig. 6d): Coxal endite with 5 terminal + 5 subterminal setae; basal endite with 12 setae arranged in two tiers; endopodite broad, irregular shaped with 5 setae; basal margin bears 4 long plumose setae. *Max 2* (Fig. 6e): Coxal endite now bilobed with 9,5 setae; basal with 6,6 setae; endopodite unsegmented with 2 setae on lower lateral

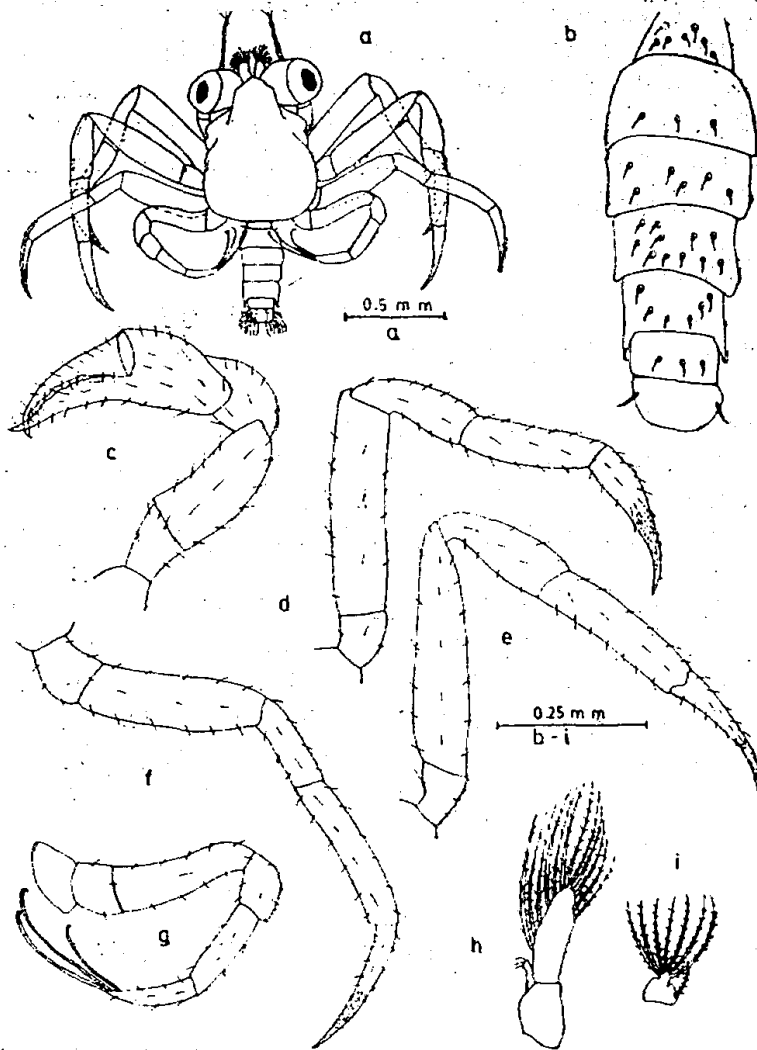


Fig. 5. *Magalopa* of *Sesarma bidens*. (a) dorsal view (without chelipeds); (b) abdomen and telson (dorsal view) (c) first pereopod; (d) second pereopod; (e) third pereopod; (f) fourth pereopod; (g) fifth pereopod; (h) first pleopod; (i) uropod.

margin; scaphognathite with 31 uniformly distributed marginal setae plus 5 lateral setae on the blade. *Mxp 1* (Fig. 6f): Coxal endrite with 5 setae and basal with 8 setae; endopodite irregular in shape, unsegmented with 3 setae terminally; exopodite 2-segmented with 2,3 setae; epipodite with 2 proximal, 2 distal aesthetasoid processes. *Mxp 2* (Fig. 6g): Endopodite 4-segmented with setal formula 0,1,3,5; exopodite 2-segmented, 0,3 setae. *Mxp 3* (Fig. 6h): Protopodite with 5 setae; endopodite 5-segmented with setal formula 6,6,3,4,5; exopodite 2-segmented with 1,4 setae; epipodite with 3 setae proximally plus 11 aesthetasoid setae distally. *P 1-5* (Fig. 5c-g): Chelipeds enlarged, equal, shorter than walking legs, setose, gape of chelae irregularly serrated; pereopods 2-5 elongate, setose; dactyl

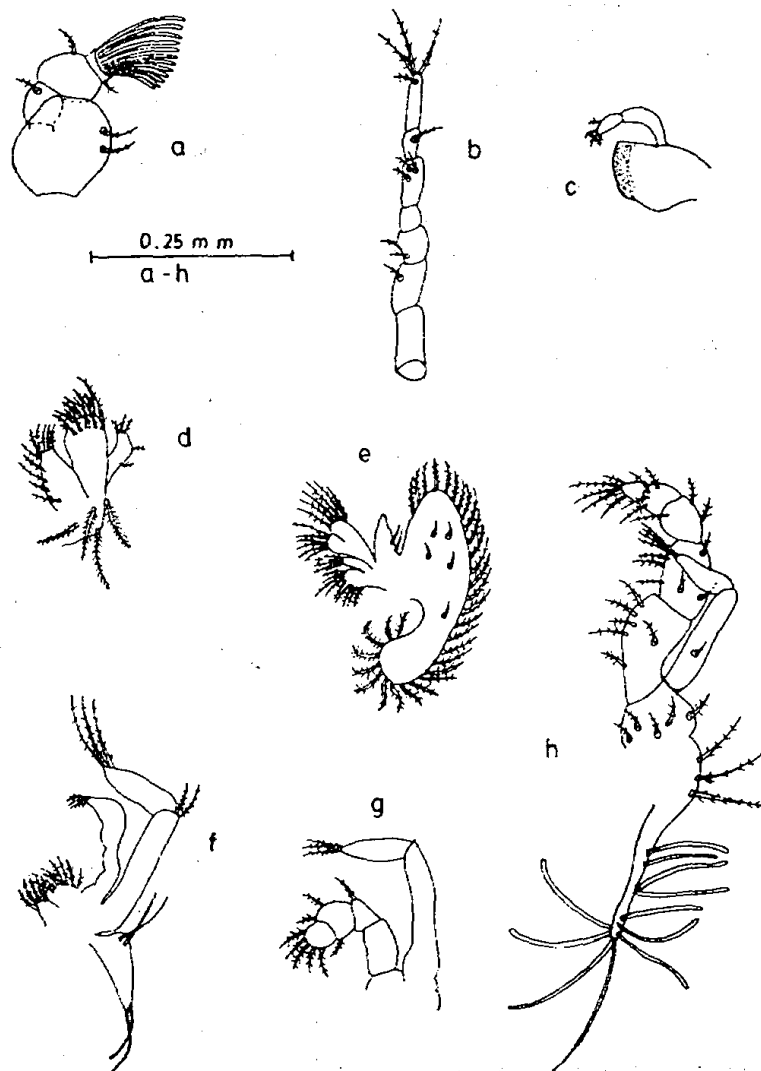


Fig. 6. Megalopa of *Sesarma bidens*. (a) antennule; (b) antenna; (c) mandible; (d) maxillule; (e) maxilla; (f) maxilliped 1; (g) maxilliped 2; (h) maxilliped 3.

of pereopods 2-4 bearing finely spinulated claw-like tip. Dactyl of fifth pereopod with 3 long feelers. Colour: Eye blackish, eye stalk reddish brown. Carapace and abdomen brownish with black spots.

Rice (1980) observed in all grapsids known till then, the first maxilliped basis has setation 8, 10 or 12, the endopodite setations of first maxilliped, 1 or 2, 2, 1, 2, 5 setae and second maxilliped always 0, 1, 5 or 6. However the current species deviates from the features of Grapsidae, basis setation is 9 in first zoea

and 10 in subsequent zoeal stages; endopodite setation of first maxilliped is 1,1,1,2, 4+1 in first zoea, 1,2,1,2, 4+1 in second zoea 2,3,2,1, 4+1 in third and 2,3,2,2, 5+1 in fourth zoea; endopodite setation of second maxilliped is 0,0,5 in first zoea, 0,0,6 in second zoea, 1,0,6 in third zoea and 3,2,6 in fourth zoea. But the generic features present in *S. bidens* are in full agreement with the descriptions of Rice (1980).

Table I - Comparison of endopodite setation of maxillipeds of *S. bidens* larvae with other known Indian species.

| Features | <i>S. bidens</i> Current study | <i>S. lanatum</i> (Kakati and Sankolli, 1975) | <i>S. andersoni</i> (Vijayakumar and Kannupandi, 1986) | <i>S. brockii</i> (Vijayakumar and Kannupandi, 1987) | <i>S. tetragonum</i> (Rajabai, 1961) |
|--------------------|-----------------------------------|--|---|---|---|
| <i>First Zoea</i> | | | | | |
| Maxilliped 1 | 1,1,1,2, 4+1 | 2,2,2,2, 4+1 | 2,2,2,2, 4+1 | 2,2,2,2, 4+1 | 2,1,1,2, 2+1 |
| Maxilliped 2 | 0,0,5 | 0,1,6 | 0,1,6 | 0,1,6 | 0,1,3 |
| <i>Second Zoea</i> | | | | | |
| Maxilliped 1 | 1,2,1,2, 4+1 | 2,2,2,2, 4+1 | 2,2,2,2, 4+1 | 2,2,2,2, 4+1 | — |
| Maxilliped 2 | 0,0,6 | 0,1,6 | 0,1,6 | 0,1,6 | — |
| <i>Third Zoea</i> | | | | | |
| Maxilliped 1 | 2,3,2,2, 4+1 | 2,3,2,2, 4+1 | 2,2,2,2, 4+1 | 2,3,2,2, 4+1 | — |
| Maxilliped 2 | 1,0,6 | 0,1,6 | 0,1,6 | 0,1,6 | — |
| <i>Fourth Zoea</i> | | | | | |
| Maxilliped 1 | 2,3,2,2, 5+1 | 2,3,2,2, 5+1 | 3,2,2,2, 5+1 | 2,3,2,2, 5+1 | — |
| Maxilliped 2 | 3,2,6 | 0,0,6 | 0,1,6 | 0,1,6 | — |
| <i>Megalopa</i> | | | | | |
| Maxilliped 1 | 3 | 1 | 1 | 3 | — |
| Maxilliped 2 | 0,1,3,5 | 0,0,1,4,7 | 0,0,0,3,5 | 0,0,4,6 | — |
| Maxilliped 3 | 6,6,3,4,5 | 7,7,2,3,7 | 4,4,3,2,6 | 6,5,3,2,8 | — |

Comparison of the zoeal characters of *S. bidens* with all other known species of *Sesarma* reveals that the endopodite setations of maxillipeds I and II are the prominent features for identification. This character can be used to separate the larvae of *S. bidens* from other known species of the genus *Sesarma* (*S. lanatum*, Kakati and Sankolli (1975); Rice (1980); *S. andersoni*, Vijayakumar and Kannupandi (1986) and *S. brockii*, Vijayakumar and Kannupandi (1987)).

The presence of 2 lateral setae on the telson can serve as an important character to distinguish the megalopa of *S. bidens* from other species.

Distinguishing characters of the larvae of *S. bidens* are compared with its Indian counterparts and tabulated (Table I).

ACKNOWLEDGEMENTS

Thanks are due to Dr. K. Krishnamurthy, Director, for facilities and to CSIR, New Delhi, for the award of JRF to one of the authors (T.K.).

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