

ZOEAE AND MEGALOPA OF THE MANGROVE CRAB
SESARMA ANDERSONI DE MAN REARED
IN THE LABORATORY

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ABSTRACT

Four zoeal and 1 megalopal stages of the crab *Sesarma andersoni* de Man 1887, reared under laboratory conditions were obtained. The period required to reach megalopa stage from hatching was 11 days, at 25‰ salinity and $30 \pm 1^\circ\text{C}$ temperature. The larval stages are described and compared with other Indian species, *S. tetragonum* and *S. lanatum*.

Key-words: Zoeae, Megalopa, *S. andersoni*, *S. lanatum*.

INTRODUCTION

Although 18 species of the genus *Sesarma* are represented in Indian waters (Alcock, 1900), there is a meagre information on complete larval development of these crabs. Rajabai (1961) was the first author who described the first zoea of *Sesarma tetragonum* and much later, Kakati and Sankolli (1975) observed the complete larval development of *S. lanatum* in laboratory culture. The present study reports the complete larval development of *S. andersoni* which inhabits Pitchavaram mangrove of the Porto Novo coast.

MATERIALS AND METHODS

Berried females of *S. andersoni* were collected by handpicking from Pitchavaram mangrove (lat. $11^\circ 29'N$; long. $79^\circ 49'E$) on 14th August, 1985. They were maintained individually in round fibre glass tanks containing freshly filtered and aerated seawater. The clutch of bright orange colour in the early stage turned bluish black when about to hatch. First zoeae were released on August 19th, 1985 in early hours, 3-4 a.m. and hatching process lasted for $1\frac{1}{2}$ hours. After hatching, without delay, 10 larvae were removed to each bowl (diameter 10 cm; capacity 100 ml) containing seawater (Sal. 25‰ and temp. $30 \pm 1^\circ\text{C}$). Larvae were fed daily with freshly hatched San Francisco Bay brand *Artemia* nauplii. The other rearing details were same as described by Mohan and Kannupandi (1985, 1986).

RESULTS AND DISCUSSION

First zoea (Fig. 1): Dorsal spine length 0.17 mm; carapace length 0.50 mm; rostral spine length 0.17 mm; abdomen length 0.87 mm.

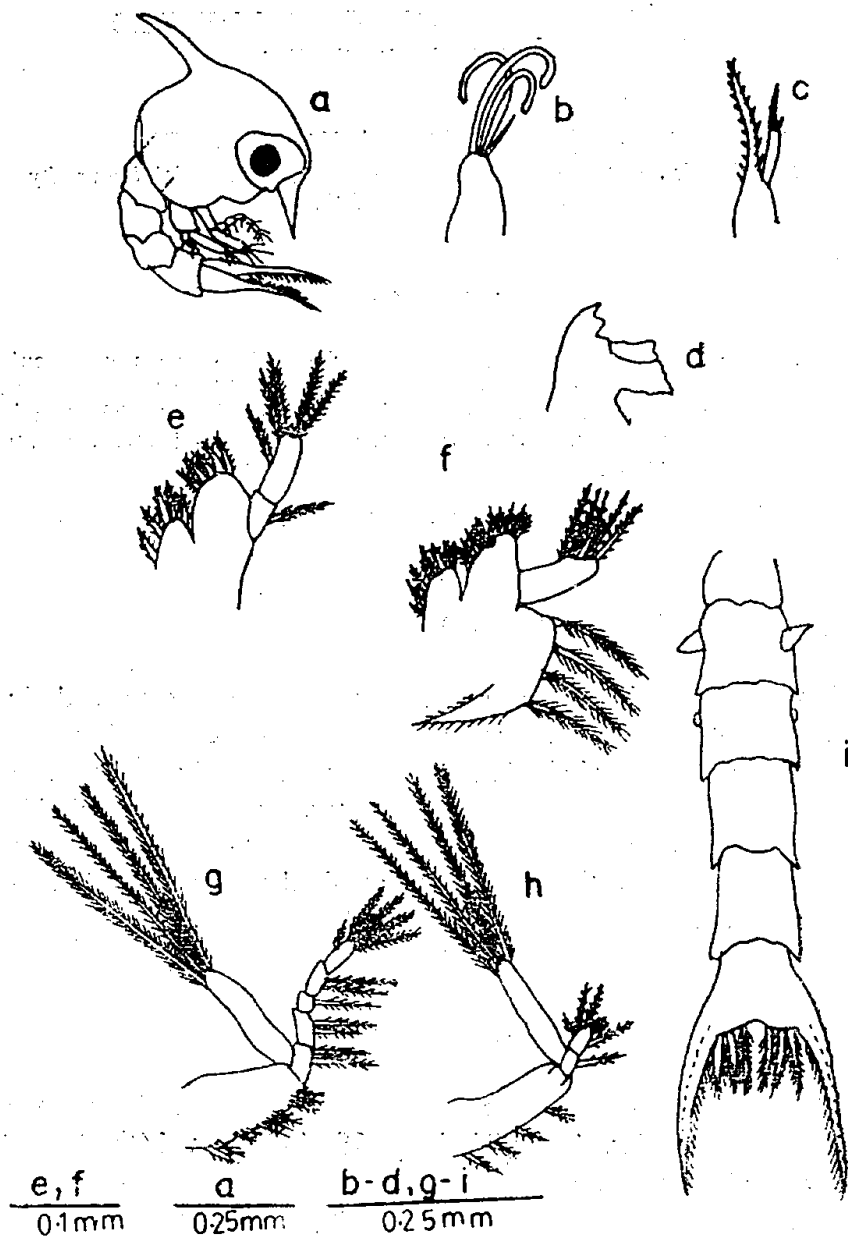


Fig. 1. First zoea of *Sesarma andersoni*.

a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen and telson (dorsal view).

Carapace (Fig. 1a): With a moderate tapering dorsal spine; lateral spines absent; rostral spine equal to dorsal spine; no setae on carapace; eyes sessile. **Antennule** (Fig. 1b): Unsegmented with 3 terminal aesthetascs and 1 small seta. **Antenna** (Fig. 1c): With a thick long spinous process; exopodite

smooth, $\frac{2}{3}$ length of protopodite with a spine midway; no endopodite bud.
Mandible (Fig. 1d): With well developed incisor and molar processes.
Maxillule (Fig. 1e): Coxal and basal endite with 5 setae, each; endopodite 2-segmented with 5 setae on terminal segment and 1 seta on basal segment.
Maxilla (Fig. 1f): Coxal endite with 8 setae; basal endite bilobed with 5 setae each on proximal and distal lobes; endopodite with 5 setae; scaphognathite with 4 marginal plumose setae and distal lobes fringed with setules representing future setae distally.
Maxilliped I (Fig. 1g): Basipodite with setation 2,2,3,3; endopodite 5-segmented bearing 2,2,1,2,5, setae from proximal to distal segments respectively; exopodite with 4 plumose natatory setae.
Maxilliped II

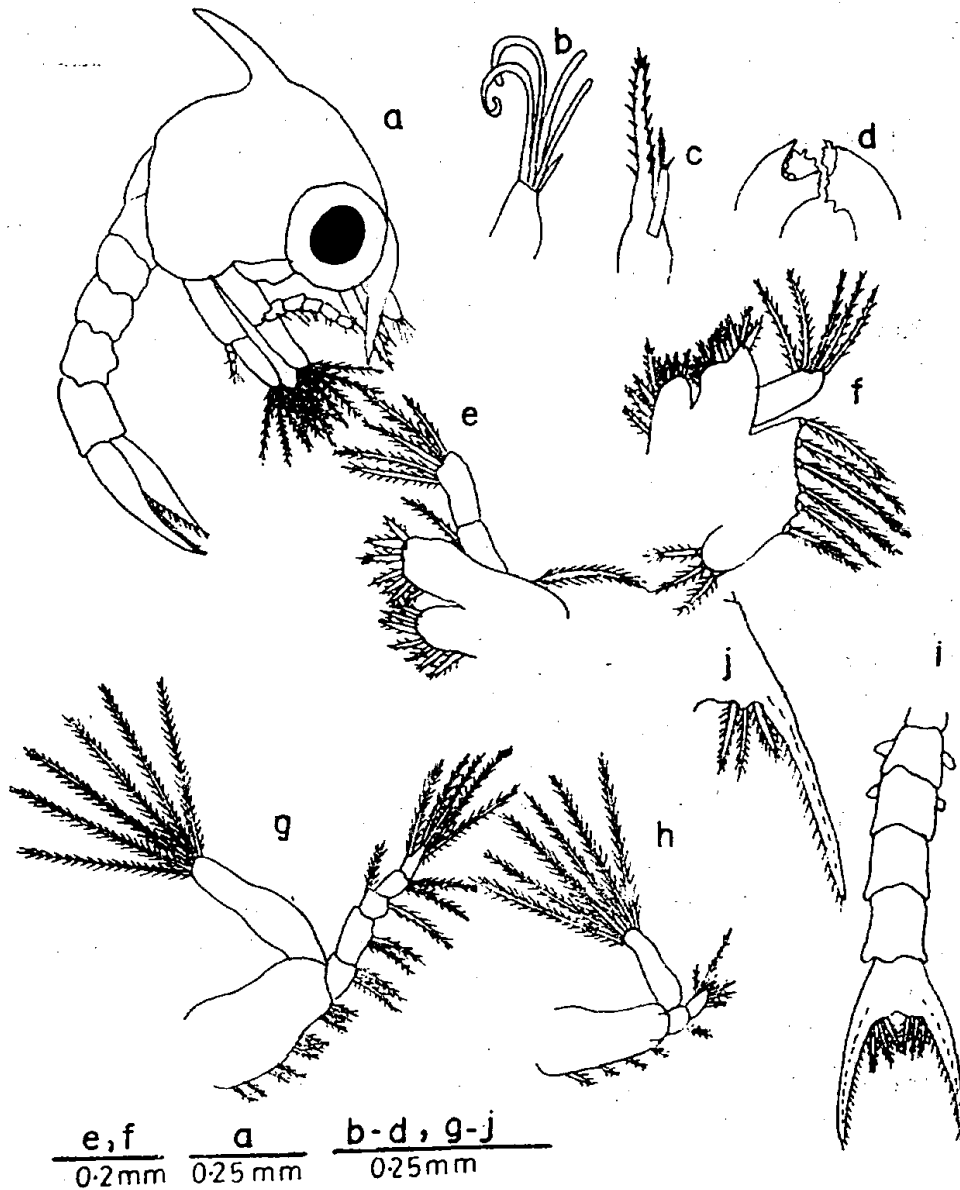


Fig. 2 Second zoea of *S. andersoni*.

a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen (dorsal view); j. telson.

(Fig. 1h): Basipodite setation 1,1,1,1; endopodite 3-segmented with 0,1,6 setae distal wards; exopodite with 4 plumose natatory setae. *Abdomen* (Fig. 1i): 5-segmented; a pair of lateral protuberances present on 2nd abdominal segment; a pair of small rudimentary knobs found on 3rd segment. *Telson* (Fig. 1j): Forked, bearing 3 pairs of serrated spines along its inner margin; mid-dorsal margin with 2 rows of spinules on the cornua.

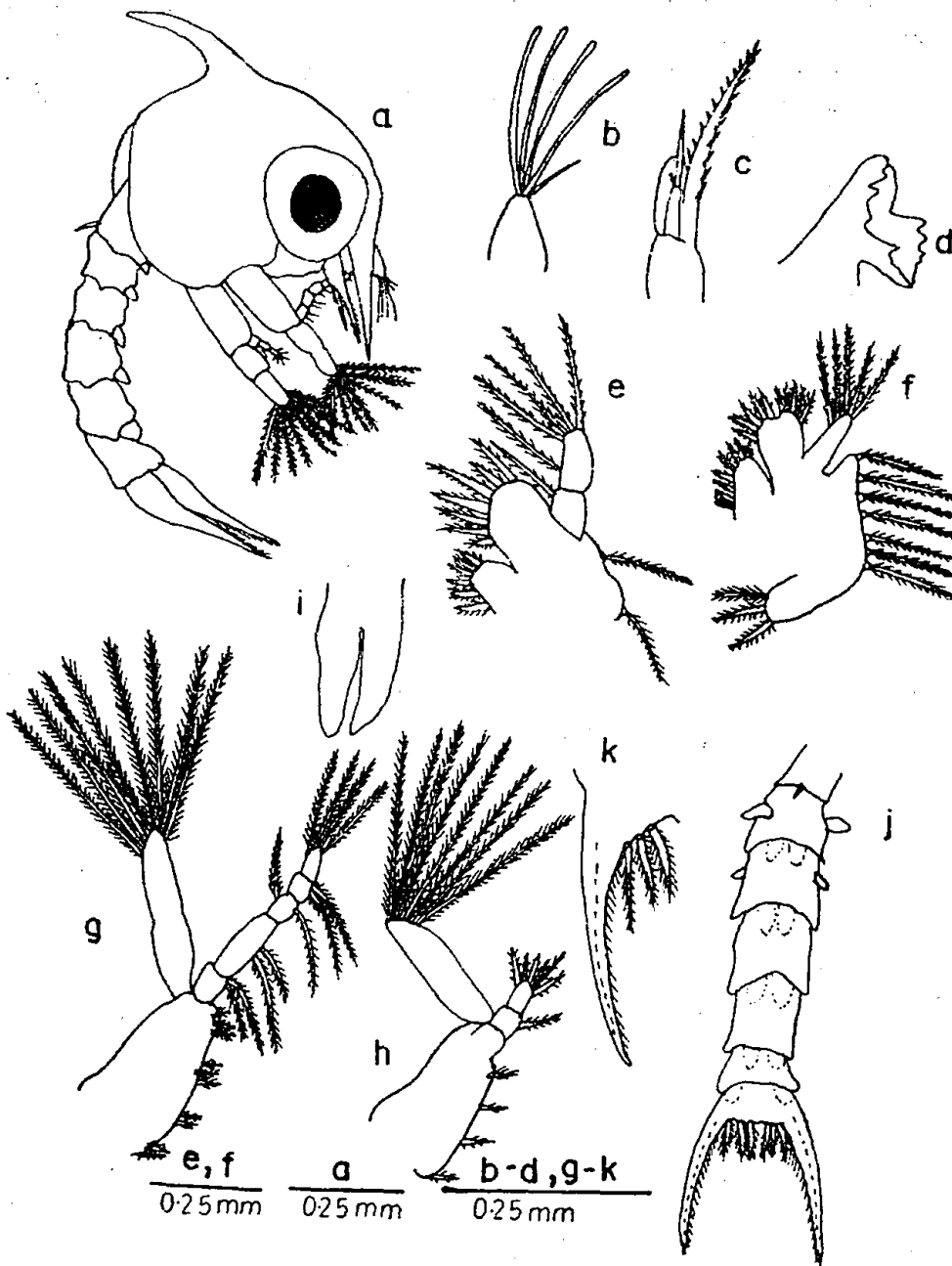


Fig. 3. Third zoea of *S. andersoni*.
 a. lateral view of entire larva; b. antennule; c. antenna; d. mandible;
 e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. maxilliped III;
 j. abdomen (dorsal view); k. telson.

Chromatophores: Brownish chromatophores present on eyes, bases of antennule and antenna. Maxillipeds with pale yellow and brown chromatophores. This pattern continues throughout the zoeal phase.

Second zoea (Fig. 2): Dorsal spine length 0.27 mm; carapace length 0.60 mm; rostral spine length 0.20 mm; abdomen length 0.94 mm. *Carapace* (Fig. 2a): No setae on carapace margin; eyes stalked and free. *Antennule* (Fig. 2b): Now with 4 aesthetascs plus 1 seta. *Antenna* (Fig. 2c): Endopodite bud formed. *Mandible* (Fig. 2d): Incisor and molar processes irregularly denticulate. *Maxillule* (Fig. 2e): Coxal endite with terminal and 3-sub-terminal setae; basal endite with 7 setae and a plumose outer marginal seta; endopodite 2-segmented with setal formula 1,5. *Maxilla* (Fig. 2f): Coxal endite with 8 setae; scaphognathite with 9 setae. *Maxilliped I* (Fig. 2g): Basipodite setation unchanged; endopodite 5-segmented with setal formula 2,2,2,2,5; exopodite now with 6 plumose natatory setae. *Maxilliped II* (Fig. 2h): Exopodite now with 6 plumose natatory setae. *Abdomen* (Fig. 2i): First segment with a dorso-median seta, second and third segments each with a pair of dorso-lateral protuberances. *Telson* (Fig. 2j): No change except increase in size.

Third zoea (Fig. 3): Dorsal spine length 0.28 mm; carapace length 0.78 mm; rostral spine length 0.34 mm; abdomen length 0.97 mm. *Carapace* (Fig. 3a): No setae on carapace. *Antennule* (Fig. 3b): Now with 4 aesthetascs and 1 seta. *Antenna* (Fig. 3c): Endopodite bud longer than in previous stage. *Mandible* (Fig. 3d): Unchanged. *Maxillule* (Fig. 3e): Coxal endite bearing 6 setae; basal endite with 7 setae and 2 outer marginal plumose setae; endopodite 2-segmented with setal formula 1,5. *Maxilla* (Fig. 3f): Scaphognathite with 10 setae. *Maxillipeds I & II* (Figs. 3g & h): Exopodites with 8 plumose natatory setae. *Maxilliped III and Pereiopods* (Fig. 3i): Biramous and 3 pairs of pereopods buds. *Abdomen* (Fig. 3j): 6-segmented, 2nd to 6th segments with pleopods buds. *Telson* (Fig. 3k): Unchanged.

Fourth zoea (Fig. 4): Dorsal spine length 0.38mm; carapace length 0.75mm; rostral spine length 0.50mm; abdomen length 1.00mm. *Carapace* (Fig. 4a): A seta on postero-dorsal margin of carapace. *Antennule* (Fig. 4b): Now with 4 aesthetascs and 2 setae. *Antenna* (Fig. 4c): Endopodite bud well developed about $\frac{1}{2}$ length of protopodite. *Mandible* (Fig. 4d): No palp. *Maxillule* (Fig. 4e): Coxal endite with 7 setae; basal endite now with 11 plus 2 outer marginal plumose setae. *Maxilla* (Fig. 4f): Coxal and basal endites with 10, 11 setae respectively; scaphognathite with 17 setae. *Maxilliped I* (Fig. 4g): Endopodite setal formula 3,2,2,2,6 (4 terminal plus 2 sub-terminal with outer setae on first two segment); exopodite with 9 plumose natatory setae. *Maxilliped II* (Fig. 4h): Exopodite now with 10 plumose natatory setae. *Maxilliped III and Pereiopods* (Fig. 4i): Buds well developed. *Abdomen* (Fig. 4j): First segment with 3 dorsal setae; pleopod buds well developed. *Telson* (Fig. 4k): No change.

Megalopa (Fig. 5): Carapace length 0.87 mm; abdomen length 0.84 mm. *Carapace* (Fig. 5a): Quadrangular, smooth, rostrum very short

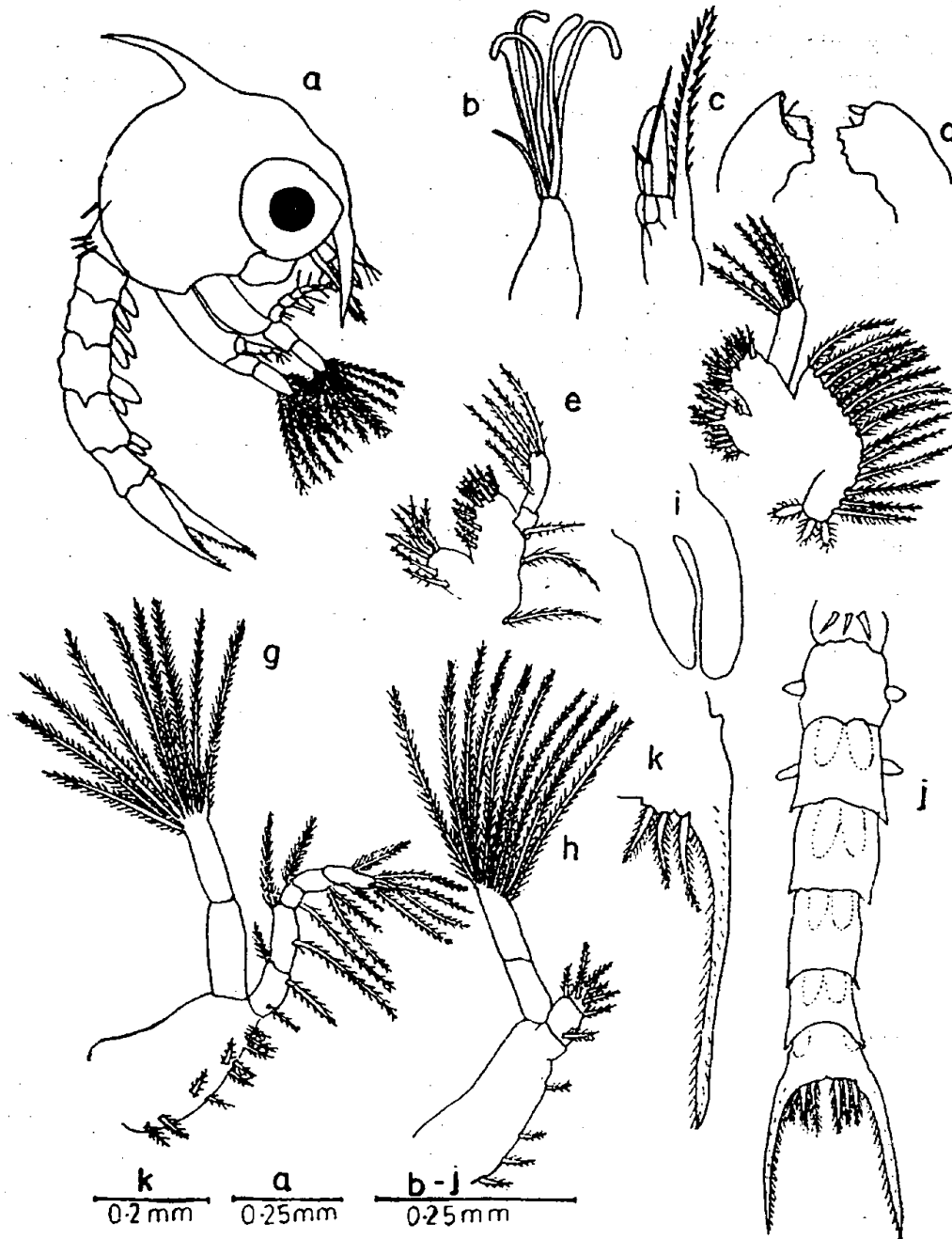


Fig. 4. Fourth zoea of *S. andersoni*.

a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. maxilliped III; j. abdomen (dorsal view); k. telson.

deflexed downwards; a pair of setae behind orbits on carapace; antero-lateral border of carapace divided into 2-rounded lobes; eyes stalked. *Antennule* (Fig. 5b): Peduncle 3-segmented with 0,4,0 setae; lower ramous represented with 1 seta; upper ramous 3-segmented, basal segment naked, middle segment with 6 aesthetascs plus a seta and terminal segment with 8 aesthetascs. *Antenna* (Figs. 5c & d): Peduncle 3-segmented with setal formula 0,0,1. Flagellum 5-segmented with setation 0,1,0,4,1. *Mandible* (Fig. 5e): Symmetrical, 2-segmented palp with setal formula 0,4; incisor

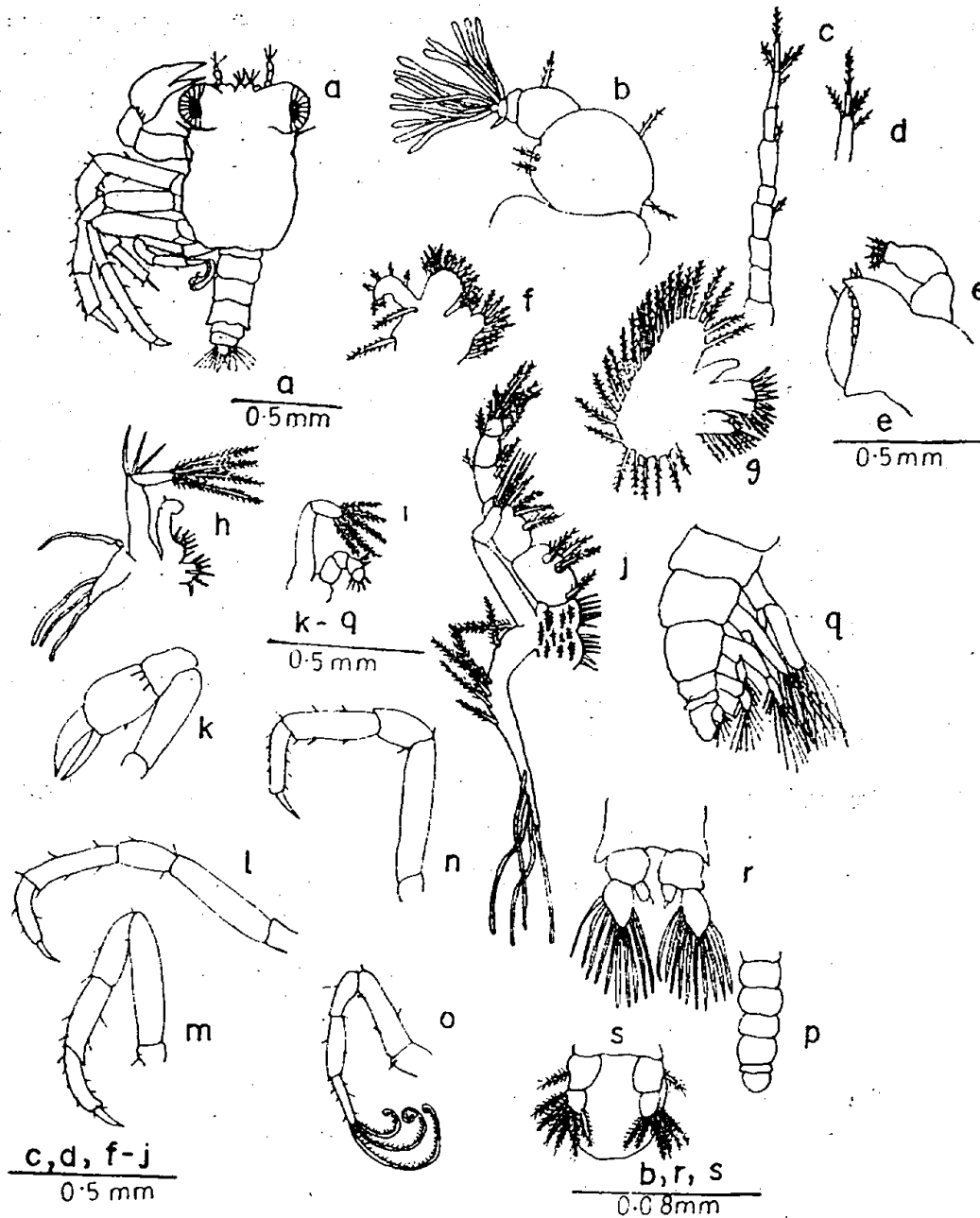


Fig. 5. Megalopa of *S. andersoni*

a. dorsal view of entire megalopa; b. antennule; c. antenna; d. terminal segment (enlarged), e. mandible, f. maxillule, g. maxilla, h. maxilliped I, i. maxilliped II, j. maxilliped III. k. first pereiopod, l. second pereiopod, m. third pereiopod, n. fourth pereiopod, o. fifth pereiopod, p. abdomen (dorsal view), q. abdomen (lateral view), r. pleopod, s. telson.

margin with 3 setae. *Maxillule* (Fig. 5f): Coxal endite bilobed with 8,3 setae; basal endite with 11 setae with 2 outer marginal plumose setae; endopodite unsegmented with 6 setae. *Maxilla* (Fig. 5g): Coxal endite with 8 setae on proximal and 3 setae on distal lobes; basal endite bilobed bearing 8,5 setae on proximal and distal lobes respectively; endopodite without setae; scaphognathite with 26 plumose setae. *Maxilliped I* (Fig. 5h): Coxal and basal endite with 6 setae each; endopodite partially 2-segmented with a small seta; exo-

podite 2 segmented with setal formula 3,4 distalwards; epipodite with 4 aesthetasoid setae. *Maxilliped II* (Fig. 5i): Endopodite 5-segmented with setation 0,0,0,3,5 distalwards; exopodite 2-segmented with 5 setae on terminal segment. *Maxilliped III* (Fig. 5j): Protopodite with 22 setae; endopodite 5-segmented with setal formula 4,4,3,2,6; exopodite 2-segmented with 4 setae terminally; epipodite with 6 plumose basal and 4 apical setae. *Pereiopods* (Fig. 5k-o): 5 pairs of pereiopods with setae; chelipeds well developed, somewhat inflated without any teeth at inner margin of propodus, 3 spines at base of palm; dactylus of pereiopods 2-5 covered with small spines; last walking leg shortest with 3 'feelers'. *Abdomen* (Fig. 5 p & q): 6-segmented, pleopods present from 2nd to 6th segments; exopodite setation of pleopods 12,10,9,8,8; endopodite buds with only one hook. Uropod with 1 seta on protopod and 6 setae on exopod. *Telson* (Fig. 5q): Semi-circular without marginal setae.

Chromatophores: Megalopa appears in brown, black pigments, Eyes-talks, supra-orbital region and posterior border of carapace with brown colouration. Black with yellow chromatophores present on either side of the cardiac region. Yellowish chromatophores present at bases of antennule, antenna and pale yellow chromatophores present on third maxillipeds and chelipeds. Abdominal segments and telson show brown colouration.

Table I. Comparison of first zoeal characters between *Sesarma andersoni* de Man and *S. tetragonum* (Fabricius).

Characters	<i>S. andersoni</i> (Present study)	<i>S. tetragonum</i> (Rajabai, 1961)
<i>Antennule</i>	3 aesthetascs + 1 seta	3 aesthetascs + no setae
<i>Maxillule</i>		
Endopodite	1,5 setae	0,4 setae
Coxal endite	5 setae	3 setae
<i>Maxilla</i>		
Endopodite	5 setae	4 setae
Basal endite	10 setae	5 setae
Coxal endite	8 setae	5 setae
Scaphognathite	4 plumose setae	3 plumose setae
<i>Maxilliped I</i>		
Endopodite setation	2,2,1,2,5	2,1,1,2,3
Basipodite setation	2,2,3,3	1,1,2,1
<i>Maxilliped II</i>		
Endopodite setation	0,1,6	0,1,3

Table II. Comparison of larval characters between *Sesarma andersoni* de Man and *S. lanatum* Alcock.

Characters	<i>S. andersoni</i> (Present study)	<i>S. lanatum</i> (Kakati and Sankolli, 1975)
ZOEAE I		
<i>Maxilliped I</i>		
Endopodite setation	2,2,1,2,5	2,2,2,2,5
ZOEAE II		
<i>Maxilla</i>		
Scaphognathite	9 plumose setae	8 plumose setae
ZOEAE III		
<i>Maxilla</i>		
Scaphognathite	10 plumose setae	13 plumose setae
ZOEAE IV		
<i>Antennule</i>		
	5 aesthetascs + 2 setae	5 aesthetascs + 1 seta
<i>Maxilla</i>		
Scaphognathite	17 plumose setae	23 plumose setae
<i>Maxilliped I</i>		
Endopodite setation	3,2,2,2,6	2,2,2,2,6
MEGALOPA		
<i>Antennule</i>		
Peduncle	0,4,0 setae	3,0,0 setae
Flagellum	0,6 aesthetascs + 1 seta, 8 aesthetascs	Single segment with 9 aesthetascs
<i>Antenna</i>		
Peduncle	0,0,1 setae	1,1,1 setae
Flagellum	0,1,0,4,1 setae	0,2,1,4,2 setae
<i>Maxillule</i>		
Endopodite	6 setae	7 setae
Basal endite	13 setae	17 setae
<i>Maxilla</i>		
Coxal endite	11 setae	12 setae
Scaphognathite setation	26 plumose setae	34 plumose setae

Characters	<i>S. andersoni</i> (Present study)	<i>S. lanatum</i> (Kakati and Sankolli, 1975)
<i>Maxilliped I</i>		
Exopodite	3, 4 setae	0,3 setae
Protopodite	6+6 setae	6+2, 6+3 setae
Epipodite	3+1 setae	3+2 setae
<i>Maxilliped II</i>		
Endopodite	0,0,0,3,5 setae	0,0,1,4,7
<i>Maxilliped III</i>		
Endopodite	4,4,3,2,6 setae	7,7,3,2,7 setae
Epipodite	2+8 basal and terminal setae	3+11 basal and terminal setae
<i>Pleopods</i>		
Exopodal setation	12,10,9,8,7	13,14,13,11,8

Rajabai (1961) has described only the first zoea of *Sesarma tetragonum* from laboratory rearing. Kakati and Sankolli (1975) reported the complete larval development of *S. lanatum* which included four zoeal stages and a megalopa under laboratory condition as also observed in the present study on *S. andersoni*. Therefore only the first zoeal characters of *S. andersoni* are compared with those of *S. tetragonum* and differences are listed in Table I. Further, all the four zoeal and megalopal characters of *S. andersoni* are compared with those of *S. lanatum* and the two species can be separated based on the characters listed in the Table II.

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