

LABORATORY REARED LARVAL STAGES OF THE MANGROVE GRAPSID CRAB, *METOPOGRAPSUS MACULATUS* H.MILNE EDWARDS

K. PASUPATHI AND T. KANNUPANDI

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

ABSTRACT

Larval development of *Metopograpsus maculatus* under laboratory conditions is described. Five zoeal stages and a megalopa stage appeared at salinity 30 ppt and temperature 29-32°C. Larval characters are compared with other known Indian species viz. *M. messor* and *M. latifrons*.

Key-words: Zoeae, Megalopa, *Metopograpsus maculatus*, Pitchavaram mangroves.

INTRODUCTION

Although crabs belonging to the family Grapsidae comprising the genera *Metopograpsus*, *Sesarma*, *Metaplex* and *Neoepisesarma* are most abundant at Pitchavaram mangroves, there is no much information on the larval development. The genus *Metopograpsus* is represented by two species viz. *M. messor* and *M. maculatus*. No studies on the larval development of this genus are available from foreign waters. Rajabai (1961) described the first zoea of *M. messor* reared in the laboratory from Indian waters. Much later, the complete larval development under laboratory conditions, comprising 5 zoeal stages and a megalopa stage of *M. latifrons* has been described by Kakati (1982). The present study is aimed at larval development of the mangrove crab, *M. maculatus* from hatching to megalopa stage and to provide detailed description of each larval stage.

MATERIALS AND METHODS

Five 'sponge' bearing crabs of *Metopograpsus maculatus* were collected from Pitchavaram mangroves (lat. 11°29'N; long. 79°49'E) on 28th July, 1985. They were maintained individually in small plastic troughs containing filtered sea water. Prior to hatching the water was changed daily. Hatching of all 5 broods took place at forenoon on 31st July 1985 and lasted 10 minutes. After hatching, 200 larvae from each brood were reared separately, 10 larvae per glass bowl (salinity 30 ppt; temperature 29-32°C). Freshly hatched nauplii of the Colombian strain of *Artemia* were provided as food, the other details followed being similar to those described by Mohan and Kannupandi (1985).

RESULTS AND DISCUSSION

Larvae of *M. maculatus* reared under laboratory conditions reached the megalopa stage after passing through 5 zoeal stages in 37-38 days.

FIRST ZOEAL (Fig. 1)

Dorsal spine length 0.30 mm; rostral spine length 0.28 mm; carapace length 0.44 mm; abdomen length 0.83 mm; telson length 0.16 mm and telson width 0.08 mm.

Carapace (Fig. 1a): Smooth, with dorsal and rostral spines, dorsal spine tapered, straight; rostral spine smooth and pointed; lateral spine represented by 2 rounded knob-like projections; a pair of setae on postero-dorsal side; eyes sessile. *Antennule* (Fig. 1b): Conical with 2 aesthetascs plus 1 seta. *Antenna* (Fig. 1c): Protopodite 1/3 length of rostral spine with spinules on distal end.

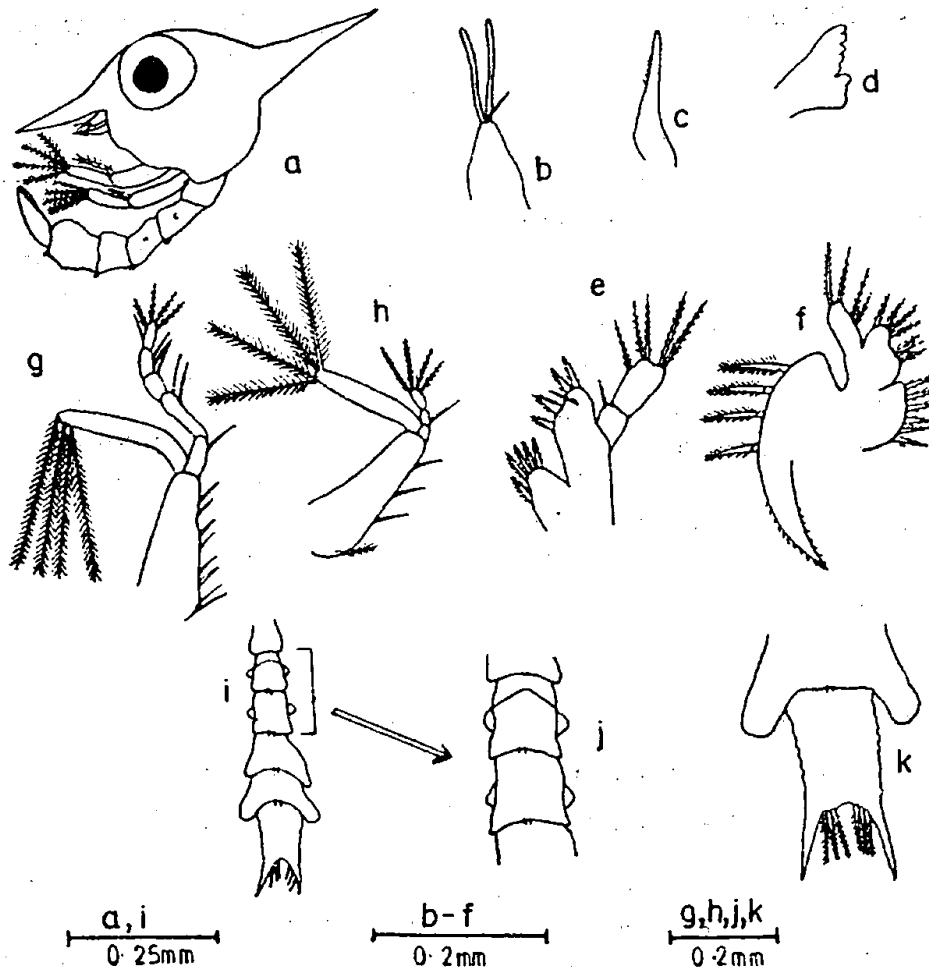


Fig. 1. First zoea of *Metopograpsus maculatus*.
a. lateral view of entire larva; b. antennule; c. antenna; d. mandible;
e. maxillule; f. maxilia; g. maxilliped I; h. maxilliped II; i. abdomen
(dorsal view); j. 2nd & 3rd abdominal somites magnified; k. telson.

Mandible (Fig. 1d): Symmetrical, molar and incisor processes with well developed teeth. *Maxillule* (Fig. 1e): Coxal and basal endites with 5 setae each; 2-segmented endopodite with 1, 5 setae distalwards.

Maxilla (Fig. 1f): Coxal endite single-lobed with 6 setae; basal endite bilobed with setal formula distalwards 3,4; endopodite with 4 setae; scaphognathite with 4 marginal plumose setae and long posterior lobe with small spinules representing future setae distally.

Maxilliped I (Fig. 1g): Basipodite with 2, 2, 2, 2 marginal setae; endopodite 5-segmented with setation 1, 2, 1, 2, 5; exopodite has 4 plumose natatory setae at distal end.

Maxilliped II (Fig. 1h): Basipodite with 1, 1, 1, 1 setae on inner margin; endopodite 3-segmented, with 0, 1, 4 setae distalwards; exopodite with 4 plumose natatory setae.

Abdomen (Fig. 1i&j): With 5 somites; somites 2 and 3 with anterolateral knobs, in the second segment a collar appears in all zoeal stages, somite 5 with wing-like postero-lateral expansions, a pair of minute dorsal setae present on 2nd to 5th somites, which is retained in all zoeal stages.

Telson (Fig. 1k): Forked, lateral margins wavy in appearance, two rami smooth, posterior margin with 3 pairs of serrated processes.

Chromatophores: Black pigments on eyes; red chromatophores present on base of dorsal spine, central region of carapace and abdominal segments; brown pigmentation prominent on mandibles. There is no change in chromatophore in subsequent zoeal stages.

SECOND ZOEAL (Fig. 2)

Dorsal spine length 0.37 mm; rostral spine length 0.30 mm; lateral spine length 0.11 mm; carapace length 0.46 mm; abdomen length 0.89 mm; telson length 0.22 mm and telson width 0.09 mm.

Carapace (Fig. 2a): In addition to increase in size, lateral spines fully developed; eyes stalked. *Antennule* (Fig. 2b): 3 aesthetascs and 1 seta. *Antenna* (Fig. 2c): Unchanged. *Mandible* (Fig. 2d): Increases in size.

Maxillule (Fig. 2e): Basal endite with 7 setae, a plumose outer marginal seta representing exopodite, continues throughout subsequent zoeal stages; endopodite now with setation 0,5 distalwards.

Maxilla (Fig. 2f): Scaphognathite with 2 groups of setae, a distal group of 6 and proximal of 3 setae.

Maxillipeds I & II (Figs. 2g & h): Exopodite with 6 plumose natatory setae. *Abdomen* (Figs. 2i&j): Only increases in size. *Telson* (Fig. 2k): No change except size increase.

THIRD ZOEAL (Fig. 3)

Dorsal spine length 0.49 mm; rostral spine length 0.56 mm; lateral spine length 0.23 mm; carapace length 0.72 mm; abdomen length 1.12 mm; telson length 0.26 mm and telson width 0.11 mm.

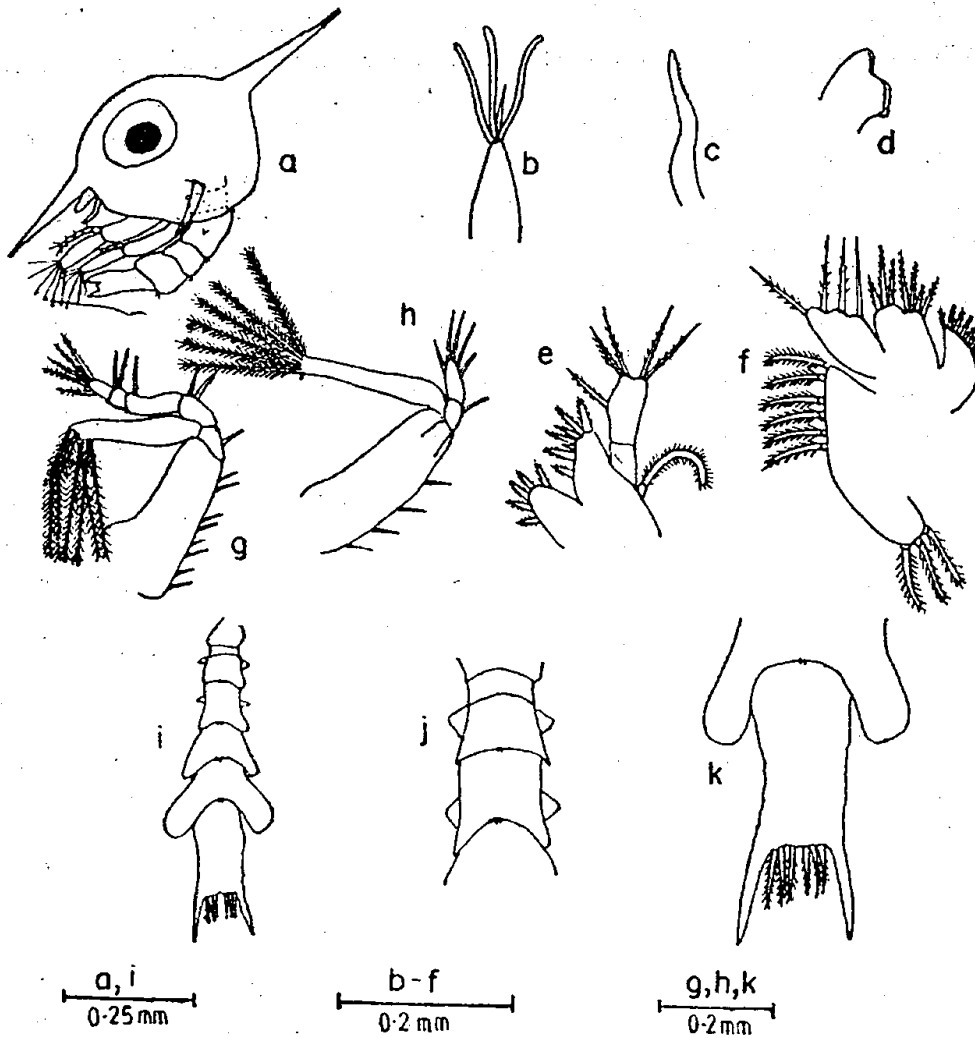


Fig. 2. Second zoea of *M. maculatus*.

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. 2nd & 3rd abdominal somites magnified; k. telson.

Carapace (Fig. 3a): Dorsal spine with 8 minute setae, ventral margin of carapace with 1 seta. **Antennule** (Fig. 3b): Base swollen, 3 aesthetascs and 1 seta. **Antenna** (Fig. 3c): Except size increase, unchanged. **Mandible** (Fig. 3d): Increased in size, incisor with blunt cutting edges. **Maxillule** (Fig. 3e): Unchanged.

Maxilla (Fig. 3f): Coxal endite now bilobed, 4 setae on proximal and 5 on distal lobes, scaphognathite with 14 plumose setae.

Maxillipeds I & II (Figs. 3g & h): Exopodite with 8 plumose natatory setae. **Abdomen** (Figs. 3i&j): 6th somite now separated from telson.

Telson (Fig. 3k): Increased in length with almost straight posterior margin.

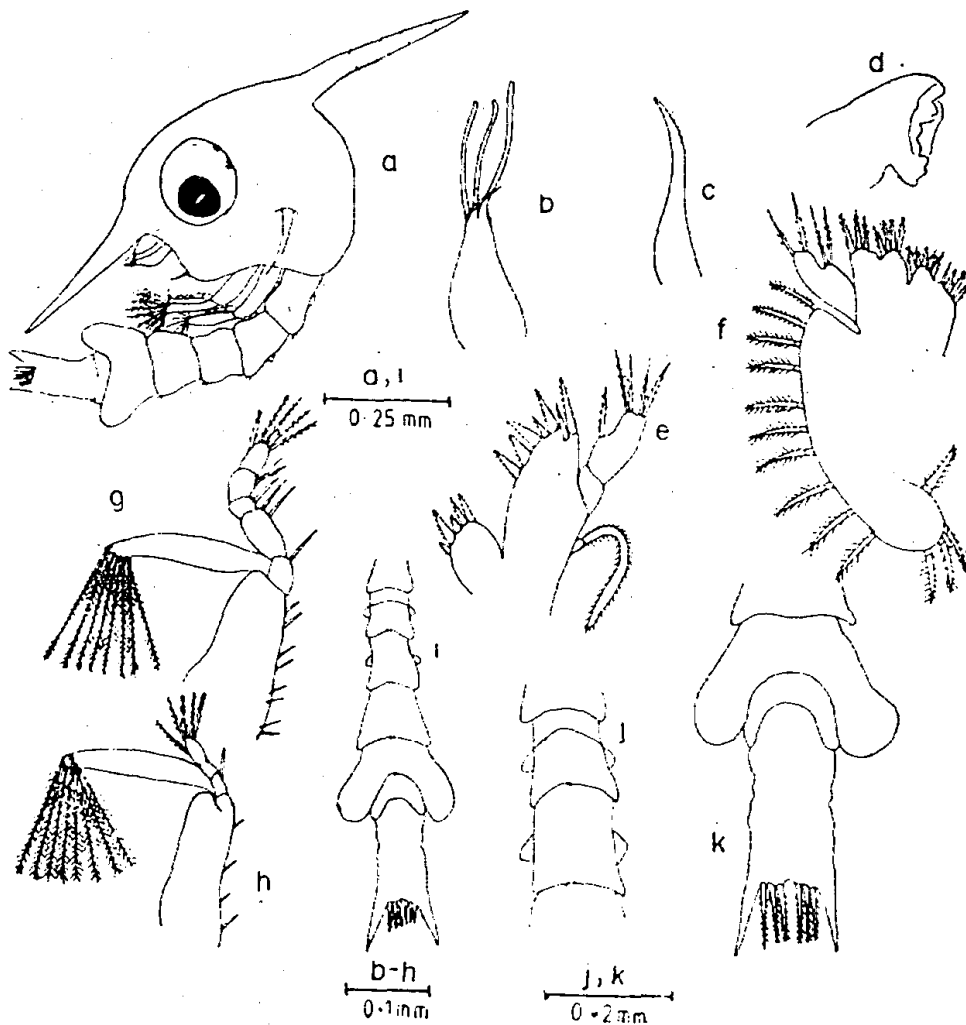


Fig. 3. Third zoea of *M. maculatus*.
 a. lateral view of entire larva; b. antennule; c. antenna; d. mandible;
 e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen
 (dorsal view); j. 2nd & 3rd abdominal somites magnified; k. telson.

FOURTH ZOEAE (Fig. 4)

Dorsal spine length 0.91 mm; rostral spine length 0.70 mm; lateral spine length 0.31 mm; carapace length 0.91 mm; abdomen length 1.21 mm; telson length 0.31 mm and telson width 0.14 mm.

Carapace (Fig. 4a): Increased in size, dorsal spine with 7 setae. *Antennule* (Fig. 4b): Base broader than in previous stage. *Antenna* (Fig. 4c): Endopod as a rudimentary bud. *Mandible* (Fig. 4d): No change. *Maxillule* (Fig. 4e): Coxal endite bilobed with 4, 3 setae distalwards; basal endite with 5 setae on proximal and 4 setae on distal lobes. *Maxilla* (Fig. 4f): Basipodite with 5, 4 setae on proximal and distal lobes respectively; scaphognathite with 20 plumose setae all over margin. *Maxillipeds I & II* (Figs. 4g & h):

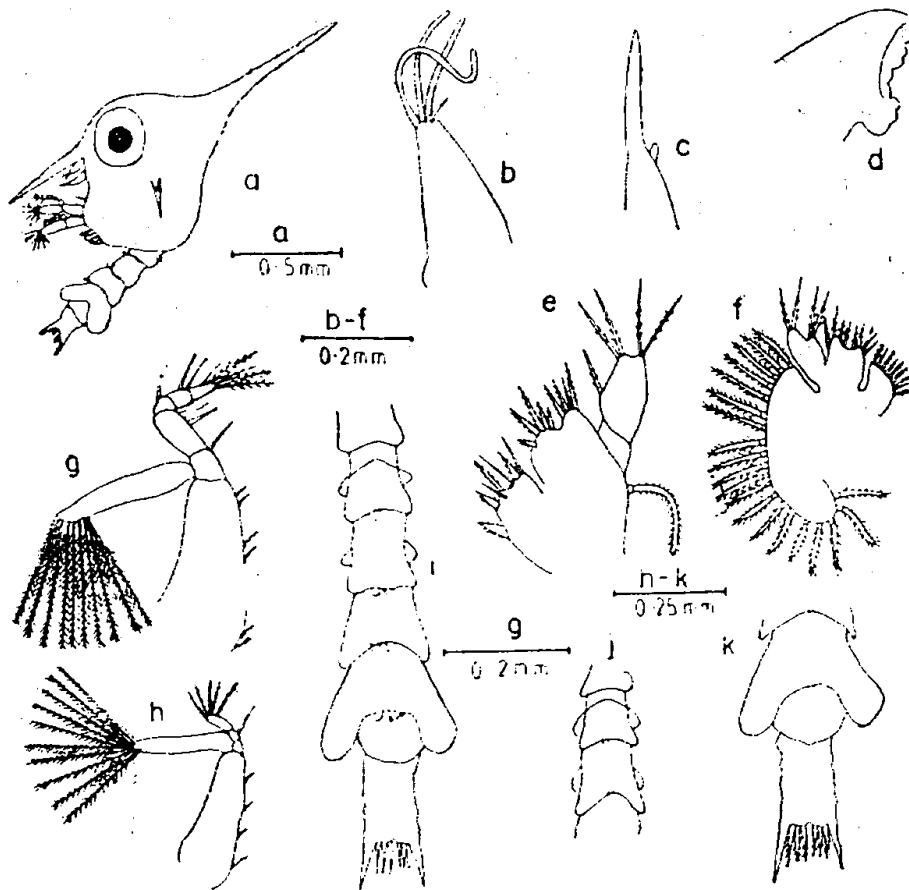


Fig. 4. Fourth zoea of *M. maculatus*.
 a. lateral view of entire larva; b. antennule; c. antenna; d. mandible;
 e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen
 (dorsal view); j. 2nd & 3rd abdominal somites magnified; k. telson.

Exopodite with 10 plumose natatory setae. *Maxilliped III and other appendages*: Maxilliped III and pereiopods appear as rudimentary buds. *Abdomen* (Figs. 4i & j): Somites 2 to 5 with pleopod buds developed. *Telson* (Fig. 4k): Unchanged.

FIFTH ZOEAE (Fig. 5)

Dorsal spine length 0.95 mm; rostral spine length 0.72 mm; lateral spine length 0.36 mm; carapace length 1.01 mm; abdomen length 1.52 mm; telson length 0.38 mm and telson width 0.18 mm.

Carapace (Fig. 5a): Dorsal spine longer with 3 setae a mediadorsal knob present between dorsal and rostral spines, ventral margin with 4 setae.

Antennule (Fig. 5b): With 11 aesthetascs distally, endopod bud developed. *Antenna* (Fig. 5c): Endopod bud well developed. *Mandible* (Fig. 5d): Now palp appears as a bud. *Maxillule* (Fig. 5e): Basal endite with 11 setae.

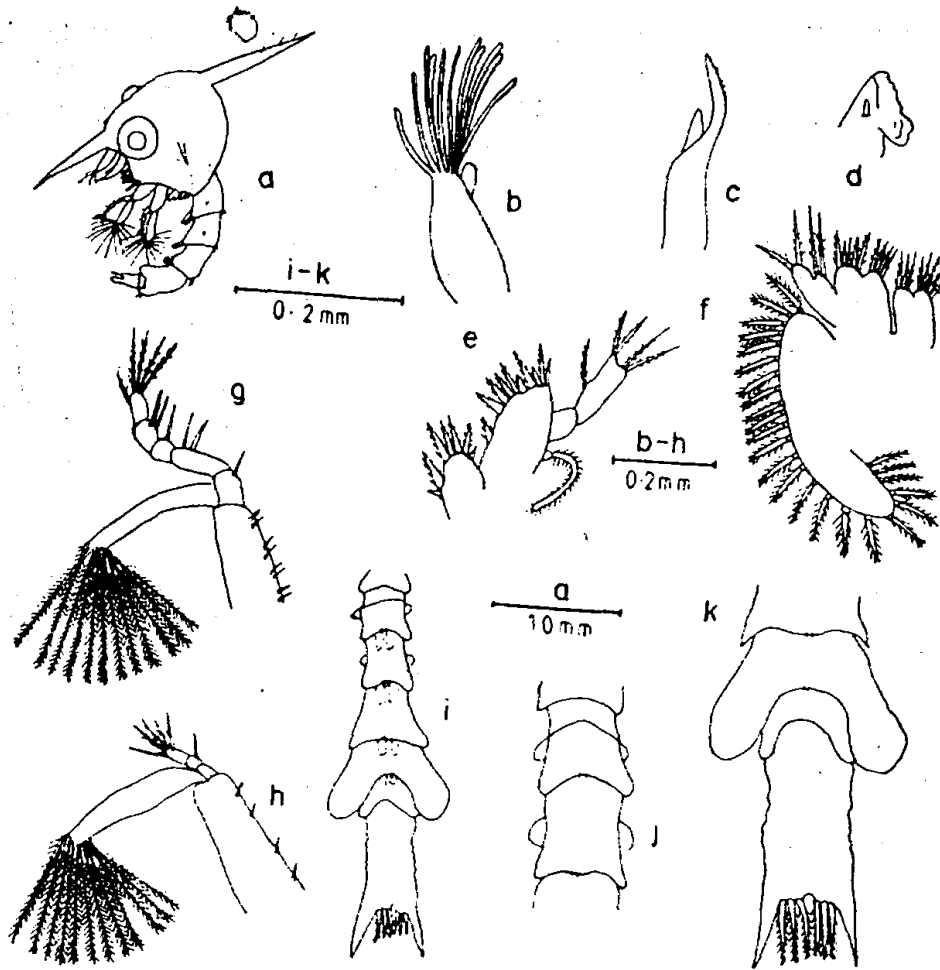


Fig. 5. Fifth zoea of *M. maculatus*.

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. 2nd & 3rd abdominal somites magnified; k. telson.

Maxilla (Fig. 5f): Coxal endite with 5 and 3 setae and basal with 4 setae on proximal and 5 setae on distal lobes; scaphognathite fully covered marginally with 24 plumose setae,

Maxillipeds I & II (Figs. 5g & h): Exopodite with 12 plumose natatory setae.

Maxilliped III and other appendages: Appear as elongated buds.

Abdomen (Figs. 5 i&j): Unchanged except for elongation of pleopod buds.

Telson (Fig. 5k): Increased in length.

MEGALOPA (Fig. 6)

Carapace length 1.79 mm; carapace width 1.60 mm.

Carapace (Fig. 6a): Smooth in dorsal view, rostrum ventrally deflexed, frontal region divided into 4 lobes with a central notch, the border of carapace fringed with marginal setae; eyes large and stalked.

Antennule (Fig. 6b): Peduncle 3-segmented, naked; unsegmented inner ramus with 2 terminal setae; outer ramus 4-segmented with 6, 7, 9 aesthetascs respectively and terminal segment with 2 setae.

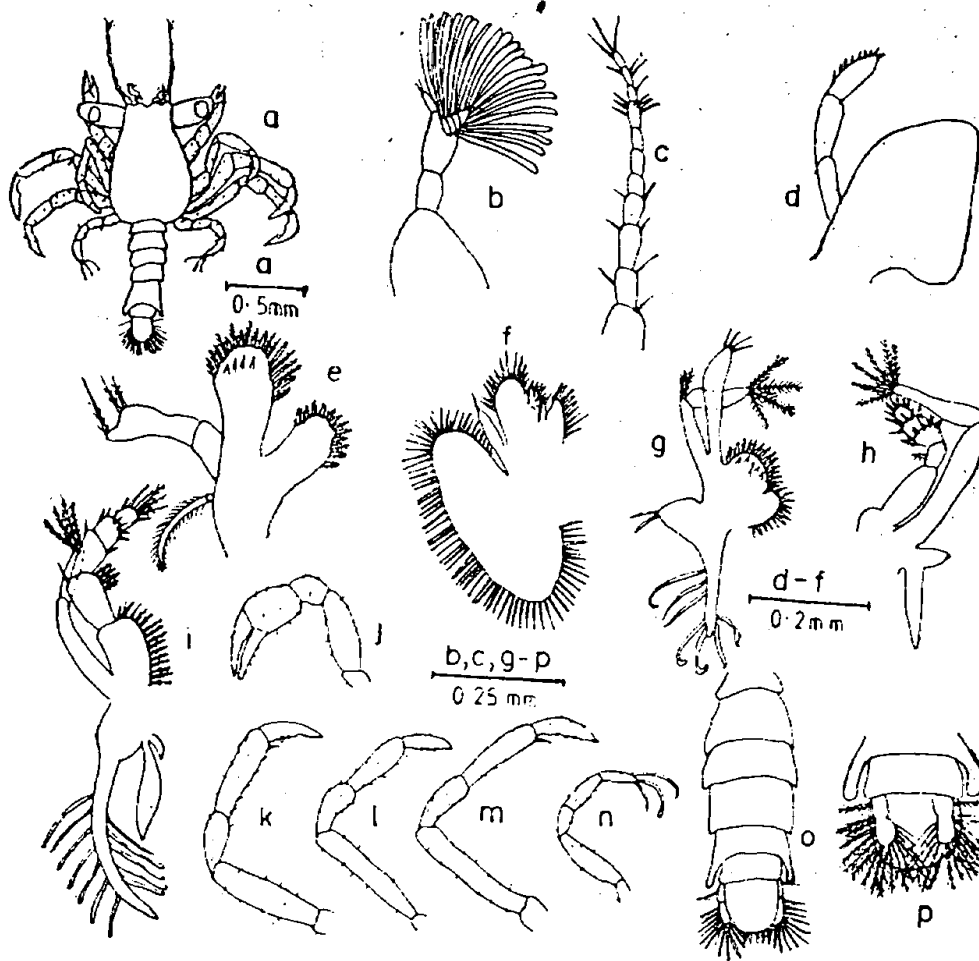


Fig. 6 Megalopa of *M. maculatus*.

a. dorsal view of entire megalopa; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. maxilliped III; j. first pereopod; k. second pereopod; l. third pereopod; m. fourth pereopod; n. fifth pereopod; o. abdomen (dorsal view); p. telson + uropods.

Antenna (Fig. 6c): Proximal segment with 1 seta, penultimate and ultimate segments each with 2 setae; flagellum 8-segmented with setation 2, 0, 0, 0, 6, 1, 3, 3 distalwards.

Mandible (Fig. 6d): 3-segmented palp with 9 setae on distal segment.

Maxillule (Fig. 6e): Coxal and basal endites with 12, 22 setae respectively; endopodite 2-segmented with 0, 3 setae; 1 long marginal plumose seta continued from zoeal stages.

Maxilla (Fig. 6f): Proximal lobe of coxal endite with 9 setae, distal lobe with 1 seta; basal endite bilobed with 12 and 13 setae; endopodite reduced to simple palp with 1 seta; scaphognathite with 76 plumose marginal setae.

Maxilliped I (Fig. 6g): Coxal and basal endites with 12 and 20 setae respectively; endopodite unsegmented with 4 setae; exopodite 2-segmented with 2 and 4 setae distalwards; epipodite with 9 long non-plumose setae.

Maxilliped II (Fig. 6h): 5-segmented endopodite with setal formula of 0, 1, 5, 5, 7 setae distalwards; exopodite 2-segmented with 6 setae distally; epipodite present without any setae.

Table I. Comparison of zoeal characters of *M. maculatus*, *M. latifrons* and *M. messor* (First zoea only).

Stage and characters	<i>M. maculatus</i> (Present work)	<i>M. latifrons</i> (Kakati, 1982)	<i>M. messor</i> (Rajabai, 1961)
ZOEA I			
<i>Maxillule</i>			
Coxal endite	5 setae	5 setae	1 seta
Basal endite	5 setae	5 setae	4 setae
<i>Maxilla</i>			
Coxal endite	6 setae	7 setae	5 setae
Basal endite	7 setae	8 setae	7 setae
<i>Maxilliped I</i>			
Endopodite setation	1,2,1,2,5	1,2,1,2,5	2,1, 0, 3, 5
ZOEA II			
<i>Carapace</i>			
Ventral marginal setae	Absent	Present	
<i>Maxillule</i>			
Coxal endite	5 setae	6 setae	
<i>Maxilla</i>			
Coxal endite	6 setae	8 setae	
Basal endite	7 setae	9 setae	
<i>Abdomen</i>			
Collar on 2nd somite	Present	Absent	
ZOEA III			
Dorsal spine setae	Present (8 in number)	Absent	
<i>Maxillule</i>			
Basal endite	7 setae	8 setae	
Coxal endite	5 setae	6 setae	
<i>Maxilla</i>			
Basal endite	7 setae	9 setae	
Coxal endite	9 setae	8 setae	
Scaphognathite	14 plumose setae	17 plumose setae	
<i>Abdomen</i>			
Collar on 2-segment	Present	Absent	

Stage and Characters	<i>M. maculatus</i> (Present work)	<i>M. latifrons</i> (Kakati, 1982)
ZOEA IV		
<i>Carapace</i>		
Ventral marginal setae	1 seta	2 setae
<i>Maxillule</i>		
Coxal endite	7 setae	6 setae
<i>Maxilla</i>		
Coxal endite	9 setae	8 setae
Scaphognathite	20 plumose setae	21 plumose setae
<i>Maxilliped I</i>		
Endopodite setation	1,2,1,2,5	1,2,1,2,6
<i>Abdomen</i>		
Collar on 2nd segment	Present	Absent
ZOEA V		
<i>Carapace</i>		
Ventral setae	3	6
Medio-dorsal-knob	Present	Absent
<i>Maxillule</i>		
Coxal endite	7 setae	6 setae
Basal endite	10 + 1 marginal setae	9 + 2 marginal setae
<i>Maxilla</i>		
Coxal endite	8 setae	10 setae
Basal endite	9 setae	14 setae
Scaphognathite	24 plumose setae	40 plumose setae
<i>Maxilliped I</i>		
Endopodite setation	1,2,1,2,5	2,2,1,2,5
Basipodite	8 setae	5 setae
<i>Maxilliped III</i>		
Basipodite	4 setae	6 setae
<i>Abdomen</i>		
Collar on 2nd segment	Present	Absent

Maxilliped III (Fig. 6i): Endopodite 5-segmented with 16, 5, 2, 7, 6 setae distally; exopodite 2-segmented with 4 setae on distal segment; epipodite with 12 setae on distal end; 2 podobranchs present.

Pereiopod (Figs. 6 j-n): 5 pairs of well developed pereiopods covered with setae, chelipeds equal, dactylus of 2nd to 4th pereiopods with 3 strong blunt spines, 5th pereiopod with 3 'feelers' and 2 small outer spines on dactylus.

Abdomen (Fig. 6 o): 6 somites, portero-lateral spines present from 2 to 4th somites, 5th somite lobe expansions upto 6th somite, 2 to 5th somites with 4 pairs of pleopods with setation on exopod as 21, 21, 22, 18, endopod with 4 hooks, uniramous uropods present on 6th somite with 16 setae on exopodite and 1 seta on protopodite.

Telson (Fig. 6p): Rounded with 5 setae on posterior margin.

Chromatophores: Megalopa looks dark-violet in colour under low magnification. Chromatophores are stellate type, present on eyes, bases of antennule, antenna, mandible, front of carapace and all pereiopods.

Table II. Comparison of megalopal characters between *M. maculatus* and *M. latifrons*

Characters	<i>M. maculatus</i> (Present work)	<i>M. latifrons</i> (Kakati, 1982)
Antennal setation	1,2,2,2,0,0,6,1,2,3	1,2,2,0,0,3,5,1,2,2
<i>Maxillule</i>		
Basal endite	22 setae + 1 marginal seta	20 setae + 2 marginal setae
Endopodite	3 setae	Absent
<i>Maxilla</i>		
Coxal endite	10 setae	12 setae
Basal endite	25 setae	21 setae
Scaphognathite	76 plumose setae	71 plumose setae
<i>Maxilliped I</i>		
Protopodite	32 setae	27 setae
Endopodite	8 setae	2 setae
Epipodite	9 setae	7 setae
<i>Maxilliped II</i>		
Endopodite setation	0,1,5,5,7	0,0,1,4,10
<i>Maxilliped III</i>		
Endopodite setation	16,5,2,7,6	14,6,1,8,5
Epipodite	12 setae	14 setae
<i>5th pereiopod feelers</i>	3	1
<i>Pleopods</i>		
Exopodal setation	21,21,22,18,16 + 1	21,21,21,21,16 + 2
<i>Telson</i>	5 marginal setae	Absent

The larval development of *M. maculatus* reared in the laboratory comprises 5 zoeal and 1 megalopa stage. Similar results were also observed for *M. latifrons* by Kakati (1982). Rajabai (1961) has described only the first zoeal stage of *M. messor*. Therefore, only the first zoeal characters of *M. maculatus* are compared with the first zoea of *M. messor* and with all zoeal stages of *M. latifrons* (Table I).

The absence of lateral carapace spine in the first zoeal stage in all three species studied so far, suggests that it may be a generic character. However, only further studies on the larval development of the remaining species of this genus will confirm the above suggestion. The presence of collar on 2nd abdominal somite in all zoeal stages of *M. maculatus* will serve as useful character in identifying the zoeae from those of *M. latifrons*.

The megalopa of *M. maculatus* can be distinguished from that of *M. latifrons* based on major differences presented in Table II. It is desirable to study the complete larval development of remaining species of the genus to formulate keys for field identification.

ACKNOWLEDGEMENTS

Authors are thankful to Prof K. Krishnamurthy, Director, for facilities and Prof. V. K. Venugopalan for helpful suggestions. Financial assistance from C. S. I. R., New Delhi is gratefully acknowledged.

REFERENCES

- Kakati, V. S., 1982. Larval development of Indian Grapsid crab, *Metopograpsus latifrons* H. Milne Edwards *in vitro*, *Indian Journal of Marine Sciences*, **11**: 311-316.
- Mohan, R. and T. Kannupandi, 1985. Life history of laboratory reared spider crab, *Doclea ovis* (Herbst). *Indian Journal of Marine Sciences*, **14**: 24-30.
- Rajabai, K. G., 1961. Studies on the larval development of Brachyura. VII. Early development of *Metopograpsus messor* (Forsk.), *Plagusia depressa squamosa* (Herbst), *Metasesarma rousseauxii* A. M. Edwards and *Sesarma tetragonum* (Fabricius) of the family Grapsidae. *Journal of Zoological Society of India*, **13**: 154-165.