

THE ZOEAE, MEGALOPA AND FIRST CRAB OF THE  
MANGROVE CRAB *METAPLAX ELEGANS* DE MAN,  
CULTURED IN THE LABORATORY

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ABSTRACT

The complete larval development in the laboratory of the crab *Metaplex elegans* de Man from hatching to first crab stage is described. Five zoeal stages and a megalopa appeared before moulting into first crab stage at the salinity 25 ppt and temperature 29-30°C. All the larval and first crab stages of *M.elegans* are compared with other known species of the subfamily Sesarminae.

Key-words: Zoeae, Megalopa, First crab, *Metaplex elegans*, *M.distincta*, Pitchavaram mangrove.

INTRODUCTION

Eventhough 6 species of the crabs of the genus *Metaplex* (Grapsidae: Sesarminae) are represented in Indian waters (Alcock, 1900; Chhapgar, 1957), very little information is available on their larval development. Based on laboratory rearing, Krishnan and Kannupandi (1988) described the complete larval development of *M.distincta* consisting of 5 zoeal stages and a megalopa. *M.elegans* is one of the most common crabs inhabiting Pitchavaram mangroves. The present study describes not only the complete larval development of *M.elegans* from hatching to first crab stage under laboratory conditions but also compares with other known larvae in the subfamily Sesarminae.

MATERIAL AND METHODS

Berried females of *M.elegans* were collected from Pitchavaram mangrove (11°29'N lat.; 79°49'E long.) on August 20, 1986 and were kept in filtered sea water of salinity 25 ppt till larvae hatched. The larvae hatched on August 22, 1986 midnight and the hatching process lasted for 5 minutes. After hatching, the larvae were removed to separate bowls with 10 larvae per bowl at salinity 25 ppt and temperature 29-30°C and fed with freshly hatched *Artemia* nauplii of Greatwall (PR China) brand. Other details of rearing followed is as described by Pasupathi and Kannupandi (1986).

RESULTS AND DISCUSSION

Larvae of *M.elegans* passed through 5 zoeal stages and a megalopa stage before the first crab instar, requiring minimum of 17 days. The 2nd, 3rd,

4th, 5th zoeae, megalopa and first crab appeared on 3rd, 5th, 7th, 9th, 12th and 17th day respectively.

After describing the first zoea stage in detail, only morphological changes are described for subsequent zoeal stages.

*First zoea: (Fig.1):* Dorsal spine length 0.17 mm; rostral spine length 0.15 mm; lateral spine length 0.09 mm; carapace length 0.44 mm; abdomen length 0.70 mm; telson length 0.18 mm.

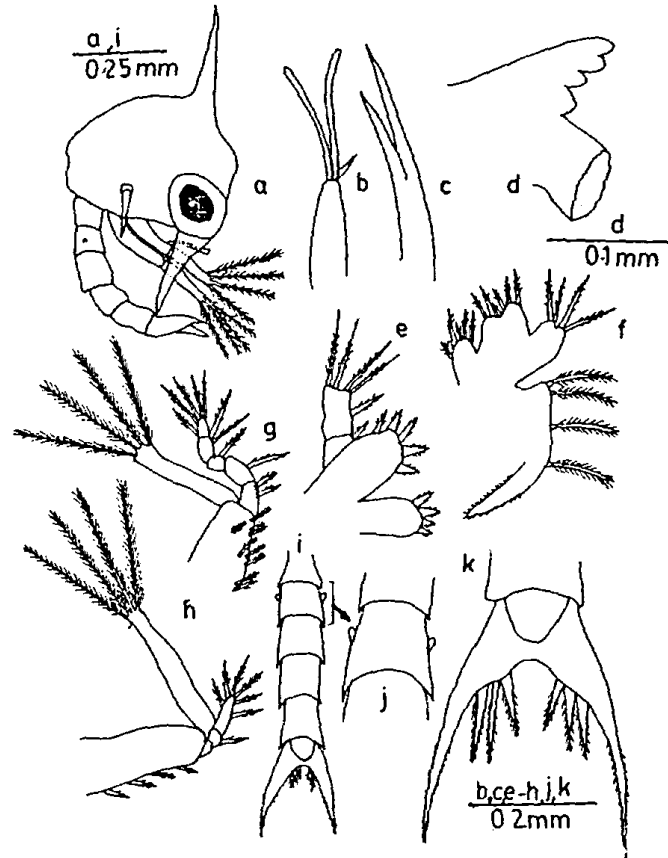


Fig.1 First zoea of *Metaplex elegans*. a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen (dorsal view); j. 2nd abdominal segment magnified and k. telson.

*Carapace (Fig.1a):* Smooth, globose with curved dorsal spine, rostral spine and short lateral spines; a medio-dorsal knob midway between bases of dorsal and rostral spine; postero-lateral margin of carapace indistinct and irregularly dentate but without setae; eyes sessile.

*Antennule (Fig.1b):* Unsegmented with 2 terminal aesthetascs plus 1 seta.

*Antenna (Fig.1c):* Protopod gradually tapering and bearing 9 small sharp spines; exopod  $\frac{3}{4}$  of total length of protopod and without any setae.

*Mandible (Fig.1d):* Symmetrical, incisor with 4 blunt teeth, molar process irregularly dentate.

*Maxillule (Fig.1e)*: Coxal and basal endites each with 4,5 serrated spines respectively; endopod 2-segmented, distal segment with 5 setae (2+2+1), proximal segment with 1 seta.

*Maxilla (Fig.1f)*: Coxal endite unilobate with 5 setae; basal endite bilobed with 2 setae on proximal and 4 setae on distal lobes; endopod bilobed with 2 setae on each lobe; scaphognathite with 4 marginal plumose setae and long posterior lobe with small spinules distally representing future setae.

*Maxilliped I (Fig.1g)*: Basis with 9 setae; endopod 5-segmented with setation 2,1,1,2,5; endopod unsegmented with 4 plumose natatory setae.

*Maxilliped II (Fig.1h)*: Basis with 4 setae; endopod 3-segmented with setation 0,2 and 6 distalwards; exopod unsegmented with 4 plumose natatory setae.

*Abdomen (Fig.1 i&j)*: 5-segmented, segment 2 with a pair of upwardly directed lateral knobs; segment 3-5 with postero-lateral spine on each side.

*Telson (Fig.1k)*: Forked, each furca with very fine spinules, inner margin of telson provided with 3 pairs of serrated spines.

*Chromatophores*: Reddish chromatophores around eye, on abdominal segments 1-3; brownish colour on mandible; yellow pigmentation observed on telson. This pattern was observed in subsequent zoeal stages also.

*Second zoea (Fig.2)*: Dorsal spine length 0.33 mm; rostral spine length 0.25 mm; lateral spine length 0.12 mm; carapace length 0.52 mm; abdomen length 1.00 mm; telson length 0.21 mm.

*Carapace (Fig.2a)*: Enlarged, postero-dorsal margin with 2 setae, postero-lateral margin within 2 setae; now dentate margin disappear; eyes stalked.

*Antennule (Fig.2b)*: 3 aesthetascs and 1 seta.

*Maxillule (Fig.2e)*: An outer marginal seta developed basally. It is short, blunt and serrated. This was present in all subsequent stages and the first crab.

*Maxilla (Fig.2f)*: Coxal and basal endites with 7 setae each; scaphognathite with 2 groups of setae, a distal group of 5 and proximal of 1.

*Maxilliped I (Fig.2g)*: Endopod with setal formula 2,2,1,2,5; exopod unsegmented with 6 plumose natatory setae as in second maxilliped (Fig.2h).

*Abdomen (Fig.2i)*: Segment 1 with a long mid dorsal seta on posterior margin.

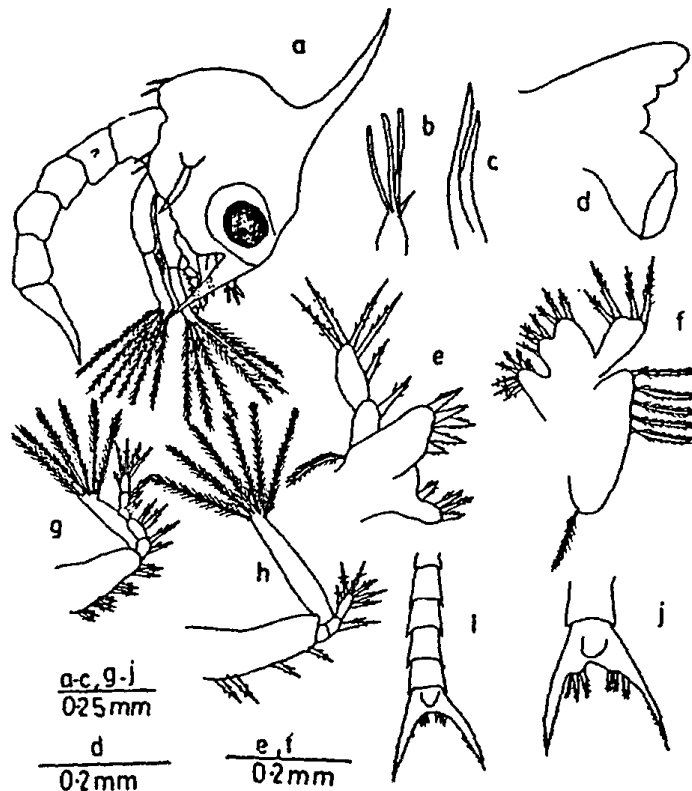


Fig.2. Second zoea of *M. elegans*. a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen (dorsal view) and j. telson.

*Third zoea (Fig.3)*: Dorsal spine length 0.77mm; rostral spine length 0.72mm; carapace length 0.90mm; abdomen length 0.16mm; telson length 0.24mm.

*Carapace (Fig.3a)*: Postero-dorsal margin with 2 setae; postero-lateral margin with 6 setae.

*Antennule (Fig.3b)*: 4 unequal aesthetascs plus 1 seta.

*Antenna (Fig.3c)*: Protopod with 17 small sharp spines; endopod bud developed.

*Maxillule (Fig.3e)*: Basal endite with 8 spines.

*Maxilla (Fig.3f)*: Coxal and basal endites with 6,9 setae respectively; scaphognathite fringed with 8+6 plumose setae.

*Maxilliped I (Fig.3g)*: Endopod setal formula 2,2,2,2,5; exopod with 8 plumose natatory setae as in second maxilliped (Fig.3h).

*Abdomen (Fig.3i)*: Segment 6 separated, segment 1 with 3 dorso-median setae, pleopod buds developed on segments 2-5.

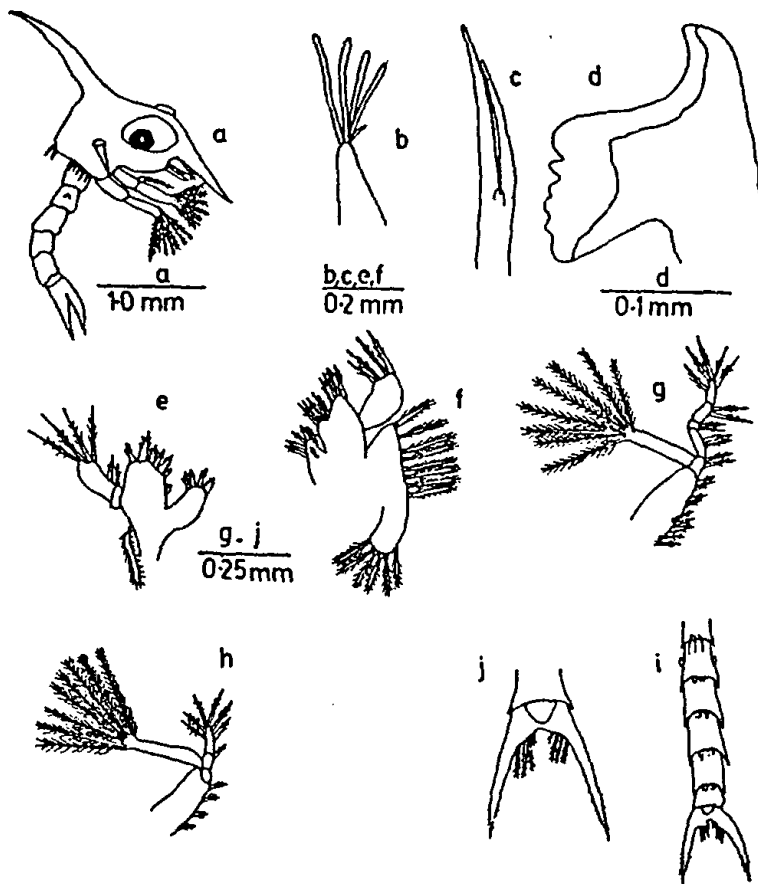


Fig.3. Third zoea of *M. elegans*. a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen (dorsal view) and j. telson.

*Telson (Fig.3j)*: Setal formula 4+4.

*Fourth zoea (Fig.4)*: Dorsal spine length 0.78 mm; rostral spine length 0.74 mm; lateral spine length 0.16 mm; carapace length 0.92 mm; telson length 0.28 mm.

*Carapace (Fig.4a)*: Postero-dorsal margin with 4 setae; postero-lateral margin with 10 setae; medio-dorsal knob disappeared.

*Antennule (Fig.4b)*: 5 aesthetascs plus 1 seta.

*Antenna (Fig.4c)*: Protodopod with 11 small spines; endopod bud well developed.

*Maxillule (Fig.4e)*: Basal endite with 10 spines.

*Maxilla (Fig.4f)*: Coxal endite with 6 setae; basal endite with 10 setae; scaphognathite with 21 plumose setae all over margin.

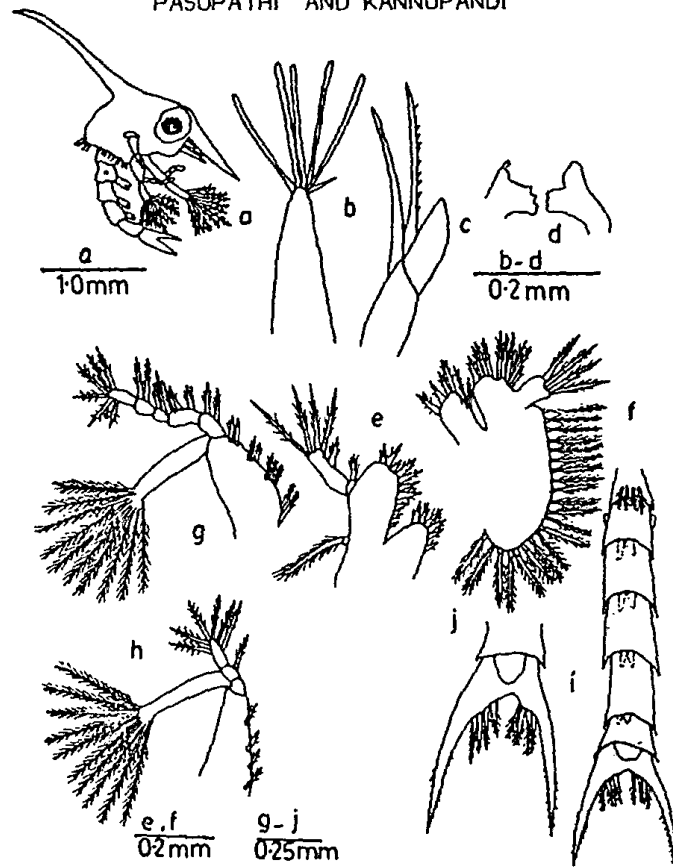


Fig.4. Fourth zoea of *M. elegans*. a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen (dorsal view) and j. telson.

**Maxilliped I (Fig.4g):** Endopod with 2,3,2,2,6 setae and exopod with 10 plumose natatory setae like in second maxilliped (Fig.4h).

**Maxilliped III and Pereiopods** appear as small rudimentary buds.

**Abdomen (Fig.4i):** Segment 1 with 4 setae; pleopod buds now well developed on segments 2-5.

**Fifth zoea (Fig.5):** Dorsal spine length 0.79 mm, rostral spine length 0.77 mm; lateral spine length 0.16 mm; carapace length 1.25 mm; abdominal length 1.86 mm; telson length 0.30 mm.

**Carapace (Fig.5a):** Postero-dorsal border with 5 setae, postero-lateral margin with 17 setae.

**Antennule (Fig.5b):** Now 2-segmented basal region swollen; 4 aesthetascs on penultimate segment; inner ramus is present as a small bud.

**Antenna (Fig.5c):** Protopod now with 12 small spines; exopod equal to protopod and with 1 seta.

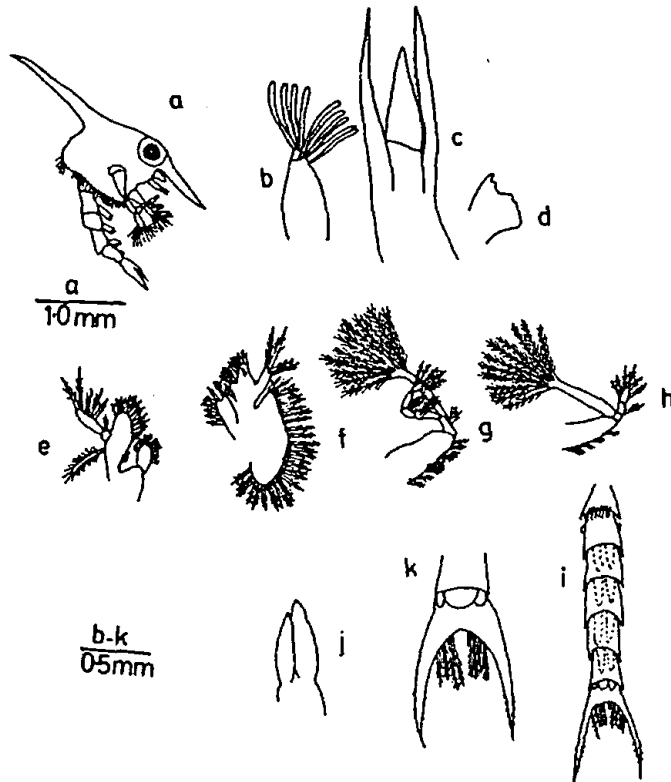


Fig.5. Fifth zoea of *M. elegans*. a. lateral view of entire larva; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. abdomen (dorsal view); j. pleopod bud and k. telson.

*Mandible (Fig.5d)*: Palp rudimentary.

*Maxillule (Fig.5e)*: Coxal endite with 9 spines, basal endite with 15 spines.

*Maxilla (Fig.5f)*: Coxal endite bearing 2 more setae on proximal lobe; basal endite now with 6 spines on proximal lobe; scaphognathite fringed with 29 marginal plumose setae.

*Maxilliped I & II (Figs.5g&h)*: Exopod with 12 plumose natatory setae.

*Maxilliped III (Fig.5j) and Pereiopods*: Buds well developed.

*Abdomen (Fig.5i)*: Segment 1 with 8 setae; pleopod buds elongate biramous.

*Telson (Fig.5k)*: One more small setae added to right furca.

*Megalopa (Fig.6)*: Carapace length 1.73 mm; carapace width 1.02 mm; abdomen length 1.15 mm.

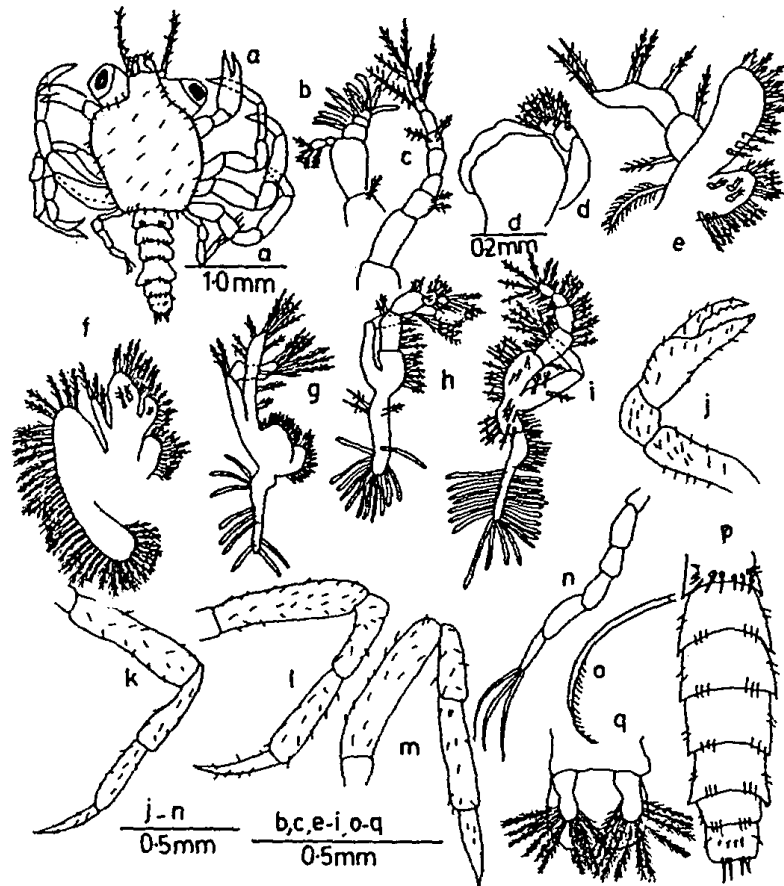


Fig.6. Megalopa of *M. elegans*. a. dorsal view of entire megalopa; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. maxilliped III; j. first pereiopod; k. second pereiopod; l. third pereiopod; m. fourth pereiopod; n. fifth pereiopod; o. hooked setae magnified; p. abdomen (dorsal view) and q. telson + uropods.

**Carapace (Fig.6a):** Oval, longer than abdomen; rostrum deflected and therefore not visible dorsally; antero-lateral margin indistinctly and irregularly dentate; eyes large.

**Antennule (Fig.6b):** Peduncle 2-segmented, basal segment bearing 2 setae and distal segment smooth, inner ramus 2-segmented with 4 setae on terminal segment, outer ramus 3-segmented, antepenultimate segment with 3 aesthetascs, penultimate and ultimate segments with 3,6 aesthetascs respectively.

**Antenna (Fig.6c):** Peduncle 3-segmented, terminal segment having 2 setae; flagellum 7-segmented. setal formula of flagellum 0,0,2,0,2,1,3 distalwards.

**Mandible (Fig.6d):** 3-segmented palp armed with 7 setae on terminal and 2 setae on penultimate segments, no prominent teeth on cutting edges.



*Maxillule (Fig.6e)*: Coxal and basal endites with 19 and 17 spines respectively; endopod 2-segmented with 2,5 setae distalwards; outer basal seta continuous. The hairs on the seta are long and slender which are also retained in the adult but are thick. Hairs are used for cleaning the gills and collecting the food particles.

*Maxilla (Fig.6f)*: Coxal endite with 12 setae, basal endite bilobed bearing 10 and 10 setae on proximal and distal lobes; endopod unsegmented with 3 setae; scaphognathite fringed with 43 plumose setae.

*Maxilliped I (Fig.6g)*: Coxal endite with 16 setae and basal one with 15 exopod 2-segmented with 6 setae on terminal and 2 setae on penultimate segments, endopod unsegmented with 4 terminal, 7 subterminal setae; epipod with 9 long nonplumose hairs.

*Maxilliped II (Fig.6h)*: Exopod 2-segmented with 4 setae on distal segment; endopod 5-segmented with setal formula 7,8,2,10,4; epipod with 15 setae.

*Maxilliped III (Fig.6i)*: Exopod 2-segmented with 3 and 5 setae; endopod 5-segmented with 14,10,7,9,11 setae distalwards, protopod with 17 setae; epipod with 11 proximal, 22 distal plain setae.

*Pereiopods (Figs 6j-n)*: 5 pairs of well developed sparsely covered with setae, without any spines, dactylus of cheliped little longer than propodus; 2 to 4th pereiopods same in structure and 4th longer than others, all pereiopods with claw like dactylus; 5th pereiopod distinct from others, having 3 long terminally hooked setae (feelers) on dactylus.

*Abdomen (Fig.6o)*: With 6 segments plus a telson; segment 1 with 12 dorsal setae; pleopods present on segments 2-5 bearing 17,17,17,16 setae on exopod and 3 hooks on endopod, uropod (pleopod of 6th segment) uniramous with 11 setae.

*Telson (Fig.6p)*: Semi-circular, smooth and with 4 setae on posterior margin and a row of 4+2 setae dorsally.

*Chromatophores*: Megalopa appears yellow in colour mingled with red, black, brown and yellow pigments, red colouration is seen on eyestalk, ischium of pereiopods and abdominal segments 1-4, presence of black pigmentation on optic region and abdominal segments, brown chromatophores are present on mandibles.

*First crab (Fig.7)*: Carapace length 1.49 mm; carapace width 1.46 mm.

*Carapace (Fig.7a)*: Quadri-lateral, smooth, anterolateral border with 5 teeth, eyes reach almost to the end of the orbital trenches.

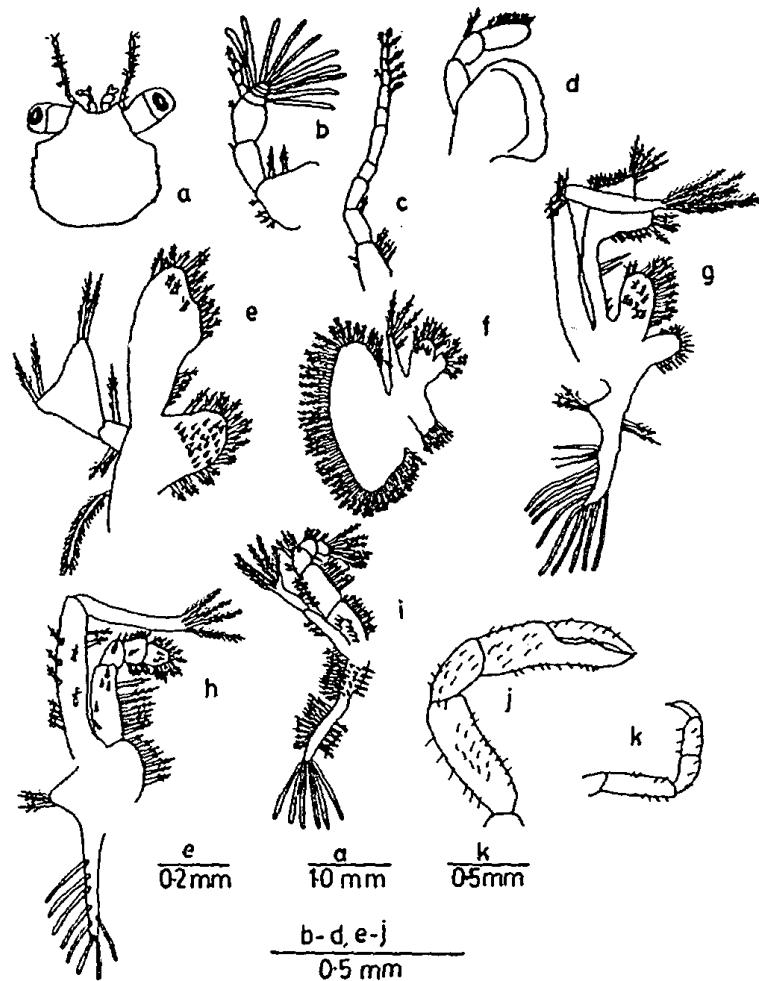


Fig.7. First crab of *M. elegans*. a. dorsal view of first crab; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. maxilliped I; h. maxilliped II; i. maxilliped III; j. first pereopod and k. fifth pereopod.

**Antennule (Fig.7b):** Peduncle 3-segmented with 6,3 and 1 setae distalwards, inner flagellum 3-segmented with 1 seta terminally, outer flagellum 3-segmented with 2,2 and 6 aesthetascs distalwards.

**Antenna (Fig.7c):** Peduncle 3-segmented, flagellum 7-segmented setal formula of peduncle 6,1,0 and that of flagellum 0,0,4,1,3,1,3 distalwards.

**Mandible (Fig.7d):** 3-segmented palp now with 9 setae on terminal and 1 seta on penultimate segment, cutting edge almost smooth.

**Maxillule (Fig.7e):** Coxal endite bears 46 spines while the basal endite has 26 spines, endopod 2-segmented bearing 3 and 4 setae distalwards. Maxillule endites setation numerous in adult. No structural change in endopod segments.

**Maxilla (Fig.7f):** Coxal endite with 6 setae, basal endite bilobed bearing 7,12 setae on proximal and distal lobes; endopod with 5 setae; scaphognathite with 52 plumose setae. The setation and morphology of maxillipeds of the first crab stage are unlike in adults, where setation is numerous and also considerable morphological changes occur in the maxillipeds.

**Maxilliped I (Fig.7g):** Coxal endite with 17 setae; basal endite has 24 setae; exopod 2-segmented with 4 setae at terminal segment and 5 setae at penultimate segment; endopod unsegmented with 26 setae terminal, 4 sub-terminal setae; epipod bears 17 setae.

**Maxilliped II (Fig.7h):** Exopod 2-segmented with 11 setae on proximal segment and 4 setae at distal segment; endopod 5-segmented with setal formula 7,13,1,11,14; epipod with 16 setae.

**Maxilliped III (Fig.7i):** Exopod 2-segmented with setation of 5,5 setae distalwards; endopod 5-segmented with 17,12,4,8,6 setae distalwards; protopod with 27 setae; epipod with 6 proximal, 18 distal setae.

**Pereiopods (Figs.7j-k):** All five pairs distinct, sparsely covered with setae; cheliped present; pereiopods 2 to 4 similar in structure; hooked setae (feelers) on 5th pereiopod of megalopa lost in this stage.

**Abdomen:** 7 free segments; 5 pairs of biramous pleopods and a pair of biramous uropods; pleopods and uropods with numerous setae.

Previous work on the larval development of *Metaplex distincta* (Krishnan and Kannupandi, 1988) indicates that it comprises 5 zoeal and a megalopal stage before moulting to first crab instar. The present study also shows similar pattern of larval development.

*Metaplex elegans* possesses lateral carapace spines 2+2 setae on the endopod of maxilla and 3 or more than 3 pairs of posterior telson processes in all zoeal stages. These larval features of *M. elegans* conform to the Rice's (1980) list of larval characters belonging to first group of the sub-family Sesarminae which includes the genera *Cyclograpsus* (Costlow and Fagetti, 1967; Fagetti and Compodonico, 1971; Gore and Scotto, 1982); *Chasmagnathus* (Baba and Fukuda, 1972); *Helice* (Baba and Moriyama, 1972) and *Metaplex* (Krishnan and Kannupandi, 1988).

The zoeae of *M. elegans* can easily be distinguished from those of *M. distincta* by the following abdominal characters; presence of dorso-lateral knobs only on segment 2; absence of postero-dorsal setae on segments 2-5.

Besides, a detailed comparison is made between *M. elegans* and *M. distincta* the major differences are listed in Table 1.

Despite many differences, the zoeae of *M. elegans* and *M. distincta* share the common characters such as endopod setation of maxillule (1,5), presence of lateral carapace spines and the maxilliped II endopod setation. This would suggest that the features may be genus specific and warrants further studies in this direction.

Table I— Differences between the zoeal characters of *M. elegans* and *M. distincta*.

Stage and characters	<i>M. elegans</i> (Current study)	<i>M. distincta</i> (Krishnan and Kannupandi, 1988)
<b>Zoea I</b>		
Antennule	2 aesthetascs + 1 seta	3 aesthetascs + 1 seta
Maxillule		
Basal endite	5 spines	4 spines
Maxilla		
Coxal endite	5 setae	6 setae
Basal endite	6 setae	8 setae
Maxilliped I		
Basipod	9 setae	10 setae
Maxilliped II		
Endopod setation	0,1,6	1,1,5
Abdomen		
Dorso-lateral knob	present only on segment 2	present on segments 2 & 3
<b>Zoea II</b>		
Carapace		
Postero-lateral margin	2 setae	1 seta
Antennule	4 aesthetascs	3 aesthetascs
Maxillule		
Basal endite	5 spines	7 spines
Maxilla		
Coxal endite	7 setae	6 setae
Basal endite	7 setae	8 setae
Maxilliped II		
Endopod setation	0,1,6	1,3,3
<b>Zoea III</b>		
Carapace		
Postero-dorsal margin	4 setae	4 setae
Postero-lateral margin	6 setae	7 setae

Stage and characters	<i>M. elegans</i> (Current study)	<i>M. distincta</i> (Krishnan and Kannupandi, 1988)
Antennule	4 aesthetascs	6 aesthetascs
Maxilla		
Basal endite	9 setae	10 setae
Zoea IV		
Carapace		
Postero-dorsal margin	4 setae	8 setae
Postero-lateral margin	10 setae	11 setae
Antennule	5 aesthetascs	6 aesthetascs
Maxillule		
Basal endite	10 spines	11 spines
Maxilla		
Coxal endite	6 setae	14 setae
Basal endite	10 setae	11 setae
Maxilliped II		
Endopod setation	3-segmented, 0,1,6	4-segmented, 0,1,2,3
Zoea V		
Carapace		
Postero-dorsal margin	5 setae	10 setae
Postero-lateral margin	17 setae	16 setae
Mandible	palp bud present	not developed
Maxillule		
Coxal endite	9 spines	7 spines
Basal endite	15 setae + 1 marginal seta	12 setae + 2 marginal setae
Maxilla		
Coxal endite	8 setae	11 setae
Basal endite	15 setae	16 setae
Maxilliped II		
Endopod setal formula	0,1,6	0,1,2,4

The megalopa of *M. elegans* has 2+5 setae on maxillule endopod as in the genus *Bresedium* (Fielder and Greenwood, 1983). Both *M. elegans* and *M. distincta* have 19 setae on maxillule coxal endite. The common character may be a genus specific which needs further confirmation. Megalopa of *M. elegans* can be easily identified from other known sesarmine megalopae such as *Cyclograpsus* (Costlow and Fagetti, 1967; Fagetti and Compondonico, 1971; Gore and Scotto, 1982); *Helice* (Baba and Moriyama, 1972); *Metasesarma* (Diaz and Ewald, 1968); *Sesarma* (Diaz and Ewald, 1968; Kakati and Sankolli, 1975; Vijayakumar and Kannupandi, 1986, 1987; Krishnan and Kannupandi, 1987; Pasupathi and Kannupandi, 1987); *Chiromantes* (Fakuda and Baba, 1976); *Chasmagnathus* (Baba and Fukuda, 1972) and *Metaplax* (Krishnan and Kannupandi, 1988) by 2-segmented flagellar lower ramus of antennule and presence of 12 setae on first abdominal segment. Since megalopal description is available in its only congener species *M. distincta*, comparison is made with the latter and most significant differences are listed in Table II.

Table II— Distinguishing megalopae characters between *M. elegans* and *M. distincta*

Characters	<i>M. elegans</i> (Current study)	<i>M. distincta</i> (Krishnan and Kannupandi, 1988)
Antennal setation		
Peduncle	3-segmented, 0,0,2	4-segmented 0,1,1,1
Flagellum	0,0,2,0,2,1,3	0,0,4,1,5,2,3
Maxillule		
Basal endite	17 spines	23 spines
Maxilla		
Coxal endite	12 setae	21 setae
Basal endite	20 setae	23 setae
Scaphognathite	43 setae	55 setae
Maxilliped I		
Coxal endite	16 setae	12 setae
Basal endite	15 setae	16 setae
Endopod	11 setae	8 setae
Maxilliped II		
Exopod setation	0,4	1,5
Endopod	5-segmented 7,8,2,10,4	4-segmented 2,2,7,6
Maxilliped III		
Endopod setation	14,10,7,9,11	15,14,8,8,9
Protopod	17 setae	18 setae
Ventral teeth on 3rd and 4th pereopods		
	absent	3 teeth

The first crab stage of *M.elegans* can be distinguished from the corresponding stage in other known sesarminid crabs on the basis of carapace marginal teeth; 2 distinct undulations in *Metasesarma rubripes*, 1 tooth and 2 undulations in *S.ricordi* (Diaz and Ewald, 1968), 3 rounded knobs in *Chasmagnathus convexus* (Baba and Moriyama, 1972), 4 teeth in *Helice tridens wauna* (Baba and Moriyama, 1972), 4 prominent teeth and 1 small tooth in *Metaplex distincta* (Krishnan and Kannupandi, 1988) and 5 distinct teeth in *Metaplex elegans*. Further, first crab of *M.elegans* can easily be separated from that of *M.distincta* by the absence of sub-terminal spines on the anterior border of merus of 2-5th pereopods.

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