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LARVAL DEVELOPMENT OF *METAPENAEUS MOYEBI* (KISHINOUYE) REARED IN THE LABORATORY

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ABSTRACT

The complete larval development of *Metapenaeus moyebi* was studied by rearing them in the CMFRI laboratory at Karwar. The viable eggs take 8½ to 10 hours to hatch out and the duration of nauplius stage ranges between 37 and 44 hours. The protozoea transforms into mysis after 5 to 5½ days. The mysis stage lasts for 9½ to 10½ days. Complete larval development from egg to post-larva I takes 16-18½ days. There are 6 nauplius sub-stages, 3 protozoea substages, 3 mysis substages and 1 intermediate stage during the course of development. The detailed structure of the larval substages is described and illustrated in this paper.

INTRODUCTION

KNOWLEDGE of larval history of commercially important penaeid prawns is a pre-requisite for understanding their occurrence in nature as well as to rear them in large scale for aquaculture purposes. In India, studies on the larval stages of some of the commercially important species belonging to the genus *Metapenaeus* has been carried out by Menon (1951), Mohamed *et al.* (1968, 1978), Raje and Ranade (1975), Rao and Kathirvel (1973), Rao (1974), Thomas *et al.* (1974 a, b), Muthu (1978), Muthu *et al.* (1978 a, b, c) and Sudhakara Rao (1978).

Metapenaeus moyebi (Kishinouye) is one of the commercially important prawns occurring in the inshore waters of Karwar, North Karnataka. The salient observations on the fishery and biology of *M. moyebi* along the Karnataka Coast have been given by Sukumaran and Nandakumar (1983). The present studies on the larval development of *M. moyebi* have been carried out for the first time in India by rearing them in the laboratory. Kurata and Pusadee (1974) studied the larvae and postlarvae of *Metapenaeus burkenroadi* which has been synonymised as *Metapenaeus moyebi* (Holthuis, 1980). When compared to the present work there are differences in the size of the larvae, number of larval stages and setation of appendages. Hence a detailed description of the egg and various larval stages are presented here.

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MATERIAL AND METHODS

Six gravid females of *M. moyebi* were collected from shore seine landings on 28-5-1981 at 1600 hrs and were brought alive to the laboratory in plastic tubs containing sea water collected from the same locality. In the laboratory the animals were kept individually in 70 litres capacity aquarium tanks containing

sediment free, filtered sea water to which sodium salt of EDTA was added at the rate of 1 gm/100 litres. The tanks were kept in darkness undisturbed during the night. Two of the females spawned the same night around 0030 hrs. The eggs were viable. The adult prawns were removed from the tank around 0500 hrs. Vigorous aeration was given to the tank water and the hatching started at 0900 hrs. Larvae were reared in aquarium tanks containing 50 litres of filtered seawater. Active nauplii which were attracted towards light were collected and stocked at the rate of 100 nauplii per one litre of seawater. Throughout the experiment vigorous aeration was provided. Temperature of the water varied between 29° and 31°C and the salinity was 33.1‰. From protozoea 1 onwards the larvae were fed with diatoms dominated by *Chaetoceros* sp. which were cultured separately.

The larvae were preserved in 5% formaldehyde solution for detailed morphological studies. Measurements were taken under a monocular microscope using micrometer. Total length of nauplius was measured between the anterior and caudal ends excluding furcal setae. Width of the body was taken at the point of greatest width. Total length was taken from the anterior end of the body including rostrum when present, to the posterior end of telson excluding setae. Carapace length was taken from tip of the rostrum to the posterior mid-dorsal margin of carapace.

OBSERVATIONS

Egg

Eggs opaque with very wide previtelline space (Fig. 1 a, b). Diameter of egg varied from 0.50 to 0.54 mm and diameter of yolk mass between 0.27 to 0.33 mm. Duration of embryonic development ranges from 8½ to 10 hours at 29.5°C.

Nauplius I

Mean total length 0.255 mm (0.25-0.26 mm); mean width: 0.135 mm (0.13-0.14 mm). Mean length of longest pair of furcal setae: 0.07 mm. Pear-shaped unsegmented body; anterior region broad bearing an ocellus; posterior end rounded bearing a pair of furcal setae; antennule uniramous, inner margin bearing 3 setae of which proximal one small, outer distal margin with one long setae; 2 long setae present at its apex which are as long as seta at distal margin. Antenna biramous, exopod with 5 long setae along its inner and distal margin, endopod shorter than exopod with 2 long setae at its apex and 3 short setae, one distolateral and two on inner margin. Mandible biramous, each rami bearing 3 long setae; all setae non-plumose (Fig. 1 c). Duration of this substage was 3-4 hours.

Nauplius II

Mean total length: 0.265 mm (0.26-0.27 mm); Mean width: 0.135 mm (0.13-0.14 mm); Mean length of longest pair of furcal setae: 0.08 (0.07-0.09 mm). All setae plumose. Antennule inner margin with 3 setae of which distal one longest, terminally it bears 3 setae of which two small, outer margin bears distally one small seta. Exopod of antenna with 1 small seta and 5 long setae of which 4th inner lateral seta, counting from proximal end, is bifurcated at tip. Retained in further nauplius stages (Fig. 1 d); no change in mandibles. Duration of this substage was 3-4 hours.

Nauplius III

Mean total length: 0.27 mm (0.26-0.28 mm); Mean width: 0.135 mm (0.13-0.14 mm); Mean length of longest pair of furcal setae: 0.105 mm (0.09-0.12 mm). 3+3 furcal setae; when compared to previous stage further changes absent in antennule and mandible; exopod of antenna with 6 long plumose setae along inner and distal margins and one spike

(Fig. 1 f). Duration of this substage was 4-5 hours.

Nauplius V

Mean total length : 0.0305 mm (0.30-0.31 mm) ; Mean width : 0.15 mm ; Mean length of longest pair of furcal setae : 0.185 mm (0.18-0.19 mm). Furcal lobes distinct bearing 6+6 setae ; antennule apically bearing 3 setae of which 2 almost of same length ; segmentation of antenna is indicated and endopod with 2 short setae in inner distal margin and 3 long plumose setae apically ; exopods with 8 setae of which 7 long and plumose and one on proximal inner margin small and spike-like ; basal swelling on mandible prominent ; 4 pairs of limb buds developed posterior to mandibles (Fig. 1 g). Duration of this substage was 3-4 hours.

Nauplius VI

Mean total length : 0.357 mm (0.34-0.37 mm) ; Mean width : 0.153 mm (0.15-0.16 mm) ; Mean length of longest pair of furcal setae : 0.243 mm (0.24-0.25 mm). Body elongated ; developing frontal organs seen; carapace demarcated ; furcal lobes distinct bearing 7+7 setae of which 4th seta longest (Fig. 1 h). Buds of first 2 maxillae and 3 maxillipeds well developed with rudimentary setae ; indistinct segmentation seen in proximal half of antennule, inner margin bearing 3 setae of which proximal one smallest, apically it bears 2 long setae ; three aesthaetes present in distal outer margin of which middle one placed more towards distal one, one minute seta present at outer lateral margin below aesthaetes ; exopod of antenna with 8 setae and one short seta along inner distal margin ; cutting edge of mandible visible inside basal swelling (Fig. 1 i). Duration of this substage was 19-21 hours.

Protozoea I

Total length : 0.78 mm (0.72-0.82 mm) ; carapace length : 0.316 mm (0.31-0.32 mm). Carapace rounded anteriorly with a median notch, ocellus persists, eyes sessile, developing compound eye seen through carapace, frontal horns present (Fig. 2 a). Thoracic somites segmented, abdominal somite and telson fused together ; caudal lobes with 7+7 setae. Antennule (Fig. 2 b) uniramous, 3 segmented, basal segment subdivided into five, second segment bears 4 setae along inner margin, distal segment with two aesthaetes and three setae, longest seta more than 1.6 times the basal segment. Antenna (Fig. 2 c) biramous, endopod two segmented bearing five setae at distal margin of distal segment, proxima, segment bearing 1+2+3 setae on inner marginl exopod ten segmented bearing ten plumose setae along inner and distal margins and two setae along outer margin.

Mandible (Fig. 2 d) : Asymmetrical without palp, exopod and endopod absent, 1-2 standing teeth in between incisor and molar processes, left mandible bearing more teeth on molar process than right one. *Maxillule* (Fig. 2 e) : Protopod with two lobes, distal with four and proximal with seven setae ; endopod 3 segmented, first, second and third segments bearing 3, 2 and 5 setae respectively, exopod small knob-like bearing four long feathery setae. *Maxilla* (Fig. 2 f) : Protopod with five lobes, proximal lobe rounded bearing 7-8 setae, other lobes with three to four setae ; endopod four segmented, segmentation between second and third indistinct, distal segment with three long setae, other segments with two setae each ; endopod small bearing five long plumose setae. *First maxilliped* (Fig. 2 g) : Biramous, protopod two segmented, distal segment with 12 setae on inner side ; endopod four segmented, distal segment bearing five long setae, first, second and third segment bearing 3, 1 and 2 setae, exopod smaller than endopod, bearing seven long plumose setae. *Second maxilliped* (Fig. 2 h) : Shorter than first maxilliped ; protopod two segmented ; endopod four segmented, first,

second and third segments with 2, 1 and 2 setae along the inner margin, distal segment with five long setae ; exopod unsegmented bearing six plumose setae. *Third maxilliped* (Fig. 2 i) : Not fully developed, biramous, exopod with two long plumose setae, endopod bare. Duration of this substage was 48-51 hours.

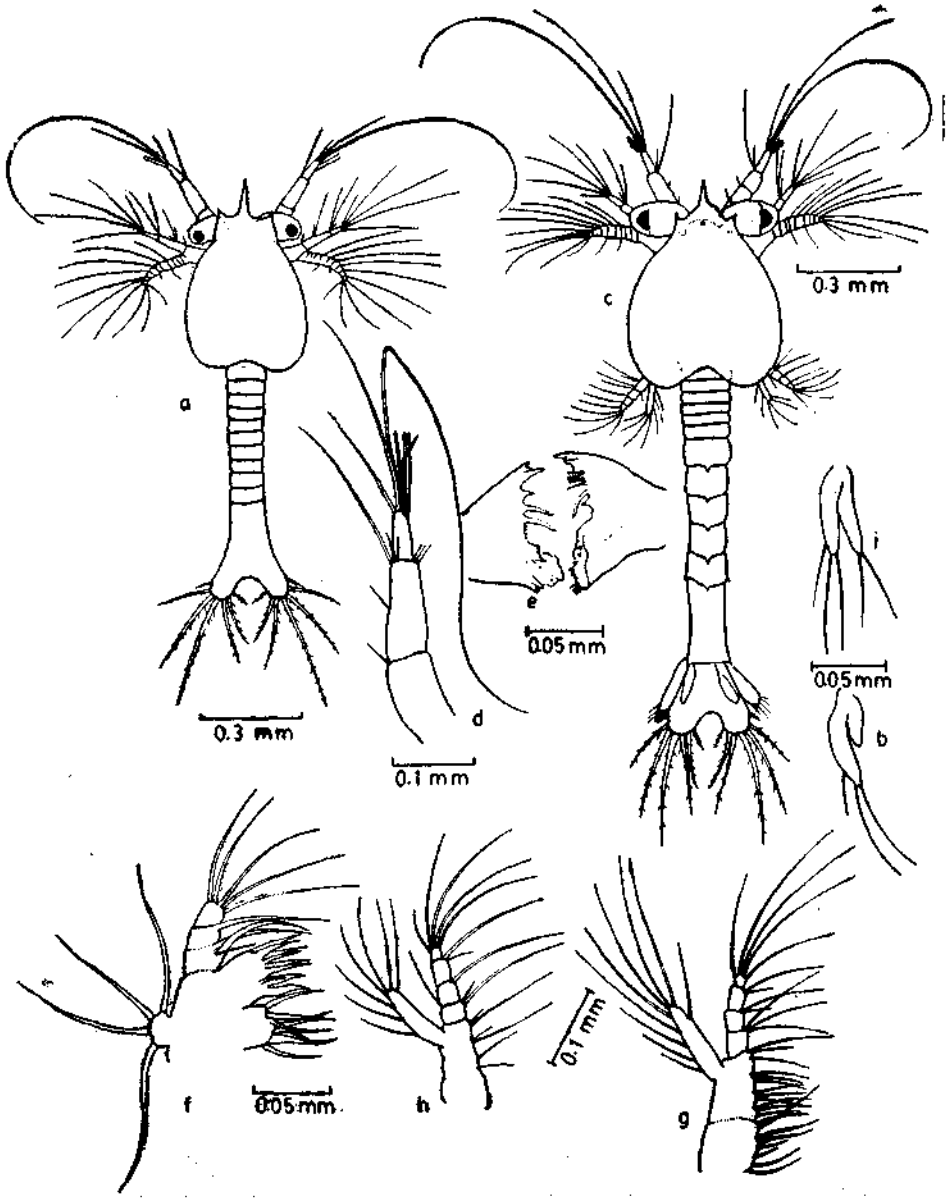

FIG. 3. *Metapenaeus moyebi* — Protozoea II : a. dorsal view of protozoea II ; b. third maxilliped ; Protozoea III ; c. dorsal view of protozoea III ; d. antennule ; e. mandible ; f. maxillule ; g. first maxilliped ; h. second maxilliped and i. third maxilliped.

liped (Fig. 4 g): Almost same as in 3rd protozoea, exopod with 7 plumose setae. *Second maxilliped* (Fig. 4 h): Exopod with 4 long plumose setae at its apex, endopod 4 segmented, 1st and 2nd segment carrying one seta on outer distal margin. *Third maxilliped:* (Fig. 4 i): Fully developed; exopod shorter than endopod bearing 4 apical and 1 or 2 subapical plumose setae; endopod 5 segmented, distal segment carrying 5 long setae, 1st, 2nd and 4th segments each carrying on their inner distal margin 2, 1 and 2 setae respectively, second segment also has one seta at its distal outer margin. *Pereopods* 1-5 (Fig. 4 j, k): All biramous, endopod unsegmented, shorter than exopod bearing at distal margin 3 long plumose setae; exopod bearing 4 apical and 4 subapical long plumose setae. *Uropod* (Fig. 4 l): Biramous; exopod with 12 plumose setae and one spine, endopod with 10 plumose setae. *Telson* (Fig. 4 m): Somewhat wider posteriorly, bearing 7+7 spines at its distal margin, median cleft at hind margin moderately wide and deep and reaches almost to base of 1st telson spine, 2nd spine serrated only on inner side, other spines serrated on both sides and first spine not serrated. Duration of this substage was 39 to 45 hours.

Mysis II

Total length: 2.128 mm; carapace length: 0.634 mm.

Rostrum short not reaching tip of eye, usually devoid of teeth, but in certain cases a small epigastric tooth present, carapace with pterygostomial and antennual spines (Fig. 5 a), pleopod buds developed and in some cases buds are longer, but unsegmented (Fig. 5 l), hepatic spine not clear. *Antennule* (Fig. 5 b): Number of setae on segments increased, inner flagellum reaching half of outer flagellum. *Antenna* (Fig. 5 c): Scaphocerite with 14 plumose setae and one distolateral spine; endopod two segmented. *Mandible* (Fig. 5 d) palp longer, unsegmented without setae. *Maxillule* (Fig. 5 e): Exopod absent. *Maxilla:* Exopod expanded bearing 12-13 plumose setae. *First maxilliped:* Same as in previous stage. *Second maxilliped* (Fig. 5 f): Proximal outer margin of first segment of endopod bearing one seta, one seta present at outer distal margin of 1st, 2nd and 3rd segment of endopod. *Third maxilliped* (Fig. 5 g): 2nd, 3rd and 4th endopod segments carry one seta on outer distal margin. *Pereopods* 1-3 (Fig. 5 h): Almost identical, endopod indistinctly segmented and as long as exopod, chela partially developed, distal segment bearing 2 subapical setae; 2-3 setae present at joints of propodus and dactylus, distal margin of 2nd segment bearing a long plumose seta; exopod bearing 4 long plumose setae apically and 3-4 long subapical setae. *Pereopods* 4-5 (Fig. 5 i): Almost identical; endopod indistinctly segmented and longer than exopod, distal segment carrying 3 long setae, 2nd segment bearing one long seta at its inner distal margin; exopod bearing 4 long plumose apical setae and 2 or 3 subapical setae. *Uropod* (Fig. 5 j): Exopod with 13 and endopod with 12-14 plumose setae, outer distal margin of exopod terminates in a short spine and near this on inner side a short movable spine also present which is longer than outer one. *Telson* (Fig. 5 k): Rectangular, bearing 7+7 spines at its distal margin, cleft at distal margin very narrow and reaches upto base of 2nd spine, first 2 spines not serrated. Duration of this substage was 84-89 hours.

Mysis II moulted twice before metamorphosing into mysis III. After first moult no major changes were noticed in size of larvae and setation of appendages; pleopod buds became slightly bigger, but remained unsegmented.

Mysis III

Total length: 2.31 mm; carapace length: 0.686 mm.

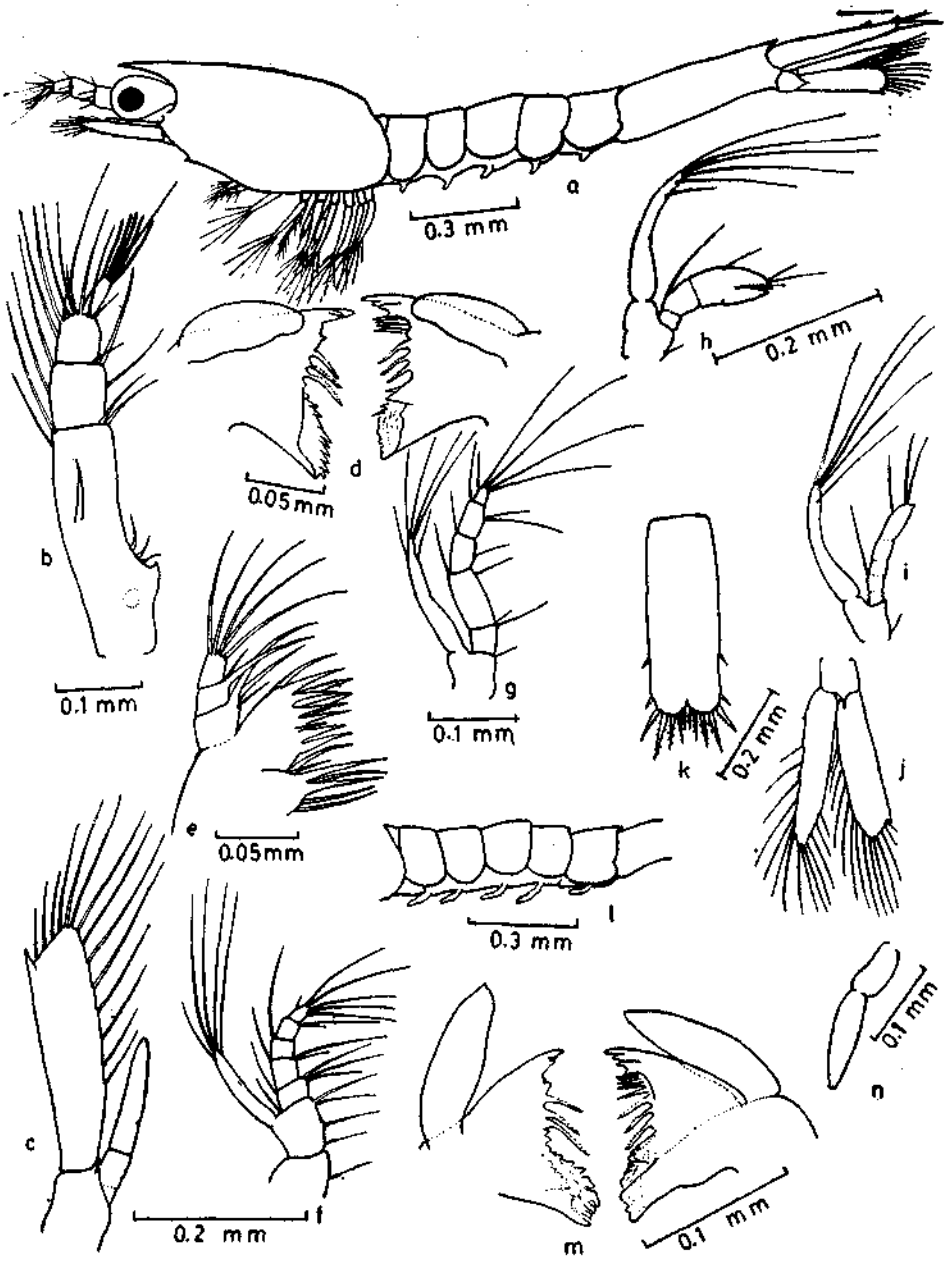

FIG. 5. *Metapenaeus moyebi* — Mysis II : a. lateral view of mysis II ; b. antennule ; c. antenna ; d. mandible ; e. maxillule ; f. second maxilliped ; g. third maxilliped ; h. first pereopod ; i. fifth pereopod ; j. uropod ; k. telson ; l. abdomen pleopods of an advanced mysis II specimen : Mysis III : m. mandible and n. pleopod bud.

Rostrum short with 1 or 2 teeth, antennal and pterygostomial spines short, a small hepatic spine present in some specimens (Fig. 6 a); pleopod buds longer and divided, but devoid of setae (Fig. 5 n).

Antennule (Fig. 6 b): Flagella equal in length, inner flagellum bearing at its apex, one long plumose seta and two short non-plumose setae, outer flagellum bearing 7-8 aesthaetes in 2 rows of 5—6+2. *Antenna* (Fig. 6 c):

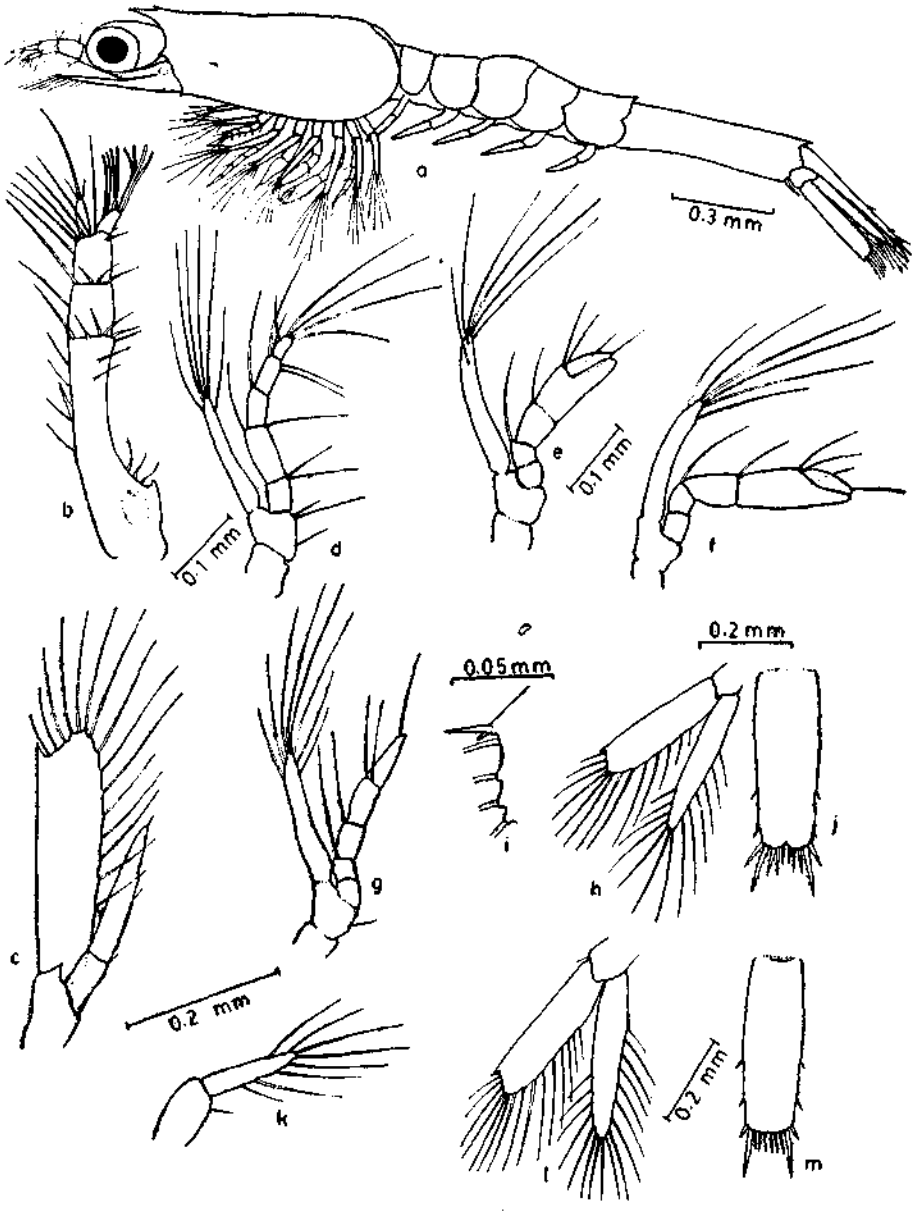

FIG. 6. *Metapenaeus moyebi* — Mysis III: a. lateral view of mysis III; b. antennule; c. antenna; d. third maxilliped; e. first pereopod; f. third pereopod; g. fifth pereopod; h. uropod; i. disto lateral outer margin of exopod of uropod; j. telson: Intermediate stage: k. third pleopod; l. uropod and m. telson.

Scaphocerite with 15 plumose setae and a spine ; endopod shorter than exopod with a basal segment. *Mandible* (Fig. 5 m) : Palp big, unsegmented and devoid of setae. First and second maxilliped same as previous stage. *Third maxilliped* (Fig. 6 d) : Exopod becomes shorter than endopod bearing at its distal margin 6 long plumose setae, 4th segment of endopod carrying 2 setae each at its distal outer and inner margins. *Pereopods* 1-3 (Fig. 6 e, f) : Almost identical and there is a progressive increase in length of endopod from pereopod 1 to 3. In pereopod 3 exopod as long as first 3 segments of endopod, chela fully developed, dactylus with a terminal seta, merus and carpus bear one seta at distal outer margin. *Pereopods* 4-5 (Fig. 6 g) : Exopod as long as first 4 segments of endopod, distal outer margin of 2nd to 5th segments each with one seta. *Uropods* (Fig. 6 h) : Exopod and endopod with 13-14 plumose setae; exopod bears 2 spines at outer distal margin in addition to setae (Fig. 6 i). *Telson* (Fig. 6 j) : Distal end narrower than proximal one, cleft very narrow or absent. Duration of this substage was 80-85 hours.

Intermediate Stage

Total length : 2.31 mm ; carapace length : 0.68 mm.

Rostrum short with 2 teeth, hepatic spine clearly developed (Fig. 7 a) ; pterygostomial and antennal spines small, pleopods divided, with 7-8 plumose setae (Fig. 6 k) ; exopod of pereopods small with few short setae distally.

Antennule (Fig. 7 b) : Inner flagellum longer than outer one, bearing at its apex 1 long and 3 short setae, outer flagellum indistinctly divided into 2, number of setae in joints of segments increased. *Antenna* (Fig. 7 c) : Scaphocerite with 21 plumose setae and a disto-lateral spine, endopod shorter than exopod with 5 segments. *Mandible* (Fig. 7 d) : Palp fairly big, two segmented with setae ; standing teeth absent, few short teeth present in molar and incisor processes. *Maxillule* (Fig. 7 e) : Distal endite with 12 short setae. *Maxilla* (Fig. 7 f) : Exopod expanded bearing 23-24 setae. *First maxilliped* (Fig. 7 g) : Exopod short with 5 setae, endopod indistinctly segmented and setae become shorter, endites of protopod expanded bearing short bristle like setae ; gills developed. *Second maxilliped* (Fig. 7 h) : Exopod shorter than endopod bearing at its distal margin 6 plumose setae, endopod more flattened, distal segment bent towards inner side bearing a number of short bristle like setae, segmentation between 4th and 5th segment indistinct. *Third maxilliped* (Fig. 7 i) : Exopod further reduced bearing setae at its apex, setae on endopod become short and bristle like. *Pereopod* 1-3 (Fig. 7 j, k) : Exopod shorter, as long as or shorter than first 2 segments of endopod bearing 4 apical and 2 subapical setae ; chela fully developed, setae at outer distal margin of endopodal segment become smaller, tip of propodus and dactylus with short setae. *Pereopods* 4-5 (Fig. 7 l) : Identical ; exopod very small bearing plumose setae at its apex. *Uropod* (Fig. 6 l) : Exopod bearing 15-17 plumose setae and 2 spines, endopod with 16-17 plumose setae. *Telson* (Fig. 6 m) : No cleft at distal margin which is convex, bearing 7+7 spines, 4th spine longest. Duration of this substage was 23-33 hours.

Postlarva I

Total length : 2.80 mm ; carapace length : 0.803 mm.

Rostrum short with 2-3 dorsal spines, carapace with antennal and hepatic spines, pterygostomial spine absent, exopod of pereopod absent or small without setae, pleopods functional with plumose setae (Fig. 8 a).

Antennule (Fig. 8 b) : Outer flagella 2 segmented only half length of inner bearing 7-8 aesthaetes in 2 groups, inner flagella longer

than outer, 3 segmented, bearing 4 slender setae at its distal end, number of setae on segments increased, statocyst fully developed. *Antenna* (Fig. 8 c): Scaphocerite broader with 25-26 plumose setae and one spine; endopod longer than exopod with 7-9 segments, distal segment bearing 6 small bristle like setae. *Mandibles* (Fig. 7 m): Palp big, flattened

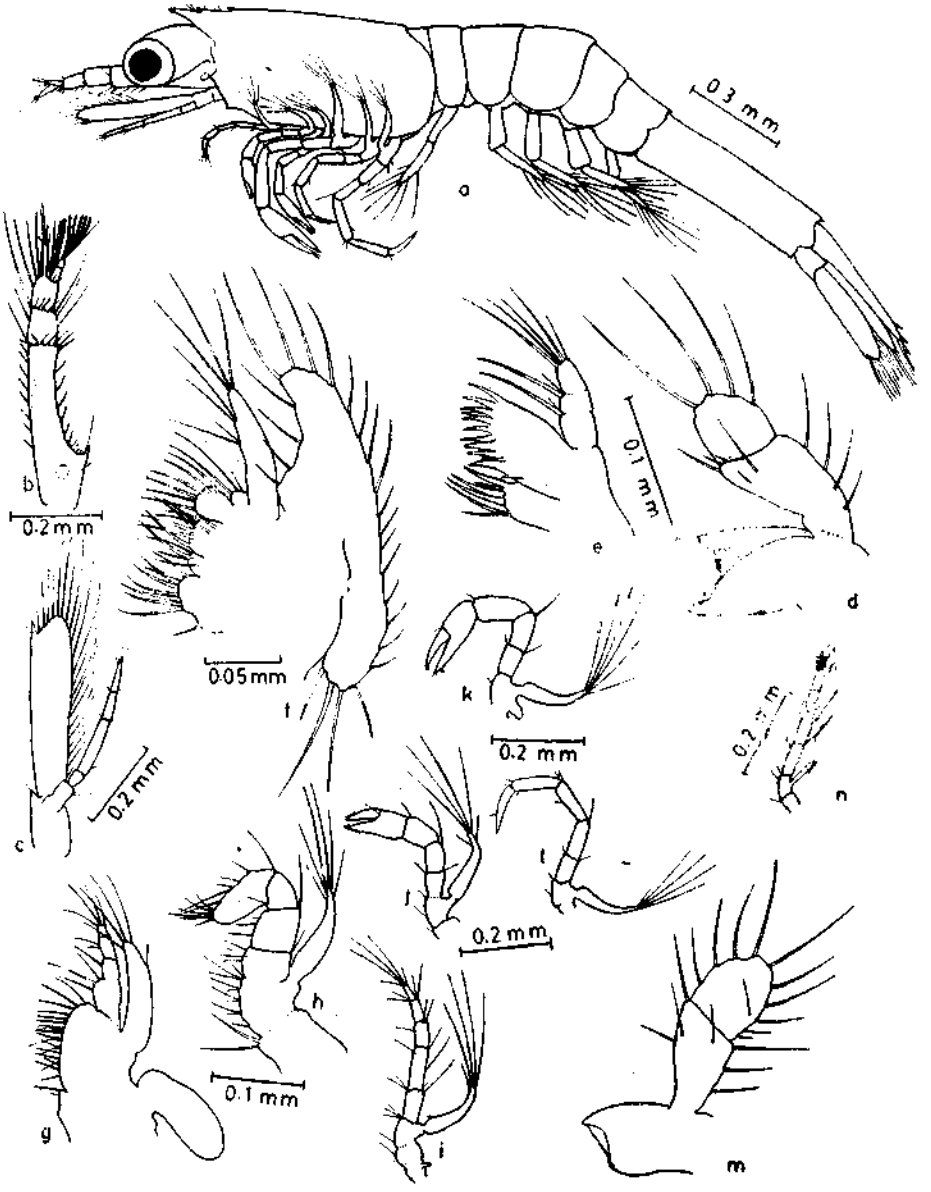

FIG. 7. *Metapenaeus moyebi* — Intermediate stage: a. lateral view of the intermediate stage; b. antennule; c. antenna; d. mandible; e. maxillule; f. maxilla; g. first maxilliped; h. second maxilliped; i. third maxilliped; j. first pereopod; k. second pereopod and l. fifth pereopod.

and two segmented bearing plumose setae. standing teeth absent, incisor and molar processes do not have teeth. *Maxillule* (Fig. 8 d): Proximal and distal endite with 8 and 14 setae; endopod unsegmented bearing a short seta at its distal margin. *Maxilla* (Fig. 8 e): Exopod flattened leaf-like bearing 38-40 short plumose setae; endopod short unsegmented bearing at its apex a short seta; protopod with 3 endites bearing at its apex 2+6+6 bristle like setae. *First maxilliped* (Fig. 8 f): Exopod with 3 short setae; endopod bearing 3 short setae at its apex and 2 at its middle, endites broad two lobed bearing a number of

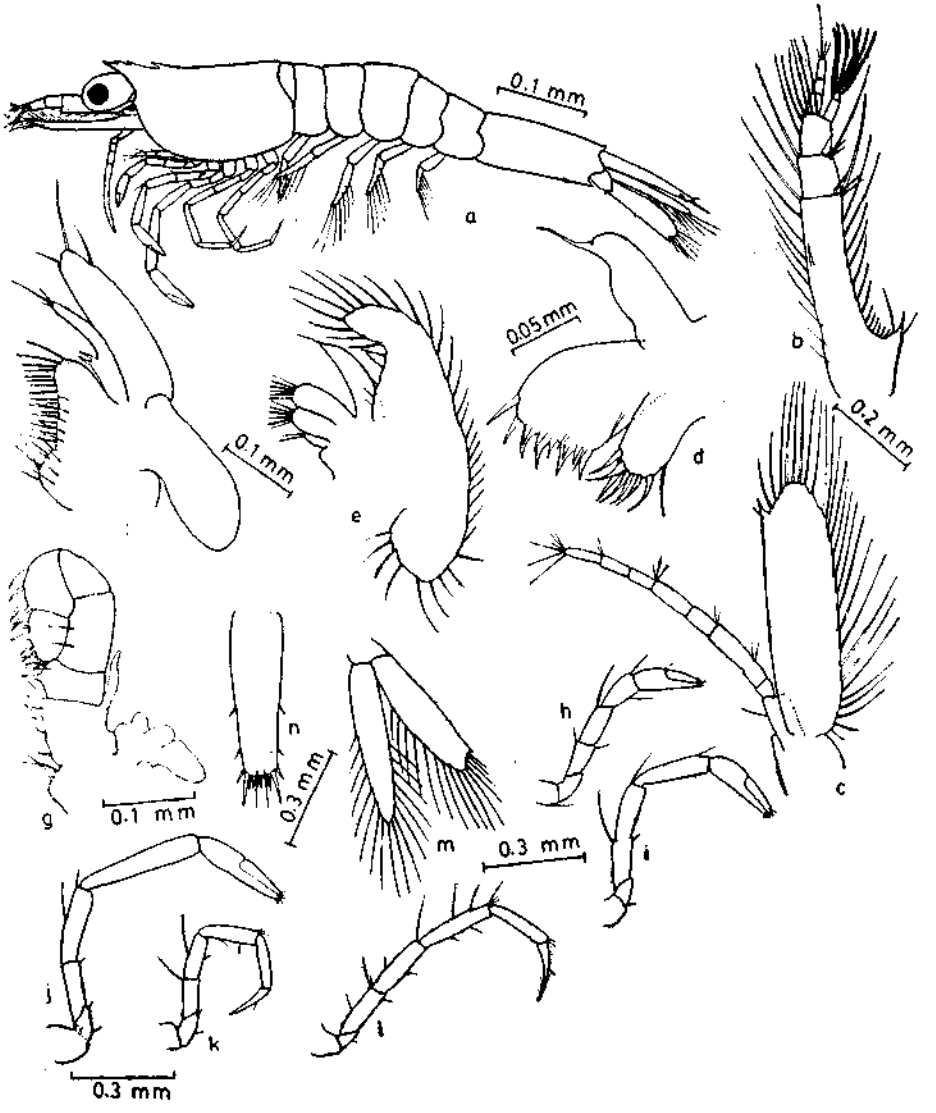

FIG. 8. *Metapenaeus moyebi* — Postlarva I; a. lateral view of the postlarva I; b. antennule; c. antenna; d. maxillule; e. maxilla; f. first maxilliped; g. second maxilliped; h. first pereopod; i. second pereopod; j. third pereopod; k. fourth pereopod; l. fifth pereopod; m. uropod and *n*. telson.

short bristle like setae at its inner margin. *Second maxilliped* (Fig. 8 g) : Exopod reduced and palp like ; endopod more flattened, sharply curved distally, distal segment bearing short spine like seta ; inner margin of endite with short setae ; gills well developed. *Third maxilliped* : (Fig. 7 n) : Endopod present, setae short and bristle like. *Pereopod* 1-3 (Fig. 8 h, i, j) : Exopod reduced without setae or absent totally ; pereopod 1 is shorter than pereopod 2 and pereopod 3, chela fully developed, carpus of 2nd and 3rd pereopod longer than pereopod 1. *Pereopod* 4-5 (Fig. 8 k, l) : Almost identical, exopod reduced without seta or absent, dactylus pointed. *Uropod* (Fig. 8 m) : Number of setae on exopod and endopod increased, telson convex posteriorly bearing 3 pairs of lateral and 8 distal setae.

Discussion

In the present studies, eggs of *M. moyebi* are slightly larger while other larval stages are comparatively smaller than the description given by Kurata and Pusadee (1974) for the same species. Stagewise differences in measurements are given in Table 1.

Table 1. *Stagewise differences in measurements (mm) between present observations and the observation by Kurata and Pusadee (1974)*

Stages	Present observations	Kurata and Pusadee
Egg	0.520	0.480
Nauplius I	0.255	0.270
,, II	0.265	0.290
,, III	0.270	0.310
,, IV	0.300	0.330
,, V	0.305	0.360
,, VI	0.357	0.420

	Carapace length	Total length		Carapace length	Total length
Protozoea I	0.316	0.780	Zoea I	0.360	0.810
,, II	0.450	1.113	,, II	0.590	1.270
,, III	0.490	1.344	,, III	0.660	1.690
Mysis I	0.630	2.070	,, IV	0.710	2.130
,, II	0.634	2.128		Not described	
,, III	0.376	2.310	,, V	0.730	2.570
Intermediate	0.680	2.310	,, VI	0.780	2.820
Postlarva I	0.803	2.800	Megalopa I	0.810—0.920	2.800—3.200

In the present work from Nauplius II onwards 4th setae of exopod (counted from the inner margin) is bifurcated at its tip and this character is retained upto Nauplius VI. Antennule of the Nauplius VI bears 3 disto-lateral aesthaetes of which, one is terminal 2 subterminal and the middle one is closer to the terminal one. This arrangement is an important distinguishing character between Nauplius VI of genus *Metapenaeus* and

Penaeus (Muthu *et al.*, 1978). These two observations were not mentioned by Kurata and Pusadee (1974).

The protozoea stages described by the above authors are similar to the present material in many respects, but for the differences noticed in the antenna and maxillule. In the present work endopod of antenna of all protozoeal stages bear 1+2+3 lateral setae. This character has been described as an important one to differentiate the protozoea of the genus *Metapenaeus* from those of *Penaeus* and *Parapenaeopsis* (Muthu *et al.*, 1978). In our material, in all stages of protozoea, the distal segment of the maxillule bears 5 setae which agrees well with the observations made by Muthu *et al.* (1978) and Sudhakara Rao (1978). Kurata and Pusadee (1974) stated the number of lateral setae on the endopod of antenna as 1+2+2 and the number of setae on the distal segment of maxillule as only 4.

In the present work, the pleopod buds are not very clear in Mysis I whereas Kurata and Pusadee (1974) have described the presence of small pleopod buds in Zoea IV which corresponds to Mysis I of our material. In other respects the descriptions are similar to our material.

In Zoea V, Kurata and Pusadee (1974) described the pleopod buds, as long and segmented without setae. Description of this stage resembles Mysis III of the present work. In our observations, Mysis II moults 2 times before metamorphosing to Mysis III and these 2 substages have been clubbed together as Mysis II since major morphological changes are not noticed between them. Mysis II can be easily distinguished by the developed pleopod buds which are bare and unsegmented and further the disto-lateral outer setae of the exopod (scaphocerite) of antenna is replaced by a spine. This substage was not observed by Kurata and Pusadee (1974).

In the mysis stage of all penaeids, the teeth on the mandible, and the structure and setae of mouth parts are related to the filter feeding habits of the larvae (Muthu, 1980). The pleopods are bare and non-functional and swimming functions are taken over by the well developed exopods of pereopods which bear long plumose setae. When mysis metamorphoses to postlarva, a sudden transformation in the mouth parts is noticed based on the change of its feeding habits. Mandible looses serrated teeth, develop sharp cutting edges; maxilla looses filtering setae and the endites become highly reduced. The protopod of the first maxilliped becomes broad and acquire stiff bristles and chela becomes fully functional (Muthu *et al.*, 1978). All the above said characters are suitable for the carnivorous habit of the animal. But in the case of many *Metapenaeus* species a transitional stage between last mysis and postlarva is noticed in which some of the characteristics of mysis as well as postlarva are exhibited (Muthu *et al.*, 1978). Such a substage is present in our studies also, which is described as Intermediate stage. Many characters of this stage agree with the descriptions given by Kurata and Pusadee (1974), for the Zoea VI stage. Postlarva I of the present studies agrees in many respects with the Megalopa I, described by the above authors. The time taken for the development of *M. moyebi* from egg to postlarva varies between 16 and 18½ days.

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