VII

Larval development — *METAPENAEUS MONOCEROS* (FABRICIUS)

K. H. Mohamed
M. S. Muthu
N. N. Pillai
K. V. George

Metapenaeus monoceros was reared from the egg to the postlarval stage in the laboratory at Narakkal. At the rearing temperature of 25.2° C to 27.0° C the viable eggs take 15-17 hours to hatch out; the duration of the nauplius stage is 44 to 60 hours; the protozoea takes 5½ to 7½ days to develop to mysis 1; the mysis stage lasts for 9 to 12 days. Complete development from egg to postlarva 1 takes 17 to 23 days. The larvae pass through 6 nauplius substages, 3 protozoea substages, and 6 mysis substages before reaching postlarva 1. All the larval stages are described and illustrated in detail and compared with the earlier larval descriptions on this species.

Metapenaeus monoceros, a commercially important penaeid prawn has spawned in the laboratory at Narakkal on a number of occasions and the larvae have been successfully reared to the juvenile stage. The larval development of *M.monoceros* differed significantly in some respects from the earlier descriptions of the larvae of *M.monoceros* given by Mohamed *et.al.,* (1968, *FAO Fish.Rep.*,57(2): 487-503)[1], Raje and Ranade (1972, *J. Indian Fish. Ass;* 2: 30-46)[2] and Rao (1974, *J. mar. biol. Ass. India,* 15(1) : 95 - 124)[3]. In this paper the larval characters of *M.monoceros* are fully illustrated to bring out the exact nature of setation of the appendages. The temperature of the water in the rearing basins was 25.2°C-2.70° C and the salinity 33.2 - 34.6 ppt.

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DESCRIPTION OF DEVELOPMENTAL STAGES

EGGS

Opaque, having a diameter of 0.28 mm; the diameter of yolk 0.22 mm (fig.1a). Embryonic development took 15-17 hours.

NAUPLIUS I

MTL : 0.27 mm (0.26-0.28 mm); MW: 0.14 mm (0.14-0.15mm); MFS: 0.07 mm

Pear shaped unsegmented body, anterior region broad bearing an ocellus, posterior end rounded bearing a pair of furcal setae (Fig.1b), a small denticle present at median posterodorsal aspect of body; A1 uniramous, inner margin bears 3 small setae, outer distal margin with one long setae and apex with 2 long setae and small spike-like setae; A2 biramous, exopod with 5 long setae along inner and distal margin and a rudimentary seta on outer distal aspect, endopod shorter than exopod bearing

terminally one rudimentary and 2 long setae and 2 small lateral setae on inner margin; Md biramous, each ramus bearing 3 long setae distally all setae nonplumose. Duration of this substage was 3-4 hours.

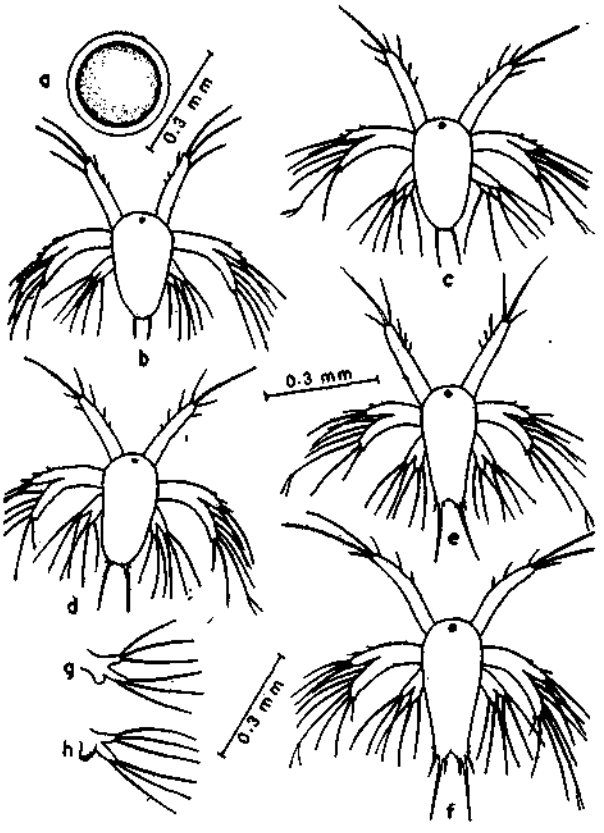

Fig. 1 *Metapenaeus monoceros* a - Egg; b - Nauplius I; c - Nauplius II; d - Nauplius III; e - Nauplius IV; f - Nauplius V; g - Md of nauplius V; h - Md of nauplius VI.

NAUPLIUS II

MTL: 0.28 mm (0.28-0.29 mm); MW: 0.15 mm MFS: 0.08 mm

A1 with 3 setae on inner margin, 3 setae apically of which middle one is the longest, and a small seta on distal outer margin; A2, 4th inner lateral seta of exopod, counting from the proximal end bifurcate at tip, this split condition is retained in all subsequent nauplius substages; no change in Md; all long setae of appendages plumose (Fig.1,c). Duration of this substage was 3-4 hours.

NAUPLIUS III

MTL: 0.28 mm (0.28-0.29 mm); MW:0.15 mm MFS: 0.10 mm (0.09-0.11 mm).

Furcal setae 3+3; exopod of A2 with 6 long plumose setae along inner and distal margin and one small spike-like seta at outer tip, endopod apically bearing one short and 2 long plumose setae; no change in A1 and Md (Fig.1d). Duration of this substage was 6-8 hours.

NAUPLIUS IV

MTL: 0.30 mm (0.29-0.31 mm); MW: 0.15 mm MFS: 0.13mm

Furcal lobes distinct, each with 4 setae A1 apically bearing 3 plumose setae of which outer is the smallest, 3 setae present on inner margin, outer distal seta absent; exopod of A2 bearing 8 setae of which proximal and distal ones small and spike like (Fig.1,e); protopod of Md shows slight swelling. Duration of this substage was 6-8 hours.

NAUPLIUS V

MTL: 0.36 mm (0.35-0.36 mm); MW: 0.16 mm (0.15-0.17 mm); MFS: 0.16 mm (0.15-0.17mm).

Furcal lobes distinct, bearing 6+6 setae; A1 apically with 3 setae of which 2 are almost of same length (Fig.1,f); endopod of A2 with 3 long plumose setae apically and 2 short setae on inner side, exopod with 9 setae of which proximal and distal ones are rudimentary (Fig.1,f); swelling on the protopod of Md clearly seen (Fig.1,g). Duration of this substage was 10-12 hours.

NAUPLIUS VI

MTL: 0.39 mm (0.38-0.41 mm); MW: 0.21 mm (0,20-0. 22mm); MFS: 0.17mm.

Body elongated, frontal organs developed, carapace demarcated, furcal lobes with 7+7 setae (Fig.2,a); developing buds of Mx1, Mx2, Mxp1, Mxp2 and Mxp3 clearly seen; A1 indistinctly segmented proximally 3 setae present on inner margin, 1 rudimentary seta and 2 long plumose setae apically, 4 setae, 1 very small seta and 3 aesthaetes present on distal outer margin; A2 endopod bearing apically 4 setae of which 3 are long and plumose, 1+2 setae present on inner margin; exopod carrying 8

long plumose setae and 2 rudimentary ones (Fig.2,a); Md further developed, outline of cutting edge of Md clearly seen inside swelling (Fig.1,h). Duration of this substage was 16-24 hours.

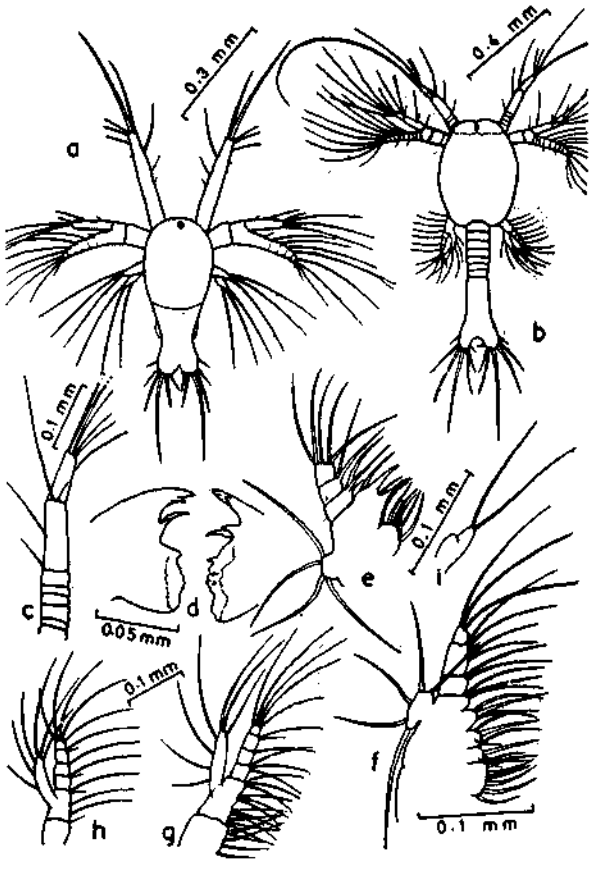

Fig. 2 *Metapenaeus monoceros:* a - Nauplius VI; Protozoea I; b - dorsal view; c - A1; d - Md; e - Mx1; f - Mx2; g - Mxp1; h - Mxp2; i - Mxp3.

PROTOZOEA I

MTL: 0.83 mm (0.80-0.85 mm); MCL; 0.37 mm (0.37-0.38 mm).

Carapace rounded anteriorly with a median notch, ocellus persists, developing compound eye seen through carapace, frontal horns minute smaller than frontal crgans; caudal lobes with 7+7 setae.

A1 (Fig.2,c) uniramous, 3 segmented, basal segment subdivided into 5, middle segment with 2 lateral setae and 2 distal setae, distal segment with 3 setae and 3 aesthaetes, 1 of the setae very long; A2 biramous, endopod 2 segmented, bearing 5 setae apically of which 4 are long and plumose and one short and nonplumose, proximal segment with 1+2+3 setae on inner margin, exopod 10 segmented bearing 10 setae along inner and distal margin and 2 setae along outer margin; Md (Fig.2,d) exopod and endopod absent, almost symmetrical, right and left Md each with one free standing tooth; Mx1 (Fig.2,e) protopod with 2 lobes, distal with 4 and proximal with 7 setae, endopod 3 segmented, distal segment apically bearing 5 long setae, 1st and 2nd segments with 3 and 2 setae respectively, exopod small, knob like bearing 4 long feathery setae; Mx2 (Fig.2,f) protopod with 5 lobes, proximal lobe rounded bearing 7 to 8 setae, other lobes with 3 to 4 setae, endopod 4 segmented, the segmentation between 2nd and 3rd indistinct, distal segment with 3 setae and other segments each with 2 long setae on inner margin, exopod with 5 long feathery setae; Mxp1 (Fig.2,g) biramous' protopod 2 segmented, proximal and distal segments with 5 and 12 setae respectively, endopod 4 segmented, 1st, 2nd and 3rd segments carrying 3, 1 and 2 setae on inner margin, distal segment with 5 long plumose setae apically, exopod unsegmented bearing 7 long plumose setae; Mxp2 (Fig.2,h) shorter than Mxp1, protopod 2 segmented, endopod 4 segmented, 1st, 2nd and 3rd segments with 2, 1 and 2 setae along inner margin, distal segment carrying apically 5 long plumose setae, exopod unsegmented with 6 long plumose setae; Mxp3 (Fig.2,i) not fully developed biramous, exopod with 2 long plumose setae, endopod bare. Duration of this substage was 48-60 hours.

PROTOZOEA II

MTL: 1.5 mm(1.41-1.64 mm); MCL: 0.59 mm.

Rostrum and stalked eyes developed, supraorbital spine present, between base of rostrum and supraobital spines there is a rostral platform whose anterolateral corners are produced into sharp spines; abdomen 6 segmented (Fig.3,a), telson not demarcated from last abdominal segment; no appreciable change in A1 and A2; Md (Fig.3,b)asymmetrical with 5 free standing teeth present in left Md and 1 in right Md; Mx1 distal protopod lobe with 7 setae; 1 more inner lateral seta added to 2nd segment of

endopod of Mxp1; Mxp3 exopod with 3 long plumose setae(Fig.3,c). Duration of this substage was 48-60 hours.

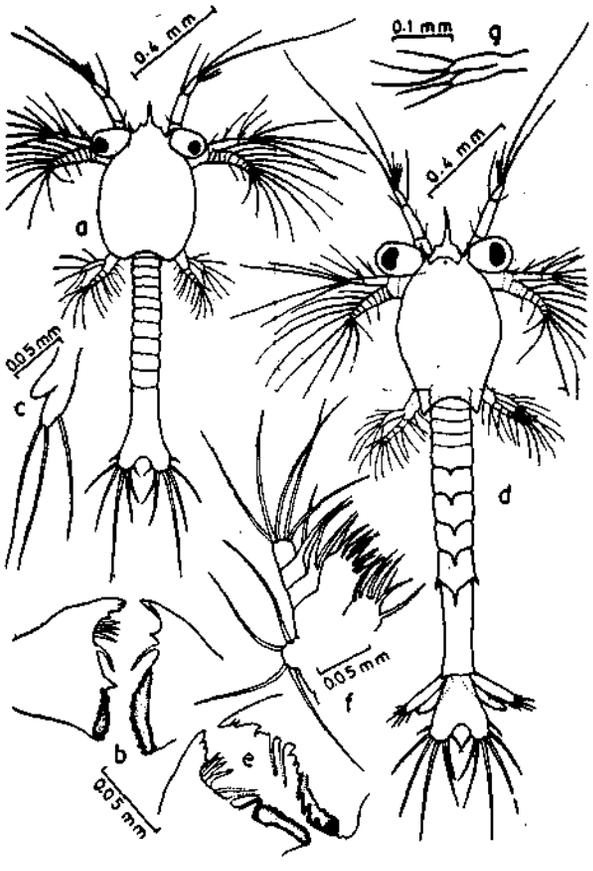

Fig. 3. *Metapenaeus monoceros:* Protozoea II. a - dorsal view; b - Md: c - Mxp3: Protozoea III: d - dorsal view; e - Md; f - Mx1: g - Mxp3.

PROTOZOEA III

MTL: 1.69 mm (1.92-2.99 mm): MCL: 0.72 mm (0.71-0.74 mm).

1 to 5 abdominal segments each with a posterodorsal spine (Fig.3,d), 5th segment with posterolateral spines, each lobe of telson with 7 setae, uropod biramous, exopod with 6 short nonplumose setae distally; A1 3 segmented, the subdivisions of basal segment absent, distal segment with 3 aesthaetes and 3 setae; A2 same as in the previous stage; left Md with 6 and right Md with 2 free standing teeth in between incisor and molar processes (Fig.3,e) Mx1 (Fig.3,f) distal lobe of protopod with 8-9 setae; Mx2 number of setae on protopod lobes increased; Mxp1 exopod wiih 6 plumose setae; Mxp2 exopod with 9 plumose setae; Mxp3 (Fig.3,g) not fully developed, exopod and endopod with 3 and 2 setae distally. Duration of this substage was 36-60 hours.

MYSIS I

MTL: 2.4 mm (2.37-2.45 mm); MCL; 0.86 mm (0.84-0.87 mm).

Rostrum extends beyond eye, devoid of teeth, carapace with pterygostomial and antennal spines, 5th and 6th abdominal segments with dorsal median spine, 6th abdominal segment with a prominent ventral median spine on posterior end (Fig.4,a).

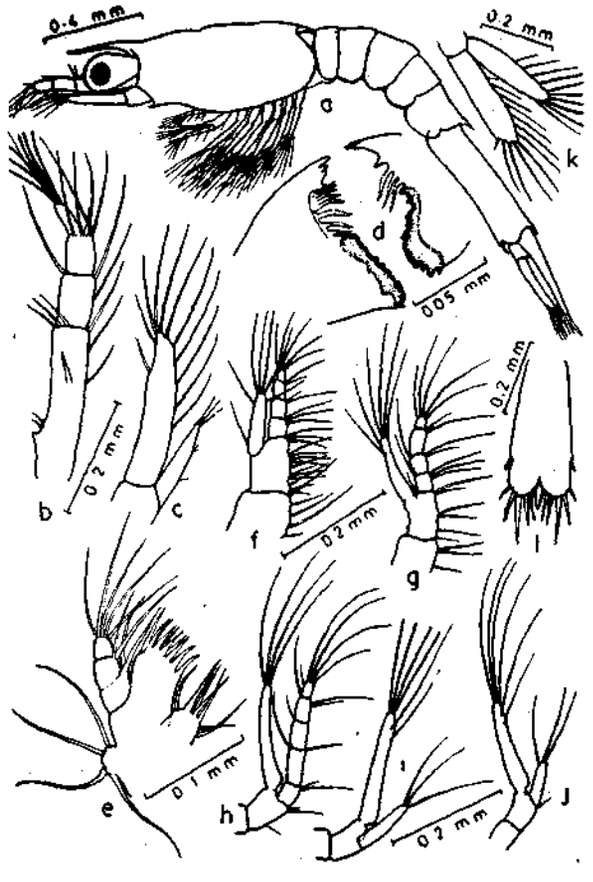

Fig. 4 *Metapenaeus monoceros:* Mysis I: a - lateral view; b - A1: c - A2; d - Md; e - Mx1; f - Mxp1; g - Mxp2; h - Mxp3; i - P1; j - P5; k - uropod; l - telson.

A1 (Fig.4,b) 3 segmented, proximal segment with a prominent ventral spine, plumose setae present on junction of segments and on inner side, distal segment bearing 2 flagellar rudiments inner one small, bud-like, bearing 2 setae; outer unsegmented bearing 6 aesthaetes and 1 seta

A2 (Fig.4,c) exopod unsegmented, scale like, bearing 10 setae along inner and distal margin and 1 seta on distolateral angle, endopod half length of exopod, bearing 3 short setae apically, and 1+2 setae on inner margin; Md (Fig.4,d) with 8 free standing teeth on left Md and 3 on right Md; Mx1 (Fig.4,e) proximal and distal endites of protopod with 7 and 10 setae respectively, endopod 3 segmented, distal segment with 5 setae, 1st and 2nd segments with 2 to 3 and 2 setae respectively, exopod with 4 feathery setae; exopod of Mx2 (Fig.5,a) with 9 plumose setae; Mxp1 (Fig.4,f) exopod with 7 plumose setae; Mxp2 (Fig.4,g) exopod with 4 apical and 2 subapical plumose setae, endopod 4 segmented, 1st and 2nd segments carrying 1 seta on outer margin; Mxp3 (Fig.4,h) biramous, fully developed, protopod 2 segmented, exopod with 4 long plumose setae apically, endopod 5 segmented, distal segment with 1 short and 4 long plumose setae, 1st, 2nd and 4th segments carrying 2, 1 and2 inner lateral setae respectively, outer distal margin of 2nd, 3rd and 4th segments with 1 seta each; P1 to P5 almost identical (Fig.4,i&j), endopod unsegmented carrying terminally 3 long setae, exopod unsegmented, bearing 4 apical and 4 subapical plumose setae; uropod (Fig.4,k) biramous, exopod with 1 short nonplumose outer seta and 11 long plumose setae; endopod with 10 plumose setae; telson (Fig.4,l) broader distally with deep median cleft carrying 7+7 setae. Duration of this substage was 36-48 hours.

MYSIS II

MTL; 2.50 mm(2.38-2.55 mm);MCL: 0.87 mm (0.84-0.90 mm).

Rostrum with a dorsal tooth, pleopod buds still absent (Fig.5,b). telson almost rectangular, median cleft reaching only to level of origin of penultimate pair of lateral setae, carrying 7+7 setae (Fig.5,k);

A1, number of setae on segments increased, inner flagellum reaching 2/3rd of outer flagellum; A2 (Fig.5,c) exopod with 14 plumose setae and 1 distolateral spine; Md (Fig.5,d) rudimentary palp developed, left and right Md with 7-8 and 3 standing teeth respectively; Mx2 exopod (Fig.5,f) with 11 plumose setae; Mxp1 (Fig.5,g) proximal and distal segments of protopod with 8 and 14 setae respectively on inner side, 1st segment of endopod with 1 seta on outer side, exopod with 7 plumose setae, a few fine hair like setae seen on proximal outer margin of exopod; Mxp2 endopod 5 segmented, with 6 setae on the distal segment, outer distal margin of 3rd segment with a seta; Mxp3 same as in previous stage; P1 to P3 (Fig.5,h) identical, endopod indistinctly segmented, distal segment with 3 long setae terminally, and a long seta on outer

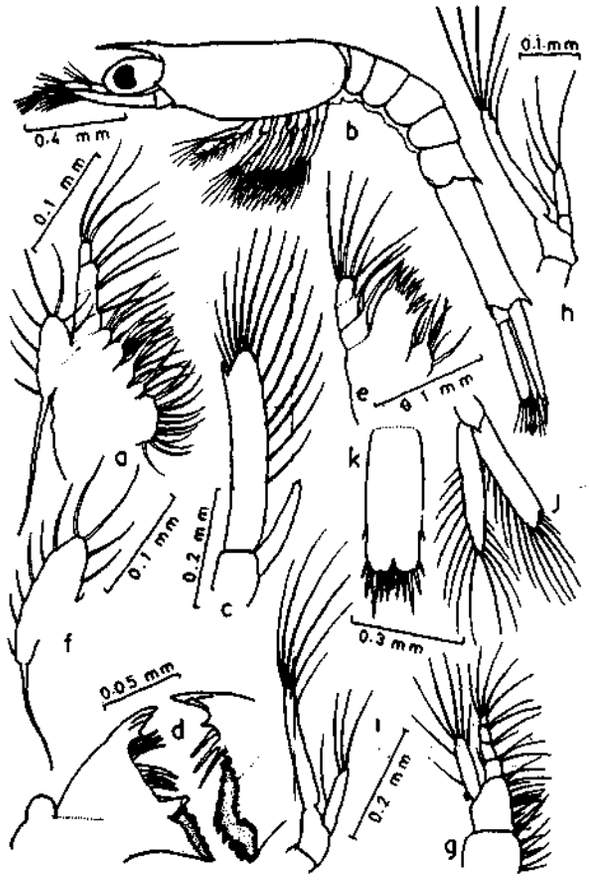

Fig. 5 *Metapenaeus monoceros:* Mysis I: a - Mx2; Mysis II; b - lateral view; c - A2; d - Md; e - Mx1; f - exopod of Mx2; g - Mxp1; h - P1; i - P5; j - uropod; k - telson.

margin, in some specimens a cleft on distal segment indicating the developing chela seen; P4 and P5 (Fig.5,i) endopod indistinctly 2 segmented; uropod (Fig.5,j) exopod with 14 to 15 plumose setae, 1 nonplumose seta and 1 short spine distolaterally. Duration of this substage was 36-48 hours.

MYSIS III

MTL: 2.7 mm (2.58-2.81 mm); MCL: 0.95 mm (0.92-0.98 mm).

Rostrum with 2 dorsal teeth (Fig.6,a), in some specimens a small hepatic spine seen; pleopod buds small and unsegmented. A1 (Fig.6,b) inner flagellum more than half of outer flagellum bearing at its apex 2 setae of which 1 is very long, outer flagellum unsegmented bearing 5 aesthaetes and 1 seta, A2 (Fig 6,c) endopod unsegmented not reaching half length of exopod, exopod

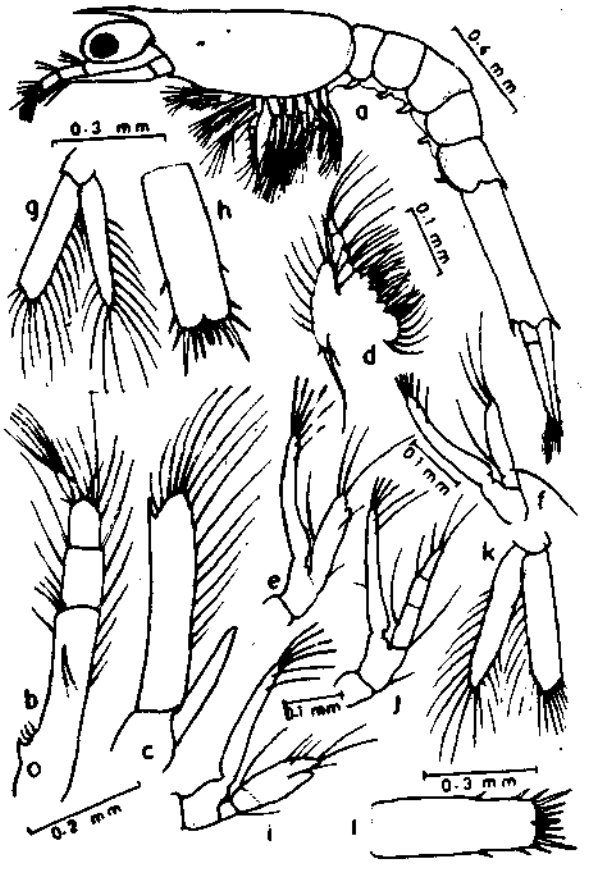

Fig. 6 *Metapenaeus monoceros:* Mysis III: a - lateral view: b - A1: c - A2; d - Mx2: e - P1: f - P5: g - uropod: h - telson. Mysis IV: i - P1; j - P5: k - uropod: l - telson.

with 16 plumose and setae and 1 distolateral spine, Mx2 (Fig.6,d) exopod with 13 plumose setae; P1 to P3 almost identical (Fig.6,e) cleft of developing chela clearly seen; P4 and P5 identical (Fig.6;f) endopod indistinctly segmented, 1st segment bearing 1 long inner seta and 2nd with 1 long outer seta; endopod of uropod (fig.6,g) with 14 to 15 plumose setae; telson (Fig.6,h) rectangular; distal cleft small bearing 7+7 setae. Duration of this substage was 36-48 hours.

MYSIS IV

MTL: 2.86 mm (2.83-2.90 mm); 0.95 mm.

Pleopod buds further developed but not segmented (Fig.7,a); flagella of A1 equal in length (Fig.7,b) inner flagellum bearing apically 1 long and 2 short setae, outer flagellum bearing 7 aesthaetes in 3 groups of 4+2+1 and 1 long seta, number of seta on segments increased; A2(Fig.7,c) endopod 2 segmented, faint indications of segnentation seen on distal

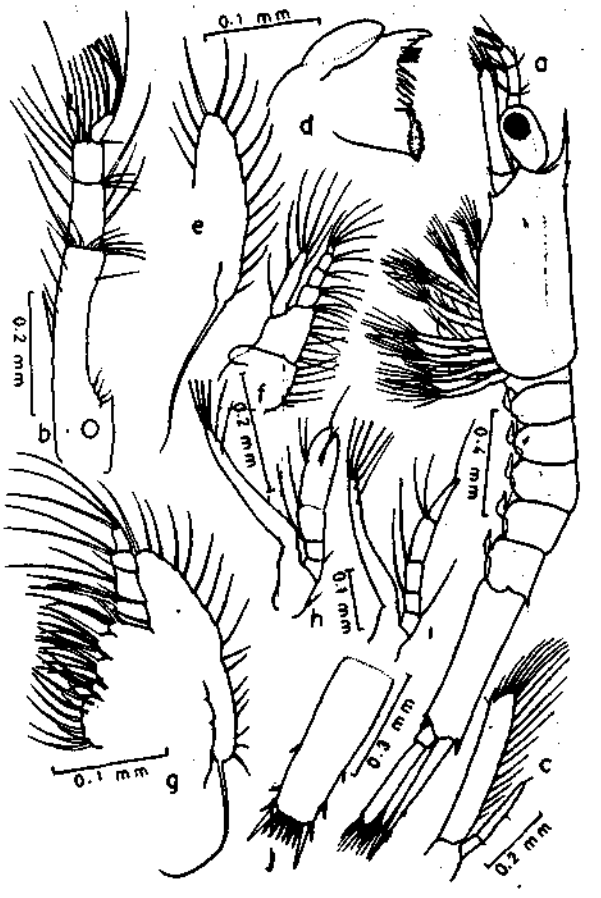

Fig. 7 *Metapenaeus monoceros:* Mysis IV: a - lateral view; b - A1; c - A2; d - Md; e - exopod of Mx2; f - Mxp1. Mysis V: g - Mx2; h - P1; i - P5; j - telson.

segment, exopod with 18 plumose setae and 1 spine; palp of Md developed into a finger shaped projection (Fig.7,d); exopod of Mx2 with 16 plumose setae (Fig.7,e); Mxp1 with a small bud like rudiment of gill (Fig.7,f); P1 to P3 (Fig.6,i) almost identical, anterior portion of endopod swollen showing developing chela and bearing 6 setae, P4 and P5 almost identical

(Fig.6,j) endopod indistinctly divided into 4 segments exopod of uropod (Fig 6,k) with 15 to 16 plumose setae, 1 nonplumose seta and 1 distolateral spine endopod with 16 plumose setae; telson with shallow cleft (Fig.6,l). Duration of this substage was 36-48 hours.

MYSIS V

MTL: 3.17 mm (2.99–3.28 mm); MCL: 1.10 mm (0.95-1.09 mm).

Pleopods 2 segmented (Fig.8,a); telson truncate posteriorly (Fig.7,j) bearing 3 pairs of lateral setae and 8 distal setae; A2 (Fig.8,b) exopod with 22 plumose setae and 1 spine,

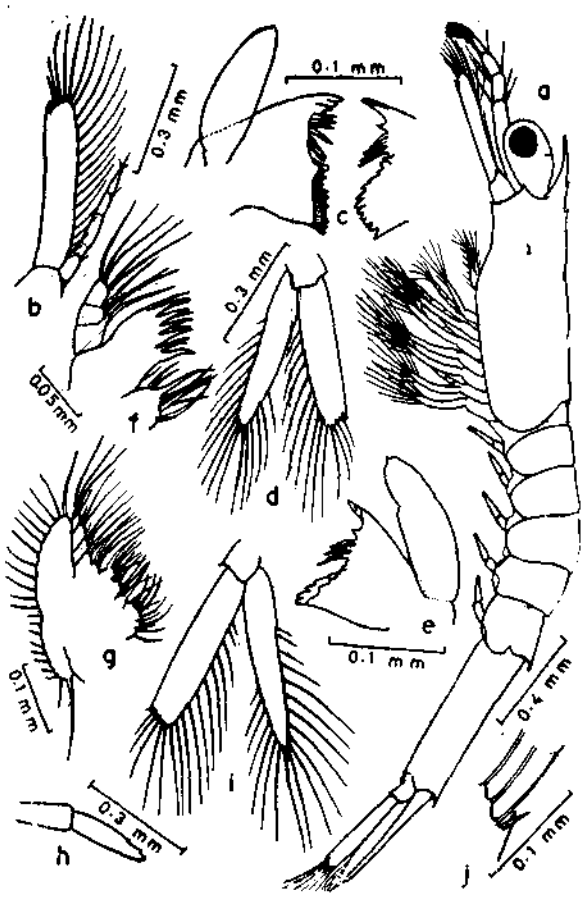

Fig. 8. *Metapenaeus monoceros:* Mysis v; a - lateral view; b - A2; c - Md; d - uropod. Mysis VI: e - Md; f - Mx1; g - Mx2; h - pleopod; i-uropod; j - distolateral tip of exopod of uropod.

endopod indistinctly 5 segmented, more than ½ length of exopod; Md (Fig.8,c), palp big, unsegmented, left and right Md with 6 to 7 and 3 free standing teeth respectively; Mx2 Fig. 7,g) exopod with 20 to 22 plumose setae; P1 to P3 almost identical in structure (Fig.7,h), endopod 4 segmented and bigger than exopod; P4 and P5 identical (Fig.7,i) endopod 5 segmented as long as exopod; endopod of uropod (Fig.8,d) with 17 to 18 plumose setae. Duration of this substage was 36-48 hours.

MYSIS VI

MTL: 3.15 mm (2.91-3.46 mm); MCL: 1.00 mm (0.94 mm 1.09mm).

Distally pleopods bear 4 to 5 projections indicating developing setae (Fig.8,h); Md (Fig 8,e) palp fairly big with a constriction at about 2/3rd from proximal end; chela of P1 to P3 fully developed; telson convex posteriorly (Fig; 9,h); A2 (Fig.9,b) exopod with 21 plumose setae and 1 distolateral spine, endopod with 5 short setae apically; Mxp1 (Fig. 9,c) gill rudiment fairly developed; Mxp2 (Fig.9,d) endopod 5 segmented, distal segment with 6 long plumose setae, 1st 3 segments carrying 1 seta on outer

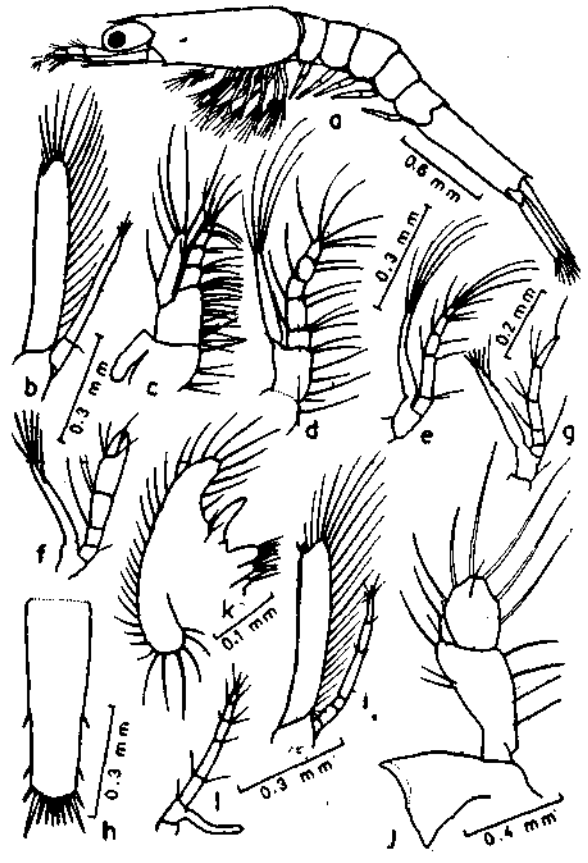

Fig. 9 *Metapenaeus monoceros:* Mysis VI: a - lateral view; b - A2; c - Mxp1; d - Mxp2; e - Mxp3 f - P1; g - P5; h - telson. Postlarva I: i - A2; j - Md; k - Mx2; l - Mxp3,

distal margin, exopod shorter than endopod; Mxp3 (Fig.9,e) endopod 5 segmented, longer than exopod. distal segment with 5 plumose setae; P1 to P3 (Fig.9,f) endopod 5 segmented chela fully developed, exopod shorter than endopod, P4 and P5 (Fig.9,g] endopod 5 segmented, longer than exopod, distal segment with a long seta, 2nd, 3rd and 4th with 1, 2 and 2 outer distal setae; endopod of uropod with 19 plumose setae (Fig.8,i) exopod with 16 plumose setae, 1 short non-plumose seta and a distolateral spine (Fig.8,j). Duration of this substage was 36-48 hours.

POSTLARVA I

MTL: 3.02 mm (2.87-3.15 mm); MCL: 0.91 mm (0.91-0.92 mm).

Rostrum short with 3 dorsal teeth [Fig. 10,a); exopods of P1 to P5 reduced, without setae; pleopods functional bearing plumose setae (Fig.10,j]; A1 (Fig.10,b) inner flagellum longer

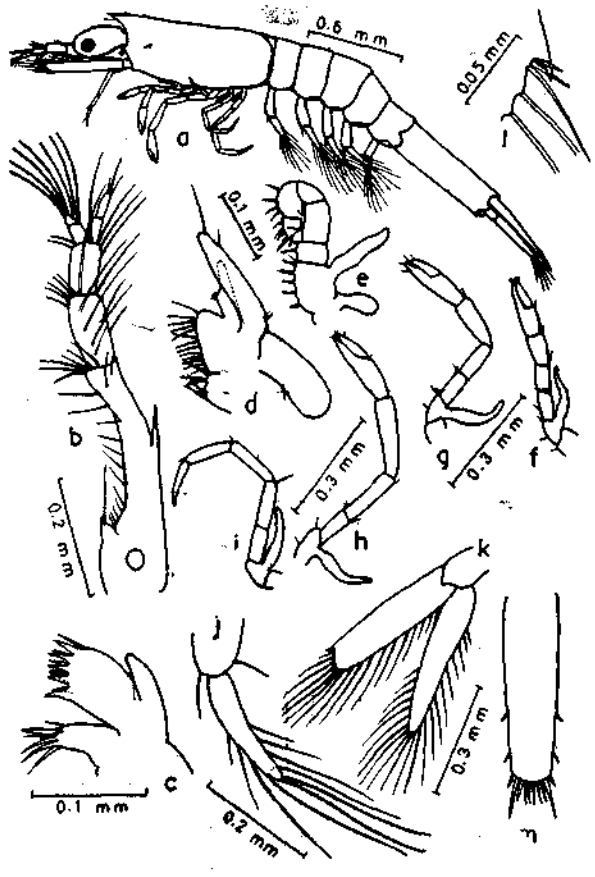

Fig. 10. *Metapenaeus monoceros:* Postlarva 1. a - lateral view; b - A1; c - Mx1; d - Mxp1; e - Mxp2; f - P1; g - P2; h - P3; i - P5 j - pleopod II ; k - uropod ; l - distolateral tip of the exopod of uropod ; m - telson.

than outer, 2 segmented bearing 3 setae apically, outer in 2 segmented bearing 7 to 8 aesthaetes, statocyst fully developed; A2 (Fig.9,i) exopod with 22 to 25 plumose setae, endopod 5 to 6 segmented and distal segment with 6 short setae apically; Md (Fig.9,j) palp big, flattened and 2 segmented carrying plumose setae, free standing teeth absent; Mx1 (Fig.10,c) endopod reduced, unsegmented and palp like, distal endites of protopod more flattened and bearing short stumpy setae proximal endite with long setae; Mx1 (Fig.9,k) exopod flattened, leaf like bearing 33 to 40 plumose setae, endopod unsegmented, without setae, protopod with 3 endites bearing small bristle - like setae apically; Mxp1 (Fig. 10, d) exopod bearing only 2 short setae distally and 2 short setae on proximal outer margin, endopod unsegmented bearing 2 small setae, protopod flattened with 2 lobes carrying number of setae, gill well developed; Mxp2 (Fig. 10,e) exopod unsegmented without setae, endopod sharply curved distally bearing a number of stout setae, protopod bearing short setae on inner side, rudimentary gills developed; Mxp3 (Fig.9,l) exopod reduced, endopod 5 segmented bearing a number of setae; P1 to P3 (Fig.10,f,g,h) exopod reduced without setae, endopod 5 segmented, chela fully developed, a progressive increase in length from P1 to P3 noticed; P4 and P5 (Fig.10,i) identical, exopod reduced, endopod 5 segmented; endopod of uropod (Fig.10,k) with 21-22 plumose setae, 2 short non-plumose setae and a distolateral spine (Fig.10,l); telson (Fig.10,m) convex posteriorly bearing 3 pairs of lateral setae and 8 distal setae.

DISCUSSION

The eggs of *M.monoceros* are 0.28 mm in diameter, the yolk mass measuring 0.22 mm. Raje and Ranade[2] have, however, recorded a larger size (0.35 mm) for the eggs of *M. monoceros*.

The six nauplius substages were observed during the present study. However, Raje and Ranade[2] found only five nauplius substages in the development of *M. monoceros*. The nauplius IV has not been described by them; their nauplius IV and nauplius V correspond to our nauplius V and nauplius VI respectively. In the following table the setation pattern of the nauplius substages observed by us is compared with that given by Raje and Ranade[2].

	Setation	
	Present observations	Raje and Ranade[2]
Nauplius I		
A1	2+i terminal	2 terminal
	3 inner lateral	2 inner lateral
	1 outer lateral	1 outer lateral
A2 exopod	5+i	5+i
A2 endopod	2+i terminal	2 terminal
	2 inner lateral	2 inner lateral
Nauplius II		
A1	3 terminal	2+i terminal
	3 inner lateral	2 inner lateral
	1 outer lateral	2 outer lateral
A2 exopod	5+1	6
Nauplius III		
A1	3 terminal	3+i terminal
	3 inner lateral	2 inner lateral
	1 outer lateral	1 outer lateral
A2 exopod	6+i	6
Nauplius IV		
A1	3 terminal	not described
	3 inner lateral	—do—
	no outer lateral	—do—
A2 exopod	1+6+i	—do—
Nauplius V		
A1	3 terminal	3 terminal
	3 inner lateral	3 inner lateral
A2 exopod	1+7+i	7
Nauplius VI		
A1	i+2 terminal	3 terminal
	3 inner lateral	3 inner lateral
	1 terminal aesthaetes	
	2 outer lateral aesthaetes	
A2 exopod	1+8+i	8+i
A2 endopod	4 terminal	3 terminal
	1+2 inner	2 inner

i respresents spike-like setal rudiment.

In our material the A1 bears 3 inner lateral setae in all the naupliar substages while Raje and Ranade[2] have shown only 2 inner lateral setae in Nauplius I to III. The relative length of the terminal setae and outer lateral setae of A1 undergo characteristic transformation in successive nauplius substages in all the penaeids studied by us. But this pattern is not seen in the illustrations given by Raje and Ranade[2]. The setation of A1 in the last nauplius substage illustrated by Raje and Ranade[2] is completelyatypical.

The setation of the protozoea substages of *M.monoceros* given by Raje and Ranade[2] closely resemble the pattern that was observed during the present study except in the following respects. The exopod of Mxp2 of protozoea I and II is shown with 5 setae instead of 6 setae as observed by us and the bud of Mxp3 of protozoea II is drawn with 2 setae at the tip of each ramus while we found only 3 setae in the outer ramus and none on the inner.

Raje and Ranade[2] described five mysis substages for *M.monoceros*. We found six mysis substages which could be distinguished on the basis of the increse in (i) length of the pleopod buds, (2) number of setae in the exopod of Mx2 and the scaphocerite and (3) total length of larvae. The fifth mysis substage described by Raje and Ranade[2] is actually equivalent to the "intermediate stage" observed by us in *M. dobsoni*. However, no "intermediate stage" was observed in *M.monoceros* during the present study.

The wide range in size of mysis II and III given by Rao[3] is suggestive of the fact that two or more substages may have been clubbed together under these two substages. The mysis substages described by Raje and Ranade[2] and Rao[3] for *M.monoceros* can be equated with the substages observed during the present study as follows:

Present Work	Raje and Ranade[2]	Rao[3]
Mysis I	Mysis I	Mysis I
Mysis II	... .	Mysis II
Mysis III	Mysis II	....
Mysis IV	Mysis III	....
Mysis V	.. ..	....
Mysis VI	Mysis IV	Mysis III

The setation of the mysis substages given by Raje and Ranade[2] is closely similar to the present observations except for the fact that the Md palp is shown as 2 segmented even in mysis III. In our material the Md palp becomes segmented only in the postlarval stage. Rao[3] has also shown an unsegmented Md palp in all the mysis substages described by him. Raje and Ranade[2] have depicted a pair of minute spines on the posterior margin of the 6th abdominal segment in the mysis substages. But these spines were not observed by us; we found a pair of very thin setae in this place.

The mysis I of *M.monoceros* described by Rao[3] is atypical in the following respects: (a) the terminal segment of the endopod of the Mx1 has 4 setae instead of 5, (b) the exopod of Mxp1 has 4setae instead of 5, and (c) the endopod of Mxp2 is 5 segmented with 4 terminal setae in the distal segment, whereas in all the penaeid larvae studied at Narakkal the endopod of this appendage is 4 segmented and has 5 setae on the distal segment. Rao[3] has also shown a lesser number of setae on the exopod of Mx2 in mysis II and III.

Rao[3] stated that the rostrum reaches the tip of eye or falls short of the eye in the mysis stage of *M.monoceros*. But during our present observations we found that the rostrum of mysis I reaches beyond the eye and gradually gets shortened in the subsequent mysis substages.

The first postlarva described by Mohamed *et. al.*[1] and Raje and Ranade[2] are similar in many respects to the present material. But Mohamed *et. al.*[1] have stated that an epigastric tooth is absent in postlarva I. It is clearly present in the present material. The two smaller rostral spines described by Mohamed *et. al.*[1] are not true rostral teeth but moveable spinelets. Rao[3] has shown a bluntly rounded rostral tip in the early postlarvae of *M.monoceros*. The rostrum is sharply pointed in our material. The blunt rostrum is characteristic of postlarva I of *M. dobsoni*.