

VI

Larval development — *METAPENAEUS AFFINIS* (H. MILNE EDWARDS)

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

The complete larval development of *Metapenaeus affinis* was studied by rearing them in the laboratory at Narakkal. At the rearing temperature of 25.2° C-27.0° C the embryo takes 15 to 17 hours to hatch out; the nauplius transforms into protozoa I 42 to 56 hours after it hatches out of the egg, the protozoa stage lasts for 4 to 8 days and the mysis I takes 6 to 9 days to transform into postlarva I. Complete larval development from egg stage to postlarva I takes 14 to 23 days. 6 nauplius substages, 3 protozoa substages, 5 mysis substages and 2 intermediate stages were observed during the course of development. All the larval substages are described and illustrated and compared with the earlier descriptions of this species.

The penaeid prawn *Metapenaeus affinis* which is of commercial importance on the west coast of India, spawned in the laboratory at Narakkal on a number of occasions and the larvae were reared to the juvenile stage successfully. While checking the morphological features of the larvae with the earlier larval descriptions of *M. affinis* given by Mohamed *et al.*, (1968) *FAO Fish. Rep.*, 57 (2): 487-503¹), Rao (1974, *J. mar. biol. Ass. India*, 15 (1): 95-124)², and Thomas *et al.* (1976, *Indian J. Fish.*, 21 (2): 543-556)³, marked differences

in the setation of the appendages and in the number of mysis substage were noticed. Hence the larval characters of *M. affinis* observed during the present study are fully described and illustrated in this paper to bring out the exact nature of setation of the larval appendages. The temperature of the water in the rearing basins was 25.2° C-27.0° C and the salinity 33.2-34.6 ppt.

The authors are grateful to Dr.E.G. Silas, Director, Central Marine Fisheries Research

Institute, for the encouragement and facilities provided and for his valuable suggestions.

DESCRIPTION OF DEVELOPMENTAL STAGES

EGG

Opaque, diameter of egg varied from 0.25 to 0.27 mm and that of yolk mass from 0.21 to 0.24 mm (Fig.1,a); eggs hatch out 15 to 17 hrs after spawning.

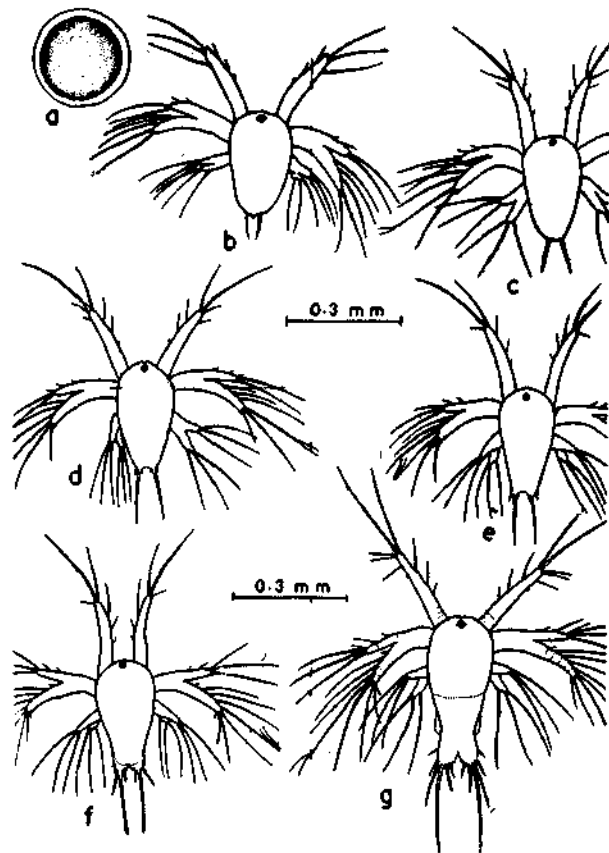


Fig. 1 *Metapenaeus affinis*: a - egg; b - Nauplius I; c - Nauplius II; d - Nauplius III; e - Nauplius IV; f - Nauplius V; g - Nauplius VI.

NAUPLIUS I

MTL: 0.25 mm (0.24-0.27 mm); MW: 0.15mm; MFS:0.06 mm (0.05-0.08 mm).

An ocellus present in anterior end; it persists in all nauplius substages; A1 uniramous carrying distally 1 rudimentary spike-like seta and 2 long setae, 1 seta as long as the long terminal setae present at outer distal margin, inner margin with 3 short setae (Fig. 1,b); A2 biramous, endopod with 2 short inner-

lateral setae and one rudimentary and 2 long apical setae, exopod with 5 long setae along inner and distal margin; Md biramous, exopod and endopod carrying 3 long setae distally; setae nonplumose; furcal setae 1+1; a small median dorsal spine present posteriorly. Duration of this substage was 3-4 hours.

NAUPLIUS II

MTL: 0.26 mm (0.25-0.27 mm); MW: 0.07 mm (0.07-0.08 mm); MFS: 0.15 mm (0.14-0.15 mm).

Setae plumose; furcal setae 1+1 (Fig.1,c); A1 with 3 short setae on the inner margin, distally with 3 setae, 1 short seta present at outer distal margin; A2 exopod with 5 long setae along inner and distal margin, and distally a rudimentary seta, 4th seta from proximal end distally split, this bifurcated condition of the seta is retained in all subsequent nauplius substages. Duration of this substage was 3-4 hours.

NAUPLIUS III

MTL: 0.26 mm (0.25-0.27 mm); MW: 0.15 mm (0.14-0.15 mm); MFS: 0.11 mm (0.09-0.11 mm).

Furcal setae 3+3 (Fig.1d); exopod of A2 with 6 long plumose setae and 1 rudimentary seta. Duration of this substage was 6-8 hours.

NAUPLIUS IV

MTL: 0.27 mm (0.26-0.28 mm); MW: 0.15mm (0.14-0.15 mm); MFS: 0.13 mm (0.13-0.14 mm).

Furcal setae 4+4 (Fig.1,e); A1 outer distal seta present in earlier stages lost; endopod of A2 distally carries 3 long plumose setae and 2 short setae on inner margin. Duration of this substage was 4-6 hours.

NAUPLIUS V

MTL: 0.27 mm (0.26-0.28 mm); MW: 0.15 mm (0.14-0.15 mm); MFS: 0.17 mm (0.16-0.18 mm).

Furcal setae 6+6 (Fig. 1, f); developing frontal organ seen; exopod of A2 with 7 long and 2 short setae; a swelling at the base

of Md present. Duration of this substage was 10-12 hours.

NAUPLIUS VI

MTL: 0.35 mm (0.34-0.36 mm); MW: 0.16 mm; (0.15-0.17 mm); MFS: 0.22 mm (0.21-0.22mm).

Body slightly elongated, developing carapace seen, furcal setae 7+7 (Fig. 1, g); 3 more setae, 2 medium and 1 short, added to outer distal margin of A1, indistinct segmentation seen in proximal part; endopod of A2 with 2 short setae on inner margin and 1 short and 3 long plumose setae distally; exopod with 9 setae along inner and distal margin, proximal inner seta small; cutting edge of developing Md visible inside basal swelling of Md. Duration of this substage was 16-24 hours.

PROTOZOEAL I

MTL: 0.77 mm (0.77-0.78 mm); MCL: 0.37 mm (0.35-0.38 mm).

Carapace rounded anteriorly with a median notch, frontal organs overhung by frontal horns (Fig. 2, a), ocellus persists; each furcal lobe with 7 setae.

A1, 3 segmented, proximal segment divided into 5 subsegments, 1st and 2nd segments carry 1 and 2 setae respectively on inner margin, distal segment carries 3 aesthaetes and 2 setae of which 1 seta more than twice length of the other; exopod of A2 (Fig. 2, a) 10 segmented carrying 10 long plumose setae along inner and distal margin and 2 setae on outer margin, endopod 2 segmented, distal segment apically with 5 long plumose setae, basal segment with 1+2+3 inner lateral setae; Md (Fig. 2, b) devoid of exopod and endopod, almost symmetrical with 1 free standing tooth in between incisor and molar processes; Mx1 (Fig. 2, c) protopod unsegmented with 2 large lobes, distal lobe with 4 setae and proximal with 7 setae, exopod knob-like and bears 4 long feathery setae, endopod 3 segmented, distal segment carries apically 5 long setae, middle segment carries 2 stout setae and proximal segment with 1 slender and 2 stout setae; Mx2 (Fig. 2, d) protopod with 5 endites on inner side, basal endite bearing 6 to 8 setae and other endites

with 3 to 4 setae, exopod carries 5 long feathery setae, endopod with 3 distinct segments, the large middle segment partially divided into 2 by indistinct segmentation, 1 to 3 segments carrying 2 setae each on inner side and distal

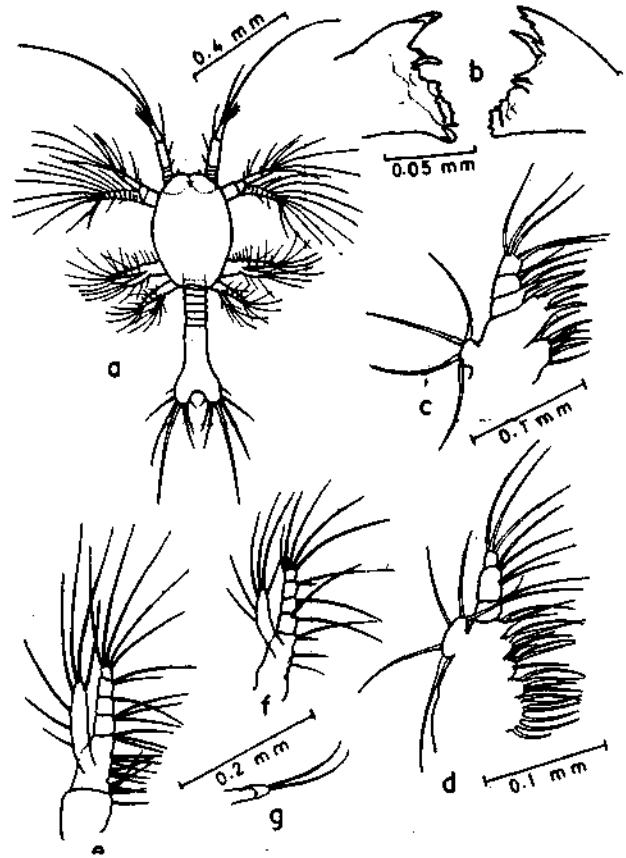


Fig. 2 *Metapenaeus affinis*: Protozoa I: a - dorsal view; b - Md; c - Mx1; d - Mx2; e - Mxp1; f - Mxp2; g - Mxp3.

one with 3 long setae; Mxp1 (Fig. 2, e) protopod 2 segmented, proximal with 3 to 4 and distal with 11-12 setae on inner side, exopod shorter than endopod carrying 7 long plumose setae, endopod 4 segmented, distal segment with 5 long plumose setae, 1st, 2nd and 3rd segments carrying on inner side 3, 1 and 2 setae respectively; Mxp2 (Fig. 2, f) protopod indistinctly segmented, exopod with 6 long plumose setae, endopod 4 segmented, distal segment carries 5 long plumose setae, 1st, 2nd and 3rd segments with 2, 1 and 2 setae respectively; Mxp3 (Fig. 2, g) biramous, exopod with 2 long setae apically. Duration of this substage was 24-72 hours.

PROTOZOEAE II

MTL: 1.23 mm (1.19-1.26 mm); MCL: 0.50 mm (0.49-0.53 mm).

Stalked eyes developed, rostrum prominent, rostral platform with blunt anterolateral corners, supraorbital spines present (Fig.3,a); 7 setae on each furcal lobe.

A1 (Fig. 3,b) distal segment with 3 aesthaetes, 3 setae and a spike-like rudimentary seta; Md (Fig. 3,d) asymmetrical, left with 5 free standing teeth and right Md with one standing

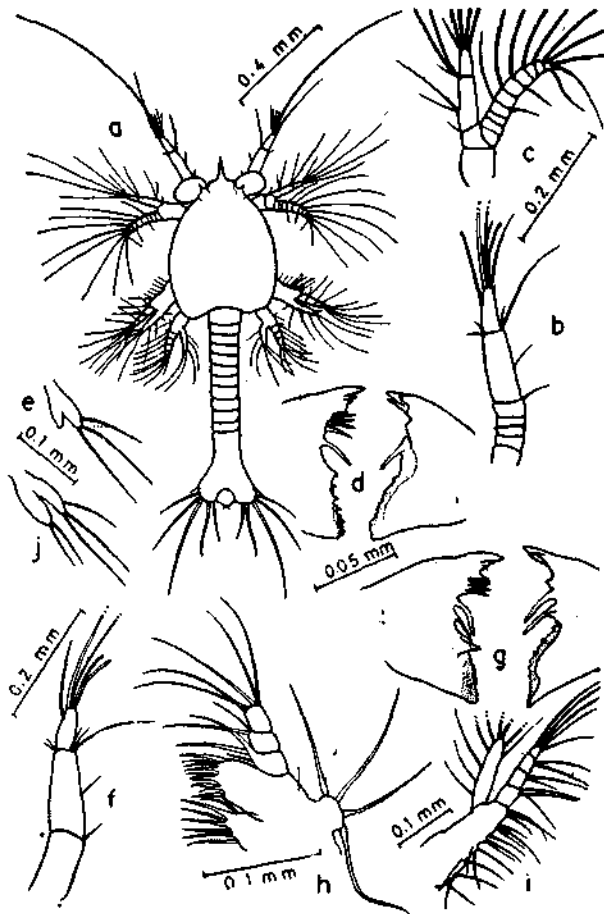


Fig. 3 *Metapenaeus affinis*: Protozoaea II: a - dorsal view; b - A1; c - A2; d - Md; e - Mxp3; Protozoaea III: f - A1; g - Md; h - Mx1; i - Mx1; j - Mxp3.

tooth; Mx1, distal endite of protopod with 7 setae; Mx2, number of setae on endite of protopod increased, a small setae added to 3rd segment of endopod of Mxp1; exopod rudiment of Mxp3 with 3 setae (Fig. 3,e). Duration of this substage was 24-48 hours.

PROTOZOEAE III

MTL: 1.85 mm (1.77-2.03mm); MCL: 0.63mm.

Rostrum prominent; abdominal segments 1 to 5 with postero-dorsal spines (Fig.4,a,) 5th segment carries posterolateral spines, 6th segment with a pair of ventrolateral spines, 7 setae on each furcal lobe, uropod biramous.

A1 (Fig. 3,f) 3 segmented; subdivisions of the basal segment vanished; Md (Fig.3,g) left and right Md with 6 and 2 free standing teeth respectively; Mx1 (Fig.3,h) distal endite of protopod with 9 and proximal with 7 setae; exopod of Mxp1 with 9 plumose setae (Fig.3,i); exopod and endopod of Mxp3 (Fig.3,j) with 3 and 2 setae respectively; exopod of uropod with 6 short setae, endopod bare. Duration of this substage was 48 to 72 hours.

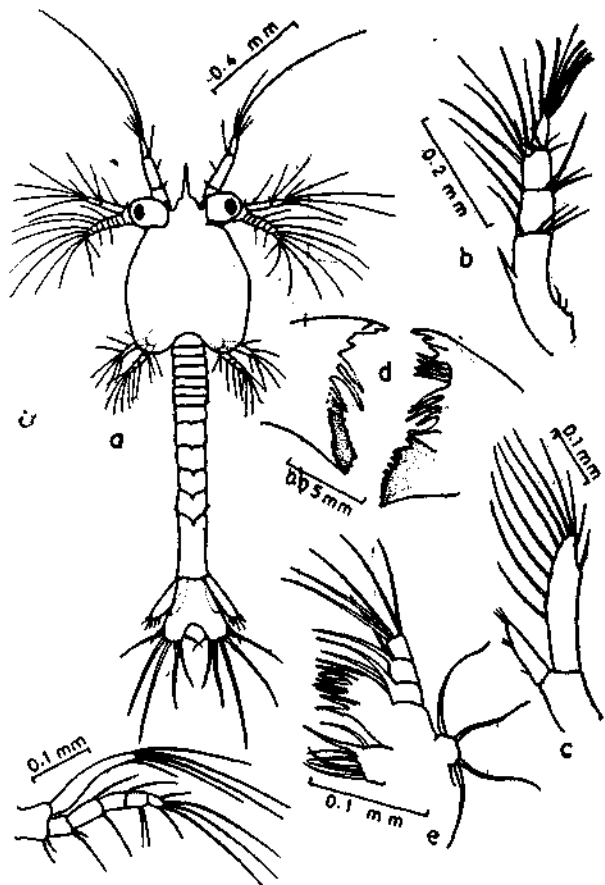


Fig. 4 *Metapenaeus affinis*: Protozoaea III: a - dorsal view, Mysis I: b - A1; c - A2; d - Md; e - Mx1; f - Mxp3.

MYSIS I

MTL: 2.27 mm (2.21-2.38 mm); MCL: 0.77 mm (0.77-0.79 mm):

Rostrum devoid of teeth, extends beyond eye; antennal and pterygostomial spines present (Fig.5,a); dorsal median spine present on 5th and 6th abdominal segments; telson with a median deep cleft and carries 7+7 setae (Fig.5,e).

A1 (Fig.4,b) 3 segmented, just above stylocerite rudiment a slight swelling carrying 2 short plumose setae present, basal segment with prominent ventral spine, distal segment carries 2 flagellar rudiments, outer flagellum with 6 aesthaetes and 1 seta, inner flagellum small, bud-like bearing apically 2 setae, one long, slender and the other short; A2 (Fig.4,c) exopod unsegmented, scale-like bearing 10 setae along inner and distal margin and a seta at disto-

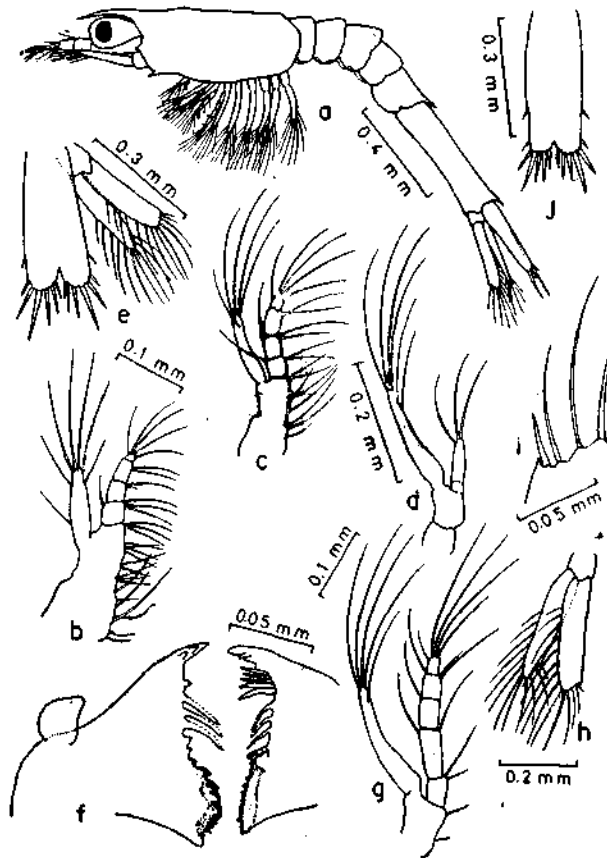


Fig. 5 *Metapenaeus affinis*: Mysis I: a - lateral view; b - Mxp1; c - Mxp2; d - P1; e - uropod and telson. Mysis II: f - Md; g - Mxp3; h - uropod; i - distolateral tip of exopod of uropod; j - telson.

lateral angle; endopod } length of exopod bearing 3 short terminal and 3 small inner lateral setae; Md (Fig.4,d) left and right Md with 7 and 3 free standing teeth respectively; Mx1 (Fig.4,e) distal endite with 10 setae and proximal endite with 7 setae; exopod of Mx2 with 9 plumose setae; Mxp1 (Fig.5,b) exopod with 7 plumose setae, 1 seta added to 1st segment of endopod at outer margin. Mxp2 (Fig.5,c) exopod carries 6 setae, endopod 4 segmented distal segment carries 5 setae, 1st, 2nd and 3rd segments each with 2 setae on inner side, 1st and 2nd segments carry 1 seta on outer side; Mxp3 (Fig.4,f) fully developed, exopod unsegmented with 4 long apical and 2 subapical plumose setae, endopod 5 segmented, distal segment with 5 long setae apically, 1st, 2nd and 4th segments carry 2, 1 and 2 setae on inner margin, 2nd and 3rd segments carry 1 seta on outer distal margin; P1 to P5 almost identical (Fig.5,d), exopod unsegmented bearing 4 apical and 4 subapical long plumose setae, endopod partially divided into 2, distal segment bearing 3 long setae; uropod (Fig.5, e) well developed, exopod with 12 plumose setae and 1 short nonplumose seta distolaterally, endopod with 10 setae. Duration of this substage was 24-36 hours.

MYSIS II

MTL: 2.42 mm (2.28-2.6 mm); MCL: 0.79 mm (0.77-0.81 mm).

Rostrum with 1 dorsal tooth, small hepatic spine present (Fig.6,a); pleopod buds not yet developed; cleft of telson reaching only level of origin of penultimate pair of lateral setae (Fig.5,j).

A1 (Fig.6,b) with 3 short plumose setae just above stylocerite rudiment, a small otolith visible in basal segment; A2 (Fig 6,c) endopod unsegmented without setae and exopod with 15 setae and 1 distolateral spine; Md (Fig.5,f) rudimentary palp developed, right and left Md with 3 and 8 free standing teeth respectively; Mx1 (Fig.6.d) exopod completely lost; Mx2 (Fig.6,e) exopod with 11 setae, number of setae increased in endites of protopod; Mxp2 endopod 5 segmented, 1st, 2nd and 3rd segments carry on outer margin 1 seta each, distal segment with 6 setae; Mxp3 (Fig.5,g) 2nd, 3rd and 4th segment of endopod with

1 seta on outer distal margin; P1 to P3 identical (Fig.6,f) endopod indistinctly 3 segmented, basal 2nd segment with 1 seta on outer side, cleft of chela started developing, distal segment with 3 long setae; P4 and P5 (Fig.6,g) identical, endopod indistinctly divided into 3 segments bearing 3 long setae distally and 1 long seta on the outer margin; exopod

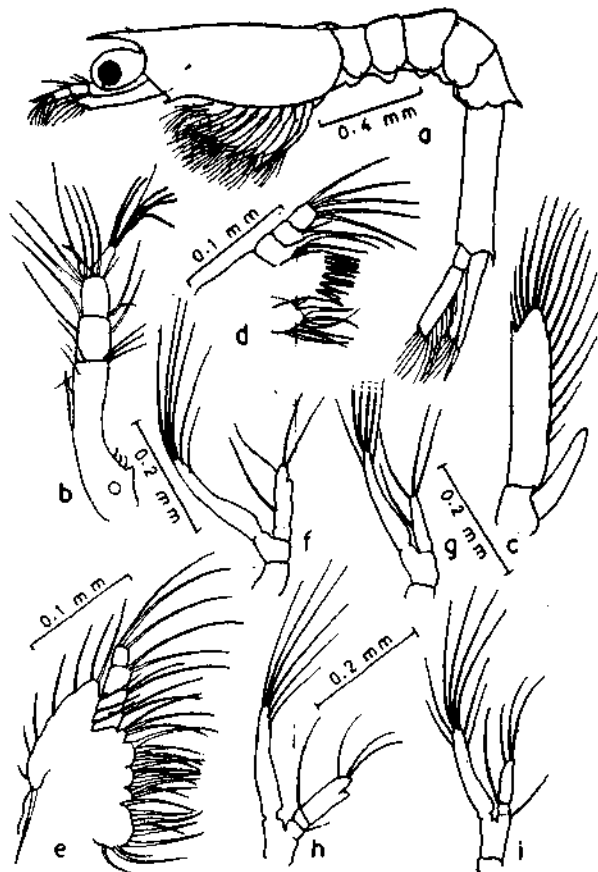


Fig. 6 *Metapenaeus affinis* Mysis II: a - lateral view; b - A1; c - A2; d - Mx1; e - Mx2; f - P1; g - P4; Mysis III: h - P2; i - P4.

of uropod (Fig.5,h) with 13 to 14 plumose setae and 1 short nonplumose seta on outer distal angle, at base of this seta outer margin of exopod produced into a minute tooth which becomes a well defined fixed spine in later substages (Fig.5,i), endopod with 12 to 13 setae; Duration of this substage was 24 to 36 hours.

MYSIS III

MTL: 2.81 mm (2.56-3.12mm); MCL: 0.87 mm (0.84 - 0.88 mm).

Rostrum with 1 dorsal spine, pleopod buds small and unsegmented (Fig.7,a); cleft of telson hardly extending to level of origin of penultimate lateral seta.

A1 (Fig. 7,b) inner flagellum half length of outer, bearing 2 terminal setae, outer with 7 aesthaetes and 1 seta; A2 (Fig.7,c) endopod unsegmented, more than half length of

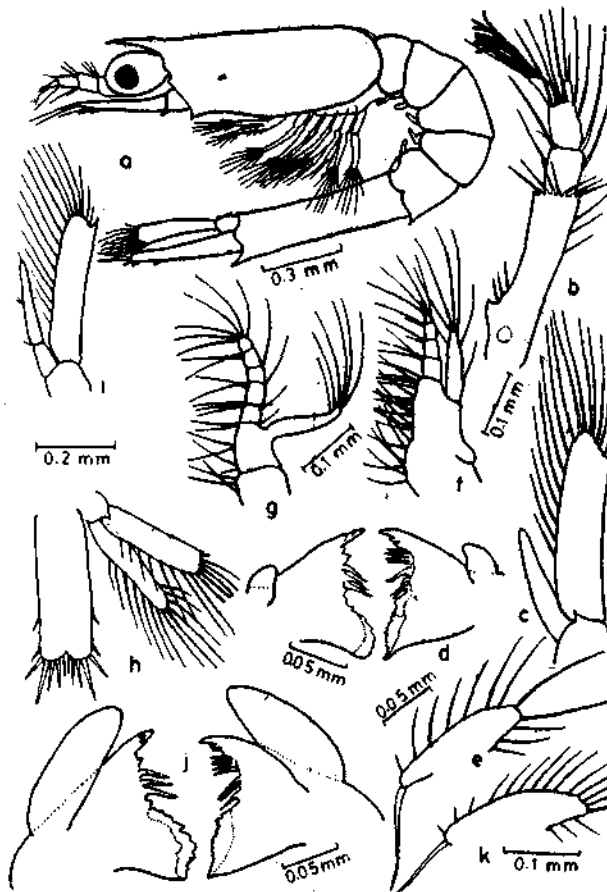


Fig. 7 *Metapenaeus affinis*; Mysis III: a - lateral view; b - A1; c - A2; d - Md; e - exopod of Mx2; f - Mxp1; g - Mxp2; h - uropod and telson. Mysis IV: i - A2; j - Md; k - exopod of Mx2.

exopod, exopod with 15 plumose setae and 1 distolateral spine; Md palp further developed (Fig.7,d); Mx2 (Fig.7,e) exopod with 13 to 14 plumose setae; Mxp1 gill rudiment present (Fig.7,f); Mxp2 with outer lateral seta on 1 to 3 segments of endopod (Fig.7,g); P1 to P3 (Fig.6,h) endopod 3 segmented, 1st segment with one inner seta, 2nd with 1 outer seta, 3rd with 3 terminal setae; P4 and P5 (Fig.6,i) with 2 segmented endopod, 1st segment with one long outer seta and

the distal with 3 setae, cleft of telson much reduced (Fig. 7,h); exopod of uropod with 13 to 14 plumose setae, one nonplumose seta and a minute distolateral spine; endopod with 13 plumose setae. Duration of this substage was 36 to 48 hours.

MYSIS IV

MTL: 2.9 mm (2.89-3.30 mm); MCL: 0.89 mm (0.84-0.92 mm).

Rostrum with 2 dorsal spines (Fig.8,a) pleopod 2 segmented (Fig.8,h), no cleft in telson, posterior part truncate (Fig.8,i).



Fig. 8 *Metapenaeus affinis*; Mysis IV: a - lateral view; b - A1; c - Mxp1; d - Mxp2; e - Mxp3. f - P1; g - P4; h - pleopod II; i - uropod and telson.

A1 inner flagellum as long as outer with 7 aesthaetes and 1 seta (Fig.8,b); A2 exopod with 17 to 18 plumose setae and 1 distolateral spine, endopod 2 segmented, more than half length of exopod (Fig.7,i); Md (Fig.7,j) with

prominent but unsegmented palp devoid of setae; Mx2 exopod with 18 plumose setae (Fig.7,k); Mxp1 (Fig.8,c) with gill rudiment on protopod further developed; no appreciable change in Mxp2 (Fig.8,d) and Mxp3 (Fig.8,e) P1 to P3 (Fig.8,f) endopod 4 segmented, 2nd and 3rd segments with 1 seta on outer side; P4 and P5 (Fig.8,g) endopod 5 segmented, 1st 3 segments with 1 seta, 4th segment with 2 setae and 5th with 3 to 4 setae, exopod with 4 apical and 2 pairs of subapical plumose setae; exopod of uropod (Fig.8,i) with 15 to 16 plumose setae, 1 nonplumose seta and a distolateral spine, endopod with 16 to 18 plumose setae. Duration of this substage was 36 to 48 hours.

MYSIS V

MTL: 3.20 mm (3.05-3.44 mm); MCL: 0.94 mm (0.91-0.95 mm).

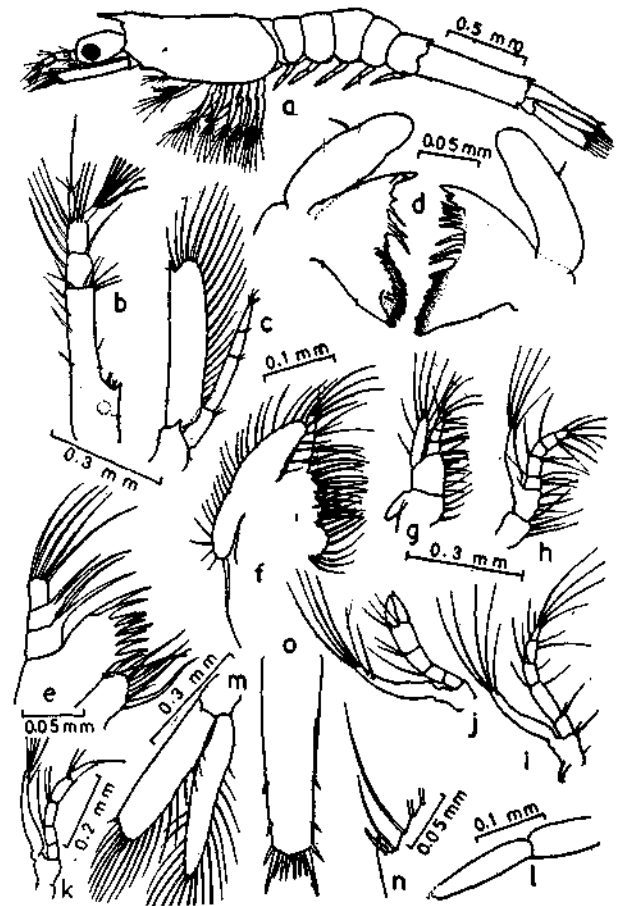


Fig. 9 *Metapenaeus affinis*; Mysis V: a - lateral view; b - A1; c - A2; d - Md; e - Mx1; f - Mx2; g - Mxp1; h - Mxp2; i - Mxp3; j - P1; k - P4; l - pleopod; m - uropod; n - distolateral margin of exopod of uropod; o - telson.

Rostrum greatly reduced in length, hardly reaching half eye (Fig.9,a); pleopods terminally with 4 short setal rudiments (Fig.9,l); telson posteriorly convex (Fig.9,o).

A1 (Fig.9,b) inner flagellum longer than outer, carrying apically 3 small and 1 long setae, outer flagellum with 7 aesthaetes and 1 seta; A2 (Fig.9,c) exopod with 20 to 22 plumose setae and 1 distolateral spine; endopod 4 segmented, distal segment with 5 minute setae; Md (Fig.9,d) palp fairly big, a constriction developed at about 2/3rd from proximal region, a small seta present near this constriction; no appreciable change in Mx1 (Fig.9,e); Mx2 (Fig.9,f) exopod with 27 to 29 setae; no appreciable change in Mxp1 (Fig.9,g), Mxp2 (Fig.9,h), Mxp3 (Fig.9,i); P1 to P3 chela well developed, exopod shorter than endopod (Fig.9,j), 3rd segment with 2 setae on distal outer margin; P4 and P5 (Fig.9,k) endopod longer than exopod, 3rd segment with 2 setae on outer distal margin; endopod of uropod with 18 plumose setae (Fig.9,m), exopod with 17 plumose setae, 1 nonplumose seta and 1 distolateral spine (Fig.9,n).

INTERMEDIATE STAGE I

MTL: 3.2 mm (3.16-3.33 mm); MCL: 0.94 mm (0.91-1.09 mm).

This substage resembles the mysis stage in all respects except in the following respects: (1) pleopods 1 to 3 with 8 setal rudiments (Fig.10,d) and pleopods 4 & 5 with 3 to 4 well developed setae in addition to 4 to 5 setal rudiments, (2) Md (Fig.10,c) retain the free standing teeth, (3) telson more convex distally (Fig.10,f). Duration of this substage was 24 to 36 hours.

INTERMEDIATE STAGE II

MTL: 3.0 mm (2.9-3.1 mm); MCL: 0.94 mm (0.91-0.98 mm).

This substage bears a closer resemblance to postlarval stage than to mysis stage; presence of exopod with plumose setae on Mxp3 and P1 to P5 distinguishes this stage from postlarval stage.

Rostrum short with 3 dorsal teeth, disto-median spine on 5th abdominal segment

absent (Fig.10,g); pleopods with 9 plumose setae (Fig.10,l); telson convex posteriorly bearing 7+7 spines; A2 (Fig.11,a) exopod with 23 to 24 plumose setae; endopod 6 segmented, distal segment bears 6 short setae apically; Md

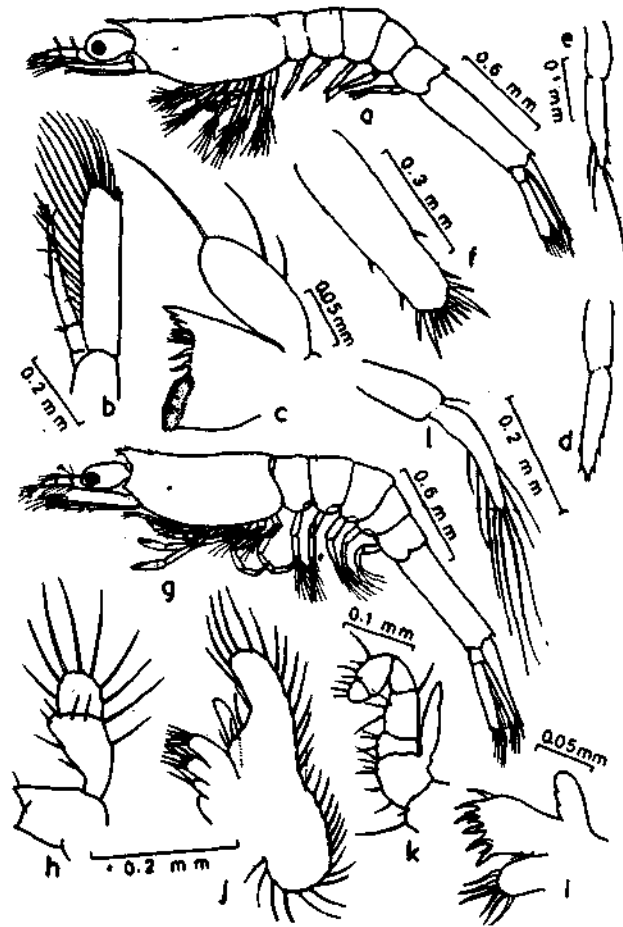


Fig. 10 *Metapenaeus affinis*; Intermediate I: a - lateral view; b - A2; c - Md; d - pleopod II; e - pleopod IV; f - telson. Intermediate II: g - lateral view; h - Md. i - Mx1; j - Mx2; k - Mxp2; l - pleopod III.

(Fig.10,h) with standing teeth absent, palp 2 segmented, proximal segment longer, both segments with plumose setae; Mx1 (Fig.10,i), setae on segments of endopod lost, distal endite of protopod with 12 setae and proximal endite with 6 setae; Mx2 (Fig.10,j) exopod with 35 setae, endopod reduced without segmentation and setae, number of setae on endites of protopod reduced; Mxp1 (Fig.11,b) endopod without segments, reduced, only 2 small setae present on inner side, gill rudiment large, protopod broader, exopod with few setae distally; Mxp2 (Fig.10,k) endopod recurved, exopod

reduced, without setae; Mxp3 (Fig.11,c) exopod short with 6 setae apically, setae on endopod reduced in length; P1-P3 (Fig.11,d) endopod 5 segmented, chela fully developed, exopod

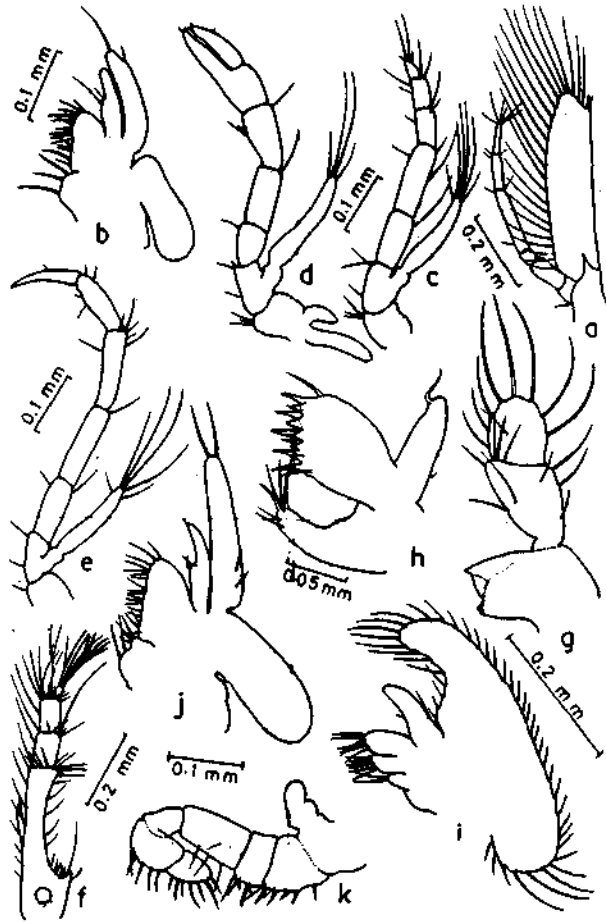


Fig. 11 *Metapenaeus affinis*: Intermediate II: a - A2; b - Mxp1; c - Mxp3; d - P1; e - P4; Postlarva I: f - A1; g - Md; h - Mx1; i - Mx2; j - Mxp1; k - Mxp2.

reduced, with plumose setae apically; P4 and P5 exopod reduced (Fig.11,e) bearing plumose setae apically, Duration of this substage was 24 to 36 hours.

POSTLARVA I

MTL: 3.3 mm (3.2-3.4mm); MCL: 0.94 mm (0.91-1.01 mm).

Rostrum short, sharply pointed with 3 dorsal spines; A1 inner flagellum longer than outer and faintly divided into 2, outer flagellum 2 segmented carrying 8 aesthaetes (Fig.11,f;) A2 (Fig.12,b) endopod 6 segmented, exopod with 23 to 24 plumose setae; Md (Fig.11,g)

palp bigger than Md, number of setae increased, Mx1 (Fig.11,h) endopod small without segments, bearing terminally on inner side one seta, distal endite of protopod more flattened bearing 13 setae of which 1 is plumose; Mx2- (Fig.11,i) exopod with more than 40 setae, endopod reduced without segmentation, protopod with 4 endites, distal 2 endites with

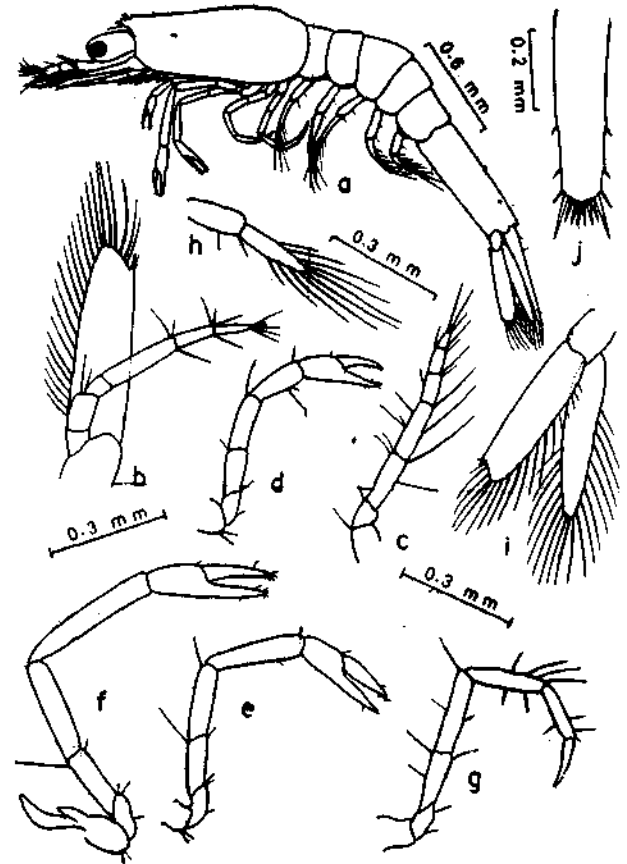


Fig. 12 *Metapenaeus affinis*: Postlarva I: a - lateral view; b - A2; c - Mxp3; d - P1; e - P2; f - P3; g - P4; h - pleopod; i - uropod; j - telson.

6 setae; Mxp1 (Fig.11,j) exopod with 2 short plumose setae distally and proximally endopod reduced, without segmentation, with 2 short seta on inner side, gills large, protopod broader with a number of setae on inner margin; Mxp2 (Fig.11,k) exopod shrunken, endopod sharply recurved, distal 2 segments carrying number of stout setae; Mxp3 (Fig.12,c) exopod absent; P1 to P3 (Fig.12,d,e,f) chela fully developed, exopod absent; exopod absent in P4 and P5 (Fig.12,g); uropod (Fig.12,i) exopod with 17 to 19 plumose setae, 1 nonplumose se a

and 1 distolateral spine, endopod with 19 to 20 setae, telson convex posteriorly (Fig.12,j).

DISCUSSION

The eggs of *M. affinis* (Fig.1,a) are 0.25 to 0.27 mm in diameter with the yolk mass measuring 0.21 to 0.22 mm. However, Thomas *et al.*, have reported smaller eggs for *M. affinis* (0.23 to 0.25 mm) and an unusually smaller yolk mass (0.14 mm).

Although Thomas *et al.*³, have also described 6 nauplius substages, the setation of the appendages is at variance with our observations. The A1 is depicted by Thomas *et al.*³, with 3 terminal and 2 inner lateral setae in the first three nauplius substages; we have consistently observed 3 inner lateral setae and an outer lateral seta, in addition to the terminal setae, in our material. Further, Thomas *et al.*³ have shown 7 setae on exopod of A2 of N I-N III while we have observed only 5 setae in N I, the number increasing with each naupliar moult (Fig.1,b.) Thomas *et al.*³ have reported that the number of setae of A1 and A2 remain constant in the first 3 naupliar stages. This is never the case in all the 6 penaeid species that we have reared in the laboratory.

On the inner lateral and distal aspect of A2 exopod, Thomas *et al.*³, have shown only 9 setae in protozoa I and II and 10 setae in protozoa II and III, whereas in our material the A2 exopod possesses 10 setae on the inner lateral and distal aspect in all the 3 protozoa substages. In the A2 endopod we found 1+2+3 inner lateral setae in all the protozoa substages (Fig.2,a; 3,c; 4,a) while Thomas *et al.*³ have shown only 1+2 lateral setae in protozoa I and 1+2+2 in protozoa II and III.

Thomas *et al.*³ have shown 5 exopod setae in Mxp2 of protozoa I and 8 and 9 exopod setae in Mxp1 and Mxp2 respectively in protozoa III. But in our material the exopods of Mxp1 and Mxp2 show the following setation pattern during the protozoa stages:

Exopod of Mxp1	Exopod of Mxp2
Protozoa I 7	6

Protozoa II	7	6
Protozoa III	9	7

The endopod rudiment of Mxp3 in protozoa III is tipped with 2 setae in our material (Fig. 3,j), while Thomas *et al.*³ have shown 3 terminal setae in the endopod rudiment of Mxp3.

A very important character which has been overlooked by Thomas *et al.*³, is the rostral "platform" in protozoa II and III. In the present material a rostral "platform" is seen between the rostral tip and the supraorbital spines in the dorsal view of the carapace (Fig.3,a;4,a)

The description of mysis I of *M. affinis* by Rao² differs from ours in the following respects:-

	Present work	Rao ²
A1 scale	11 setae	9 setae
Endopod of Mx1	5 terminal setae	3 terminal setae
Exopod of Mx2	9 setae	5 setae
Endopod of Mxp1	4 segmented	5 segmented
Exopod of Mxp1	7 setae	5 setae
Endopod of Mxp2	4 segmented	5 segmented
Exopod of Mxp2	6 setae	5 setae

The setation and segmentation pattern of the appendages of mysis I illustrated by us and indicated above is consistent and applicable to all the *Metapaneus* spp. studied by us.

During the present study of *M. affinis* it was observed that the rostrum of the early mysis substages (mysis I and II) reaches beyond the eye as described by Rao² but in the later mysis substages the rostrum becomes shorter, falling short of the anterior end of eye.

Although Rao² and Thomas *et al.*³ have found only 3 mysis substages, during the present study 5 mysis substages could be distinguished on the basis of increase in the number of setae in the appendages and increase in length of the larvae and of the pleopod buds. Some of the last mysis larvae appear to moult into one of the intermediate substages described in this paper, before metamorphosing into postlarva I.

The postlarval stage of *M. affinis* is very similar to that described by Mohamed *et al.*¹, but the description of the rostral spines given by Mohamed *et. al.*¹, is not clear. They mention about 2 large teeth and 2 smaller spines. In the present material the 1st postlarval stage

was found to possess 2 rostral teeth and 1 epigastric tooth. The smaller spines found in between the teeth and posterior to the epigastric, are not to be confused with the rostral teeth; they are minute moveable spines while the rostral teeth are large and fixed.