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Larval development — *METAPENAEUS DOBSONI* (MIERS)

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Complete larval history of *Metapenaeus dobsoni* was studied by rearing them in the laboratory. At the rearing temperature of 25.5°C to 26.8°C the viable eggs took 16-17 hours to hatch; the duration of the nauplius stage was 40-56 hours; protozoea took 5-7 days to reach the mysis stage and the mysis transformed into postlarva I after 6-9 days. Thus it took 14-20 days for the eggs to develop through the various larval stages into postlarva I. The larvae pass through 6 nauplius substages, 3 protozoea substages and 5 mysis substages before reaching the postlarval stage. There may be one or two intermediate substages between the last mysis substage and postlarva I. All the larval stages are described and illustrated, and compared with the earlier larval descriptions of the species.

At the Narakkal prawn culture laboratory of the Central Marine Fisheries Research Institute, *Metapenaeus dobsoni*, the most abundant species of penaeid prawn on the south west coast of India, has spawned on many occasions and the eggs have been reared up on a large scale to the stocking size. The larval stages of *M.dobsoni* have been described by earlier workers, Menon (1951, *Proc. Indo-Pacif-Fish Coun.* 3rd meeting, Sec II: 80-93[1]), Rao and Kathirvel (1973, *Indian J.Fish*, 20 (1): 228-230[2]), Rao (1974, *J.mar. biol. Ass. India* 15 (1): 95-124[3]), and Thomas et al. (1974, *Indian J.Fish.* 21 (2): 575-579[4]). But, a routine examination of the larvae reared at Narakkal revealed a number of interesting morphological features which had been overlooked by these authors The setation of the appendages which is of great taxonomic value in the identification of the penaeid larvae was in particular not fully described by the earlier authors. It was also found that *M. dobsoni* passes through more number of mysis substages than hitherto recorded. Hence a description of the eggs and the various larval stages is presented here. The temperature of the water in the rearing tanks varied from 25.5° C to 26.8° C and the salinity from 30.2 to 35.2 ‰.

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DESCRIPTION OF DEVELOPMENTAL STAGES

EGGS

The eggs are opaque with a very wide perivitelline space (Fig.1,a), diameter of the egg and yolk mass varied from 0.35 to 0.41 mm and 0.20 to 0.22 mm respectively, the freshly spawned eggs of *M.dobsoni* do not have any radiating jelly-like substance seen in the case of *Penaeus indicus*. Embryonic development takes 16-17 hours.

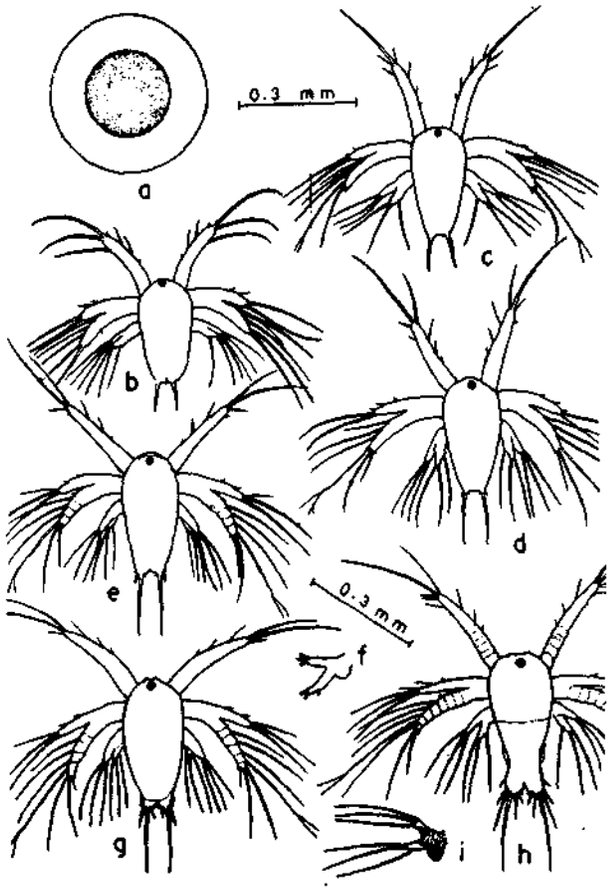

Fig. 1 *Metapenaeus dobsoni:* a - egg; b - Nauplius I; c - Nauplius II; d - Nauplius III; e - Nauplius IV; f - Md of Nauplius IV; g - Nauplius V; h - Nauplius VI; i - Md of Nauplius VI.

NAUPLIUS I

MTL: 0.26 mm (0.25-0.28 mm); MW: 0.14 mm (0.14-0.15 mm);MFS: 0.08 mm (0.07-0.10 mm).

Furcal setae 1+1; minute posterodorsal tooth present; setae nonplumose; A1 with 3 short lateral setae on inner margin, 2 long setae and 1 spike-like seta terminally and 1 long seta on outer distal margin; exopod of A2 with 5 long setae along inner and distal margin, endopod with 2 short lateral setae on inner margin and 2 long setae and a rudimentary seta terminally; Md with 3 distal setae on exopod and endopod (Fig.1,b). Duration of this substage was 3-4 hours.

NAUPLIUS II

MTL: 0.27 mm (0.26-0.28 mm); MW: 0.15 mm (0.14-0.15 mm); MFS: 0.08 mm (0.07-0.10 mm).

Furcal setae 1+1; posterodorsal tooth absent; setae plumose; the spike-like terminal seta of A1 has become a short seta while long outer terminal and outer lateral setae have become short (Fig.1,c); exopod of A2 with a minute seta added to outer terminal end, 4th seta from proximal end bifurcate, with a characteristic bend proximal to split, this condition of the seta is retained in all nauplius substages; no change in Md. Duration of this substage was 3-4 hours.

NAUPLIUS III

MTL: 0.29mm (0.28-0.29mm); MW: 0.15mm (0.14-0.15mm); MFS: 0.12mm (0.11-0.14mm).

Furcal setae 3+3 (Fig. 1,d); inner terminal seta of A1 longer than outer; exopod of A2 with 6 long and one rudimentary seta. Duration of this substage was 5-8 hours.

NAUPLIUS IV

MTL: 0.31 mm (0.29-0.32 mm); MW: 0.15 mm (0.15-0.16 mm); MFS: 0.13 mm (0.10-0.14 mm).

Furcal setae 4+4 (Fig. 1,e); developing frontal organs and buds of mouth parts seen; distolateral outer seta of A1 very thin and short, inner terminal seta longer than in previous substage; exopod of A2 with faint segmentation, 1 rudimentary seta added to inner lateral margin proximally, endopod with one short and 2 long setae terminally; Md with a swelling at base (Fig.1,f). Duration of this substage was 3-4 hours.

NAUPLIUS V

MTL: 0.33 mm (0.32-0.34 mm): MW: 0.15 mm (0.14-0.15 mm); MFS: 0.17 mm (0.15-0.18 mm).

Furcal setae 6+6 (Fig.1,g); frontal organs prominent; outer lateral seta in A1 lost; exopod of A2 with 9 setae, the proximal and terminal ones rudimentary; swelling at base of Md enlarged. Duration of this substage was 10-12 hours.

NAUPLIUS VI

MTL: 0.35mm(0.35-0.36mm); MW: 0.15 mm (0.15-0.17 mm); MFS: 0 17 mm (0.16-0.18mm).

Furcal setae 7+7 (Fig.1,h); A1 with 1 short additional terminal seta, 2 setae, 1 short and 1 minute added to outer lateral margin in distal half, indistinct segmentation in proximal half; exopod of A2 with 9 setae, endopod with 1 short and 3 long setae apically; cutting edge of Md visible inside basal swelling, exopod and endopod usually empty (Fig.1, i). Duration of this substage was 16-24 hours.

PROTOZOEA I

MCL: 0.33 mm (0.32-0.34 mm); MTL: 0.76 mm 0.73-0.77 mm).

Frontal organs overhung by frontal horns (Fig.2, a) telson with 7 setae on each furcal lobe.

A1 (Fig. 2,b) with 3 main segments, the proximal one subsdivided into 5 subsegments, basal segment with 1 distal seta on inner margin, middle segment with 2 distal setae, 1 long and 1 very short, and 1 short lateral seta in the middle, distal segment bears terminally an aesthaetes and 3 setae of which 1 is very long, and a subterminal aesthaetes; A2 (Fig.2,c) exopod 10 segmented, bearing 10 long setae along inner and distal margin and 2 short setae on outer margin, endopod 2-segmented, distal segment tipped with 4 long plumose setae and 1 short nonplumose seta, basal segment with 1+2+3 nonplumose setae on inner margin;Md (Fig.2,d) almost symmetrical with 1 serrated free standing tooth between incisor and molar processes; Mx1 (Fig.2,e) protopod with 2 endites, distal one with 4 stout setae and proximal with 7 setae, exopod with 4 long feathery setae, endopod 3 segmented, distal segment with 5 long terminal setae, middle segment with 2 setae and proximal with 3 setae of which 1 is small; Mx2 (Fig. 2, f) protopod with 5 endites, basal one with 8 setae and the rest with 3 to 4 setae, exopod with 5 long feathery setae, endopod 4 segmented, the segmentation between 2nd and 3rd segments indistinct, the distal one with 3 terminal setae and the rest with 2 setae

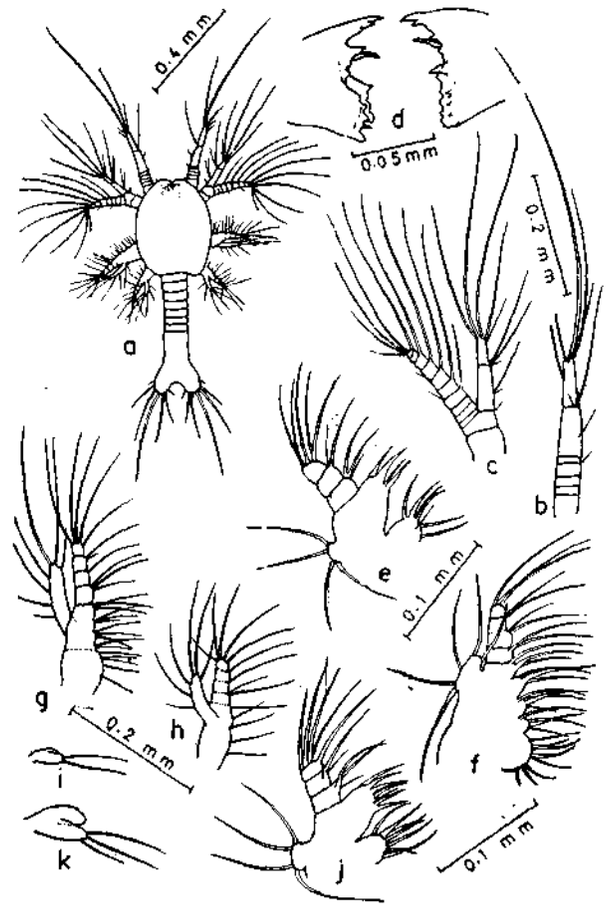

Fig. 2 *Metapenaeus dobsoni:* Protozoea I: a - dorsal view; b - A1; c - A2; d - Md; e - Mx1; f - Mx2; g - Mxp1; h - Mxp2; i - Mxp3. Protozea II: j - Mx1; k - Mxp3.

each; Mxp1 (Fig.2, g) protopod indistinctly divided into 2 segments, distal one bearing 11 to 12 setae and the proximal one 4 to 5 setae, endopod 4 segmented, 1st segment with 3 setae, 2nd with 1 and 3rd with 2 and distal with 5 setae, exopod unsegmented with 7 setae; Mxp2 (Fig.2,h) endopod indistinctly divided into 4 segments, 1st segment with 2 setae, 2nd and 3rd with 1 each and distal with 5 setae, exopod with 6 setae, protopod with 5 setae; Mxp3 (Fig.2,i) biramous rudiment with 2 setae on exopod; Duration of this substage was 36 to 48 hours.

PROTOZOEA II

MCL: 0.45 mm (0.43-0.46 mm); MTL: 1.21 mm (1.15-1.30mm).

Eyes stalked; carapace with rostrum and 2 supraorbital spines (Fig.3,a); telson bears 7 setae on each furcal lobe; A1 (Fig.3,b) with some hair like setae added to middle segment on outer distal margin; A2 (Fig.3,c), shortest of 5 terminal setae on endopod has become plumose, out of 6 lateral setae 3 longer ones

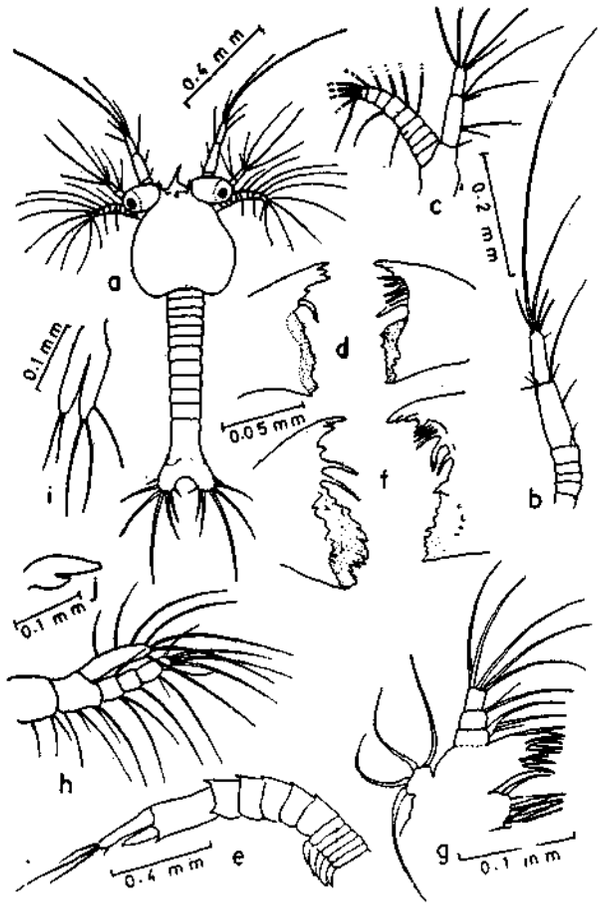

Fig. 3 *Metapenaeus dobsoni:* Protozcea II; a - dorsal view; b - A1; c - A2; d - Md. Protozoea III: e - lateral vaew of abdomen and telson: f - Md: g - Mx1: h - Mxp2: i - Mxp3: j - pereiopods bud.

plumose; Md (Fig.3,d) asymmetrical, left with 5 free standing teeth and right with 1 free standing tooth; Mx1 (Fig.2,j) distal endite with 7 setae; Mx2, more setae added to endites Mxp1, antepenultimate segment of endopod with 1 more additional seta; Mxp3 (Fig 2,k) exopod rudiment with 3 setae. Duration of this substage was 48 to 72 hours.

PROTOZOEA III

MCL: 0.58 mm (0.56-0.64 mm); MTL: 1.61 mm (1.48-1.75 mm).

Rostrum prominent, supraorbital spines reduced in size (Fig.4, a); thoracic segments bear biramous pereopod buds (Fig.3,e,j); abdominal segments 1 to 5 with posterodorsal spines (Fig.3,e), 5th segment with posterolateral spine on each side,with posterolateral spine on each side, 6th segment demarcated from telson, lacks dorsomedian spine but has a minute pair of

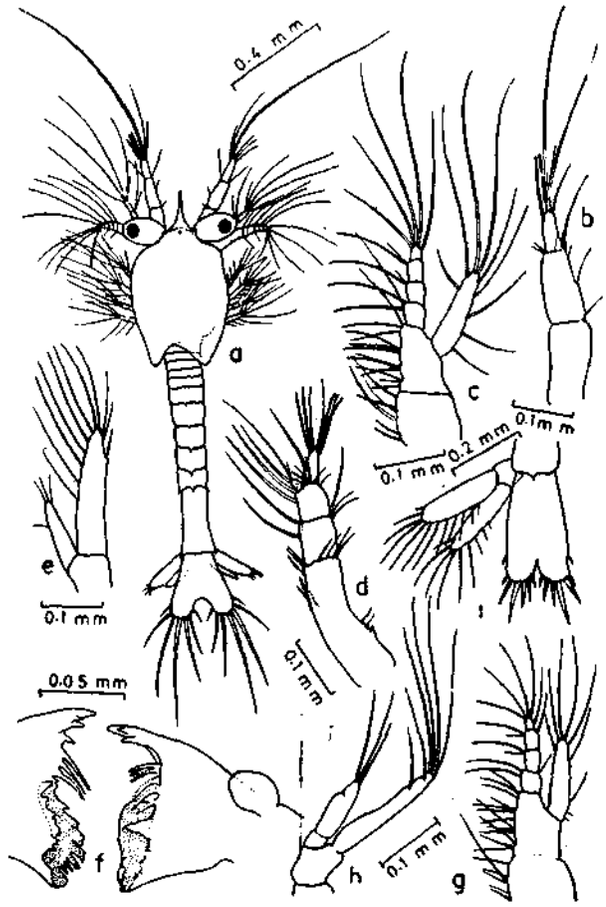

Fig. 4. *Metapenaeus dobsoni:* Protozoea III: a - dorsal view; b - A1; c - Mxp1; Mysis I: d - A1; e - A2; f - Md; g - Mxp1; h - P2; i - uropod & telson.

posterolateral and a pair of ventrolateral spines; uropod rudiments formed, outer ramus tipped with 5 small setae; telson with 7 setae on each furcal lobe.

Al (Fig.4,b) 5 subsegments of basal segment fused into one unit, more hair like setae added to distal margin of middle segment, 1 slender terminal seta added to distal segment; Md (Fig. 3,f), right Md with 2 free standing teeth and left with 6 standing teeth; Mx1 (Fig.3,g) distal endite with 9 setae; Mxp1 (Fig.4,c) exopod with 9 setae; Mxp2 (Fig.3,h) exopod with 7 setae, one more seta added to distal outer margin of basal segment of endopod and one additional seta on inner distal margin of penultimate segment; Mxp3 (Fig.3,i) endopod rudiment also tipped with 2 setae. Duration of this substage was 36-48 hours.

MYSIS I

MCL: 0.63 mm (0.60-0.66 mm); MTL: 2.04mm (1.97-2.14 mm).

Carapace with rostrum just falling short of anterior end of eye (Fig.5,a), rostrum withou

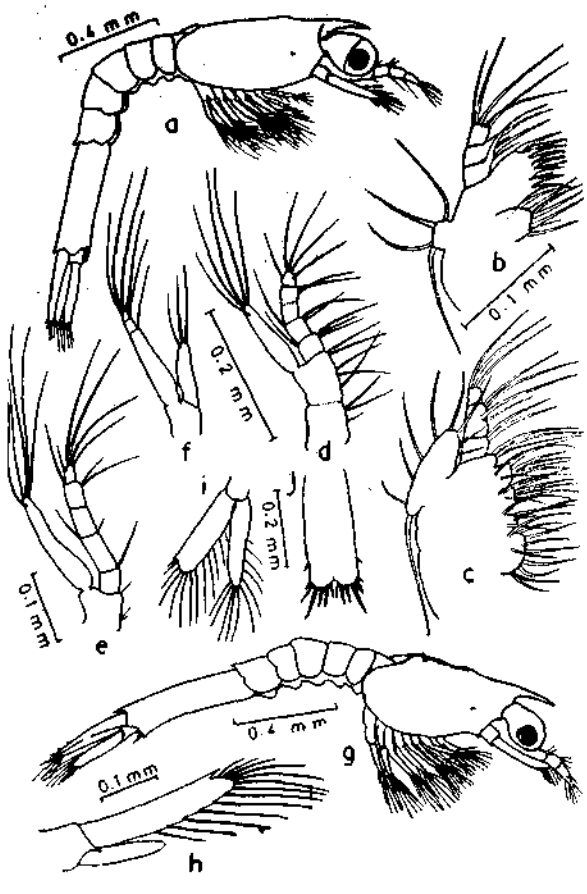

Fig. 5 *Metapenaeus dobsoni:* Mysis I: a - lateral view; b - Mx1; c - Mx2; d - Mxp2; e - Mxp3; f - P5. Mysis II: g - lateral view; h - A2; i - uropod; j - telson.

teeth, antennal and pterygostomial spines well developed, minute vestige of supraorbital spines may be present, minute hepatic spine present; abdominal segments 1 to 4 lack dorsal spines, 5th and 6th with dorsal spines, that on the 5th may be very small or rarely absent, no lateral spines on 5th and 6th segment, minute posteroventral pair of spines on 6th, a prominent ventromedian spine on posterior end of 6th segment at junction with telson; no pleopod buds on abdomen; telson (Fig.4,i) with 7+7 setae., deep cleft reaching level of origin of outermost pair of setae.

A1 (Fig.4,d) 3 segmented, basal segment with prominent ventral spine and slight basal swelling with 2 setae just above stylocerite rudiment, outer flagellum terminally with 1 seta and 6 aesthaetes, a bud-like inner flagellar rudiment bearing 2 setae, one long and one short, numerous setae at junction of segments; A2 (Fig.4,e) both exopod and endopod unsegmented, exopod scale-like with 10 setae and 1 short seta at distolateral angle, no spine on distal outer margin, endopod half length of exopod, bearing 3 terminal and 1 to 2 lateral setae; Md (Fig.4,f) asymmetrical, right with 3 and left with 6 free standing teeth, rudimentary palp present; Mx1 (Fig.5,b) distal endite with 10 setae; Mx2 (Fig.5,c) exopod with 9 setae, more setae added to endites; Mxp1 (Fig.4,g) number of setae on exopod reduced to 7, in rare instances all the 9 setae may be retained, below the proximal lateral seta, 1 to 2 small hair-like seta seen, 1 outer lateral seta added to penultimate and basal segments of endopod; Mxp2 (Fig.5,d), number of setae of exopod reduced to 6, in endopod 1 more inner seta added to 1st segment and 1 outer and 1 inner to 2nd segment, penultimate segment has become longer with indistinct segmentation in middle; Mxp3 (Fig.5,e) fully developed with 5 segmented endopod and unsegmented exopod, endopod with 5 terminal setae on distal segment, 2 inner and 1 outer on 4th segment, 1 outer and 1 inner on 2nd segment and 1 inner on basal segment, exopod with 4 terminal setae and a pair of subterminal setae; P1 to P3 almost identical (Fig.4,h) with unsegmented exopod bearing 4 terminal setae and 2 pairs of subterminal setae, endopod indistinctly divided into 2, distal larger segment with subterminal cleft representing incipient chela and tipped

with 3 long plumose setae; P4 and P5 (Fig.5,f) with unsegmented endopod tipped with 3 long setae, exopod with 4 terminal setae and 2 pairs of subterminal setae; uropod (Fig.4,i), exopod with 11 plumose and one non-plumose seta, endopod with 9 to 10 plumose setae. Duration of this substage was 24 to 36 hours.

MYSIS II

MCL: 0.64 mm (0.63-0.67 mm); MTL: 2.16 mm (2.08-2.31 mm).

Rostrum without teeth; carapace with no trace of supraorbital spines (Fig.5,g); no trace of pleopod buds yet; cleft of telson reaching only level of origin of penultimate pair of lateral setae (Fig.5,j).

A1 small otolith visible in basal swelling, 3 short setae just above stylocerite rudiment; A2 (Fig.5,h) scaphocerite with 13 setae and a distolateral spine, endopod without setae, protopod with ventral spine on distal segment; Md (Fig.6,b) right with 3 and left with 8 free standing teeth, palp larger; Mx1 (Fig.6,c) exopod lost; Mx2 (Fig 6,d) exopod with 10 setae, more setae added to endites; Mxp2 (Fig.6,e) endopod 5 segmented, one more seta added to distal segment and 1 outer lateral seta to 3rd segment; Mxp3 with an outer seta added to 3rd segment of endopod; P1 to P3 (Fig.6,f) with 1 long outer lateral seta added to endopod; P4 to P5 (Fig.6,g) show indistinct segmentation in endopod but no additional setae; uropod (Fig 5,i) exopod with 12 plumose setae and 1 short non-plumose seta at outer distal angle, at the base of this seta outer margin of exopod produced into a minute tooth which becomes a well defined fixed spine in later substages, endopod with 11 to 12 plumose setae, a short spine on ventral aspect of protopod. Duration of this substage was 24 to 36 hours.

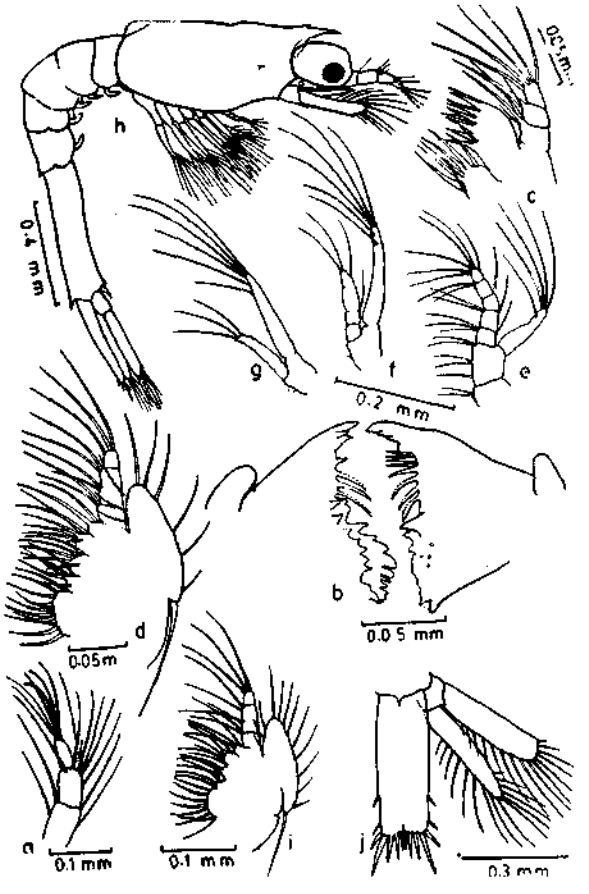

Fig. 6 *Metapenaeus dobsoni:* Mysis III: a - anterior part of A1; b - Md; c - Mx1; d - Mx2; e - Mxp2; f - P1; g - P4. Mysis III: h - lateral view; i - Mx2; j - uropod and telson.

MYSIS III

MCL: 0.71 mm (0.67-0.74 mm);MTL: 2.35mm (2.17-2.67mm).

1 rostral tooth present (Fig.6,h), no other change in the spination of carapace and abdomen; unsegmented pleopod buds developed; cleft in telson shallow (Fig.6,j).

Inner flagellum of A1 half size of outer; A2 (Fig.7,a) scaphocerite with 15 plumose setae and one anterolateral spine; Md palp larger; Mx2 (Fig. 6,i) exopod with 13 plumose setae; Mxp1 with one outer seta added to basal segment of endopod; Mxp2 with one short seta added to junction of exopod and endopod; P1 to P3 (Fig.7,b) endopod larger and 3 segmented, cleft of chela deep, one seta originating from cleft, a short inner seta added to basal segment; P4-P5 (Fig.7,c) endopod 3 segmented, distal segment may have 2 annulations indicating indistinct segments, basal segment acquires a long inner lateral seta and 2nd segment a long outer lateral seta; uropod (Fig. 6,j) exopod with 14 plumose setae and 1 non-plumose seta distolaterally, endopod with 14 to 15 setae. Duration of this substage was 36 to 48 hours.

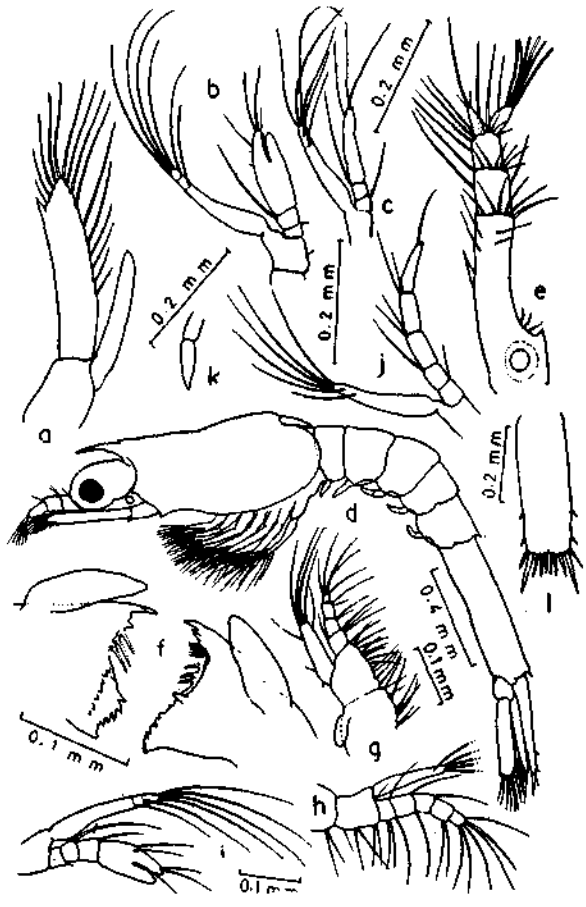

Fig. 7 *Metapenaeus dobosni:* Mysis III: a - A2; b - P1; c - P5. Mysis IV: d - lateral view; e - A1: f - Md: g - Mxp2: h - Mxp3; i - P1: j - P5: k - pleopod bud: l - telson.

MYSIS IV

MCL: 0.75 mm (0.74-0.77 mm); MTL: 2.56mm (2 52-2.62 mm).

2 rostral spines present (Fig.7,d); pleopods 2 segmented but small (Fig.7,k); cleft of telson very shallow (Fig.7,l); inner flagellum of A1 almost as long as outer (Fig.7,e); scaphocerite of A2 with 17 seate, endopod 2 segmented with 2 small lateral setae (Fig.8,a); palp of Md larger (Fig.7,f); distal endite of Mx1 with 11 setae; exopod of Mx2 with 15 setae; Mxp1 (Fig.7,g) with gill rudiment; P1 to P3 (Fig.7, i) with 4 segmented endopod, 1 outer seta added to 3rd segment, 2 outer seta added to base of dactylus; P4 to P5 (Fig.7,j) with 5 segmented endopod, dactylus pointed and tipped with 1 to 2 setae, a pair of outer setae added to carpus and propodus, endopods longer than exopods, exopod of uropod with 15 plumose setae and a non-plumose seta distolaterally, endopods with 15 plumose setae. Duration of this substage was 36 to 48 hours.

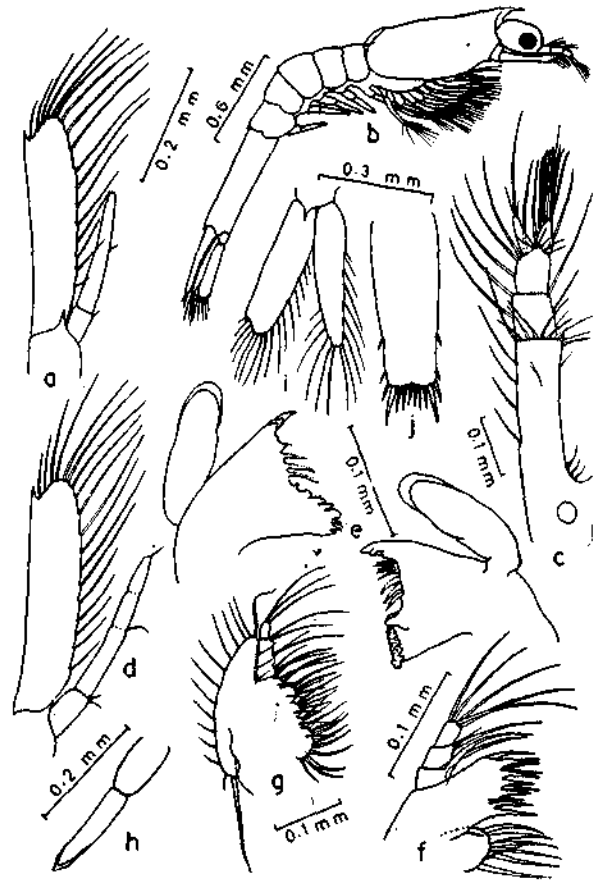

Fig. 8 *Metapenaeus dobsoni:* Mysis IV: a - A2. Mysis V: b - lateral view: c - A1: d - A2; e - Md: f - Mx1: g - Mx2: h - pleopod bud: j - telson.

MYSIS V

MCL: 0.80 mm (0.77-0.84 mm); MTL: 2.73 mm (2.48-2.97 mm).

Rostrum shorter, extending only to middle of eye (Fig.8,b); no other change in spination of carapace or abdomen; pleopods long and 2 segmented; telson almost truncate (Fig.8,j); A1 (Fig.8,c) with inner flagellum longer than outer; A2 (Fig.8,d) scaphocerite with 18 setae, endopod with 2 segments, the long distal segment bears 2 faint annulations and a short distal seta (Fig.8,d); Md (Fig.8,e) palps very large but without setae; Mx1 the slender seta on middle and basal segments of endopod may be absent (Fig.8,f); exopod of Mx2 with

17 setae (Fig.8,g); gill rudiments on protopod of Mxp1 (Fig.9,a) Mxp2 (Fig.9,b) and Mxp3 (Fig.9,c) present; P1 (Fig.9,d) endopods have

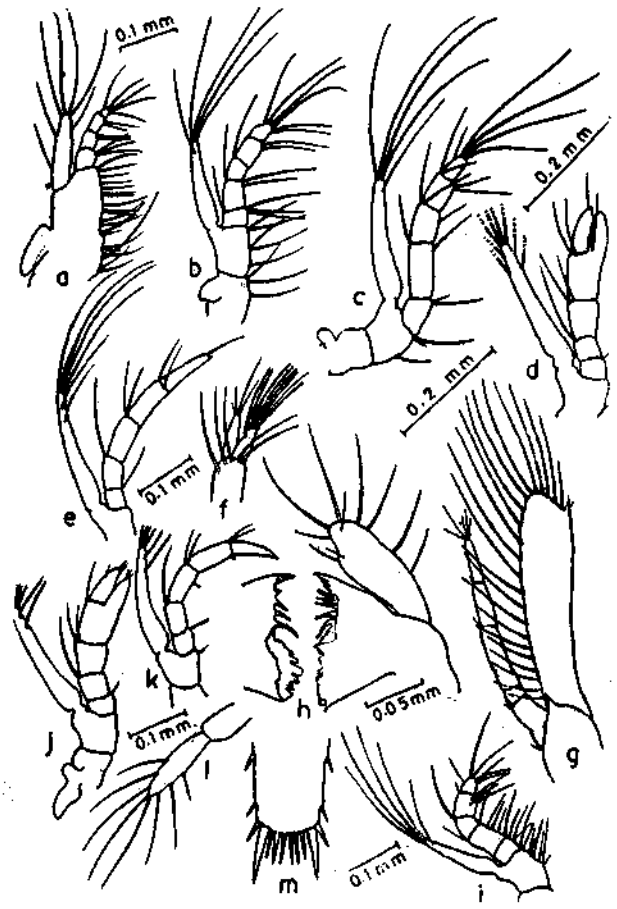

Fig. 9 *Metapenaeus dobsoni:* Mysis V: a - Mxp1: b - Mxp2; c - Mxp3: d - P1: e - P4. Intermediate stage I: f - A1 flagellum: g - A2: h - Md: i - Mxp2: j - P1: k - P5: l - fifth pleopod: m - tip of telson.

become longer, one more outer seta added to carpus of P1 to P3, dactylus clearly demarcated. Duration of this substage was 24 to 48 hours.

INTERMEDIATE STAGE I

MCL: 0.69 mm (0.68-0.70 mm); MTL: 2.88 mm (2.83-2.93 mm).

Rostrum very short extending to ¼ eye (Fig.10, m) pterygostomial spine absent; no dorsal spine on 5th abdominal segment; posterior margin of telson convex (Fig.9,m); pleopods fringed with 8 plumose setae (Fig.9,l) functional exopods of thoracic appendages retained.

A1, 5 setae above stylocerite, outer flagellum indistinctly 2 segmented (Fig.9,f); A2, scaphocerite with 22 to 23 setae; a very thin non-plumose seta present at outer base of anterolateral spine (Fig.9,g), endopod 5 segmented, distal segment tipped with 5 setae, 6 to 7 short setae on inner margin of endopod; Md palp unsegmented but with 9 to 10 setae, standing teeth retained (Fig.9,h); Mx1

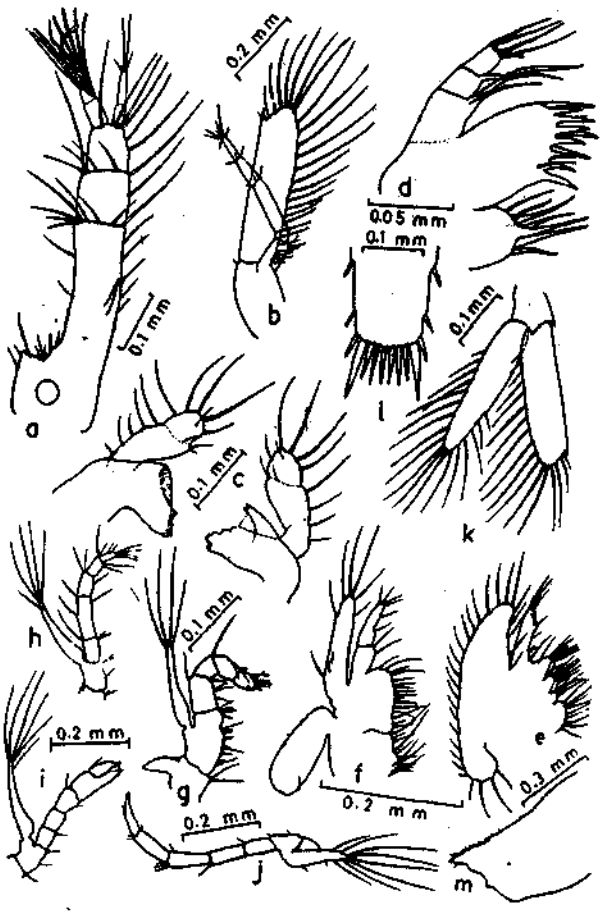

Fig. 10 *Metapenaeus dobsoni:* Intermediate stage II: a - A1; b - A2: c - Md: d - Mx1; e - Mx2; f - Mxp1; g - Mxp2; h - Mxp3; i - P1: j - P5: k - uropod: l - telson tip. m - rostrum and anterior part of intermediate stage I.

basal and middle segments of endopod have each lost 1 seta; Mx2 endopod segmentation lost, exopod with 22 setae; Mxp2 (Fig.9,i) endopod slightly sigmoid, more setae developed on inner margin of 1, 2 and 4 segments, P1 to P3 (Fig.9,j) with functional chelae, long outer setae retained, long terminal setae on dactylus lost; P4 and P5 (Fig.9,k) with sharply pointed dactylus which has lost the

long terminal seta, long outer setae retained; exopod of uropod with 17 plumose setae and a non-plumose seta, endopod with 16 setae; no setae on basal segment of pleopods (Fig.9,l). Duration of this substage was 24 to 36 hours.

INTERMEDIATE STAGE II

MCL: 0.76 mm (0.73-0 78 mm); MTL: 2.91 mm (2 88-2.95 mm).

Rostrum blunt with 2 dorsal spines; pleopods with 9 to 10 plumose setae; inner flagellum of A1 2 segmented (Fig.10,a); flagellum of A2 5 segmented tipped with 7 short setae, bristle-like setae at junction of segments (Fig.10,b); Md (Fig.10,c) standing teeth lost, palp faintly 2 segmented; Mx1 (Fig.10,d) terminal setae on endopod shortened; Mx2 (Fig.10,e) setae on endopod reduced in size, distal endite of protopod vestigial, exopod with 27 to 28 setae; Mxp1 (Fig.10,f) endopod setae highly reduced, protopod broader, exopod still with long setae, gill rudiment long; Mxp2 (Fig.10,g) endopod recurved, long plumose setae along inner margin replaced by stout setae, exopod still with long plumose setae; Mxp3 (Fig.10,h), setae on endopod reduced in length, exopod still with long plumose setae; P1 to P5 (Fig.10,i and j) have lost the long outer setae on endopod, exopods still with long setae; telson with convex posterior margin (Fig.10,l); uropod (Fig.10,k), no change in exopod, endopod with 18 setae; pleopods, distal segment longer with 10 plumose setae, basal segment broader with 2 distolateral short setae. Duration of this substage was 24 to 36 hours.

POSTLARVA I

MCL: 0.73 mm (0.73-0.78 mm); MTL: 2.65 mm (2,60-2.72 mm).

Rostrum blunt with 2-3 dorsal spines (Fig. 11,a); dorsal spine on 5th abdominal segment and posteromedian ventral spine on 6th abdominal segment lost; A1 (Fig.11,b) both inner and outer flagella 2 segmented; A2 (Fig.11,c), no appreciable change; Md (Fig. 11,d) palp clearly 2 segmented, standing teeth replaced by thin blade like cutting edge; Mx1 (Fig.11,e), endopod segmentation lost and setae hightly reduced in size, 12 setae on distal endite; Mx2 (Fig.11,f), endopod further reduced; Mxp1 (Fig.11,g) endopod segmentation lost, setae highly reduced, exopod setae also reduced in size, protopod broader; Mxp2 (Fig.11,h) exopod without setae and reduced in size, endopod sharply recurved; Mxp3 (Fig.11,i), exopod reduced in size, setae lost; P (Fig.12,a to e), exopod of all legs shrunken, without setae; pleopods (Fig.12,f,g), distal

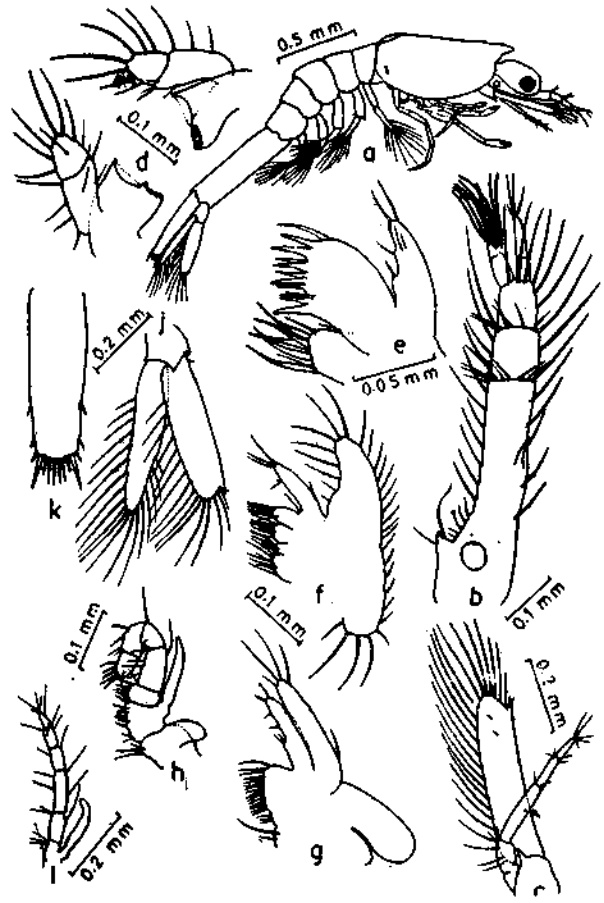

Fig. 11 *Metapenaeus dobsoni*: Postlarva I: a - lateral view; b - A1; c - A2; d - Md; e - Mx1; f - Mx2; g - Mxp1; h - Mxp2; i Mxp3; j - uropod; k - telson.

segment long and narrow with 10 plumose setae, basal segment broader with lateral setae in middle of segment also; uropod (Fig.11,j), endopod with 19 setae, no change in exopod, telson with convex posterior end (Fig.11,k).

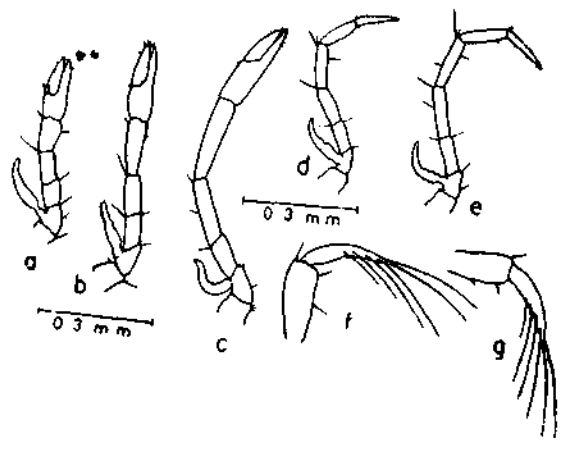

Fig. 12 *Metapenaeus dobsoni:* Postlarva 1: a - P1; b - P2; c - P3; d - P4; e - P5; f - third pleopod; g - fourth pleopod.

DISCUSSION

The eggs of *M. dobsoni* are large and have a characteristically wide perivitelline space which is perhaps responsible for making the eggs of this species more buoyant than those of the other species of penaeids. The slightest agitation of the water stirs them up from the bottom and keeps them suspended in water. This may be the reason for getting the eggs of *M. dobsoni* very frequently in the surface plankton hauls, from the inshore region. The eggs described by Subrahmanyam (1965, *J. mar. biol. Ass. India.* 7(1): 83-88[5]) from the inshore plankton of Madras as those belonging to *P. indicus* were most probably the eggs of *M. dobsoni* as they were large (0.45-0.47 mm) with a wide perivitelline space.

6 nauplius substages were observed during the present study. Menon[1] recorded only 3 nauplius substages while Rao[3] described 2 more substages and Thomas *et. al.*[4] have reported 6 nauplius substages. These earlier descriptions of the nauplius substages can be equated with the present description as follows:-

Present work	NI	NII	NIII	NIV	NV	NVI
Menon[1]	NI		...	...	NII	NIII
Rao[3]	NI		..	NII	NIII & NIV	NV
Thomas *et. al.*[4]	NI	NII	...	NIII	NIV & NV	NVI

The N I of Menon[1] appears to combine the characters of N I and N II. The 2 long terminal setae and the long outer lateral seta of the A1 shown in his Fig.4 resemble those of N I, but in the same figure the A2 and Md are shown with plumose setae. The plumose setae are acquired only in N II, the setae are not plumose in N I. Further in Fig. 4 of Menon[1] there are only 2 inner lateral setae on A1. During the present observation 3 inner lateral setae are clearly seen even in N I. The N II of Menon[1] with 6 pairs of furcal spines is clearly equivalent to our N V; but the relative length of the terminal setae on A1 is different. N III of Menon[1] is similar to our N VI except for the very prominent A1 segmentation.

N II of Rao[3] agrees with our N IV in the number of furcal spines and in the setation of the A2 endopod but the setation of the A1 and A2 exopod are slightly different. N III and N IV of Rao[3] appears to be equivalent to our N V; the 6th pair of minute furcal spines are not easily visible in preserved material. This is confirmed by the statement of Rao[3] that in N IV which is said to bear 6 pairs of furcal spines the "setation of the appendages remains same as in the previous substage". Progressive addition of setae in each substage was noticed during the present investigations. N III and N IV of Rao[3] also appear to have more number of setae on A2 exopod, than our N V. NIII with 3 pairs of furcal setae appears to have been overlooked by the earlier workers; the minute pair of inner spines is very small indeed and is not seen well in dorsal view.

The spination of the carapace and abdomen of 3 protozoea substages described by Menon[1] is similar to our observations, but many setae have been missed by him in his illustrations of the appendages; especially those of the A2, Mx2, Mxp1 and Mxp3. The setal formula of 1+2+3 lateral setae on the A2 endopod appears to be characteristic; out of the 3 distal lateral setae, 2 are long and 1 is short, hair-like and could easily be overlooked. Menon[1] has shown only 2+2 lateral setae and 4 terminal setae instead of 5. He has also shown lesser number of setae on the exopod of Mxp1 and Mxp2.

All previous workers reported only 3 mysis substages for *M. dobsoni*. During the present investigations 5 substages were observed. The transition from one substage to the next is very gradual but clearly marked by increase in (a) length of the pleopods, (b) the size of the larvae and (c) in the number of setae on the scaphocerite and exopod of Mx2.

Menon[1] and Rao[3] have stated that mysis I of *M. dobsoni* has no hepatic spines. But during the present study a minute hepatic spine was observed in mysis I. Rao[3] stated that the dorsal spine on the 5th abdominal segment is absent in mysis stages of *M. dobsoni* and used this character to distinguish the mysis of *M. dobsoni* in the key provided by him. But after examining hundreds of specimens during the present study we found that the dorsal spine on the 5th abdominal segment is normally present in the mysis substages of *M. dobsoni* although it is distinctly smaller than in *M. affinis* and *M. monoceros*. Only very rarely was it found to be absent,. The size of this spine is highly variable and sometimes it is represented by a minute tooth; when compared with the present observations, the Mx1, Mx2, Mxp1, Mxp2, and Mxp3 of mysis I described by Rao[3] appear to be deficient in the number of setae.

As a deviation from the normal course of development the last mysis substage sometimes moults into one of the intermediate substages described in the present paper before transforming into postlarva I.