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Agenda item 1

Experience Paper

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Postlarvae of penaeid prawns of southwest coast of India with a key to their identification

by

K.H. Mohamed, P. Vedavyasa Rao and M.J. George

Contents

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POSTLARVAE OF PENAEID PRAWNS OF SOUTHWEST COAST OF INDIA WITH A KEY TO THEIR IDENTIFICATION

by

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Abstract

The first postlarvae of five commercially important penaeid prawns of the southwest coast of India, viz., Penaeus indicus, Metapenaeus monoceros, M. affinis, M. dobsoni and Parapenaeopsis stylifera, are described. A comparison of their diagnostic features and a key for their identification are given together with notes on distribution and swimming behaviour.

POSTLARVES DE PENAEIDAE DE LA COTE SUD-OUEST DE L'INDE ET CLEF POUR LEUR IDENTIFICATION

Résumé

La communication décrit les premières postlarves de cinq Penaeidae d'importance commerciale de la côte sud-ouest de l'Inde : Penaeus indicus, Metapenaeus monoceros, M. affinis, M. dobsoni et Parapenaeopsis stylifera. Elle compare leurs caractéristiques et fournit une clef pour leur identification, ainsi que des notes sur la répartition et le comportement en matière de nage.

POST-LARVAS DE PENEIDOS DE LA COSTA SUDOCCIDENTAL DE LA INDIA CON UNA CLAVE PARA SU IDENTIFICACION

Extracto

Se describen las primeras post-larvas de cinco especies de peneidos comercialmente importantes de la costa sudoccidental de la India, a saber: Penaeus indicus, Metapenaeus monoceros, M. affinis, M. dobsoni y Parapenaeopsis stylifera. Se hace una comparación de sus características distintivas y se da una clave para su identificación, junto con algunas notas sobre su distribución y comportamiento natatorio.

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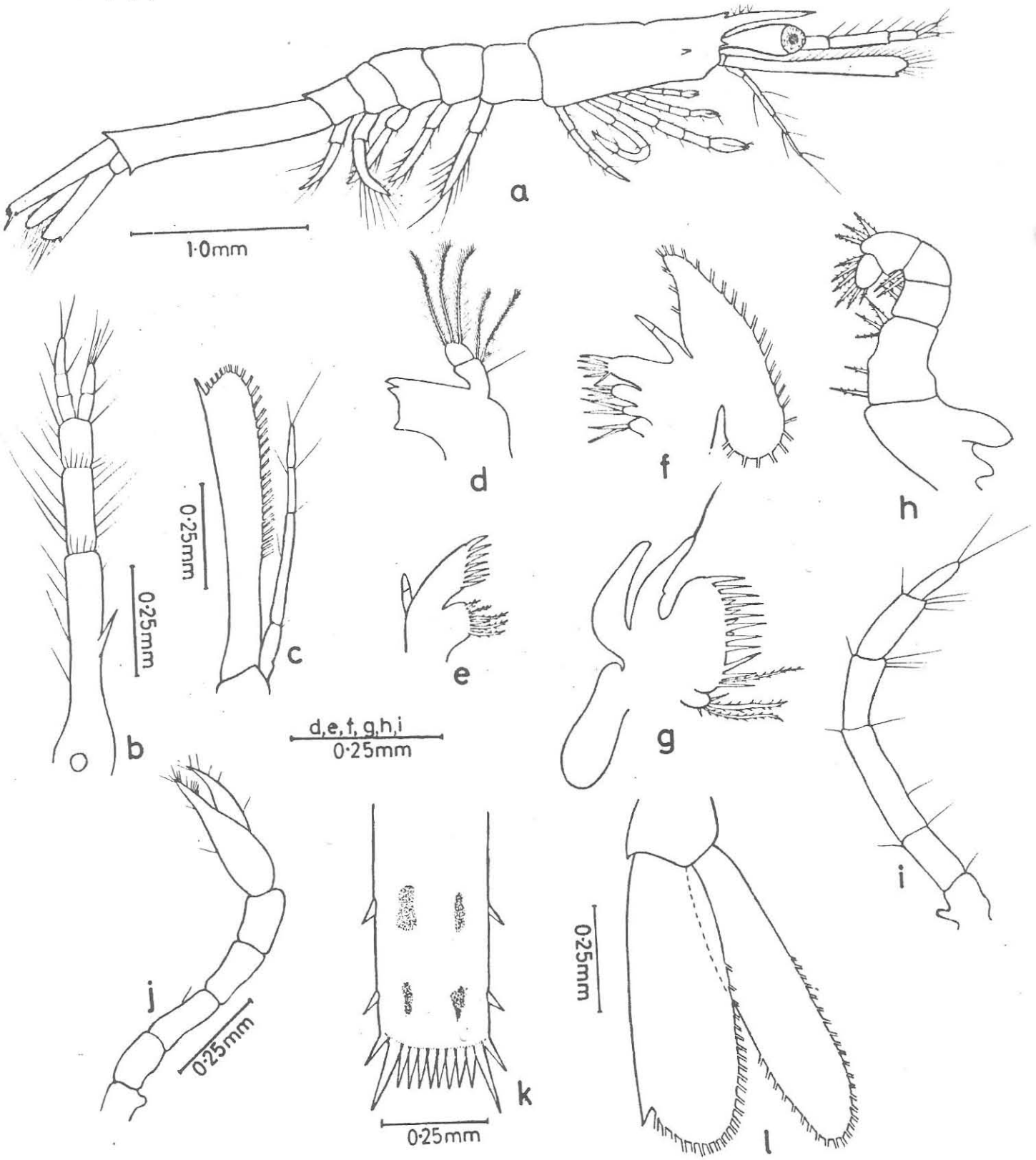

Fig. 1 Penaeus indicus, first postlarva (a) Lateral view. (b) Antennule. (c) Antenna. (d) Mandible. (e) Maxilla I. (f) Maxilla II. (g) Maxilliped I. (h) Maxilliped II. (i) Maxilliped III. (j) First pereiopod. (k) Telson. (l) Uropod.

1 INTRODUCTION

The commercial fisheries for penaeid prawns of the southwest coast of India are supported by several species that often occur simultaneously. It is a known fact that these prawns breed in the sea and their planktonic larvae enter the estuaries and backwaters as they transform into late mysis or postlarval stages. The establishment of the correct identity of the postlarval forms of each of the constituents of this multispecies fishery is essential in order to understand the dynamics of the juvenile and adult populations. This is particularly so, when the juveniles as well as adults are subjected to commercial exploitation. Differentiation of these developing stages into their respective species has been rendered difficult owing to their apparent similarities in shape, size and habits.

Information on the larval and postlarval stages of Indian penaeids is limited to the descriptions of a few early stages of Penaeus indicus (Menon, 1937; Subrahmanyam, 1965) and complete larval history of Metapenaeus dobsoni (Menon, 1951). George (1962; 1963) has studied the postlarvae of three species from Cochin backwaters and suggested the use of postlarval abundance as an index for predicting the magnitude of the trawl fishery. In view of the importance of the differentiation of these co-existing species in the study of the larval population, an attempt is made here to make a comparative description of the first postlarval stages of five important species viz., Penaeus indicus, Metapenaeus monoceros, M. affinis, M. dobsoni and Parapenaeopsis stylifera.

2 MATERIAL AND METHODS

Regular bi-weekly plankton collections were made off Cochin Bar mouth and from the adjoining backwaters. The plankton tows were of 10 min duration, generally made with an organdy net of half a metre diameter during the early hours of the morning at subsurface waters. In the laboratory the postlarvae were sorted out and examined live for colouration and behaviour, and then preserved in 5 percent formaldehyde for further studies. Late mysis stages of some of the species were reared in the laboratory to the subsequent stages.

3 FIRST POSTLARVA

Late mysis stage metamorphoses into the first postlarva. The salient feature of this stage is the taking over of locomotory function by the pleopods and this is accomplished with the development of setae on pleopods and loss of exopodites on the perieopods. Other morphological changes include loss or reduction of median dorsal spines on the abdominal segments and development of a conspicuous forwardly directed spine on the midventral aspect of the 7 to 8 thoracic somite.

3.1 Penaeus indicus Milne Edwards (Fig. 1)

Although different stages of the postlarvae were encountered in all the collections, the earliest stage was obtained only from the offshore collections. They are relatively few in number and their sizes range from 5.22 to 5.95 mm in total length 1/ and 1.28 to 1.35 mm in carapace length.

Carapace: Rostrum bears a single tooth and slightly exceeds the eye. A small supraorbital spine present, but the anterolateral angle of the carapace is devoid of any spine. Hepatic spine well developed.

Antennule: Peduncle 3-segmented, with well developed statocyst at the base. The proximal segment longest; the inner branch of the distal segment 3-jointed, while the outer is only 2-jointed.

1/ Total length is from tip of rostrum to posterior end of telson excluding spines

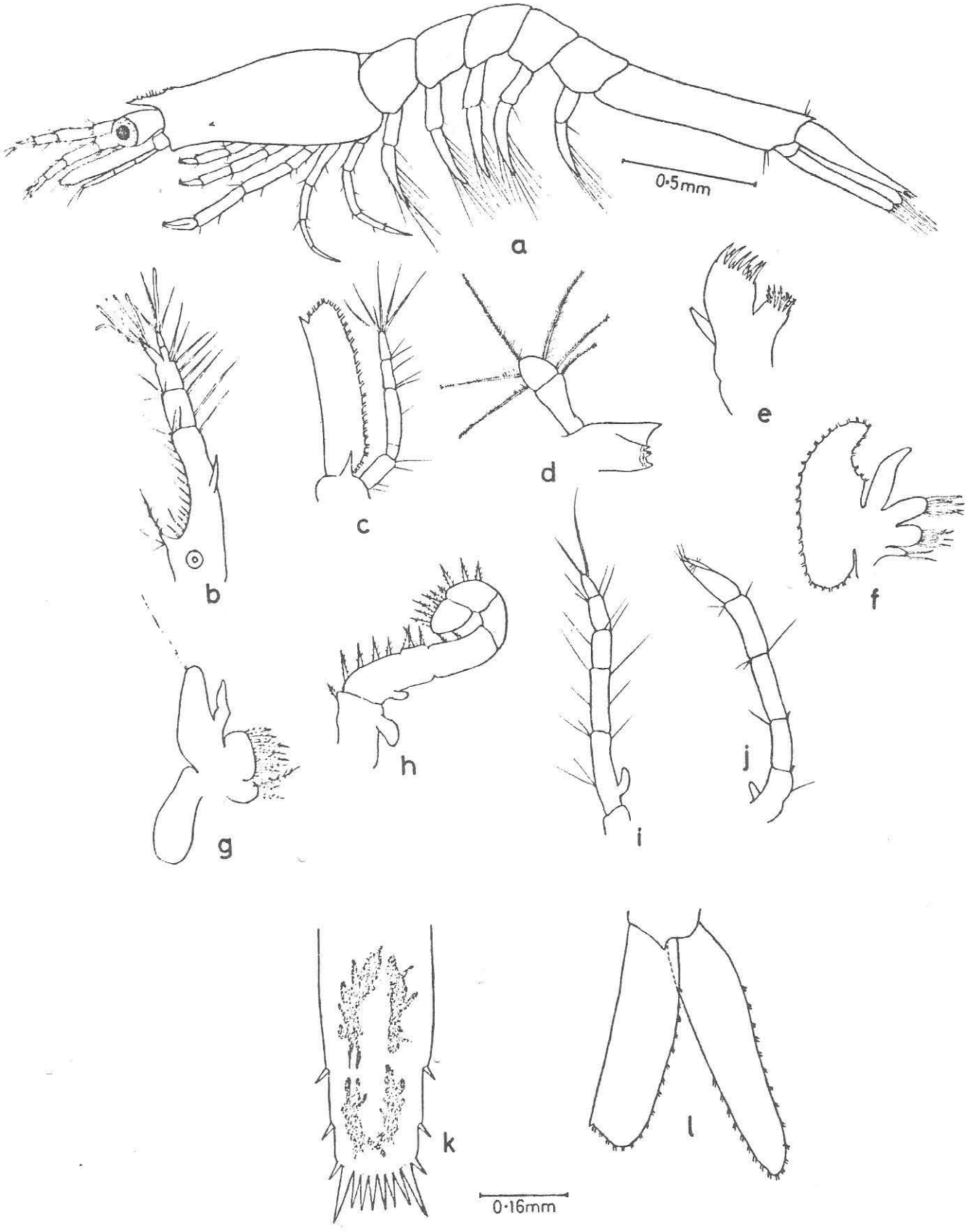

Fig. 2 Metapenaeus monoceros, first postlarva. (a) Lateral view. (b) Antennule. (c) Antenna. (d) Mandible. (e) Maxilla I. (f) Maxilla II. (g) Maxilliped I. (h) Maxilliped II. (i) Maxilliped III. (j) First pereiopod. (k) Telson. (l) Uropod.

Antenna: Flagellum 4-jointed and about 3/4 length of the scale. Scale with well developed anterolateral spine projecting slightly beyond the tip and with 28 plumose setae.

Mandible: Mandibular palp well developed and jointed; the outer border of both segments beset with setae.

Maxilla I: The endopod small, 2-segmented and without setae, its line of demarcation from the peduncle faintly visible.

Maxilla II: The endopod has 4 functional endites; the palp is faintly segmented near the tip and provided with 2 minute setae. Scaphognathite very conspicuous and with 27 plumose setae.

Maxilliped I: Very much reduced; peduncle wide and 2-segmented with numerous setae along inner margin. Exopod and endopod unjointed, the former non-setose and the latter with a single terminal seta. Epipodite well developed.

Maxilliped II: Protopod with a gill; exopod rudimentary; endopod 5-segmented with the distal 3 segments curved inward.

Maxilliped III: Vestigial exopod present; endopod 5-segmented.

Perieopods: First 3 pairs chelate, 3rd pair the longest. Each chelate leg has 2-jointed protopod and an endopod of 5 segments. The 4th and 5th pairs non-chelate, but having the same number of segments as the first 3 pairs.

Pleopods: Uniramous, first 3 pairs well developed and longer than the last 2. Each pleopod 3-jointed with the distal segment bearing 10 setae.

Abdomen: Median dorsal spine present on 5th and 6th abdominal segments. Anal spine present.

Telson: Bears 3 pairs of lateral and 5 pairs of terminal spines.

Uropod: Well developed, with a large spine on the externodistal border of the exopod which possesses 25 marginal setae. The endopod fringed with 29 to 30 setae.

Colouration (Fig. 6a): Tips of 2nd and 3rd segments of antennular peduncle light reddish; eye stalk yellowish. Middle region of the carapace and the 2nd, 3rd and 4th abdominal segments slightly yellowish and with a few branched brownish red chromatophores. The distal end of the last thoracic somite as well as proximal portion of the tail fan yellowish and with red pigmentation. Distal end of telson also possesses reddish brown chromatophores.

Swimming behaviour: Fast swimmers, seen to perform rapid forward movement along the edges of the container and surface, often trying to jump out of the water when disturbed.

3.2 Metapenaeus monoceros (Fabricius) (Fig. 2)

First postlarval stage was obtained from both marine and backwater collections, the former containing more early stage larvae. A few larvae were also obtained by rearing late mysis stage. Their size range varied from 3.75 to 3.95 mm total length and 1.104 to 1.112 mm carapace length.

Carapace: Rostrum small, not quite reaching middle of eye stalk, tip pointed and appears triangular; bears 2 principal teeth, the first arising at the level of the anterior border of carapace and the second considerably posterior to it. The first has a smaller tooth in front and the second, larger tooth is followed by a much smaller spine. A conspicuous antennal and a smaller hepatic spine present. Pterygostomial spine absent.

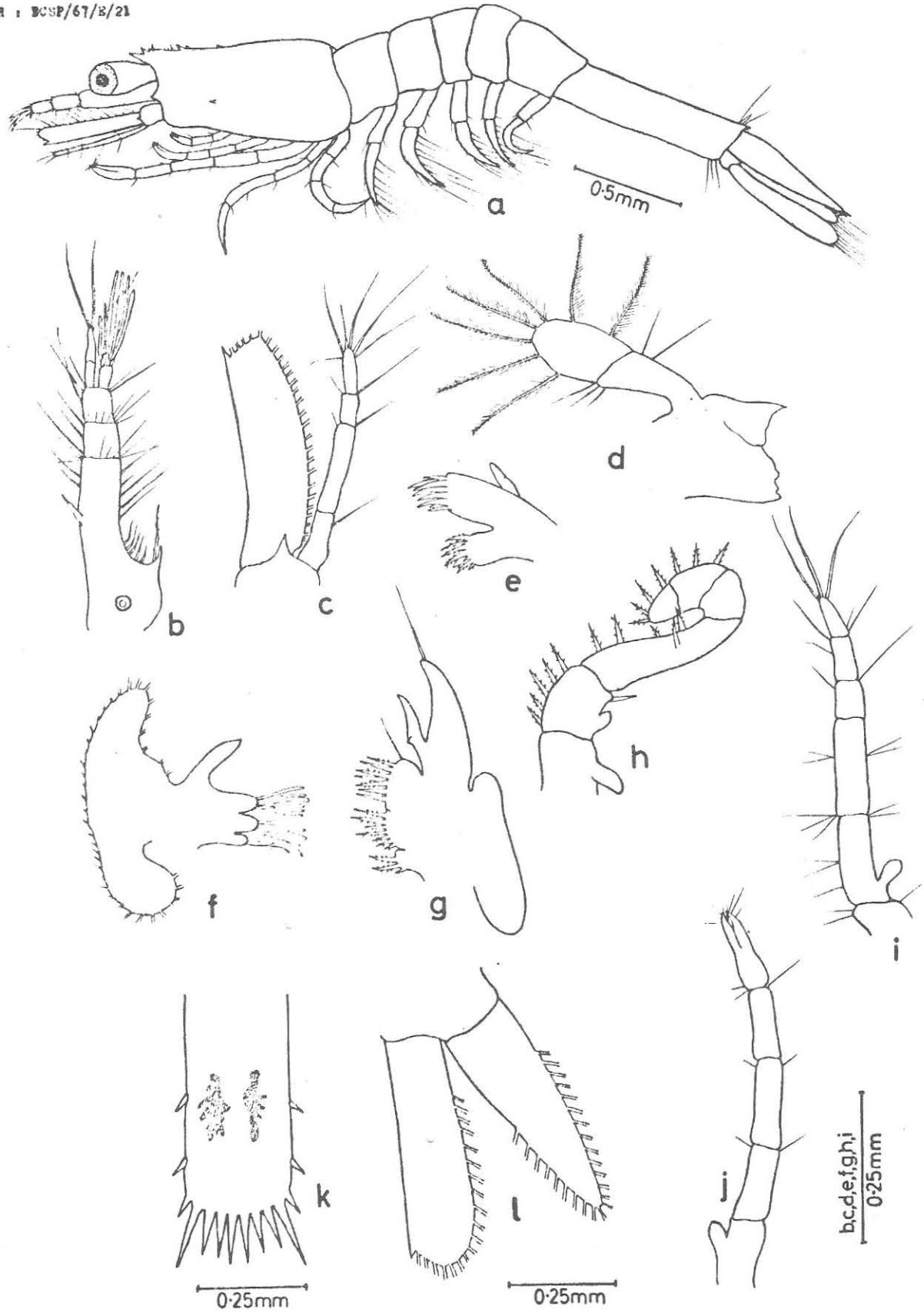

Fig. 3 Metapenaeus affinis, first postlarva. (a) Lateral view. (b) Antennule. (c) Antenna. (d) Mandible. (e) Maxilla I. (f) Maxilla II. (g) Maxilliped I. (h) Maxilliped II. (i) Maxilliped III. (j) First pereiopod. (k) Telson. (l) Uropod.

Antennule: Peduncle 3-segmented, proximal segment being the longest. A well developed statocyst present at the base, the top of the statocyst swelling bearing 5 hairs as in Metapenaeus mastersi (Muriel and Bennett, 1951). The inner branch of the 3rd segment 2-jointed, carrying 4 setae at the tip and the outer branch faintly segmented with 5 to 6 aesthetes. Ventral spine present.

Antenna: Spine on the protopodite well developed; flagellum 4 to 5 jointed, 5 setae on the distal segment which reaches 3/4 length of the scale. Scale with 26 setae and an anterolateral spine which falls short of the anterior margin of the scale.

Mandible: Palp well developed, segmented, bearing 6 setae.

Maxilla I: Endopod unjointed, small and without setae.

Maxilla II: Only 3 functional endites; palp unsegmented and the scaphognathite with 32 plumose setae.

Maxilliped I: Very small in size; peduncle 2-segmented with numerous setae on its inner margin; exopod and endopod unjointed, the former with a single terminal seta and the latter non-setose. Epipodite present.

Maxilliped II: Vestigial exopod and a small epipodite present. Endopod 5-segmented and bent inward at the distal portion.

Maxilliped III: Exopod vestigial present as a small bud on the base; endopod 5-segmented.

Perieopods: Each 5-segmented and beset with small setae; 3rd pair of the first 3 chelate legs the longest. First perieopod with a minute basial and ischial spine; 3nd and 3rd with basial spine only.

Pleopods: Uniramous, 3-segmented, the distal segment bearing 10 setae.

Abdomen: None of the abdominal segments except the 6th has a median dorsal spine. Anal spine present. The lateral aspect of the distal portion of the 6th segment carries 2 to 3 pairs of long setae.

Telson: With 2 pairs of spines on the lateral margin and 5 pairs posteriorly.

Uropod: Exopod with 17 setae and a minute spine on th anterodistal border. Endopod narrower than exopod and with 22 setae.

Colouration (Fig. 6b): The postlarva can be readily spotted in the plankton due to its brownish appearance to the naked eye. The whole antennular peduncle is covered with reddish pigments. The carapace is provided with a number of branched chromatophores. The ventral side of the abdomen is profusely pigmented with arborescent reddish chromatophores, as a result of which the whole abdomen appears brownish red. Under the microscope each segment is seen to bear 3 or 4 branched chromatophores on either side. Almost the entire telson is pigmented with reddish chromatophores.

Swimming behaviour: Swims straight in a forward direction without any jerk and rests horizontally on the edges of the container or at the surface. This habit and its conspicuous colouration make it easy to be spotted in the plankton.

3.3 Metapenaeus affinis (Milne Edwards) (Fig. 3)

The postlarvae of this species are relatively few in the collections. The material described was obtained by rearing the late mysis stage in the laboratory. Sizes ranged from 3.85 to 3.95 mm total length and 1.168 to 1.170 mm carapace length.

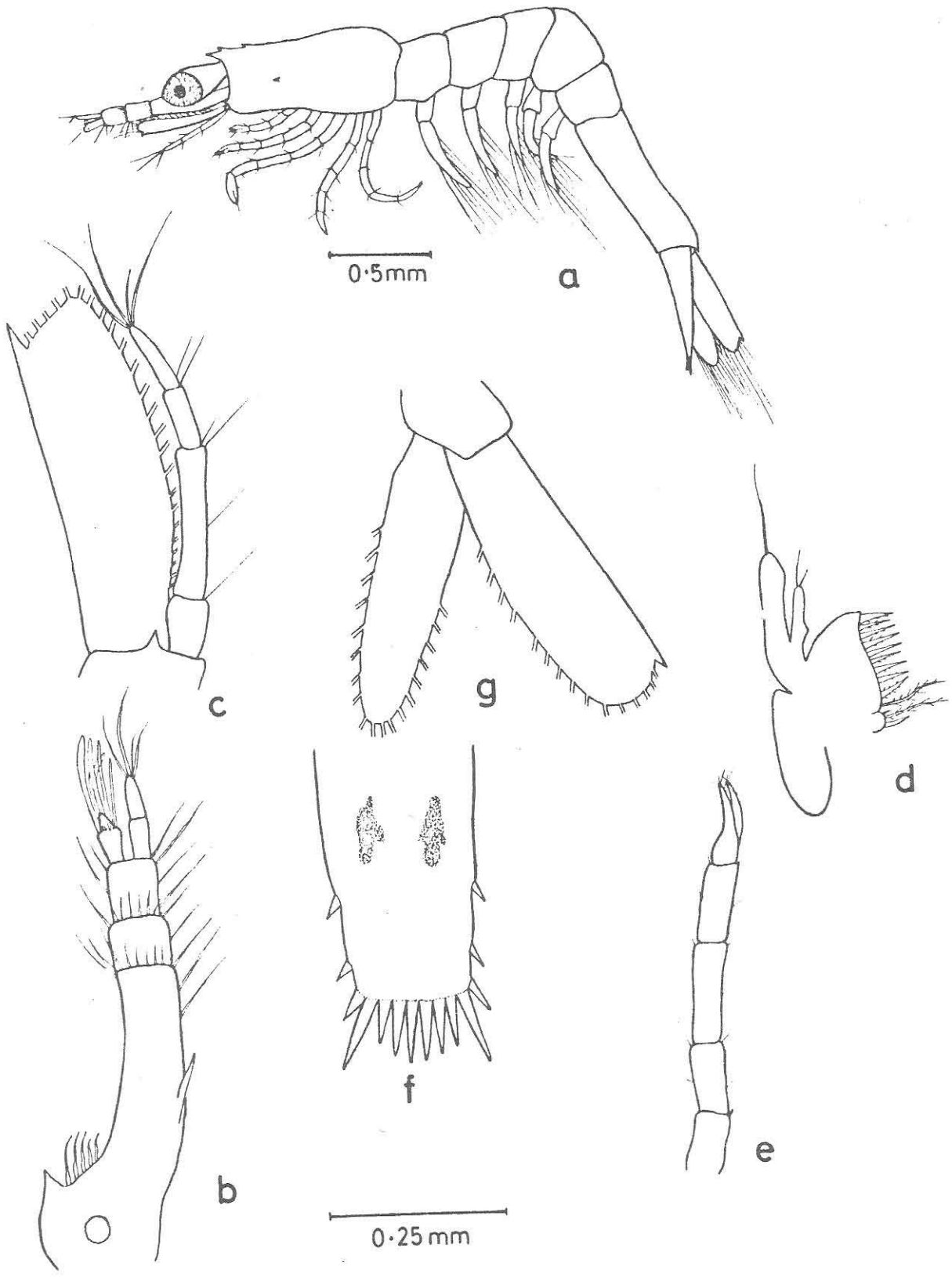

Fig. 4 Metapenaeus dobsoni, first postlarva. (a) Lateral view. (b) Antennule. (c) Antenna. (d) Maxilliped I. (e) First pereiopod. (f) Telson. (g) Uropod.

Carapace: Rostrum very small, projecting a little beyond the frontal border of the carapace, rostral tip triangular, and dorsally toothed. Just behind the tip there is a tooth which is followed by a minute spine. Posterior to this, there is another pair of spines, the anterior of which is larger. In addition and posterior to these the dorsal margin carries another tooth which probably represents the epigastric tooth, posterior to which one or two minute spines are also present in some of the specimens. Carapace with well developed antennal and hepatic spines, the anterolateral angle being smooth.

Antennule: Peduncle 3-segmented with a conspicuous statocyst at the base. 5 small stout hairs present on top of the statocyst swelling. Both inner and outer branches of the distal segment faintly jointed, the former carrying 3 setae at its tip and the latter with 6 to 8 aesthetes. Ventral spine present.

Antenna: Protopodite bears a small spine. Flagellum almost equal or slightly shorter than the scale and 4-jointed, the distal joint carrying 6 setae. Scale with well developed spine on the externodistal border, reaching almost the tip of the scale which is provided with 26 plumose setae.

Mandible: Palp jointed and the distal segment carries 7 to 8 plumose setae; 4 setae on the proximal segment.

Maxilla I: Endopodite small, unjointed and without setae.

Maxilla II: As in M. monoceros 3 functional endites present; palp unjointed and unarmed. Scaphognathite well developed and bearing 39 setae along its outer border.

Maxilliped I: Same as in M. monoceros.

Maxilliped II: Vestigial exopod and an epipodite present; endopod 5-segmented and tip curved as in M. monoceros.

Maxilliped III: Vestigial exopod present; endopod 5-segmented.

Perieopods: First 3 pairs chelate as in other penaeids. Basial and ischial spines absent on first pereiopod.

Pleopods: Uniramous and functional, 3-segmented, distal segment with 10 to 11 long plumose setae.

Abdomen: Median dorsal spine on 6th abdominal segment only. The lateral aspect of the distal portion of the 6th segment carries more than 3 pairs of long setae. Small anal spine present.

Telson: As in M. monoceros there are 2 pairs of lateral and 5 pairs of posterior spines.

Uropod: Endopod with 24 and exopod with 19 setae. Spine on externodistal border conspicuous.

Colouration (Fig. 6c): Tips of the segments of the antennular peduncle pigmented. Eye stalk yellowish. Carapace and abdominal segments provided with branched dark chromatophores, but much less in density than in M. monoceros. In the telson, the chromatophores are distributed in patches in between the 2 pairs of lateral spines.

Swimming behaviour: Show slight jerking or springing movement. Rest along the edges of the container, mostly orientated towards areas of intense light, their bodies more or less parallel to the sides of the container with tail portion raised and head somewhat bent down. When disturbed they perform a sort of rotatory movement and then come to occupy the original 'resting' position.

Fig. 5 Parapenaeopsis stylifera, first postlarva. (a) Lateral view, (b) Antennule. (c) Antenna. (d) Mandible. (e) Maxilla I. (f) Maxilla II. (g) Maxilliped I. (h) Maxilliped II. (i) Maxilliped III. (j) First pereiopod. (k) Telson. (l) Uropod.

3.4 Metapenaeus dobsoni (Miers) (Fig. 4)

This is by far the most abundant larva in the collections, and is equally distributed in the marine and backwater plankton. The first postlarvae were also obtained by rearing in the laboratory. Their sizes ranged from 3.0 to 3.50 mm total length and 0.928 to 0.975 mm carapace length.

The material on hand agrees in all essential characters with the descriptions of same stages given by Menon (1951). However, slight variations noticed in certain characters and a few additional features are shown in Fig. 4.

Colouration (Fig. 6d): Almost similar to that of M. affinis. Tips of 2nd and 3rd segments of antennular peduncle slightly brownish. Eye stalk yellowish. The abdominal segments appear light yellowish and each segment is provided with a branched dark chromatophore. There is also a patch of this chromatophore in the middle region of the telson.

Swimming behaviour: Show same movements and resting position as M. affinis.

3.5 Parapenaeopsis stylifera (H. Milne Edwards) (Fig. 5)

The postlarvae of this species were collected in very small numbers from the marine plankton only. They were also reared in the laboratory from the mysis stage. Sizes ranged from 4.25 to 4.75 mm total length and 1.290 to 1.315 mm carapace length.

Carapace: Rostrum lanceolate, reaching almost middle of eye stalk and with 2 dorsal spines, the posterior of which arises at the level of the frontal margin of the carapace. An epigastric spine also present. Carapace has well developed antennal and small hepatic spine. Branchiostegal spine broadly pointed and placed near the antero-inferior angle of the carapace. The region behind this spine is beset with 9 to 10 small setae.

Antennule: Peduncle 3-segmented as in other penaeids and with a median ventral spine on the basal segment. Statocyst well developed and the top of its swelling carries 6 small and stout setae and 1 long bipectinate seta. The outer branch of the 3rd segment is 3-jointed and the inner 5-jointed, the distal segment of which carries 6 setae.

Antenna: Flagellum long with 10 segments. Scale reaching tip of the third segment of the antennular peduncle and with a conspicuous spine on the antero-lateral border, not reaching the tip of the scale which is acutely rounded. Scale with 39 setae.

Mandible: Palp segmented, the proximal segment 1/5 the size of the distal which carries 25 to 26 setae.

Maxilla I: Very much reduced; endopodite unjointed and without seta.

Maxilla II: With 4 functional endites, the proximal of which is without setae. Palp unsegmented; the scale very large with the whole border beset with 54 to 55 setae.

Maxilliped I: Endopod and exopod not segmented, but with a few setae at their tips. Epipodite present.

Maxilliped II: Vestigial exopod present; the endopod similar to that of other larvae described above.

Maxilliped III: Endopod 5-segmented; vestigial exopod present.

Perieopods: First three legs chelate, the 3rd the longest reaching to middle of antennal scale.

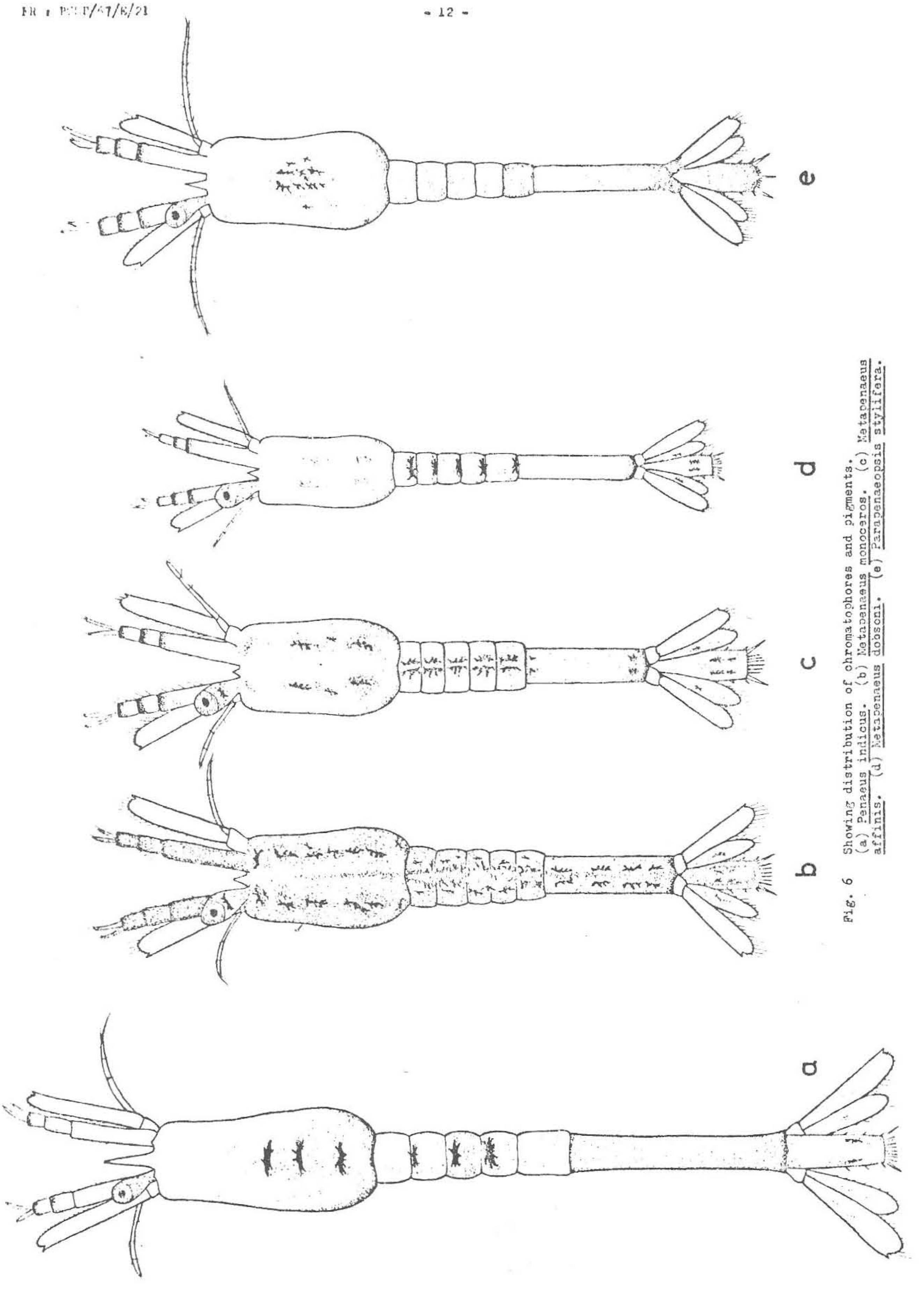

Fig. 6 Showing distribution of chromatophores and pigments.
(a) *Penaeus indicus*. (b) *Metapenaeus monoceros*. (c) *Metapenaeus affinis*. (d) *Metapenaeus dobsoni*. (e) *Parapenaeopsis stylifera*.

Pleopods: Well developed and functional. All the pleopods are uniramous and 4-segmented, the distal one the smallest. The first 4 pleopods have 20 to 21 setae and the last one which is also the smallest carries only 18 setae.

Abdomen: None of the abdominal segments bear dorsal median spine, but the median ventral margin of 6th segment pointed.

Telson: With 3 pairs of lateral and 11 posterior spines. The median posterior spine is very large and almost equal in length to the large outermost pair of posterior spines. The posterior margin between the outermost pair of posterior spines tapers towards the middle spine. A few pairs of plumose setae present on the posterior margin.

Uropod: Exopod with well developed externodistal spine and 24 to 25 setae; endopod carries 32 setae.

Colouration (Fig. 6e): Tip of each segment of antennular peduncle light brownish; eye stalk yellowish. Middle region of carapace with a few branched brownish chromatophores; abdomen yellowish, the posterior portion of the last abdominal segment and the basal portion of the uropod tinged with yellowish colour and with light brownish pigment. Tip of telson light brownish.

Swimming behaviour: Swims straight forward without jerk and rests horizontally on the edges of the container.

4 COMPARISON OF LARVAE

The occurrence of postlarvae of all these species at the same time and place in the general plankton collections and their apparent similarities renders their separation to species difficult. A comparison of the various characters is given in Table I.

Comparison of some of the important features of the first postlarva of P. indicus with the corresponding stage of P. trisulcatus, P. setiferus, P. japonicus and P. duorarum, described by Heldt (1938), Pearson (1939) and Heegaard (1953), Hudinaga (1942) and Dobkin (1961), respectively, reveals certain differences. The size of P. indicus larva is quite striking in that it is the largest among these. Characters, such as the presence of supraorbital spine, number of joints on the inner branch of the distal segment of the antennular peduncle, segmentation of the endopodite of first maxilla, nature of the palp of second maxilla, setation of the scaphognathite, the number of segments of exopod and endopod of first maxilliped, also show some clear differences.

The general features of the first postlarvae of Metapenaeus monoceros, M. affinis and M. dobsoni exhibit close resemblances, although there are clear specific features by which they could be distinguished from each other as shown in the above description. Comparison of the identical stages of M. stebbingi, described by Gurney (1927), and M. mastersi (Muriel and Bennett, 1951) shows numerous common characters and similar pattern of development. The first postlarva of Parapenaeopsis stylifera is clearly different from that of other species in the collection, but the general shape and nature of the telson and rostrum show apparent resemblances to that of the genus Parapenaeus (Heldt, 1938; Pearson, 1939; Cook, 1966).

A provisional key for distinguishing the first postlarval stages of these prawns is given below.

1	Telson with 7 + 7 spines	2
	Telson with more than 7 + 7 spines	4
2(1)	Rostrum with 4 spines (2 large and 2 small); long setae on distal lateral aspect of 6th abdominal segment	3
	Rostrum with 2 spines; no setae on distal lateral aspect of 6th abdominal segment	Metapenaeus dobsoni

TABLE I

Comparison of first postlarval stages of five species

Structure	Penaeus indicus	Metapenaeus monoceros	Metapenaeus affinis	Metapenaeus dobsoni	Parapenaeopsis stylifera
Total length (mm)	5.22-5.95	3.75 -3.95	3.85 -3.95	3.00 -3.50	4.25 -4.75
Carapace length (mm)	1.28-1.35	1.104-1.112	1.168-1.170	0.928-0.975	1.290-1.315
Rostrum	Exceeding eye; 1 dorsal tooth	Small, not quite reaching middle of eye; 2 pairs of dorsal spines	Small; just projecting beyond frontal margin of carapace; 2 pairs of dorsal spines and 1 epigastric	Small; 2 dorsal spines	Reaching middle of eye; 2 dorsal and 1 epigastric spines
Carapace	With supraorbital and hepatic spines	With antennal and hepatic spines	With antennal and hepatic spines	With antennal and hepatic spines	With antennal, hepatic and branchiostegal spines
Antenna I	Inner branch of distal peduncular segment 3-jointed with 2 setae at tip; outer branch 2-jointed	Inner branch of distal peduncular segment 2-jointed with 4 setae; outer branch faintly segmented	Inner and outer branches of distal segment faintly jointed; inner branch with 3 setae	Inner branch of distal peduncular segment 2-jointed with 4 setae at tip; outer branch faintly segmented	Inner branch of distal peduncular segment 5-jointed with 6 setae at tip; outer branch 3-jointed
Antenna II	Flagellum 4-jointed; scale with 28 setae	Flagellum 4-5 jointed; scale with 26 setae	Flagellum 4-jointed; scale with 26 setae	Flagellum 4-jointed; scale with 24-25 setae	Flagellum 10-jointed; scale with 39 setae
Mandible	Palp jointed, distal joint with 3-4 setae	Palp jointed, distal segment with 5-6 setae	Palp jointed, distal segment with 7-8 setae	Palp jointed, distal segment with 7 setae	Palp jointed, distal segment with 25-26 setae
Maxilla I	Endopod segmented	Endopod unjointed	Endopod unjointed	Endopod segmented	Endopod unjointed
Maxilla II	4 endites; palp faintly segmented, scaphognathite with 27 setae	3 endites; palp unjointed, scaphognathite with 32 setae	3 endites; palp unjointed, scaphognathite with 39 setae	3 endites; palp unjointed, scaphognathite with 26 setae	4 endites; palp unjointed, scaphognathite with 54-55 setae
Pereiopods	1st 3 pairs without spines	1st pair with basial and ischial spines; 2nd and 3rd with basial spine only	No spines	1st 3 pairs with basial spines	No spines
Abdomen	Median dorsal spine on 5th and 6th segments	Median dorsal spine on 6th segment	Median dorsal spine on 6th segment.	Median dorsal spine on 6th segment	None of the segments with median dorsal spine
Pleopod	Uniramous, 3-jointed; distal segment with 10 setae	Same as in P.indicus	Same as in P.indicus	Same as in P.indicus	Uniramous, 4-segmented; distal segment with 18-21 setae
Telson	Spine formula 8 + 8; posterior margin straight	Spine formula 7 + 7; posterior margin straight	Spine formula 7 + 7; posterior margin straight	Spine formula 7 + 7; posterior margin straight	Spine formula 8 + 1 + 8; margin of telson tapering between posterolateral spines

3(2)	Epigastric spine on the carapace present and with 1 or 2 minute spines posterior to it; distal lateral aspect of 6th abdominal segment with more than 3 pairs of setae; larva not brownish	Metapanaeus affinis
	Epigastric spine on the carapace absent; distal lateral aspect of 6th abdominal segment with 2 or 3 pairs of setae; larva appears brownish	Metapenaeus monoceros
4(1)	Telson with 8 + 8 spines; posterior margin straight, median posterior spines equal; median dorsal spines present on 5th and 6th abdominal segments	Penaeus indicus
	Telson with 8 + 1 + 8 spines, posterior margin between the posterolateral spines tapering; median posterior spine very much longer than the adjacent spines; median dorsal spines on abdominal segments absent	Parapenaeopsis stylifera

5 GENERAL REMARKS

The fact that the young pelagic larvae of most of the penaeids have a strong tendency to come to shallow inshore areas or estuaries has already been established and this is true of all the species under study, except P. stylifera. This species completes its life cycle in the marine environment without entering the estuaries at any stage of its life. The rarity of its larvae in the inshore plankton and the complete absence of it in the backwater collections supports this view and suggests the possibility of their preference for offshore waters. The distribution of other species in the plankton collections reveals that the early postlarval stages of M. dobsoni are more or less equally distributed in the inshore as well as backwater plankton. In the case of M. monoceros and M. affinis, their numbers are comparatively less in the backwaters, the former species having been reported to breed in 50 to 60 m depth off Cochin (George and George, 1964). The early postlarva of P. indicus is encountered only in the collections from the offshore regions and later stages are more abundant in the backwater collections. Panikkar and Menon (1956) suggested a deeper water spawning habitat for these prawns. George (1962) observed the occurrence of large numbers of advance stage postlarva (8 to 14 mm) in Cochin backwaters. The absence of the first postlarva in the inshore plankton may probably be due to the distant location of spawning grounds, the postlarva becoming advanced stage during the period of transport to the inshore areas and backwaters. The occurrence of relatively larger numbers of advanced stage postlarvae in the backwater plankton shows that they are no longer passive and that they have by this time developed sufficient locomotory powers to withstand the flow of ebb tide.

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