J. mar. biol. Ass. India, 1982, **24** (1 & 2) : 23–32

BOPYRID PARASITES OF PRAWNS AT KAKINADA

S. LALITHA DEVI*

Central Marine Fisheries Research Institute, Cochin - 682 031

ABSTRACT

A total of 1,064 prawns belonging to 12 species of penaeid and 3 species of non-penaeid prawns were infected with 10 species of Bopyrid parasites belonging to 5 genera. *Epipenaeon georgei* is described as new to science. *Epipenaeon japonicus* Thielemann and *Orbione bonnieri* Nobili are new records to Indian waters. There was no host specificity except in *E. japonicus* Thielemann and *Stegoalphaeon kempi* Chopra. Incidence of infestation was higher during October-January. Statistical analysis revealed that the male and female prawns of a given species have equal chance of being infested by the bopyrids. Infested prawns exhibited degeneration of the primary and secondary sexual organs. The index of condition in the infested prawns was low compared with non-infested prawns.

INTRODUCTION

WHILE engaged in studies on prawns at Kakinada region, it was noticed that some of the prawns were infected by Bopyrid isopod parasites, which gave a characteristic bulge at the branchial region of the host. These parasites were represented by 5 genera.

Chopra (1923, 1932) gave a detailed account of Bopyrid isopods parasitic on Indian Decapoda and Macrura, especially on non-penaeid prawns and he gave only two instances of penaeid prawns *Penaeus monodon* and *Sicyonia bispinosa* being infected by *Epipenaeon elegans* and *Orbione kempi* respectively. Menon (1953) while dealing with the fishery and bionomics of the penaeid prawn *Parapenaeopsis stylifera* from Malabar Coast, mentioned the infestation by the Bopyrid parasite belonging to the genus *Epipenaeon* Nobili, which differs from the species described by Chopra (1923); but he has not described the parasite.

Thomas (1977) reported on the infestation by *Epipenaeon ingens* Nobili. of *P. semisulcatus* from Palk Bay and Gulf of Mannar. Apart from these, no other published information is available on the Bopyrid parasites infecting penaeid prawns from India. Hence a study on this interesting group of parasites was taken up.

The author expresses her deep sense of gratitude to Dr. E. G. Silas, Director, C. M.F. R. Institute, Cochin for constant encouragement and to Dr. M. J. George for critically going through the manuscript.

MATERIAL AND METHODS

The study was based on weekly observations during 1979 to 1983 when small sized trawlers operated otter trawls in 5-70 m depth in the sea off Kakinada. The sampling of prawn catches of 20-100% of the fishing units was done at Kakinada fisheries harbour. Prawns from the brackishwater areas were also observed. The prawns collected on observation days from different types of units, were sorted specieswise and those infested and not infested were segregated. The sex, stage of maturity and side of infestation were also noted.

The infected and non-infected prawns were weighed to the nearest mg using double pan electric balance and for the infected prawns the weight of the parasite was deducted from the total weight.

Length-weight relationships of the non-infected and infected prawns were calculated separately by the least squares method after the logarithmic transformation of the parameters. The index of condition was calculated

by the formula: observed weight/expected weight.

Genus **Epipenaeon** Nobili

Epipenaeon georgei sp. nov.

Host: Parapenaeopsis sculptilis (Heller), *P. stylifera* (H. M. Edw), *Metapenaeopsis barbata* (de Hann).

Material: One female specimen of *P. sculptilis*, 440 specimens of *P. stylifera* (males 157, females 283) and 24 specimens of *M. barbata* (males 9, females 15). Detailed studies on 15 parasites were made.

Material is in the reference collections museum of CMFRI, Cochin.

Etymology: The species is named in honour of Dr. M. J. George, Joint Director, Central Marine Fisheries Research Institute, who contributed greatly to the systematics and biology of crustaceans from Indian waters.

Description - Female (Fig 1 a - g): Body distinctly longer than broad, length range from 6-19.8 mm; length to width ratio 1.3:1. Head distinct, deeply set in thorax, anterior margin broadly rounded, posterior slightly notched in the centre, continues as a groove on the dorsal side of thorax. Frontal lamina well developed, more than half the length of head, slightly notched in centre.

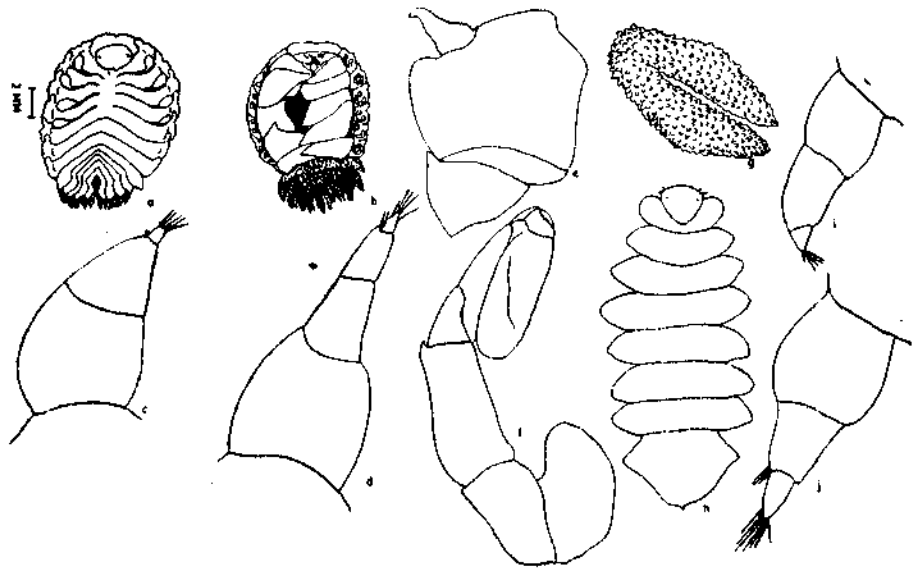

Fig. 1. *Epipenaeon georgei* n. sp - Female: a. Dorsal view, b. Ventral view, c. Antennule (10 x 15), d. Antenna (10 x 15), e. Maxilliped (2.5 x 5), f. Thoracic leg (10 x 5), g. Pleopod (2 x 5), Male: h. Dorsal view (2.5 x 5), i. Antennule (45 x 5) and j. Antenna (45 x 5).

Holotype: Female: Total length (from tip of frontal lamina to the tip of last abdominal segment) 9.0 mm, width of the body at 4th thoracic segment 6.9 mm, length of abdomen 2.95 mm and width of abdomen 4.2 mm.

Total length of paratypes (6 females) ranges from 7.5 to 19.5 mm).

Thoracic somites distinct, epimera highly developed, first segment half the length of second and second to seventh segments more or less equal. Ovarian bosses well developed, seen as oval structures occupying more than

anterior half of margins of their respective segments in deformed side. Thoracic lamellae with wavy margin, posteriorly covered by preceeding one. In some specimens, thoracic segments from second to fifth on dorsal side have in centre, indistinct coxal lines of demarcation, and sixth and seventh segments have more distinct lines.

The epimera of first six segments extend forward from their origin and overlap posteerior portion of epimera immediatley in front of them, but epimera of seventh segment extends outward. Epimera of deformed side comparatively less developed.

Abdomen onethird the length of body, broader than long and 5 somites visible dorsally with well developed pleural lamellae which are rounded with pointed tip (obtuse) and in some tuberculate. The pleural lamella of last abdominal segment is formed of two portions which are distinct throughout the length.

Ventrally head presents usual appendage, antennules triarticulate. The basal segment swollen while terminal is small. The antennae seem to be formed of four segments of which basal considerably swollen and terminal somewhat small and bears hairs distally.

The "lips" and rostrum as usual well developed. The mandibles curved, first maxilla somewhat elongated. Second pair extremely reduced. Maxilliped formed of two portions, basal triangular segment smaller. Palp with large finger shaped process, margins of which wrinkled and devoid of setae. Palps of maxilliped in natural position almost meet in middle line.

Incubatory cavity large, partly roofed over by oostegites, a large open space (left) in middle. Inner margins of anterior and posterior lobes of first oostegite do not bear hairs.

Internal crest is prominent and lower margin carries a large number of digitations and processes along its entire length. Fifth oostegite on its posterior margin is beset with a row of cilia.

Thoracic leg typically of the genus *Epipenaeon*. Ischium large and margin of basal segment has a very large, almost oval prominence, not covered with hairs and scales. This boss does not increase in size from first to seventh appendage. Propodus large and with the help of a small dactylus forms the claw.

Abdomen onethird of body length, broader than long; all five segments distinct with well developed pleural lamella which are rounded and slightly pointed (obtuse). Ridges on the ventral surface of abdomen frilled. Pleopods biramous, occupy entire portion of ventral surface of abdomen, first three pairs placed near the margins and fourth and fith pairs near the centre. Biramous uropods partly covered by 5th pair of pleopods, pleopods and uropods have very thick tubercles and warts.

Colour: In fresh condition white, eyes reddish brown.

Male (Fig 1 h-j) : Length range 1.5 - 4.4 mm, length to width ratio 2:1. Head distinct, antennule and antenna 3 segmented, basal segment much swollen, terminal segment very much reduced with a tuft of setae. Anterointernal margin of second segment of antenna bears few hairs.

Thoracic segments distinct, with outer margins slightly rounded and notched laterally. Thoracic legs as usual well developed than those of female with a powerful dactylus.

Abdomen one fourth of body length, abdominal somites completely fused to form a sub-triangular structure. No trace of pleopods and uropods.

Remarks: Present species closely resembles *E. japonicus* in the body being distinctly longer than broad, partly tuberculate nature of dorsal

side; in the proportion of length of abdomen to the total length being 1/3. *E. georgei* differs from *E. japonicus* in the shape of the pleural lamellae being rounded in the latter and obtuse in *E. georgei*. The pleural lamellae on ventral side in *E. georgei* are tuberculate. Abdomen of the male in *E. japonicus* is more or less rounded, in *E. georgei* sub-triangular.

E. georgei differs from *E. ingens* in the absence of median groove on the head, dorsal surface being partly tuberculate, the last abdominal segment being formed of two portions. Antennule and antenna are 3 segmented in *E. ingens* and 3 and 4 segmented in *E. georgei* respectively. Uropods in *E. ingens* are not covered by the 5th pair of pleopods. Thoracic segments of male in *E. ingens* are deeply notched.

E. georgei differs from *E. elegans* in general shape, being oval in the former and almost round in the latter, dorsal surface of abdomen being tuberculate. Body of adult females as long as broad in *E. elegans*, abdomen of female a little less than half the length of the body. The boss of the thoracic leg in *E. elegans* increases in size from 1st to 6th segment, the pleural lamella of last abdominal segment is formed of two portions in *E. elegans*, which are distinct only at the rear end. The terminal segments of antennule and antennae of females in *E. elegans* are devoid of any hairs.

Menon(1953) has observed a Bopyrid parasite belonging to the genus *Epipenaeon* in *P. stylifera* from Malabar coast of India. He has not described the species, but stated that his species do not closely resemble any of the species described by Chopra (1923).

Epipenaeon ingens Nobili

Epipenaeon ingens Nobili 1906, p. 1098; Thomas 1977, p. 258-261

Host: Penaeus indicus and *Solenocera crassicornis*.

Material: Eight specimens (5 females and 3 males) of *P. indicus* of 122-178 mm length were found to be infected with the parasite and only one female specimen of *S. crassicornis* of 64 mm length was infected by a female parasite only.

Description - Female: Body large, oval, larger than broad, slightly asymmetrical. Total length range 10.8-20.1 mm. Abdomen 1/3 of total length. Frontal lamina poorly developed epimera of thoracic segments with rounded outer margins.

Male: Length of body 3 to 7 mm, twice as long as broad, head distinct, small , thoracic segments with deeply notched lateral margin. Description given by Nobili (1906) and Thomas (1977) fully agree with present observations.

Remarks: Thomas (1977) described this species from *P. semisulcatus* from Palk Bay and Gulf of Mannar. At Kakinada although *P. semisulcatus* occurs in considerable quantities (4,210 specimens were observed) it was not found to be infested by Bopyrid parasite. Male in *E. ingens* has a sub-triangular abdomen, while Chopra (1923) noted it to be rounded. *P. indicus* and *S. crassicornis* form the new hosts recorded for *E. ingens*.

Epipenaeon japonicus Thielemann

Epipenaeon japonicus Thelemann 1910, p.7981.

Host: Penaeus japonicus Bate.

Material: A single 159 mm long male specimen of *P. japonicus* was found infected with the female parasite, accompanied by male.

Description - Female: Body distinctly longer than broad, total length 18.51 mm; abdomen 1/3 of total length, broader than long, partly tuberculate on the dorsal side, head distinct, deeply set in, the anterior and posterior margins rounded. Antennule 3 segmented and antenna 4 segmented. Pleural lamellae well developed, round and devoid of tubercles on ventral side.

Male: 4.5 mm long, body elongate, 2.25 times longer than broad, head small, distinct from thorax; thoracic segments disctinct with outer margins slightly pointed and notched laterally. Abdomen 1/4 length of body, sub-triangular, devoid of pleopods or uropods. The description and key given by Chopra (1923) agree with present observations.

Remarks: E. japonicus resembles *E. ingens* closely, but differs from it in the nature of frontal lamina being well developed, the pleural lamellae of abdomen poorly developed and the abdomen on dorsal side tuberculate. *E. japonicus* is distinctly longer than broad, whereas *E. elegans* Chopra is almost round. The pleural lamella of last abdominal segment in *E. elegans* is formed of 2 portions.

E. japonicus is recorded for the first time from Indian waters.

Epipenaeon elegans Chopra

Epipenaeon elegans Chopra 1923, p. 454, Dawson 1958.

Host: Penaeus monodon and *P. merguiensis*

Material: One male specimen of *P. monodon* of 238 mm length, 5 specimens of *P. merguiensis* (2 males and 3 females) of 159-187 mm length. In two female specimens of 168 and 187 mm length, parasite is absent, but the characteristic bulge with disturbed gills were found.

Description – Female: Body somewhat circular in outline and slightly asymmetrical. Colour greenish, oostegite on deformed side having dark pigment spots.

Total length range from 15.6 – 25.65 mm, abdomen a little less than half length of body, head broader than long, posterior border notched. Epimera well developed.

Male: 4-5 mm long. Description given by Chopra (1923) agree with the present material.

Remarks: E. elegans differs from *E. ingens* and *E. japonicus* in the different proportions of the body and the larger abdomen. The epimera are comparatively larger and foliaceous than the other two species. Frontal lamina in *E. elegans* is longer when compared with *E. ingens* and shorter when compared with *E. japonicus*. Arrangement of pleopods differs from that of *E. ingens*. In *E. elegans*, uropods are covered by the last pair of pleopods which are placed in the centre. The pleotelson (pleural lamella of last abdominal segment) in *E. elegans* is slightly notched in the middle, whereas it is rounded in *E. ingens*. Structure of maxilliped also differs in the three species, being slightly bent with rounded maxilliped in *E. elegans*.

E. elegans has been recorded from Calcutta (Chopra 1923) from *P. carinatus* (=*P. monodon*), Persian Gulf (Dawson 1958) from *P. semisulcatus*.

Occurrence of *E. elegans* in Kakinada region extends its distribution to Godavari delta. *P. merguiensis* is recorded as a new host.

Orbione bonnieri Nobili

Orbione bonnieri Nobili 1906. p. 1102. Chopra 1923. p. 447.

Host: Metapenaeus dobsoni (Miers).

Material: 2 specimens of *M. dobsoni* measuring 84 and 94 mm were found infected with the parasite, only one female parasite is accompanied by a male.

Description – Female (Fig 2 a - d): Body distinctly longer than broad, total length ranged from 10.5 - 12.75 mm. Ratio of total length to width of thorax 1.75:1.0; ratio of length of cephalothorax to width of thorax 1.5:1.0

Frontal lamina well developed, slightly longer than head, thoracic and abdominal lamellae well developed; first few pleural lamellae of abdominal segments well developed and are

rounded. Pleural lamella of deformed side of abdomen not very much reduced.

Antenule triarticulate, antenna penta articulate; mandible with a finger like pointed palp.

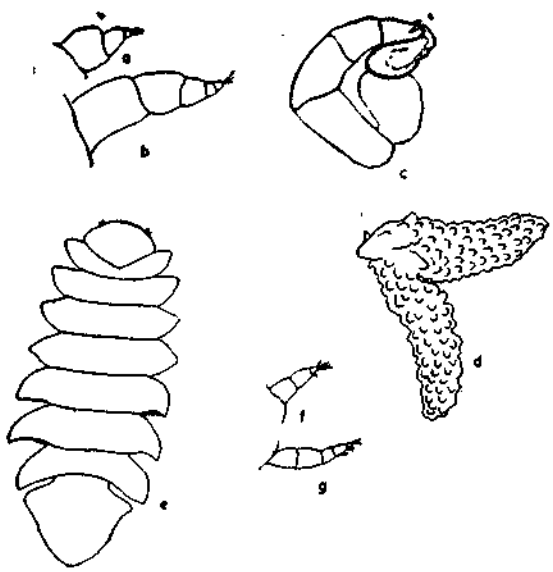

Fig. 2. *Orbione bonnieri* Nobili – Female: a. Antennule (10 x 5), b. Antenna (10 x 5), c. Thoracic leg (2 x 5), d. Pleopod (2 x 5), Male: e. Dorsal view (2 x 5) f. Antennule (10 x 5) and g. Antenna (10 x 5).

Six abdominal segments visible on dorsal side with 5 pairs of biramous pleopods on ventral side and uniramous uropod.

Description and the key given by Chopra (1923) agree with the present observations.

Male: 3.6 mm long, width at 3rd segment 1.17 mm, abdomen 1/5th of total length. Head sunken, fused with 1st thoracic segment. Anterior segments of thorax directed forward, 4th directed outside and rest directed backwards. Abdominal segments fused, sub–triangular, devoid of pleopods and uropods.

Remarks: Previous records of this parasite are from South of Singapore, recorded from *Metapenaeus monoceros.* This is the first record from *M. dobsoni* and new to Indian waters.

Orbione kempi Chopra

Orbione kempi Chopra 1923, p. 447.

Host: Metapenaeus brevicornis and *M. lysianassa.*

Material: One male *M. brevicornis* and a female *M. lysianassa* were infected. Unfortunately both hosts do not have the male parastie.

Description – Female: Total length 6. 15 mm and width 4. 05 mm. Body oval in shape, longer than broad. Dorsal surface of abdomen not tuberculate, frontal lamina nearly half length of head, head slightly broader than long.

Body white to light pink in colour with no colour markings on dorsal or ventral surface.

The description given by Chopra (1923) fully agrees with the present specimens. Chopra recorded the species from *Sicyonia bispinosa.* It was until then known from Japan and the Sulu Archipelago only, was collected by Dr. S. W. Kemp in Ross channel, Port Blair, Andaman Islands.

Remarks: M. brevicornis and *M. lysianassa* are the new hosts recorded for *Orbione kempi.*

Genus **Stegoalphaeon** Chopra, 1923

Stegoalphaeon kempi Chopra

Stegoalphaeon kempi Chopra 1923, p. 462.

Material: 3 specimens of *Alphaeus* sp. of 38-47 mm size, female parasites accompanied by their males.

Description – Female: Adult female is 5.2 - 6. 72 mm in length and 4–4.8 mm in width at level of 3rd thoracic segment. Body is asymmetrical, one side being deformed.

Description given by Chopra for male and female fully agree with present forms, except size of parasite.

Remarks: Chopra (1923) collected the parasites from *Alphaeus* sp. from the backwaters of Visakhapatnam in the Bay of Bengal. Present collection is from the backwaters of Kakinada.

Genus **Bopyrella** Bonnier

Bopyrella deformans Hay var *india* Chopra.

Synsynella deformans Hay 1917, p. 270.

Bopyrella deformans sub. sp. *indica* Chopra 1923, p. 470.

Host: *Alphaeus* sp.

Material: 2 specimens of *Alphaeus* sp. of 42. and 47 mm length were infested by female parasites, accompanied by male.

Description – Female: 7.2 mm long and 4.8 mm broad. Breadth two thirds of length, body asymmetrical, one side markedly shorter than other, head completely fused with first thoracic segment; lateral margins of abdomen acute, pleopods biramous.

The description for female specimens given by Chopra (1923) agree with present material

Male: 1.89 mm long, ratio of its length to thoracic width is 2.7:1, head fused with first thoracic segment.

Abdomen large, a little less than 1/5th of total length, its segments fused on dorsal surface, but distinct laterally.

The description for male, given by Chopra (1923) agrees in all respects with the present material, except in the shape of the last two abdominal segments. In Chopra's description, the 5th segment has round bulges, and the last abdominal segment is very much elongated finger-like structure. In the present form, the 5th abdominal segment is pointed at the tip and distinct, the 6th segment short, with rounded apex. Pleopods and uropods absent.

Remarks: *Bopyrella deformans* var *indica* has been reported from *Synalphaeus hululeniss* Coutiere at Karachi in the Arabian Sea, and at Madras from the Bay of Bengal. Present collection is from the backwaters of Kakinada.

Genus **Palaegyge** Giard and Bonnier

Palaegyge pica Chopra

Palaegyge pica Chopra 1923 and 1932, p. 503.

Host: *Macrobrachium rude* (Heller).

Material: 12 specimens of *M. rude* infected by parasite. In many cases female parasite accompanied by male.

Description – Female: Length of adult female varied from 4-6 mm, width 3-5 mm, body markedly asymmetrical, head in larger specimens broader than long.

Description of various body parts and colour pattern given by Chopra fully agrees with present form.

Males: Whitish in colour and size ranges from 1.5 – 2 mm in length. The discontinuous bands of pigment running longitudinally on the thorax, that were described by Chopra (1923) cannot be made out in present forms. Head on dorsal surface is drawn out posteriorly in first thoracic segment. Posterior margin is rounded.

Thoracic segments and abdomen agree with description given by Chopra (1923).

Remarks: *Palaegyge pica* was so far known to infest *Leander potaniscus* and an unidentified species of *Palaemon.* Both the hosts are from the waters subjected to the influence of tides. Present collection is from the host *Macrobrachium rude,* and is from the backwaters of Kakinada where there is a strong influence of tides.

Palaegyge bengalensis Chopra

Palaegyge bengalensis Chopra 1923, pp. 501-503; 1930, pp. 131-132.

Host: *Macrobrachium rosenbergi* (De Man).

Material: 6 specimens (2 males and 4 females) of *M. rosenbergi* of size range 31-60 mm were found infected. The female parasites in 2 forms were not accompanied by the males.

Description - Female: Length from 2.2 to 6.5 mm and 3.15-9.4 mm broad at 4th thoracic segment. General colour of body and arrangement of pigment spots as given by Chopra (1923). Head in posterior portion also coloured in present forms. Head longer than broad and formed of two halves. Abdomen proportionately shorter and broader than long.

Description of male and female parasites given by Chopra (1923, 1932) fully agree with present material.

Remarks: P. bengalensis Chopra has been previously recorded from the host *Palaemon malcolmsoni* obtained from the local market of Calcutta (Gangetic delta). Nierstrasz and Brender Bradis (1923) reported from Bangkok as a parasite of the closely allied *Palaemon carcinus* Fabricius. Present collection is from the backwaters of Kakinada (Godavari delta).

Incidence of Infection and its Effect on the Host

The percentage of incidence of parasites was higher during October-January. The proportionality test revealed that the sex ratio among the infested prawns was not significantly different when compared with non-infested prawns. Also the chances for infestation are equal to occur either in the right or, left branchial chambers.

Length data of the hosts indicate (Fig. 3) that in general, the parasite infests when the hosts are small (31 mm in the case of *M. rosenbergi* and 52 mm in the case of penaeid prawns). Prawns larger than 120 mm have very low infestation rate. Absence of parasitised specimens in the above length range may indicate that the parasite retards the growth rate in the host as suggested by Thomas (1977), or may cause early mortality of the host. It is also possible that the life span of the parasite may be shorter since some prawns longer than 140 mm showed the characteristic bulge in the branchial region without the parasite.

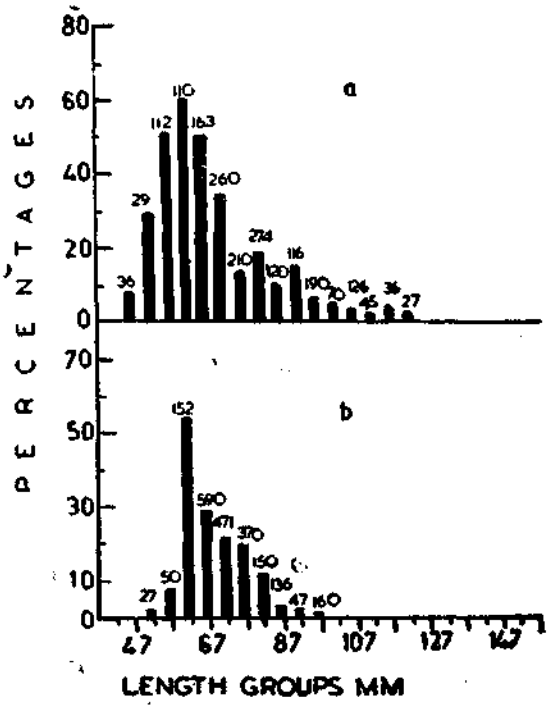

Fig. 3. Percentage infection in relation to length of prawns: a. *Parapenaeopsis stylifera* and b. *Metapenaeopsis barbata*. Number indicates the total number of prawns observed.

All the host specimens exhibited degeneration of the primary and secondary sexual organs (Fig. 4). The petasma of the male failed to develop to normal size and shape in relation to the size of the infested prawn. The ovaries were undeveloped irrespective of the size of the host and season (in *M. barbata* mature females were found even at the length of 58 mm and in *P. stylifera* above 64 mm, *P. indicus* 126 mm, *M. brevicornis* 75 mm, *M. dobsoni* 69 mm, *P. monodon* 180 mm and in *P. merguiensis* 136 mm).

The parasite causes considerable pressure on the gills, thereby reducing the efficiency of respiration.

Fig. 4. Male of *Penaeus monodon* (238 mm) showing undeveloped petasma.

The infested and non-infested prawns showed significant differences in the length-weight relationship and the index of condition was low in infested prawns when compared with non-infested prawns.

Length weight relationship of healthy female prawns of *P. stylifera* is

$$\log W = -12.251501 + 3.019 \log. TL$$

$$r = 0.923$$

Where 'W' is the weight in grams and TL is total length in mm; that of infested prawns is

$$\log W = -11.45089 + 2.8570 \log. T.L$$

$r = 0.96022$. No. observed = 97 (length range 52–160mm).

Observed weight by expected weight is less than one.

General Remarks and Distribution

Based on the examination of 1,064 infested prawns, it is found that 12 species of Penaeid prawns and 3 species of Non-penaeid prawns

Table 1. *Bopyrid parasites of prawns at Kakinada*

Name of the parasite	Hosts in the present study	Previous host records of the parasite	Remarks
Epipenaeon georgei n.sp.	*Parapenaeopsis sculptilles* (Heller) *P. sty ifera* H.M. Edwards *Metapenaeopsis barbata* (de Haan)		Hosts are new to the genus *Epipenaeon*.
Epipenaeon elegans Chopra	*Penaeus monodon* Fabricius *Penaeus merguiensis* de Man	*Penaeus carinatus* = *P. monodon* *P. semisulcatus* de Haan	*P. merguiensis* is a new host record. Extends distribution to Godavari delta
Epipenaeon ingens Nobili	*Penaeus indicus* H. M. Edwards *Solenocera crassicornis* (H.M.Edw.)	*Penaeus semisulcatus* de Haan *P. semisulvatus* de Haan	Extends its distribution to North East Coast of India.
Epipenaeon japonicus Thielemann	*Penaeus japonicus* Bate	*Penaeus japonicus* Bate	Recorded for the first time in Indian waters
Orbione bonneiri Nobili	*Metapenaeus dobsoni* (Miers)	*Metapenaeus monoceros* Fabr.	Extends its distribution to Indian waters. Host is a new record.
Orbione kempi Chopra	*Metapenaeus brevicornis* (H. M. Edwards) *M. lysianassa* (de Man)	*Sicyonia bispinosa* Kemp	Extends distribution to North Bay of Bengal. Hosts are new records.
Stegoalphaeon kempi Chopra	*Alphaeus* spp.	*Alphaeus* spp.	
Bopyrella deformans var *indica* Chopra	*Alphaeus* spp.	*Synalphaeus hululensis* Coutiere	
Palaegyge pica Chopra	*Macrobrachium rude* (Heller)	Undetermined species of *Palaemon*	Extends its distribution to North East coast of India
Palaegyge bengalensis Chopra	*Macrobrachium rosenbergi* (de Haan)	*Palaemon malcolmsoni* H.M. Edward *P. carcinus*	Distribution extended to Godavari delta.

were infested by the Bopyrid parasites (Table 1). Richardson (1916), Chopra (1923, 1932) and several other workers have shown that the same species of parasite has been found living on a large number of host species.

In the present study, *P. indicus* and *S. crassicornis* have the same parasite *E. ingens* which has been reported to infest *P. semisulcatus* alone in the Palk Bay and Gulf of Mannar (Thomas 1977). *E. elegans* was found to infest *P. monodon* at Calcutta (Chopra 1923) and *P. semisulcatus* alone in the Persian Gulf (Dawson 1958) whereas it was found to infest *P. monodon* and *P. merguiensis* at Kakinada. Though *P. semisulcatus* occurs in considerable quantity, it was not infested by this parasite.

Metapenaeus spp. were infested by *Orbione* spp. Though *M. monoceros* and *Sicyonia lancifera* occurred along with other species of *Metapenaeus* they were not infested by any parasites. There is no host specificity except in *E. japonicus* which was reported from *P. japonicus* and *Stegoalphaeon kempi* on *Alphaeus* sp. *E. japonicus* has been earlier reported from Japan from the same host species. Similar observations were made by Chopra (1923) in the case of *Argeia. Stegoalphaeon kempi* collected from *Alphaeus* species at Kakinada was reported on the same host species from Visakhapatnam.

Regarding geographical distribution of the family Bopyridae, Chopra (1923) gave several examples of hosts, parasites and their distribution being extended to Indian waters. He also pointed out that the Indian forms more closely resemble the Atlantic forms rather than the Pacific forms. Nierstrasz and Bradis (1923) have also emphasised the similarities between the forms of Atlantic Ocean and that of the Indo-pacific region by giving numerous examples. Most of the Bopyrids are widely distributed, being found in the Atlantic, the South Pacific and the Indian Oceans.

References

*Bonnier, J. 1900. Contribution a l'etude des Epicarides: Les Bopyridae. Traveaux. *State. Zoolog. Wimereux*, **8**: 1-475.

Chopra, B. 1922. Preliminary note on isopoda of the family Bopyridae, parasitic on Indian Decapoda, Macrura. *Journ. As. Soc. Bengal* (n.s), **18**:69.

———— 1923. Bopyrid isopods parasitic on Indian Decapoda, Macrura. *Rec. Indian. Mus.*, **25**: 411-550.

-———— 1932. Further notes on Bopyrid isopids parasitic on Indian Decapoda, Macrura. *Ibid.*, **32**: 113-147.

Dawson, C. E. 1958. Observation on the infection of the shrimp *P. semisulcatus* by *Epipenaeon elegans* in the Persian Gulf. *J. Parasit.*, **44**: 240-242.

Giard, A. and J. Bonnier 1888 c. Two new genera of Epicarides (Probopyrus and Palaegyge). *Ann. Mag. Nat. Hist.*, (6) **1**: 234.

Hay, W. P. 1917. A new genus and three new species of parasitic isopod crustaceans. *Proc. U.S. Nat. Mus.*, **51**: 569.

Menon, M. K. 1953. Notes on the bionomics and fishery of the prawn *Parapenaeopsis stylifera* (M. Edw) on the Malabar Coast. *J. Zool. Soc. India*, **5**: (1): 153-162.

Nierstrasz, H. F. and G. A Brender Bradis 1923. Die isopoden der Siboga Expedition. Isopoda, Genuina Epicaridea. *Siboga Exped. Rep*, **32**: 57.

*Nobili, G. 1906 a. Nuovi Bopiridi. *Atti. R. Acad. Sci. Torino*, **41**: 1098.

———— 1906 b. Diagnoses preliminaires de crustaces Decapodes et. Isopodes nouveaux recueillis par M. le. Dr. G. Seurat aux iles Tou amoton. *Bull. Mus. Paris*, **12**: 270

*Richardson 1911 b. Description of a new parasitic isopod from the Hawaiian Islands. *Proc. U.S. Nat. Mus*, **38**: 615.

———— 1912. Description of two new parasitic isopods belonging to the genera *Palaegyge* and *Probopyrus* from Panama. *Proc. U.S. Nat. Mus*, **42**: 521.

*Thielemann, M. 1910. Beitrage Zur Kenntis. Der. Isopodenfauna *Ostasiens Abh. Bayer. Akad. Wiss Munehen.*, **2** (3)

Thomas, 1977. A new record of *Epipenaeon ingens* Nobili (Bopyridae Isopoda) parasitic on *Penaeus semisulcatus* de Haan. from Palk Bay and Gulf of Mannar. *Indian. J. Fish.*, **24** (1 & 2):258-261.

* Not referred to original.