A record of Probopyrus bithynis (Richardson, 1904) in Macrobrachium rosenbergii (De Man) from coastal Andhra Pradesh, India, with special reference to host-parasite relationship

A RECORD OF *PROBOPYRUS BITHYNIS* (RICHARDSON, 1904) IN *MACROBRACHIUM ROSENBERGII* (DE MAN) FROM COASTAL ANDHRA PRADESH, INDIA, WITH SPECIAL REFERENCE TO HOST-PARASITE RELATIONSHIP

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ABSTRACT

An incidence of bopyrid isopod infestation was observed in giant freshwater prawn, *Macrobrachium rosenbergii* (de Man) juveniles (40-60 mm/0.9–1.5 g) in a scampi culture farm in East Godavari district of Andhra Pradesh. The presence of parasite was observed by conspicuous boil like swelling of the branchial chamber where the parasite was found lodged on the gills. The infested gill was highly compressed and necrosed. Only one branchial chamber was infested by the parasite while the other gill was normal. The infested prawns were thin and emaciated and showed retarded growth. The parasite was identified as *Probopyrus bithynis* (Richardson, 1904) which caused inhibition of ventilation due to its permanent lodging in the branchial chamber and impaired the gaseous exchange by gills. It was also observed that this parasite caused 'parasitic castration' in the infested prawns.

Keywords : *Probopyrus*, parasitic castration, branchial chamber, *Macrobrachium rosenbergii*

INTRODUCTION:

Bopyrid isopods are a fascinating group of parasites as they provide a very interesting example of host-parasite relationship. These parasites have wide host preferences and they have been reported from a variety of hosts like freshwater prawns, shrimps, crabs, lobsters, finfishes etc.(Astall *et al.*, 1996; Oliveira and Masunari, 1998; Pardo *et al.*, 1998; Williams and Boyko, 1999; Jayasree *et al.*, 2001; Chinabut, 2002). They show one of the extreme examples of parasitic adaptation when they get themselves lodged in the branchial chamber of penaeid and palaemonid prawns so much so that their bodies are more or less rudimentary and

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profoundly modified for their parasitic existence. They do not move once they get themselves lodged in the branchial chamber of the host and lead almost a symbiotic life with the parasite rarely dying before the host. Jayasree *et al.* (2001) reported the presence of bopyrid isopods in the juveniles of *Metapenaeus dobsoni* (Miers) and *Macrobrachium rosenbergii* (de Man) collected from Gosthani estuary, Bheemunipatnam near Visakhapatnam. However, they did not specify the species of the parasites involved in the infestation. Although many researchers have worked on bopyrid isopods (Giard and Bonnier, 1888; Bonnier,1900; Richardson, 1911,1912; Chopra, 1922,1923,1932; Nierstrasz and Brender Bradis, 1923; Van Name, 1936; Truesdale and Mermillod, 1977; Johnson, 1977, Natarajan *et al.*, 1982; Devi, 1982; Overstreet, 1983; Markham, 1985; Raju *et al.*,1986; Ghosh and Sarangi, 1987; Brock, 1993), no information is available about *Probopyrus bithynis* infestation in giant freshwater prawn, *Macrobrachium rosenbergii* (de Man). It is in this respect that an attempt has been made to present a preliminary study of the parasite and its effect on the scampi host.

MATERIAL AND METHODS

In course of investigation on parasites, a statistically significant number of giant freshwater prawn, *Macrobrachium rosenbergii* samples were taken from scampi culture pond in East Godavari district of coastal Andhra Pradesh.

During quarterly sampling prawns were checked for the presence of any infestation. The sex, stage of maturity and side of infestation were also noted.

The infested and uninfested prawns were weighed to the nearest mg and the weight of the parasite was deducted from the total weight of the infested prawn. The infested prawn samples were preserved in 10% formalin solution containing 1% sodium chloride and brought to the laboratory for identification. The pathomorphological and pathoanato- mical studies were conducted on host prawns to assess the effect of parasite on host's body and relative degree of damage in both infested and uninfested prawns.

RESULTS

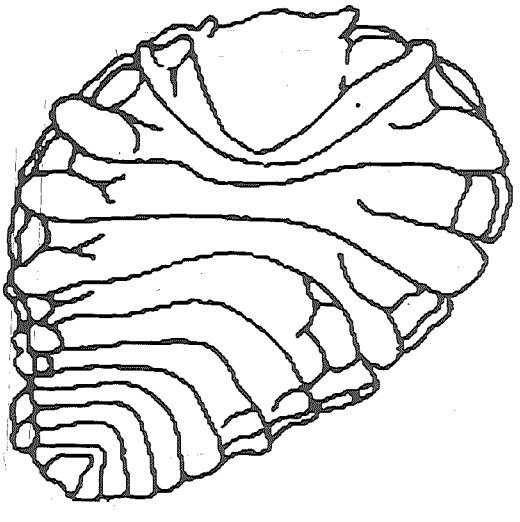
The culture of *M. rosenbergii* was started in the first week of August and continued up to the end of December. The infestation was noticed in mid September in 40 day old prawn juveniles.

The length and weight of the host specimen at the time of infestation ranged between 40-60 mm and 0.92-1.4g, whereas in the uninfested specimens the range was 81-96 mm and 2.5-3.7 g respectively. The infested prawns were thin and emaciated and showed retarded growth while the uninfested specimens showed normal growth and were healthy in appearance.

The parasite was detected by the appearance of large boil like localized swelling of the branchial chamber of the host prawn. The infestation were observed either in the right or the left brachial chamber but at a time only one branchial chamber was found infested with this parasite. The parasite was having blackish pigmentation and it was quite conspicuous and visible through the carapace of the host. The gills were highly compressed and necrotized due to the permanent attachment of the parasite on the gills. The brachiostegite of the uninfested gill chamber was very thin and transparent. The cephalic region of the parasite was directed posteriorly in relation to the body of the host. The ventral side of the parasite was found facing outwards whereas the dorsal side was in close contact with the gills. The parasite accounted for about 4% (41-54 mg) of the biomass of the entire host-parasite system. The infestation was found in about 10% of the population.

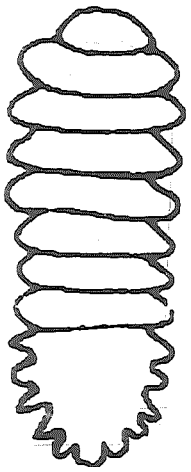
The female parasite (Fig.1a) was found lodged in the branchial chamber of the host. The total length (from the anterior margin of the head to the tip of the last abdominal segment) ranged from 10-11 mm. The body of the female parasite was slightly asymmetrical. The ventral side of the parasite was convex while the dorsal side was flat. The head of the female parasite was lobe like and distinct from the thoracic segments. There was no eye. The segments of the abdomen were dorsally defined. The female parasite had style-like mandibles which were used to pierce the soft gill tissues and inner wall of the brachiostegite margin and suck the hemolymph of the host. Five pairs of pleopods were present. The pleopods were double branched and its size decreased from the first to the fifth segment of the abdomen. There was blackish pigmentation on the marsupial plates, and also on the ventral and lateral side of the thoracic segments. There was no uropod.

The male parasite (Fig. 1b) was found clinging to the ventral side of the



(a) Female

Fig.1a: Probopyrus bithynis (Richandson, 1904)



(b) Male

Fig.1b: Probopyrus bithynis (Richandson, 1904)

body of the female between her abdominal pleopods. The total length of the male parasite from anterior to posterior part of the body varied from 1.6 – 2.9 mm. The head was small with antennae present in the cephalic region. The legs were small but well developed. The eyes were in the form of small pigmented spots. The abdominal segments were fused dorsally into a semicircular mass exhibiting ten distinct lobes around the margin and a median lobe. Five pairs of small, tuberculiform pleopods were present. Uropod was absent.

The above characteristic features of the parasite agrees with descriptions given by Chopra (1923 and Van Name 1936) and it was identified as *Probopyrus bithynis* (Richardson, 1904) and its systematic position is mention as under:

Class- Crustacea, Order- Isopoda, Family- Bopyridae, Genus- *Probopyrus* Species- *bithynis* (Richardson, 1904).

DISCUSSION

Case studies of bopyrid isopod *Probopyrus bithynis* (Richardson, 1904) infestation in freshwater prawn of the genus *Macrobrachium* are very limited. Whatever information available pertain to *Macrobrachium acathurum* (Wiegman), *M. olfersii* (Wiegman), *M. amazonicum* (Heller) (Van Name, 1936) and *M. ohionis* (Smith) (Van Name, 1936; Truesdale and Mermillod, 1977). The studies by various authors mentioned above clearly shows that there is no significant host specificity so far as *Probopyrus bithynis* is concerned as it has been found from so many species. Richardson (1912) and Chopra (1923, 1932) have also shown that the same species of bopyrid isopods were found infesting different host species.

In the present case, the *Probopyrus bithynis* infestation was observed in the juvenile stage (40-60 mm) of *Macrobrachium rosenbergii*. This is in agreement with the observation of Overstreet (1983) who has reported that bopyrid isopods, in general, attack mainly the post larval and juvenile prawns (Van Name, 1936; Natarajan *et al.*, 1982; Devi, 1982; Raju *et al.*, 1986). It was observed that the parasites retarded the growth rate in host *M. rosenbergii*. Similar observations have also been made by Thomas (1977). In the present incidence, it was seen that larger adult prawns had very low infestation rate. Recently, Masunari *et al.*, (2000) has studied the population structure of a bopyrid isopod

Probopyrus floridensis in *Macrobrachium potiuna* from the Pereque River, Paranagua Basin, southern Brazil. They observed that the parasitic density fluctuated between 1 (January and May) and 33 (June) parasites per host. The parasitic incidence varied from 1.1% (April) to 97.6% (September). Ovigerous females were observed only in October. The cryptoniscus infestation occurred mainly in June (early winter) and continued for three months. By July (winter), the majority of the parasite population composed of juvenile or immature parasites, but from August to October (spring), the adult stages predominated (Masunari *et al.*, 2000). However, most of the reports from India suggested that bopyrid isopod infestations are likely to occur in colder months. For example, *Palaegyge pica* infested *M. malcolmsoni* in a hatchery in Kakinada, Andhra Pradesh from January to March (Raju *et al.*, 1986). Bopyrid isopods, in general, infested prawn and shrimps in Kakinada between October and January (Devi, 1986) and in the present case, *P. bithynis* infestation was noticed from September to December. It was found that sex ratio among the infested prawn was not significantly different when compared with uninfested prawns and host prawns of either sex were equally susceptible to the bopyrid infestation.

The host prawns infested with *P. bithynis* showed degeneration of the primary and secondary sexual organs. *P. bithynis* acted as parasitic castrator and retarded the development of gonads. The testes in male and ovaries in female host were found undeveloped in the parasitized hosts whereas the gonads were normal in the healthy uninfested hosts. Oliveira and Masunari (1998) also observed parasitic castration in porcelain crab *Petrolisthes armatus* (Gibbes, 1850) (Decapoda: Porcellanidae) from Farol Island, southern Brazil infested with *Aporobopyrus curtatus* (Richardson, 1904) (Isopoda: Bopyridae). They found that *A. curtatus* parasitism was related to the parasitic castration of the female host, but it did not affect the growth of *P. armatus*. Parasitic castration allied to low parasitic prevalence and to the dominance of the stable couple of parasites in the host population, is an adaptation of the bopyrid isopod that allows advantages for both populations (Oliveira and Masunari (1998). Munoz (1997) has studied the effect of two bopyrid species, *Pseudione brattstroemi* Stuardo, 1986 and *Ione ovata* Shiino, 1964 on ghost-shrimp *Notiax brachyophthalma* (M. Edwards, 1970) where a considerable reduction of the gonads in the female hosts was noticed. Their findings were further supported by the histological analysis of ghost-shrimp's ovaries, where the mature ovocites were found smallest than in those non-parasitized ghost-shrimps. Similar observations have also been made by Devi (1982) and Overstreet, (1983). After detachment of the

parasite, however, the host's gonad seems to regenerate (Overstreet, 1983).

It was observed that the parasites caused mechanical inhibition of ventilation due to its permanent lodging on the gills in the brachial chamber due to which the gills became compressed and necrosed. Consequently, the effective area for gaseous exchange was highly reduced. As a result, the infested prawns respired less than the healthy uninfested hosts. Working on the shrimp *Palaemonetes argentinus* (Nobili, 1901) infested by *Probopyrus ringueleti* (Verdi & Schuldt, 1987), a gill chamber parasite known for its capacity to cause host metabolic changes, including changes in oxygen consumption rates, Neves *et al.*(2000) observed that superoxide dismutase (SOD) activity was significantly reduced in infested shrimps, suggesting that bopyrid isopod caused respiratory impairment and resulted in reduced SOD enzyme activity. Overstreet (1983) opined that the depressed respiration may also be due to sterilization of host. However, in the present study, only one branchial chamber of the host was found infested with the parasite. The uninfested branchial chamber, although was thin and transparent, the gills were functioning normally. It is, thus, observed that the host prawn could respire with one functional gill chamber and survive. Although, the infestation did not cause immediate death, it affected the natural growth of the host prawns.

The potential risk of significant disease outbreak or epizootics from *P. bithynis* is low. However, extension of the range of these isopod parasites, by transfer or introduction of infested prawns should be prohibited, as these infested species/stages could be the vehicle for transmission of pathogens in the new areas. The trade, transfers/ introductions of live fish/prawn must be governed by well defined rules and regulations and strict quarantine measures should be adhered to minimize the risk of parasitic infestation in native population.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. S. Ayyappan, former Director, Central Institute of Fisheries Education, Mumbai for his keen interest in the study. They are also thankful to Dr. S. C. Mukherjee, Joint Director and HOD, Aquatic Animal Health Management Division, CIFE Mumbai for valuable suggestions.

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