

A Note on Lernaea Cyprinacea (Crustacea, Copepoda, Lernaeidae) 
Parasitizing the Cultured Sailfin Molly Poecilia latipinnna 
and Their Control with Salinity Treatment

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Abstract: Lernaea cyprinacea, a parasitic cyclopidcopepod, is reported parasitizing sailfin molly Poecilia latipinnna breeders, cultured in the Center of Advanced Study in Marine Biology, Parangipettai (India). The fish were severely infected on their body surface with the highest number of 38 parasites per host. Feeding and reproductive activities, including spawning, stopped following parasitic infection. The parasites are females unsegmented, sub-cylindrical shaped and 20 mm in length. They are provided with paired appendages including prominent egg sacs. This is the first report on their occurrence in the cultured ornamental fish P. latipinnna, in India. Lernae infection was successfully controlled by gradually changing the water salinity to 10%.

Key words: Lernaea cyprinacea, parasitic copepod, Poecilia latipinnna, ornamental fish, parasitosis control, India

Introduction

India is an emerging country in ornamental fish trade and, with its favorable climate and cheap human resource available, is suitable for mass production of exotic ornamental fishes (Gosh et al., 2003). Among the 288 exotic fish varieties identified in the domestic market of India, Poeciliids like sailfin molly (Poecilia latipinnna), swordtail (Xiphoophorus helleri), guppy (Poecilia reticulata) and platy (Xiphoophorus maculatus) contribute for fifty percent of the market share (Elamapathy, 1999; Mahapatra et al., 2000; Ramachandran, 2002). This tooth carp is very easy to breed with minimal water holding facilities and limited labour costs (Ramachandran, 2002). So, Poecilia latipinnna (Lesueur, 1821) is highly recommended for newcomers in ornamental fish breeding and especially, in this country, for women’s self-help groups who are trained in this way as a business enterprise.

Lernaeids are mesoparasitic copepods infecting most freshwater fish, anchoring to their host by means of enlarged powerful maxillae and resulting in deleterious effects (Kabata, 1985; Trilles and Hippeard-Jacquotte, 1996; Raibaut, 1996). Lernaea cyprinacea L., 1758 is the most studied Lernaeid (Kabata, 1970; Paperna, 1980; Post, 1987; Roberts, 1989). This copepod has been identified infecting several species of ornamental fish both in natural habitats and cultured tanks (Thalakarame et al., 2003). It was found in pacu (Colossoma sp.), brycon (Brycon sp.), tém (Astyanax sp.), tohar (Hoplias sp.), leporin and headstander (Leporinus sp.), flame-mouthed characin (Prochilodus sp.) and others (Eletrobal Eletrobrás, 1985). The deleterious effects depend on the host species and the degree of infection which is depending on the characteristic of host-parasite system and often correlated with the size and age of the fish. Besides that, environmental temperature plays an important role with the ideal value for parasitic development ranging between 23 and 30°C (Putz and Bowen, 1964).

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Chemicals like potassium permanganate (KMnO₄), formalin, malachite green at various concentrations have been described for treatment of lernaeid infections (Al-Hamed and Hermiz, 1973; Tonguthai, 1997) in other fish species. Bathing the fish in water with altered salinity is a useful treatment for several parasitic and fungal infections (Stephens et al., 2003). Previous studies had demonstrated the remarkable salinity tolerance of P. latipinna (Kristensen, 1969; Kumaraguru Vasagan et al., 2005). On the other hand, it has been reported that Lernaea is a highly sensitive parasite to salinity change (Valasquez, 1979). Hence it has been hypothesized that salinity modification could be successfully used to control lernaeosis in mollies.

For the first time we report here the infection of exotic sailfin mollies P. latipinna in India by L. cyprinacea and its control using altered salinity treatment.

Materials and Methods

Fish and Parasitic Infestation

In January 2004, breeders were obtained from a commercial ornamental fish hatchery in Chennai, India. They were transported to the Center for Advanced Study (CAS) in Marine Biology of Parangippettai, by road, in bags filled with oxygenated water and stocked directly in four (4000 L) epoxy coated concrete tanks. Each tank was stocked with 40 females and 20 males (3.2±0.5 cm; 1.8±0.35 g). The breeders were fed with a mixed food consisting of oyster meat, living tubifex and formulated feed (crude protein of 35 g kg⁻¹) distributed in alternate rations (08:00, 13:00 and 18:00 h). The water was changed fortnightly at an exchange rate of 50%. Continuous aeration was given. The ambient water quality parameters such as salinity, temperature, pH and DO were monitored daily and they ranged between 0-2%, 26-29°C, 7.8-8.2 and 6.0 mg L⁻¹ respectively. Heavy infection was observed during regular sampling for experiments on breeding and this resulted in the death of some infected individuals. The parasitized fish were immersed in 2% KMnO₄, and copepods were manually removed with help of forceps. The parasites were observed microscopically and identified.

Saltwater Treatment

Saltwater treatments were investigated in a separate test. The test included four treatments and one control and there were three randomly allocated replicates of each treatment and control tanks. Experimental tanks were glass aquaria of 90 L capacity. Four heavily infected brood fish were randomly placed in each tank and acclimatized for a day with same water as in the common breeders holding tank. On day 2, salinity was increased up to 5, 10, 25 and 35% at the rate of 4% per hour in treatment tanks T1, T2, T3 and T4, respectively. Filtered seawater (35%) was used to change the salinity. Salinity was measured using (Atago®) Refractometer. The temperature of the bath water was within 2°C of the culture water. The altered salinity was kept stable for 13 day and observations were made on fish behaviour and mortality. Water exchange was made every two days without altering the salinity of treatment tanks. The effect of treatment was assessed based on falling of dead parasite. Water was siphoned daily from the bottom of aquaria and passed through a 200 μM sieve, followed by flushing with water. The number of Lernaea was counted manually from pieces of parasite found in the flushed material on the screen. Analysis of variance (single factor) was used to determine the statistical significance of the collected data. Duncan’s multiple range tests was used to determine significant differences between treatment means.

Results

From May 2004, the breeders in the holding tanks died one by one owing to a parasitic infection. The moribund and dead fish were severely infected all over the body with not less than 20 parasites (Fig. 1). The highest number of 38 individuals per host was observed in a female fish of 78 mm in
lengths and 4.7 g weight. The species was identified as *L. cyprinacea* after the description of Kabata (1970, 1983). The female body length ranged between 9-20 mm. The sub-cylindrical body of the parasite was unsegmented with four cephalic horns around the mouth and two egg sacs posteriorly (Fig. 2). Most of the parasites were fixed in the midbody region and at the base of the dorsal fin at initial stages.

The breeders were 8 months old at the time of the outbreak of parasitic infection and they provided an average of 4 spawnings with a gestation period ranging between 29 and 32 days. From the second month after initial stocking, the fish started to spawn when the breeders were aged 4 months. The tanks with brood fishes were regularly monitored and the newly released juveniles were safely transferred to larval rearing tanks. From the onset of the parasitic disease, the reproduction was completely stopped and no fish spawned afterwards. Besides that, normally, the male frequently chased the female for mating. Feeding and mating were reduced when fishes are infested. Wounds, loss of pigmentation and erosion of fins were observed on the site of the parasite settlement. Despite the infection often with one to five parasitic copepods, mortality occurred after 1 month in that case of severe parasitosis with 20 copepods and over.

Survival (%) of fish and parasitic fall (nos.) from the fish are presented in Table 1 and 2, respectively. There was a significant (p<0.05) difference among the treatments tested for both fish.
Table 1: Survival (%) of infected Pocilops latipinnna in different salinity treatments

<table>
<thead>
<tr>
<th>Day</th>
<th>Control (0‰)</th>
<th>5‰</th>
<th>10‰</th>
<th>25‰</th>
<th>35‰</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100±0.0%</td>
<td>100±0.0%</td>
<td>100±0.0%</td>
<td>58±21.0%</td>
<td>0±0.0%</td>
</tr>
<tr>
<td>2</td>
<td>100±4.0%</td>
<td>91±4.0%</td>
<td>91±4.0%</td>
<td>16±8.0%</td>
<td>0±0.0%</td>
</tr>
<tr>
<td>5</td>
<td>83±4.0%</td>
<td>83±4.0%</td>
<td>91±25.0%</td>
<td>8±4.0%</td>
<td>0±0.0%</td>
</tr>
<tr>
<td>10</td>
<td>75±4.0%</td>
<td>83±4.0%</td>
<td>91±29.0%</td>
<td>0±0.0%</td>
<td>0±0.0%</td>
</tr>
</tbody>
</table>

Means in the same row sharing different superscripts are significantly different (p<0.05)

Table 2: No of parasites fell down in different salinity treatments per tank

<table>
<thead>
<tr>
<th>Day</th>
<th>Control (0‰)</th>
<th>5‰</th>
<th>10‰</th>
<th>25‰</th>
<th>35‰</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0±0.0%</td>
<td>4±1.0%</td>
<td>25±2.0%</td>
<td>46±4.0%</td>
<td>46±8.5%</td>
</tr>
<tr>
<td>2</td>
<td>0±0.0%</td>
<td>18±2.0%</td>
<td>33±3.5%</td>
<td>8±1.5%</td>
<td>0±0.0%</td>
</tr>
</tbody>
</table>

Means in the same row sharing different superscripts are significantly different (p<0.05)

Survival and parasitic fall. Treatments such as 25 and 35‰ were lethal for P. latipinnna. In 35‰ all the fishes together with the parasites were found died on day 1. However in 25‰ single fish survived up to day 5, with no parasites attached. On the other hand, 5 and 10‰ showed no mortality of fish and the reduction in parasite was greater in 10‰ than 5‰, indicating that salinity 10‰ was optimum for treating copepod parasite without killing fish.

Discussion

As described previously, L. cyprinacea is the most studied Lernaeid. This species has been observed infecting a number of freshwater fish (Paperna, 1989; Post, 1987; Roberts, 1989; Electrosul Electrobris, 1985; Thalakanth, et al., 2003). Also, it has been found elsewhere in North America, Asia, Africa and Europe (Marcogliese, 1991). Thalakanth et al. (2003) reported an overall prevalence of parasitism reaching 45.3% in the freshwater ornamental fish exported from Sri Lanka. Three species of copepods including L. cyprinacea were identified from about 13 species of fish inspected. This species spread mostly following the lack of satisfactory sanitary control during fish transport (Booher and Santos-Neto, 1993). In Brazil, L. cyprinacea is common in all the states where fish culture is developed (Torres et al., 2003). Ceccarelli (1988) investigated the susceptibility of different species of cultured fish in Prasssnunanga and Sao Paulo (Brazil) to the infection by L. cyprinacea. It was found that the most susceptible species are grass carp and common carp. For the first time, saltfin molly breeders reared in experimental breeding facilities were observed parasitized by this Lernaeid copepod. This paper is the first documented report of infection on cultured P. latipinnna with L. cyprinacea in India as a new record for this species.

Settlement of parasites that observed especially in the midbody region and at the base of dorsal fin is usual. A higher affinity of L. cyprinacea for the basal area of the dorsal fin was already observed in fishponds (Haley and Winn, 1959) and in perennial rivers (Whitaker and Schluter, 1975). However, an affinity for the base of the pectoral, pelvic and anal fins, for the caudal peduncle, the head and gill regions was also established in the event of much severe infection. This is matching as reported by Medeiros and Malchik (1997). But, they noted a change in settlement site with regard to the hydrological cycle.

The pathology of such parasitosis was reviewed by Kabata (1985). In our study, injuries can be attributed to the extremely heavy parasitic attack with the consequent loss of large amount of blood because of feeding of parasites and multiple wounds and the loss of appetite of the affected fish. However, the reproduction stopped and mortality in such a severe parasitic attack proves that this host is highly tolerant for this infection. But, Medeiros and Malchik (1997) reported that increased stress can intensify the fish vulnerability.

The injurious effects on the host are direct or indirect; parasites induce lesions and inflammation at the site of settlement, which often leads to secondary infections by opportunistic bacterial invaders.
Importance of Lernaeids as vectors of pathogens like bacteria and fungi was reviewed by Tonguthai (1997). Lernaeids are strongly anchored to the host. With help of anesthetics, they can be manually removed in the case of large fishes with parasites in small numbers. But, an incomplete extraction of the fixed copepod or the rupture of host muscle tissues can also cause damages leading to secondary microbial infections.

We assume that L. cyprinacea reached the culture system as larval stages carried by the immature fishes from the commercial ornamental fish farm or maybe with the rearing water. The parasitic outbreaks were probably attributable to environmental factors such as high temperature of the water (26-29°C) prevailing in that summer months. A study on effect of hydrological disturbance of the Lernaea infection on stream fishes specified that the number of parasitized specimens were higher during the drying phase, when the mean water temperature was 28.53°C and mean dissolved oxygen 7.9 mg L⁻¹ (Medeiros and Malchik, 1997). Putz and Bowen (1964) and Bulow et al. (1979) considered temperature and running water speed as important parameters with the ideal temperature for parasitic development ranging between 23 and 30°C.

The concern about the loss of productivity in pisciculture caused by this parasitic copepod brought several attempts to control it by using organo-phosphorous compounds, lime and some natural products such as garlic (Shariff et al., 1986; Weston, 2000) and Pinus resin (Tóro et al., 2003). In Singapore, Demerin (chlorophenyl difluorobenzoyl) was recently introduced as a treatment against Lernaea (Shariff et al., 2000). In another study, in ponds, Dipterex treatment at 0.5-1.0 ppm resulted in failure of life cycle of cyclopid copepods (Tonguthai, 1997). Mass infection of milkfish by the larval stages of Lernaea sp. is treated with 3-5% salt solution, while adult stages of the parasite can be controlled by drying and liming the pond bottom (Velasquez, 1979). Lernaea in Tilapia breeding stock and silver carp fry are treated with 0.25 ppm Dipterex (Cruz-Lacierda et al., 2000). However, no chemotherapeutants, often costly and dangerous, were applied against L. cyprinacea parasitizing P. latipinna.

The present study on salinity treatment of Lernaeaidosis proves that P. latipinna is a highly tolerant fish to salinity changes (Kristensen, 1969; Kumaraguru vasagam et al., 2005). Lernaea infection could be controlled successfully by changing the salinity of ambient water up to 5-10%/day and no more. The severe mortality observed with treatment T3 (25%) and T4 (35%) reveals that the fish is not capable tolerating such a sudden change in salinity. However, in a previous study (Kumaraguru Vasagum et al., 2005) P. latipinna was acclimatized to 35% salinity at the rate 3%/day and spawned successfully. So the mortality of fish in our study may be due to the over stress as a result of both diseased condition and change of salinity.

Though the reduction in parasite was maximum with 25 to 35% salinity, the treatment was unrealistic due to heavy fish mortality associated with the above salinities. As a moderate parasite fall was observed in 10% salinity and the survival of the fishes was satisfactory. Hence one can look at 10% salinity as optimum in treating Lernaea infection on P. latipinna. In the future, optimal husbandry management should be applied to prevent or reduce such parasitic problems.

References


