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Effect of isopod parasite, *Cymothoa indica* on gobiid fish, *Oxyurichthys microlepis* from Parangipettai coastal waters (South-east coast of India)

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Abstract: *The present study reported for the first time on the effect of isopod parasite, Cymothoa indica infestation on Oxyurichthys microlepis an ecologically important gobiid fish from Parangipettai coastal environment (South-east coast of India). The loss of weight in host fishes (male 20.47 and female 32.84%) were observed due to parasitism. The weight of uninfested female fish was found to be higher than that of infested one. The calus like thickening developed on the gill arch and gill filaments of host fish due to the persistent irritation caused by the appendages of the parasite. The reduction of gill surface area was observed due to the attachment of the parasites. The maximum reduction noticed in the first gill arch is mainly due to the heavy pressure exerted by the parasite. Details of gross lesions observed in the branchial chamber, buccal cavity and body surface was enumerated. Heavy infestations of parasitic juveniles have the potential to kill small fingerlings. The swimming capacity of the fish was also found to be affected.*

Key words*: Isopod fish parasite, Loss of weight, Gross lesions, Gill surface, Reduction*

Introduction

Parasites play an important role in the biology of fishes and can affect their behaviour, health and distribution (Rohde, 1993). Several facultative and obligatory parasitic members of the order Isopoda are deleterious parasites on fishes, capable of exhibiting tremendous destructive activity (Trilles, 1979; Maxwell, 1982). Most are cymothoids flabelliferans, a group of isopods with a short free living planktonic phase. Cymothoids are exclusively parasitic, and the presence of a few adults can cause damage to hosts. They are protandric hermaphrodites, living on the skin in the gill chambers or in the mouth of the host fish, the position is thus highly specific (Baer, 1951; Trilles, 1969). Isopods absorb their nourishment directly from the host's body and depend upon their hosts for feeding. Segal (1987), observed that the host fish, *Meniida beryllina* died due to attack of isopod *Nerocila acuminata*.

Studies pertaining to pathological effects of isopod parasites on the physiology of host fishes are scanty and few studies have been made along Parangipettai coastal environment. Though, *Oxyurichthys microlepis* is not a commercial important fish, it plays an important ecological role and maintains a balance in ecosystem. Hence the present attempt was made to study the effect of isopod infestation on host fish, with reference to reduction of the respiratory surface area and loss of weight in the gobiid fish *O. microlepis*.

Materials and Methods

The gobiid fish were collected from Vellar estuary (Lat. 11°29'N, Long. 79°46'E) (Parangipettai coast, Fig. 1) and the fishes were examined thoroughly for the presence of isopod parasites. The gobiid fish, *Oxyurichthys microlepis* can be identified by its 5 large brown blotches on sides first one below D_1 (first dorsal fin) in middle, 2 to 4 in D_2 (2^{nd} dorsal fin) region while the fifth one on the caudal base and a small dark brown spots in the upper half of the caudal fin body elongate, compressed ventral fins unified and oblong while caudal fin pointed about twice head. The total length of the fish was ranged from 59 to 125 mm. It is a common species occurring throughout the year. The site of attachment, orientation of parasites on the host and the number of parasites in each location was recorded.

To study the effect of infestation on the gobiid fish *O. microlepis*, the length (mm) and weight (g) data were analysed. The fishes were categorized as infested and uninfested and the average length and weight were determined. The loss of weight and percentage loss of weight of male and female fishes was determined. Respiratory surface area of gill arch was measured to find out the influence of parasites on the gill surface area. The gill arches of uninfested and infested fishes were carefully dissected out and blotted to remove the moisture. Then the total surface area of gill arch of both infested and uninfested fish was compared and the difference in area was considered as the reduction of respiratory area due to infestation.

Results and Discussion

Effect on weight of host fish: The effect of *Cymothoa indica* infestation on the weight of *O. microlepis* is presented in Table 1, 2 and Fig. 3, 4). It is evident from the results that the infestation affected the weight was 8.4 g when compared to that of parasitised

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Table - 1: Effect of *Cymothoa indica* in relation to the body weight (g) of *Oxyurichthys microlepis*

Nature of infestation	Mean body weight	Reduction of weight	Percentage reduction of weight
Uninfected	8.71	2.47	8.47
Infected	6.17	1.26	–

fish. Further the weight loss was more pronounced in female (32.8% in *O. microlepis*) than in males (20.4% in *O. microlepis*).

Effect on length and weight relationship: The effects on length and weight relationship of *O. microlepis* due to infestation of *C. indica* in both male and female fishes were compared and the results are as follows :

(i) *Length and weight relationship in male fish -*
The rate of growth is almost similar in uninfested and infested fishes. It can be inferred that the rate of growth by weight and average size was not affected much due to infestation.

(ii) *Length and weight relationship in female fish -*
The rate of increased growth by weight in uninfested female fish was found to be higher than that of the infested. It can be inferred that the weight gain is more in uninfested fish than in the infested fish.

Table - 2: Percentage weight (g) variation in male and female of *Oxyurichthys microlepis*

Mean weight	Sex of host	Uninfected	Infected
	Male	6.59	5.47
	Female	9.10	6.85
Loss of weight	Male	–	1.12
	Female	–	2.25
Percentage loss of weight	Male	–	20.47
	Female	–	32.84

Effects on respiratory surface area: Variations in the respiratory surface area of *O. microlepis* were due to the infestation of *C. indica*. Maximum reduction in respiratory surface area was noticed in the first gill arch and a minimum in the third gill arch. Thus considerable variation in the respiratory area was observed due to the attachment of the parasite (Fig. 2).

Gross lesions: The gross lesions observed in the branchial chamber, buccal cavity and body surface are reported.

Branchial chamber: Infested fishes had extremely pale gills indicating severe anemia. Gill rakers were seriously lost, apical edges damaged and gill lamellae heavily destroyed. Some secondary gill lamellae were fused or thickened. Between the gill lamellae calus-like thickenings were observed. Gill lamellae

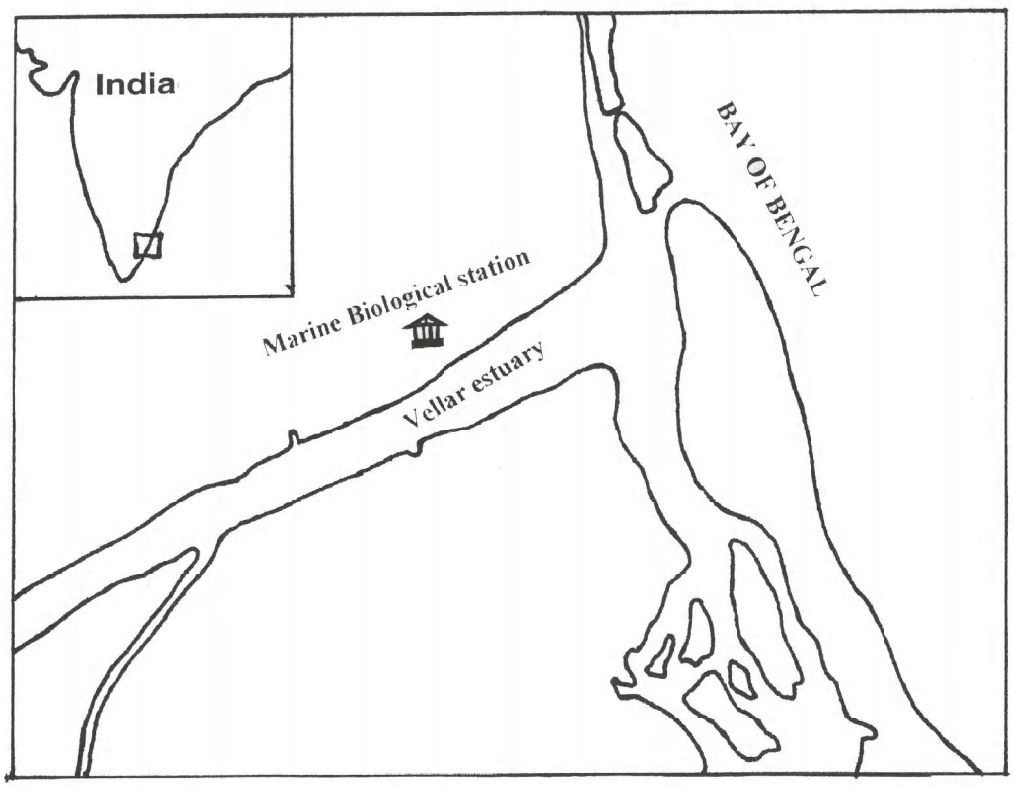

Fig. 1: Map showing the study area

Fig. 2: Photograph showing the *Oxyurichthys microlepis* in the *Cymothoa indica*

Table - 3: Infestation of *Cymothoa indica* on *Oxyurichthys microlepis* in relation to different months (July 2003 - June 2004)

Months	No. of fishes examined	No. of fishes infested (% prevalence)	No. of parasites collected (Mean intensity)
July 2003	51	20 (39.2)	27 (1.3)
August	54	15 (27.7)	20 (1.3)
September	53	18 (33.9)	26 (1.4)
October	68	16 (23.5)	29 (1.8)
November	32	12 (37.5)	16 (1.3)
December	28	9 (32.1)	17 (1.8)
January 2004	31	7 (22.5)	14 (2.0)
February	42	10 (23.8)	14 (1.4)
March	47	13 (27.6)	16 (1.2)
April	30	8 (26.6)	12 (1.5)
May	36	5 (13.8)	9 (1.8)
June	45	11 (24.4)	14 (1.2)
Total	**517**	**144 (27.8)**	**214 (1.4)**

Table - 4: Infestation of *Cymothoa indica* on *Oxyurichthys microlepis* in relation to sex at different months

Months	Male fishes			Female fishes		
	No. of fishes examined	No. of fishes infested (% prevalence)	No. of parasites collected (Mean intensity)	No. of fishes examined	No. of fishes infested (% prevalence)	No. of parasites collected (Mean intensity)
July 2003	39	13 (33.3)	17 (1.3)	12	7 (58.3)	10 (1.4)
August	31	9 (29.0)	12 (1.3)	23	6 (26.0)	8 (1.3)
September	28	10 (35.7)	14 (1.4)	25	8 (32.0)	12 (1.5)
October	48	9 (18.75)	13 (1.4)	20	7 (35.0)	16 (2.2)
November	21	7 (33.3)	10 (1.4)	11	5 (45.4)	6 (1.2)
December	17	5 (29.4)	10 (2.0)	11	4 (36.3)	7 (1.7)
January 2004	21	4 (19.0)	7 (1.7)	10	3 (30.0)	7 (2.3)
February	26	7 (26.9)	11 (1.5)	16	3 (18.1)	3 (1.0)
March	25	9 (36.0)	12 (1.3)	22	4 (18.1)	4 (1.0)
April	18	5 (27.7)	8 (1.6)	12	3 (25.0)	4 (1.3)
May	21	3 (14.2)	7 (2.3)	15	2 (13.3)	2 (1.0)
June	27	7 (25.9)	10 (1.6)	18	4 (22.2)	4 (1.0)
Total	**322**	**88 (27.3)**	**131 (1.4)**	**195**	**56 (28.7)**	**83 (1.4)**

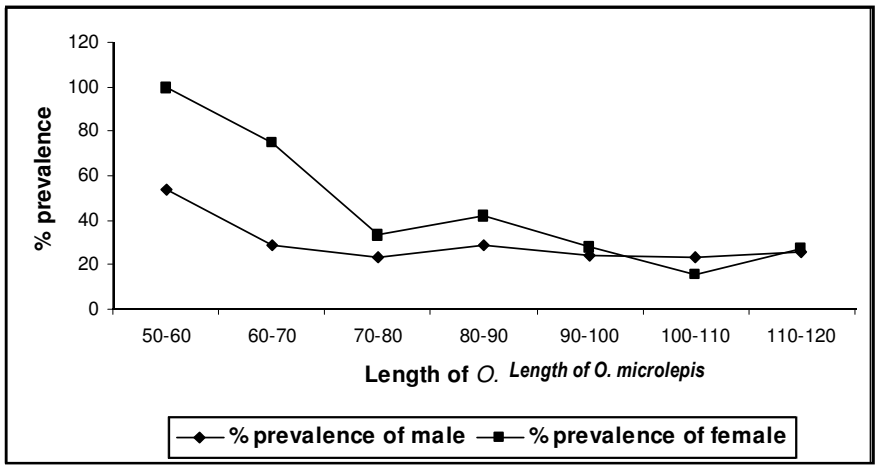

Fig. 3: The percentage prevalence in relation to size and sex of *Oxyurichthys microlepis*

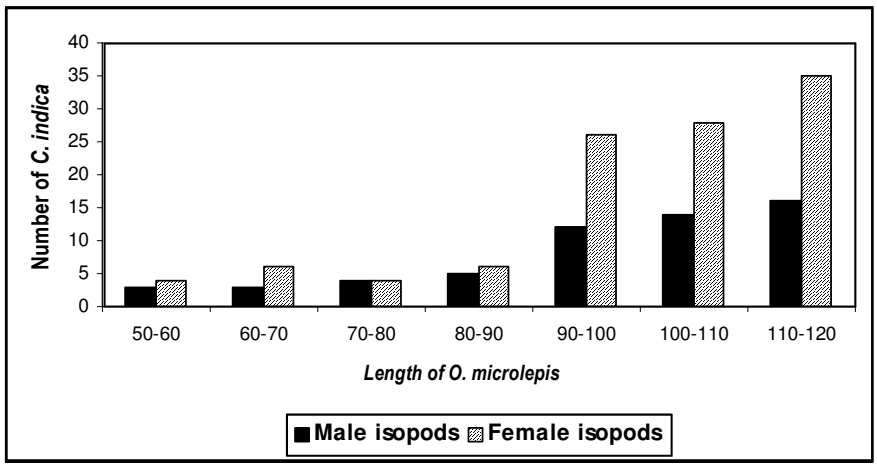

Fig. 4: The number of male and female *Cymothoa indica* in relation to length of *Oxyurichthys microlepis*

of the first and second gill arches were found eroded towards posterior position due to *C. indica*. Due to the lodging of parasites at the gill clefts and the gill arches showed lesions with a wide depression. The parasites further stimulated over secretion of the mucus production.

Buccal cavity: Gross lesions observed in the buccal cavity of infested fishes showed small pin-holes in the cartilage support of the gill arches developed, through which dactyls of peropod of isopod were penetrated, claws are dig into the host tissues. The result is usually a localized destruction of the epidermis and inflammatory response around the attachment area was noticed.

Body surface: Isopods make frequent shifts in position on the host causing a serious wound. They often move about as they feed. The activities also stimulate mucus secretion, epidermal proliferation and dilation of dermal capillaries. Mucous cells increase in number in the epidermis peripheral to the wound. Due to increased mucus secretion, there are signs of inflammation in the dermis beneath the wound. The digestive secretion apparently causes significant damage to the host's tissues.

O. microlepis is commonly distributed and occurring throughout the year in the Vellar estuary. They do not form economic importance of fisheries but it is consumed by local poor people; and is rarely displayed in local fish markets. It is used as fish bait to catch seabass, *Lates calcarifer*. However, Al-Abdersalaam (1995) pointed out that gobiid fishes play a very important ecological role, which provides a critical and necessary balance in the ecosystem.

Infestation causes serious problems to host animals either directly or indirectly affecting the physiological status of host. Loss of weight has been probably the most common effects on crustacean infestation. The present study also revealed that there was significant weight loss in the infested gobiid fish, *O. microlepis* thereby showing the fact that infestation causes weight loss in fishes.

Kabata (1984), expressed that the general effects as loss of weight can be attributed to more than one cause and the most obvious one could be the loss of food reserve drawn from the various depots and other tissues to help in coping with the ranges of infestation. Low weight of infested fish might result from failure to grow normally. However, the present study on the length and weight relationship proved that the infestation alter the growth of the fish. It shows that the increase in length of fish is not in accordance with the increase in weight of fish due to infestation. Trilles (1979), found that several species of European cymothoids were capable of slowing down the growth in their hosts, although they did not affect weight-size ratios of the fish. However, Maxwell (1982) reported that the significant difference in the length and weight relationship of infested and uninfested fishes of Jack Mackeral, *Trachurus decliuis* as infested by *Cerotothea impricatus*.

The present study showed significant reduction of respiratory surface area due to infestation of cymothoids in the branchial chamber was noticed. The dorsal surface of the parasite was always in close contact with the first gill arch, causing more atrophy of the first gill filament. The pressure exerted towards second to fourth gill arches were comparatively lesser than the first gill arch and the damage was also less.

Kroger and Guthrie (1972) stated that male, *Olencira praegustor* damaged the gill of juvenile Atlantic Menhaden, *Brevoorita tyrannus*. Stephenson (1976) studied that the gill damage was owing to buccal parasites. Bowmen (1960), found that the gill filaments of Hawaiian Moray eel, *Gymnothorax eurostus* were missing in the anterior or posterior most region of gill arches owing to the attach of *Lirneca puhi*. Overstreet (1978) reported that the similar males and juveniles of isopod, *Olencira praegustator* parasitic on Gulf Menhaden cause change on the gill filaments through feeding.

In the present observation the parasites *C. indica* mostly attach with buccal region and the branchial chamber of the (host fish) first gill arch. *C. indica* first described from Bangkok, Thailand has been recorded by Chilton (1924) from Chilka lake where it is stated to infest the mouth of *Gobius giuris*, causing deformation of the host's tongue. Subsequently, Panikkar and Aiyar (1937) recorded *C. indica* on *Etroplus maculatus*, *E. suratensis* and *Glossogobius giuris* from the Adyar estuary. Evangeline (1963) reported the occurrence of this parasite, in the Adyar fish farm, from a variety of host's, *viz*., *E. suratensis*, *Tilapia mossambica*, *Macrones gulio*, *Gobius giuris*, *Polynemus tetradactylus*, *Pomadasys hasta* and *Sphyraena obtusata*. It is thus evident that *C. indica* exhibits a wide geographic and host distribution. Jayadev Babu and Sanjeevaraj (1984) noticed the infestation in several regions like the chin, nape and pectoral fin base and the buccal cavity. But, Ravichandran *et al*. (1999) found that the dorsal surface of the parasite facing the first gill arch where the parasites were attached in *Joryma brachysoma*. The damage of gill filaments thus was not only due to feeding but also by the pressure exerted by the dorsal side of the parasite.

The gross size and shape of parasites can ac t as physical irritants, which may be responsible for the observed damages of the branchial tissues noticed in the present study. The reduction in the surface area was thus due to several factors such as mode of attachment, movement, size and duration of stay of the parasites.

Pale gills, damaged gill rakers and erosion of gill lamellae are the severe gross lesions observed as a consequence of isopod infestation. Pale gills of infested fishes indicate anemia, which may be due to the loss of blood and the construction of branchial circulation by the attachment of parasite and of the haemophageous nature of the branchial cymothoids (Romestand and Trilles, 1977; Romestand, 1979). The calus like thickening observed on the gill arch and gill filaments may be due to the constant irritation caused by the body and appendages of the parasite. Erosion and thickening are the two unique morphological changes noticed owing to the infestation. These changes are mainly due to the heavy pressure exerted by the parasite and also by their feeding nature. Kabata (1985) observed destruction of host tissues as a result of the pressure exerted by the parasite body, when present in the gill cavity. Longer stay of parasite within the gill chamber may also prevent and obstruct the normal growth of the gill arches. This may be the reason for the erosion of gill arch and fusion of gill lamellae. More mucus secreted in the infested gills may be due to the reaction to irritation created by the parasite. Romestand and Trilles (1977) observed that the secretion of mucus on the ligament surface as a reactive response of the host against infestation. Due to the attachment of peropods host tissues were compressed and eroded at the attachment sites, which were surrounded by an inflamed peripheral welt of peropods.

Lesions associated with reproduction of parasite to the host are related to the direct activity of the parasites. A marked increase in the size of the parasite may be seen with the development of marsupium full of juvenile isopods. This can significantly increase the pressure atrophy caused by the presence of the parasites. These reproduction related activity in the host increases the chance that the parasite will serve as a vector for microbial parasites such as hematozoans (Smith, 1975). Uninfested fishes were more so active than the infested, and were quite still or swim feebly than the infested fishes, resulting to low rate of activity. Assessment of the general effects of parasites on the condition of their hosts is beset with numerous difficulties. The main difficulty in garging the extent of damage inflicted on the fish lies the normal condition of the fish. Some reports suggested that the effects of parasitization might become apparent after a latent period of fairly long duration (Reichenbach Klinke *et al*., 1968). The parasitic infections also result in the abnormal behaviour of the host. The parasitic infections change the blood picture and also the parasitic condition of many species leads to the secondary infections by bacteria and fungi. Some reports (Venkataraman and Sreenivasan, 1952, 1954) indicated

that the environmental factors may influence the bacterial flora of the skin and gills.

In general, parasitic infection of fishes mainly depends upon host factors such as age, size, sex, maturity, stage, behaviour, feeding and breeding, lifecycle, physico-chemical and particularly environment factors. The negative impact of parasites on host's growth and survival has been demonstrated for several parasite-host systems, both in aquaculture and in natural populations (Sindermann, 1987). However, host parasite relationships are generally very complex and difficult to clarify. With the exception of cases of mass mortalities caused by outbreaks of parasites, assessment of the effects of parasite infection in natural fish populations is particularly difficult because of the presence of predators or scavengers which rapidly remove moribund or dead fish.

It appears that *C. indica* occurs in a limited range of teleost fishes and that it takes shelter in the host mainly for the purpose of breeding (Misra and Nandi, 1986). In the present study, the gobiid fish, *O. microlepis* parasitised by the isopod, *C. indica* showed loss of weight, loss of fat content, changes in the water content of various tissues and reduction in respiratory surface area of the host fish.

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