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EFFECT OF PARASITIC ISOPODS IN COMMERCIAL MARINE FISHES

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Abstract: Crustacean ectoparasites on marine fish are diverse. Isopods form an order in the crustaceans. Parasitic isopods are typically marine and usually inhabit the warmer seas. They are blood-feeding; several species settle in the buccal cavity of fish, others live in the gill chamber or on the body surface including the fins. Isopods can cause morbidity and mortality in captive fish populations. The damage of gill filaments thus was not only due to the feeding but also by the pressure exerted by the dorsal side of the parasite. Erosion of gill lamellae, damage of gill rakers and pale gills were the severe gross lesions observed as a consequence of isopod infestation. Infested fish exhibited histopathological anomalies such as tissue reactions, primarily associated with the formation of granulomas consisted of macrophages and epithelioid cells, which are occasionally surrounded by a thin rim of fibroblasts. A marked increase in the size of the parasite is associated with the development of marsupium full of juvenile parasite. The infestation usually pressure atrophy often accompanies the presence of larger parasites. They may lead to economic losses in commercial species of fish.

Key words: Marine fishes, Parasitic isopods, Infestation, Economic loss

INTRODUCTION

The majority of parasites extracts nutrients from their hosts and thus, is expected to damage and/ or exert an energetic deficiency in them. As a result, host fitness is expected to decrease under parasitism. The majority of cymothoid isopods are not histozoic. They are often abundant ectoparasites attached to the skin, gills or inside the buccal cavity. Single isopod can cause damage with their biting and sucking mouth parts. Heavy infestations of parasitic juveniles can kill small fish when they first attach (Noga, 2000). These cymothoids have a variety of pathogenic effects, causing direct damage not only to skin, gills and tongue at the site of attachment (Brusca, 1978; Adlard and Lester, 1994), but also indirectly affect host condition, physiological performance and reproductive output (Romestand, 1979; Ostlund-Nilsson *et al*., 2005). The effect of isopod parasites exhibited considerable variation in host (Grutter *et al*., 2008; Rameshkumar and Ravichandran, 2013a). The studies of the effects of cymothoids mostly consider their effects on adult fish, rather than interactions between young isopods and young fish (Bunkley-Williams, 1984; Adlard and Lester, 1995; Williams and Bunkley-Williams, 2000; Papapanagiotou and Trilles, 2001). The effects of the cymothoid infection vary according to the combination of the host-parasite status, with regard to the injurious effects on host species. These effects include: behavioral changes; tissue damage; decrease in mean weight, size and growth; and in some cases, death (Trilles, 1979; Kabata, 1984). These isopods cause varying degrees of harm to their hosts, ranging from minor tissue damage at the site of attachment to differential rates of mortality (Adlard, 1989). All of these reports of isopod parasites pertaining to pathology effects of isopod parasites of host commercial fishes are very scanty and no such studies have been made along Parangipettai coastal environment. Though, that fishes are commercially important, they play an important ecological role and maintain balance in ecosystem. Hence the present attempt was made to understand the effect of isopod infestation on commercial fishes.

MATERIALS AND METHODS

The host fishes were collected directly from the trawlers landed at Parangipettai coast. Isopods were removed from the branchial cavities, buccal cavities and body surfaces of the fish hosts and immediately placed into 70% ethanol. Mouthparts and appendages were carefully dissected by using dissecting needles and forceps. To study the effect of infestation on the host fish data were analysed. The feeding status of the isopods was confirmed by the presence/absence of a darkened and host specificity of isopods was also examined. The influence of infestation of respiratory surface area of the gill arch was studied. The average gill raker count of first, second, third and fourth gill arches of infested and uninfested fishes were made. The data collected were tabulated and variation in the gill raker count as a function of infestation was recorded. The damaged fish tissues were taken from the parasite attachment area of infested fishes were cut out in fresh condition fixed in 10% buffered neutral formalin. Tissues and gills were considered for histopathological study.

RESULTS

During the present study three species including three genera (*Catoessa, Joryma* and *Nerocila*) of isopods belonging to the family Cymothoidae infesting three species of commercial fishes along the Parangipettai coast were studied (Table 1). *Catoessa* were collected from the buccal cavity and *Joryma* was noted on the gill regions and another one *Nerocila* species were found to penetrate on the body surface of the hosts. Many cymothoids occur in the buccal cavity of the host fish and their position is thus highly specific (Table 1).

C. boscii was found to occur only in *Carangoides malabaricus*, the site of infection in the buccal cavity of the parasite on a diagrammatic representation of the individual fish species. Fig. 1 shows that mass of *C. boscii* invaded the buccal cavity of *C. malabaricus*. The site of attachment of the parasite, indicative of mucus and blood feeding were found at the time of observation. The parasites were normally seen protruding through the mouth opening of the host. The studies have found that parasitic infection may reduced or interfere with the ability of the host. Gross lesions observed in the buccal cavity of infested fish showed small pin-holes in the tongue region, through which dactyls of pereopod's penetrating claws dig into the host tissues.

Fig. 1. Infected mass of *Catoessa boscii* attached *Carangoides malabaricus*

Joryma hilsae were found in the branchial region of *Stolephorus commersonii*. Infested fishes, gill rakers were seriously lost, apical edges damaged and gill lamellae heavily destroyed. Gill lamellae of the first and second gill arches were eroded due to isopods. A wide depression was found due to the lodging of parasites at the gill debts

Table 1. Cymothoid isopods collected from commercial fishes

Species	Number of parasites	Host	Site of attachment	Capture
Catoessa boscii	250	*Carangoides malabaricus*	Buccal cavity	Trawlers
Joryma hilsae	54	*Stolephorus commersonii*	Branchial cavity	Trawlers
Nerocila phaeopleura	112	*Dussumieria acuta*	Body surfaces	Trawlers

and the gill arches showed torsion. Nature of damage, observed in the gill remained the same, but the degree of damage varies, as the closely opposed gill arch observed a higher damage. Terminal and middle regions of the gill lamellae bulged and the growth was stunted. Secondary gill lamellae uneven clubbed and showed fusion. Middle portion of some of the gill lamellae expanded to have some space or gap. Bifurcation was noticed at the tip of lamellae and the cartilaginous support of the gill arch was twisted. The damage of gill filaments thus was not only due to the feeding but also by the pressure exerted by the dorsal side of the parasite. Erosion of gill lamellae, damage of gill rakers and pale gills were the severe gross lesions observed as a consequence of isopod infestation (Fig. 2).

Fig. 2. *Joryma hilsae* attached in the gill region of *Stolephorus commersonii*

Species belonging to the genus *Nerocila* are generally found as external parasites on fishes. *N. phaeopleura* invading on the body surface of *Dussumieria acuta*. They were found attached to the host by hook-like projections mandibles and first maxillae and first two thoracic legs (Fig. 3). In all cases of the attached position, the body was directed towards the anterior end of the fish. The hooks of the pereopods penetrate into the skin and anchor the isopod to the fish host. At the mouth part or pereopod site of attachment, the skin (epidermis and dermis) are eroded and exposed to the underlying tissue (Fig. 4). All these appendages are highly modified to hold the body surface and tearing the body muscles of host fish strongly. Isopods make frequent shifts in position on the host causing a series of wounds. The parasites often move about as they feed. These activities also stimulate mucus production, stimulate epidermal proliferation and dilation of dermal capillaries.

Fig. 3. *Nerocila phaeopleura* using hook-like legs penetrated in the skin of *Dussumieria acuta*

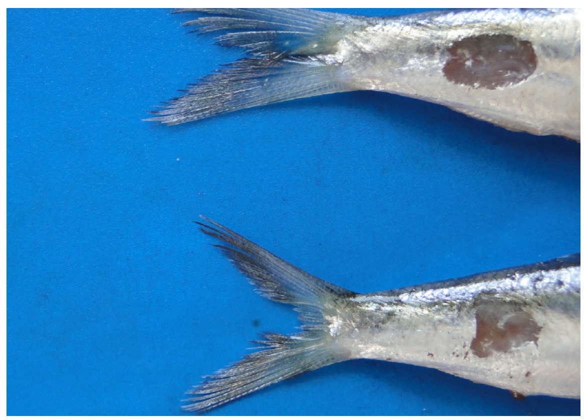

Fig. 4. Demaged at the skin caused by biting of *N. phaeopleura*

Infested fish exhibited histopathological anomalies such as tissue reactions, primarily associated with the formation of granulomas consisted of macrophages and epithelioid cells, which are occasionally surrounded by a thin rim of fibroblasts (Fig. 5). The tissue damage to host by cymothoids was often impressive, but this damage was caused by crypting (a necrotic eroding reaction of host tissues pressed against the parasite) or deformation (host growing against the parasite). Cymothoid piercing sucking mouth parts seemed more suited to body fluid.

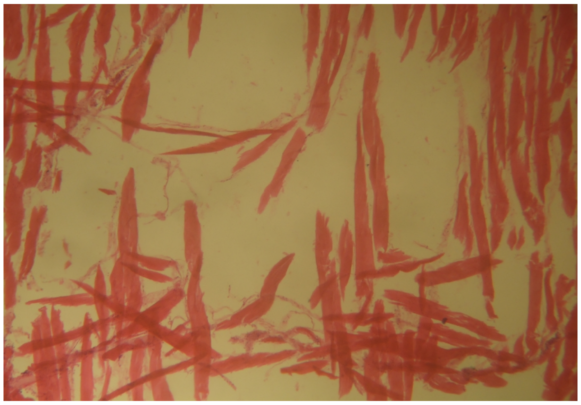

Fig. 5. Infected tissue of *Dussumieria acuta*

DISCUSSION

The findings of the present study also supports with earlier works. Jayadev Babu and Sanjeeva Raj (1984) noticed infestation in several regions like the chin, nape and pectoral fin base and the buccal cavity. 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 findings of the present investigation indicate that infestation causes serious problem to host animals either directly or indirectly affecting the physiological status of host. Parasites can infect larval, juvenile or adult marine fishes; however, the effects of parasites on the growth and condition of fish larvae have seldom been investigated (Palacios-Fuentes *et al*., 2012). The site of attachment of *C. boscii* in *C. malabaricus* the brushlike pads on the roof of the buccal cavity renders much protection to the parasite. The threat of being washed into oesophagus with the incoming water current, which parasites of the buccal cavity have overcome by resorting to firm attachment to the host tissue. *C. boscii*, although comparatively primitive in being a buccal parasite and being highly host specific is also highly specialised to a mode of life upon a pelagic, fast swimming host. This position is determined by the needs of the parasite and the limitations exerted by the morphology and habits of the host. However, our data indicate that infection by *C. boscii* had little effect on the mass of *C. malabaricus* stomach contents.

Isopods inhabiting the branchial chamber inflict damage to gills through attachment and feeding and that the extent of damage is directly proportional to the size of the parasite and duration of settlement. Erosion of gill lamellae, damage of gill rakers and pale gills were the severe gross lesions observed as a consequence of isopod infestation. Pale gills of infested fishes indicated anemia, which may be due to loss of blood the obstruction of branchial circulation by the attachment of parasite and of the homophagous nature of the branchial cymothoids (Romestand, 1979). Meyers (1978) recorded damage done to two specimens of bluefish (neither age or size given), stating that the crustacean caused an erosion of the gill filaments, and that their bulk caused the opercula of the fish to flare. While it is possible that as the parasite grows there is an increase in the amount of mechanical damage done to the gill, we found no visible evidence of this damage in our young-of the-year bluefish sampled (Matthew Landau *et al*., 1995). There was no obvious bleeding, loss of gill filaments, or discoloration; this finding agrees with the description of hosts of *Elthusa neocyttus*, a similar isopod gill parasite (Stephenson, 1987). But in the present study damage of gill filaments thus was not only due to the feeding but also by the pressure exerted by the dorsal side of the parasite. Erosion of gill lamellae, damage of gill rakers and pale gills were the severe gross lesions observed as a consequence of isopod infestation. The damage of gill filaments thus was not only due to the feeding but also by the pressure exerted by the dorsal side of the parasite. The gross size and shape of parasites can act as physical irritants, which may be responsible for the observed damages of the branchial tissues. The reduction in the surface area was thus due to several factors such as the mode of attachment, movement, size and duration of stay of the parasites. Kabata (1985) observed destruction of host tissues as a result of the pressure exerted by the parasite's body. Longer stay of parasite within the gill chamber may also prevail and obstruct the normal growth of the gill arches. This may be the reason for the torsion of gill arch and fusion of gill lamellae.

Generally, most pelagic fish within a population are not infected by isopod parasites. In this case, more than 50% of the commercial fish sampled were infected by the cymothoid isopod. Furthermore, infected fish were found to be lighter than uninfected fish, indicating the effect of infection on the host. All known species of *Nerocila*, as adults, reside on the surface of their hosts (Brusca, 1981). In this study, *N. phaeopleura* was most frequently found on the body surface area. The position of attachment area might depend on the host's body movement. Fish swim using undulatory movements of their body and/or their paired and unpaired fins. In undulatory swimming, a backward-travelling wave is generated by the sequential activation of the segmental myotomes from head to tail (Altringham and Ellerby, 1999). The cause of attachment at this position may be due to easier attachment at this site by the parasite or due to easier shedding of the parasite from other areas by the host.

Histopathological studies reviewed the damage caused by the cymothoid isopod on the infected fish host. The pathological effects of cymothoid isopods on their hosts cluster at two extremes. Some associations are quite severe and can even cause host death (Adlard, and Lester, 1994]. Infested fish exhibited histopathological anomalies such as tissue reaction, primarily associated with the formation of granulomas consisted of macrophages and epitheleoid cells, which are occasionally surrounded by a thin rim of fibroblasts (Radhakrishnan and Nair, 1981). The damage caused to the tissues and their subsequent exposure could have caused the death of fish, thus causing the fish population to decline (Printrakoon and Purivirojkul, 2011). Healthy tissue were absent at the pereopod attachment sites. Infested tissues appear to be deteriorated and are irregular in structure. The effects may be due to the stress excreted by the parasite to the underlying tissues (Rameshkumar and Ravichandran, 2013b). However, in this study, tissue damage to host by cymothoids was often impressive, but this damage was caused by crypting or deformation. The infestation usually pressure atrophy often accompanies the presence of larger parasites. They may lead to economic losses in commercial species of fish.

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