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Incidence of Parasitic Isopods on the Fish *Sphyraena obtusata* *

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Abstract: The incidence of parasitic isopods in the fish *Sphyraena obtusata* was studied. The reduction in gill raker count and gill surface area was observed as a function of infestation was found to be statistically significant. Maximum reduction in respiratory surface area was observed in Ist gill arch (10.7%) and minimum (9.2%) in the IIIrd gill arch. The percentage reduction of surface area in the IInd and IVth gill arches was 10.2 and 9.7, respectively. The infestations such as, hemorrhagic lesions, anemia; encapsulation; inflammation and penetration of dactylus usually pressure atrophy often accompanied by the presence of larger parasites. This may lead to huge economic losses in commercial species of fish.

Key words: Infestation, isopod parasites, gill arch, anemia, lesions, inflammation

INTRODUCTION

Fish parasites and diseases constitute one of the most important problems confronting the fishery biologist today. Cymothoids are all obligatory parasites, infesting mostly commercially important fishes. They are protandric hermaphrodites and are blood suckers, living on the skin, in the gill chambers, or in the mouth of the fishes. The parasitic effects include growth retardation, emaciation and frequently death of those fish affected. Mortality losses are increased by weight losses resulting from the lowered conditions of the parasitised fish. Pathological conditions resulting from parasites and diseases assume high magnitude of epidemics under crowded and other unnatural conditions.

The incidence and intensity of isopod parasite exhibited considerable variation (Ravichandran *et al*., 1999; Ravichandran *et al*., 2001; Grutter, 2003; Cuyas *et al*., 2004). The incidence of infection of *Lironecea puhi* on Hawaian Moray eel *Gymnothorax eurostus* ranged from 15 to 70% (Bowman, 1960). Histological changes in *Mugil cephalus* caused by *Stellantchasmus falcatus* were reported by Lee and Cheng (1979). Kabata (1985) and Ravichandran *et al*. (2000) described the pathogenecity of isopods and stated that the effect of the destruction of host tissue was mainly due to the pressure exerted by the Parasite's body.

Although considerable information is available on the pathological effects of different groups of parasites, no serious attempt has so far been made to study on the same due to isopod parasites. Hence the present attempt was made to study the infestation of isopod parasite *Cymothoa indica* in the fish *Sphyraena obtusata*.

MATERIALS AND METHODS

In the routine observation of *S. obtusata* fishery in Parangipettai (Southeast coast of India), an interesting incidence of isopod parasitization was observed in several fishes. Fishes were collected from three major landing centers viz (Fig. 1) Mudasalodai, Annankovil and Pudupettai.

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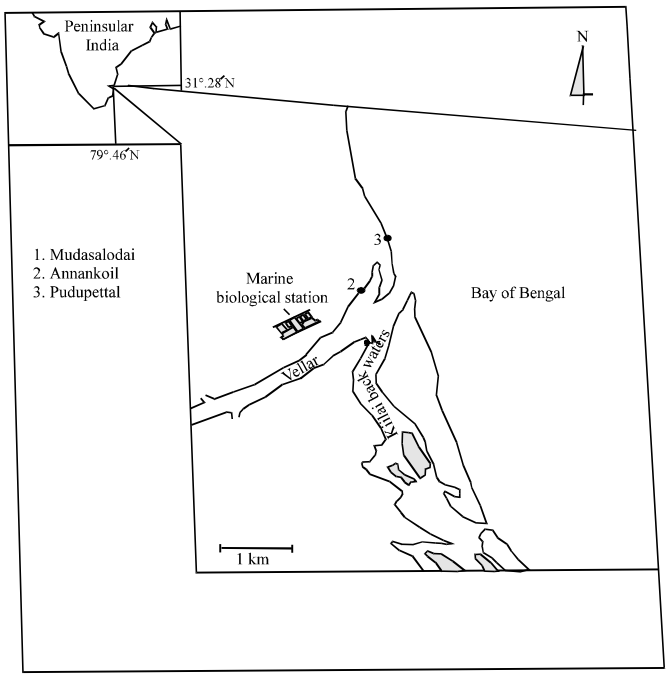

Fig. 1: The study area

Respiratory Surface Area

To find out the influence of infestation over the respiratory surface area, the changes in the gill arch was studied. The gill arches of infested and uninfested fishes were carefully dissected out and blotted to remove the moisture. The surface area of gill arch was calculated by the imprint drawings of each gill arch on a millimeter graph paper. Surface area of each tracing was determined by counting the number of small squares and the total area was obtained by addition. The value was than doubled to consider the total functioning of the gill arch. The total (functional) 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. Students t-test was employed to signify the influence of infestation.

Gill Raker Count

The average gill raker count of first, second, third and fourth gill arches of infested and uninfested *S. obtusata* were made. The data collected were tabulated and variation in the gill raker count as a function of infestation was recorded. They were then analyzed statistically using students t-test.

RESULTS

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 *Cymothoa indica*. A wide depression was found due to the lodging of parasites at the gill debts 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 (Fig. 2).

Changes in Respiratory Surface Area

Changes in the respiratory surface area of *S. obtusata* owing to the infestation of *C. indica* are presented in Table 1. Maximum reduction in respiratory surface area was observed in the I gill arch

Table 1: Infestation of gill surface area of *Sphyraena obtusata* due to *Cymothoa indica*

	Gill arch					
	I		II		III	
Nature of infestation	Infested	Uninfested	Infested	Uninfested	Infested	Uninfested
Mean value (mm^2)	187.4±0.41	250.8±0.63	185.8±0.63	230.2±0.21	155.0±0.49	190.3±0.69
Percentage value	42.3	53.0	44.8	55.0	45.0	54.2
Percentage reduction of gill arch area	10.7		10.2		9.2	
t-value	83.6*		65.80*		30.58*	

Table 1: Continued

	Gill arch			
	IV		V	
Nature of infestation	Infested	Uninfested	Infested	Uninfested
Mean value (mm^2)	143.3±0.57	176.7±0.26	671.1±0.47	847.4±0.25
Percentage value	45.1	54.8	177.2	217.0
Percentage reduction of gill arch area	9.7		39.8	
t-value	2.889*		326.85*	

*Significant (p>0.01)

Table 2: Infestation of *Cymothoa indica* in gill raker count of *Sphyraena obtusata*

	Male		Female		Total	
	Infested	Uninfested	Infested	Uninfested	Infested	Uninfested
Mean value	27.7±0.67	30.0±0.54	27.8±0.78	31.7±0.42	27.7±0.51	30.8±0.50
% value	47.3	50.4	47.0	51.2	47.1	50.8
% reduction of gill raker	3.1		4.2		3.7	
t-value	2.07		3.050*		4.180	

*Significant (p>0.01)

Fig. 2: *Cymothoa indica* attach to the branchial and buccal region of *Sphyraena obtusata*.

(10.7%) and minimum (9.2%) in the III gill arch. The percentage reduction of surface area in the II and IV gill arches was 10.2 and 9.7, respectively. A significant ($p<0.01$) reduction in the gill surface area was observed due to infestation.

Changes in Gill Raker Count

Variation in the gill raker count of *S. obtusata* due to infestation is presented in Table 2. Reduction in the number of gill rakers was noticed due to the attachment of *C. indica* in the branchial chamber. The percentage gill raker count in the infested male fish was 47.3 and in uninfested it was 50.4. In the infested female fish, it was 47.0 and in uninfested it was 50.8. The reduction of gill raker count was pronounced (4.2%) in female fish compared to that of the male fish (2.07%). The reduction in gill raker count observed as a function of infestation was found to be statistically significant ($p<0.01$) (Table 2).

DISCUSSION

Isopods inhabiting the buccal cavity and 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 *et al*., 1977; Ramestand, 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. Stephenson (1976) reported calus-like thickening only between the gill rakers, but in the present study, its occurrence was noticed not only at the gill arches but also at the base of the gill filaments. This extra thickening on the gill arches could be related to constant irritation caused by the body of the parasite.

Thickening and erosion are the two unique morphological changes noticed owing to the infestation. These changes were 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'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.

Kabata (1985) stated that no serious attempt has so far been made to estimate quantitatively the variation of the respiratory surface area in infected fishes. The present study undertaken in this direction, showed significant reduction of respiratory surface area due to infestation of cymothoids in the branchial chamber. The percentage reduction of surface area varied depending up on the nature of attachment of the parasites. The maximum reduction observed in the Ist gill arch was mainly due to the heavy pressure exerted by *C.indica*. The dorsal surface of the parasite was always in close contact with the Ist gill arch, causing more atrophy of gill filaments. Williams and Williams (1985) reported serious erosion of gill filaments in the IIIrd and IVth gill arches of *Abudefeeef sexatilis* due to the adult female isopod *Kuna insularis*. Significant reduction of respiratory surface area to a larger extent may depend on the longevity of infestation. Stephenson (1976) also discussed that the extent of gill damage may reflect the duration of infection, since eroded gill lamellae were noticed more frequently in very young fishes. It was also a fact that, the extent of erosion of gill lamellae was always more towards the posterior half of the gill arch.

Overstreet (1978) reported that the smaller males and juveniles of isopod *Olencira praegustator* parasitic on Gulf Menhaden caused damage on the gill filaments through feeding. But in case of *C. indica* a situation reverse to the above was noticed that the dorsal surface of the parasite was facing the first gill arch. 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.

Stephenson (1976) reported that the gill rakers are often widely spaced in parasitized individuals of *Trichiurus* spp. and *Hyporhamphus ihi* and that the gill raker counts were not significantly different from that of the gill raker counts of the uninfested fish. In the present study more similar effects were noticed in parasitized individuals of *S. obtusata*. However, contrary to the observation of Stephenson (1976), a significant reduction of gill raker count was observed in the present study. The reason for the significant reduction in gill raker count could be related to the direct impact of the branchial parasites on the respective gill arches. The present study also reported different types of effects and this could be attributed to the nature and position of attachment of isopods. In the case of *S. obtusata* the gill raker count was less in the posterior half of first and second gill arches. This is owing to the fact that the isopod parasite *C. indica* was oriented towards the posterior end and that its ventral side was facing the opercular covering. The antero-lateral margins of the parasite lied over the gill rakers thereby preventing its growth. Further more due to the pressure exerted, the gill rakers become damaged showing more space in between. In the case of *C. indica*, the damage to gill arch was not as intense as the parasite was facing towards the operculum and not the gill arches. The infestation such as, haemorrhagic lesions, anemia, inflammation and penetration of dactylus usually pressure atrophy which often accompanies the presence of larger parasites. They may lead to severe economic loss in the commercial species of fishes.

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