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Histological effect of monogenean parasites on gills of freshwater carps

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Abstract

Present investigation was carried out to study the histological effect of monogenetic parasite (*Paradactylogyrus* sp. and *Dactylogyrus* sp.) on gills of freshwater cultivable carps. During present investigation *Labeo rohita* and *Hypophthalmichthys molitrix* were collected from eutrophic lakes (Lower Lake and Mansarovar Lake) of Bhopal region. Maximum prevalence was exhibited by *Labeo rohita* (20.0%) and least prevalence is recorded in *H. molitrix* (12.8%). Histological analysis revealed that the gills of *H. molitrix* was greatly affected which may be due to multiple infection by unidentified protozoan and *Dactylogyrus* sp. The pathological changes includes upliftment of respiratory epithelial layer, damaged cartilaginous core, deshaped secondary gill lamellae and damaged pillar cells.

Keywords: Gills, Carps, Monogenetic, Histology

1. Introduction

Monogenea (Platyhelminthes) of the gills are common in fish. These parasites affect the health of fish and can be one of the major factor contributing to host mortality and epizootics Iversen *et al.* [1]. According to Karlsson [2] the gills of fish are a sensitive organ which is easily damaged by numerous pollutants, even at low concentrations. As, most of the vital functions viz. respiration, osmoregulation and excretion are performed by the gills and have a large surface area in contact with the external environment, they are particularly sensitive to chemical and physical changes of the aquatic environment, thereby being the target organ in fish for pollutants carried by water (Mallatt [3]; Mazon *et al.* [4]; Cerqueira and Fernandes [5]). Cerqueira and Fernandes [5] also explained that because the gills are the principal site for gas exchange and histopathological changes in the structure of these organs involve respiratory disturbances and electrolyte imbalance. *Paradactylogyrus* was reported from a number of freshwater fishes and characterized by elongated body, haptor with fourteen hooks and single onchium. *P. catalaius* and *P. himalayensis* were two reported species from India under the genus *Paradactylogyrus*. Singh and Rastogi [6] collected *Paradactylogyrus* from *Mystus tengara* and described it as *P. indicus*. But Yamaguti [7], Agrawal [8], Singh and Rastogi [6] and Agrawal *et al.* [9] retained this genus as *Paradactylogyrus* since it is validated due to the presence of an onchium and its orientations. Carps are most abundant cultured and edible fish in Madhya Pradesh. During present investigation different species of carps were collected from eutrophic lakes of Bhopal city namely, Lower Lake and Mansarovar Lake. Though, this is preliminary investigation carried out for the first time to study the effect of monogenetic trematodes in cultivable fishes.

Materials and Methods

2.1 Collection of host fishes

The host fishes (Carps) were collected from the two major water bodies of Bhopal region namely Lower Lake and Mansarovar Lake. Fishes were collected ones in a weak for one year (during different seasons i.e. summer, rainy, post-monsoon and winter months). The hosts brought to laboratory were subjected to a thorough investigation as per the methods employed by Meyer and Olsen [10], Cable [11] and Madhavi *et al.* [12]. For the purpose of collection of Monogeneans, the gills were taken out and placed in petridishes, containing tap

water. They were scraped with the help of scalpel to collect the parasites attached to the gills. The parasites collected were examined in live condition using neutral red as vital stain.

2.2 Histo-pathological study

The infected gills of *Labeo rohita* and *H. molitrix* were taken out and fixed in alcoholic Bouin's fluid for 24 hours. After the complete removal of picric acid, the tissue was dehydrated through 30%, 40%, 50%, 70% and 90%, clarified with xylene and processed for preparation of paraffin wax blocks. The tissue was then cut at 4 - 5 µm thickness by rotary microtome and stained routinely with haematoxylin and eosin (H-E) for histopathological examination, Luna [13]. Stained histopathological sections were examined under Olympus research microscope. Histopathological changes observed were photographed and interpreted in comparison to the work of others.

3. Results

Maximum prevalence was exhibited by *Labeo rohita* (20.0%) and least prevalence is recorded in *H. molitrix* (12.8%). The infected gills appeared reddish-white in color with excessive mucous secretion.

3.1 Infected gills of *Hypophthalmichthys molitrix*

The gills of *H. molitrix* showed multiple infections by protozoan and flukes due to which gills were total destroy and damaged. Histopathological examination revealed damaged cartilaginous core. Pathological effect of flukes revealed the proliferation of branchial tips, shortening and fusion of secondary gill lamellae and desquamation of primary and secondary gill lamellar epithelium. The uplifting of respiratory epithelial wall and damaged pillar cells can also be seen (Fig. 1, 2, 3).

3.2 Infected gills of *Labeo rohita*

Histopathological examination in gills of *Labeo rohita* infected by *Paradactylogyrus* sp. Parasites were observed to be attached to the primary gill lamellae by its haptor due to which the primary gill lamellae and cartilaginous core got badly damaged and disrupted. Pathological effect of flukes revealed the proliferation of branchial tips, shortening and curling of secondary gill lamellae and desquamation of primary and secondary gill lamellar epithelium. Telangiectasia was also observed at the tips of secondary gill lamella. The uplifting of respiratory epithelial wall and damaged pillar cells can also be seen (Figs. 4, 5).

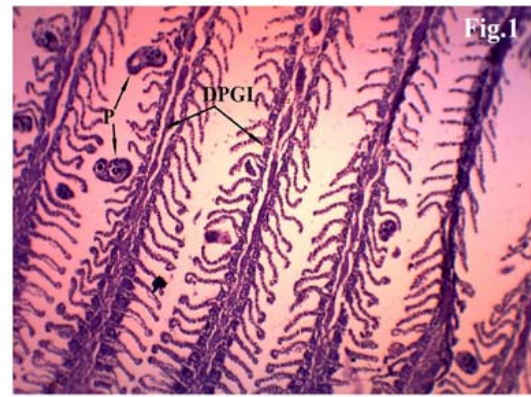


Fig.1 Microphotograph of cross section of gills of *H. molitrix* showing parasites (P), damaged primary gill lamellae (DPGL) X 100

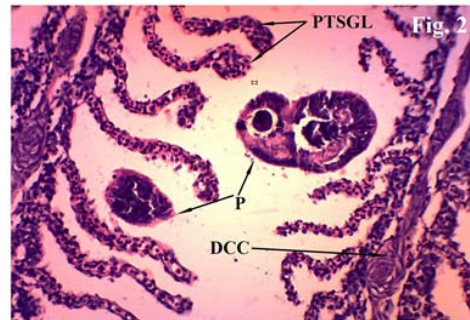


Fig.2 Microphotograph of cross section of gills of *H. molitrix* showing parasites (P), proliferated tips of secondary gill lamellae and damaged cartilaginous core (DCC) X 150



Fig.3 Microphotograph of cross section of gills of *H. molitrix* showing parasites (P), upliftment of epithelial layer (ULEL), damaged cartilaginous core and attachment site of parasite (AS) X 150

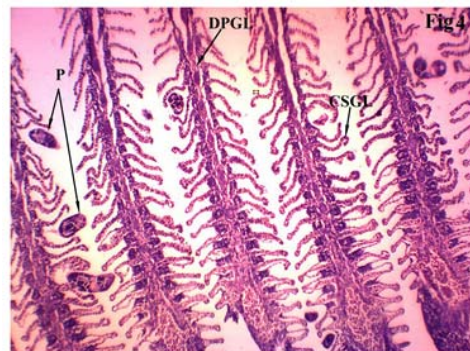


Fig. 4 Microphotograph of cross section of gills of *Labeo rohita* showing parasites (P), damaged primary gill lamellae (DPGL) and curling of secondary gill lamellae (CSGL) X100

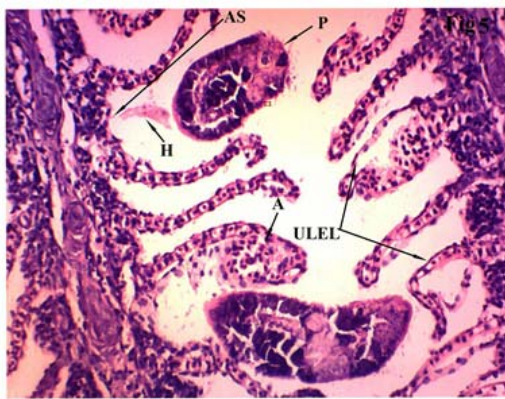


Fig. 5 Microphotograph of cross section of gills of *Labeo rohita* showing parasites (P), attachment site of parasite (AS), hook of parasite (H), upliftment of epithelial layer (ULEL) and telangiectasia in branchial tips (A) X 150

4. Discussion

Pathological effect of infected gills of carps by monogenetic trematodes showed proliferation of branchial tips, desquamation of primary and secondary gill lamellar epithelium, epithelium detachment and thinning and curling of secondary gill lamellae and damaged pillar cells. This observation is supported by Derwa ^[14], Andrew *et al.* ^[15], Endrawes ^[16], Hanna ^[17], Osman ^[18], Ebtasam and Tantawy ^[19] and Arafa *et al.* ^[20].

The histopathological effect caused by monogeneans are mainly due to their morphological structures and specialized mode of attachment with host tissues. Infestation of the fish with monogeneans *Cichlidogyrus halli typicus* and *Dactylogyrus afrobarbae* resulted severe damage to gills lamellae may be similar to lesions that were reported by Abdel-Meguid ^[21]. Severe alterations of gills might be negatively affected on the respiratory process of the fish. Also, Thurston ^[22] discussed that, monogenean gill parasites are pathogenic in massive infestations because they damage the epithelia and cause secretion excessive amount of mucus which affects respiration. Moreover, Molnar ^[23] confirmed a lethal effect of *Dactylogyrus lamellatus* infected grass carp fry.

Modu *et al.* ^[24] studied the impact of monogenean parasite in relation to water quality effects on the structural changes in the gills of freshwater catfish, *Hemibagrus nemurus* Valenciennes 1840. They revealed number of pathological alterations which included proliferative, degenerative and necrotic changes in the epithelium of gill filaments and secondary lamellae, telangiectasia (an indication of ballooning dilatation in form of club deformation at the tip of secondary lamellae), congestion and fusion of secondary lamellae and mucous cells proliferation. Correlation was made between water quality parameters and intensity of monogenean infestation in the ponds.

The present observation is more or less similar to the finding of Daib *et al.* ^[25] studied the gills of *O. niloticus* infected by *Clinostomum* sp. and reported the sloughing of secondary gill lamellae, desquamation of epithelial cells and severe congestion of branchial blood vessels which might be due to the scraping and sucking activities of the parasites on host gills.

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