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REVIEW ARTICLE

A HISTOPATHOLOGICAL STUDY OF INTESTINAL LESIONS OF INDIGENOUS CARP (*SCHIZOTHORAX* SPECIES) INFECTED WITH *POMPHORHYNCHUS* SPECIES IN RIVER JEHLUM, KASHMIR.

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ABSTRACT

Pomphorhynchus kashmirensis Kaw, 1941 is the first of 09 species of *Pomphorhynchus Monticelli*, 1905 described from freshwater fishes in the Jammu-Kashmir region of the Northern Indian subcontinent. It was originally well described from *Nemachilus kashmirensis* Hora, 1922 (Balitoridae) in Kashmir but many of its features could not be adequately visualized or confirmed. Histopathological aspect of *Pomphorhyncus* species (Acanthocephala) infecting *Schizothorax* species was studied. The parasite- *Pomphorhynchus* bores deeply with proboscis into the intestinal wall with ensheathed proboscis floating freely in the coelom and part of trunk lying in the lumen of intestine. The histopathological studies showed that whole organisation of the normal intestine was found to be disrupted. The neck and proboscis were surrounded by a layer of compact rounded fibroblasts and scattered connective tissue. These layers extended across the entire gut wall and into the capsule that enclosed proboscis outside the gut wall. The formation of fibrous capsule evoked by the penetration of intestine by *Pomphorhyncus* species of Acanthocephala was found to be one of the most significant parasites responsible for fish morbidity and mortality.

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INTRODUCTION

The distribution of parasites varies not only in different species of fish but also seasonally and from one water body to other. Fishes are infected with three major groups of helminths: the Platyhelminthes (flat worms), Nematoda (round worms), and Acanthocephala (spiny headed worms). The pathogenicity of parasitism has been reported to cause extensive damage to the host leading to the lower production of the fish (Rai, 1970). In certain studies the parasite has been found to be responsible for the death of the host (Bookmer *et al.,* 1981). About 20,000 to 30,000 helminth species have been reported worldwide which cause heavy losses to the fish industry. Dhar (1972) reported 31 species of helminth parasites from Kashmir valley which cause severe damage to the fish production and population. The relationship of parasitism and pollution is not simple and involves a double edged phenomenon in which parasitism may increase host susceptibility to toxic pollutants or pollutants may result in an increase or decrease in the prevalence of certain parasites. Fish harbor a variety of parasites viz., protozoa, cestodes, trematodes and acanthocephalans (Ali, 1990) and the degree of damage by infection is influenced to a large extent by the type and numbers of parasites present (Bauer, 1941). Numerous reports are available on the harmful effects of many acanthocephalan parasites. Of the 24 known species of *Pomphorhynchus Monticelli*, 1905, 09 species are reported in the Indian subcontinent that are only found in the Jammu and Kashmir area; 02 (two) ecologically distinct regions (Amin *et al*., 2003). *Pomphorhynchus kashmirensis* Kaw, 1941 was the first of the 09 Indian species described. Dhar (1972) also reported 07 species of *Pomphorhynchus* from Jammu and Kashmir and distinguished between them based on proboscis armature. The frequent, often, daily reports of fish mortalities in different water bodies constantly remind us of the importance of the responsible factors. It is not just the sad sight of the floating belly upwards that makes it imperative to find out the causes of such a catastrophe, it is also a problem concerning the feeding of World's population. Maximum infection of Pomphorhynchus species (Acanthocephala) was reported in the Schizothorax species of river Jhelum. There was mixed infection of Cestode, Adenoscolex and Acanthocephala. Tremendrous reduction in weight was observed in the infected fishes Ahangar *et al* (2012). All living beings can in certain circumstances become subject to diseases and fishes make no exception. Fishes like other animals fall prey to large number

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of diseases caused by variety of parasites. The parasites are normally in a complex dynamic equilibrium with the hosts. However the equilibrium may be disturbed by numerous environmental factors. The consequences may lead to serious diseases in the fish population. Many parasites are also responsible for high mortality rate particularly in younger stages. The research studies conducted in different parts of India have resulted in tremendous increase in fish production. There is a great potential for increasing it in the water bodies of Kashmir Valley through proper development and management. Since the much prized dwindling *Schizothorax* species are more acceptable to the local population as compared to exotic carps it becomes therefore, imperative to study the cause of the depletion, diseases and their parasitic fauna. The present study is an attempt on histopathology of *Pomphoryncus* species (Acanthocephala) and will help in finding out the extent of damage to the infected part by these parasites. Destruction of host's tissues is one of the most common effects of parasitism. This may be by a mechanical action when parasites or their larvae migrate through or multiply in tissues or organs, or when various organs of attachment of parasites are inserted into fish tissues as anchors. Destruction may also be due to pressure as a result of increase in parasite size, multiplication or by blockage of ducts. Parasitization of the intestinal tract with even a few Acanthocephalids leads to acute inflammation and apparently is capable of influencing the growth rate of small fishes. Roubal (1993) studied the comparative histopathology of Longicollum (Acanthocephala) infecting the alimentary tract and spleen of a fish. He observed that the neck and proboscis had penetrated the entire gut wall. A layer of compact, rounded fibroblasts and scattered connective tissue fibres were surrounding the neck and proboscis. The pathogenicity of parasitism has been reported to cause extensive damage to the host leading to the lower production of the fish (Rai, 1970)

MATERIAL AND METHODS

Study Area: The River Jhelum (Vyeth in Kashmiri, Vetesta in Sanskrit and Hydaspes in Greek) is the main waterway of the valley of Kashmir. It initiates from a beautiful spring called Verinag. This spring is situated at the foot of a spur of the Pir Panjal Mountain

Collection of the hosts and histopathology: Fishes under consideration were subjected to detailed macroscopic examination, physical parameters such as weight, length, standard length and colour of the skin were noted. Fishes were dissected midventrally exposing the whole visceral organs followed by visual scanning of the whole visceral cavity. Special emphasis on examination of intestine and lesions (if present) were recorded. The infected organs thus obtained were placed in the separate Petri dishes containing normal saline. For histopathological studies portions of *in situ* material of parasite and intestine were processed through the routine parasitological techniques such as washing, dehydration, de-alcoholization, infiltration by paraffin, and embedding in molten wax. Continuous ribbons of sections of 5 to 15 microns were cut and affixed by Mayer's Affixative on clear glass slides. These slides were air dried, deparrafinized, hydrated and stained with Mallory`s triple stain followed by mounting and photomicrography.

RESULTS AND DISCUSSION

Various workers such as Prakash and Adams (1960), Chaicharn and Bullok (1967) and Raina and Koul (1984) have mostly studied the pathology and histopathology of *Echinorhynchus* species infection. We have studied the effect of *Pomphorhynchus* species on the intestine of *Schizothorax* species. During the present study there was mixed infection of *Adenoscolex* species (Cestode) and *Pomphorhynchus* species (Acanthocephala). The infected fishes showed tremendous reduction in weight. The fishes appeared more elongated with narrow body, sluggish and presented an emaciated look. Externally the intestine of infected fish with *Pomphorhynchus* species presented a nodulated appearance due to the protruded bulbs (proboscis) of parasites, which were generally ensheathed by a fibrous covering (Fig.2,3,4). They were seen as yellowish white granules in colour. The outer surface of infected intestine was observed having more fat lobules (Fig.3).

Fig 1: Parasite Embedded in the Intestine

Fig 2: Parasite Embedded in the tissue

Pomphorhynchus species was found to have well developed hooked proboscis and bulb, by which they were firmly attached with the host intestine. They penetrate their proboscis and bulb deep into the host tissues and thereby damage the villi, and epithelial layer. In the areas of trunk contact with the host tissue, compression/absence of intestinal folds and loss of columnar appearance of epithelial cells were evident. Intense cellular infiltrations were noticed at the site of attachment which gave a granuloma like appearance.

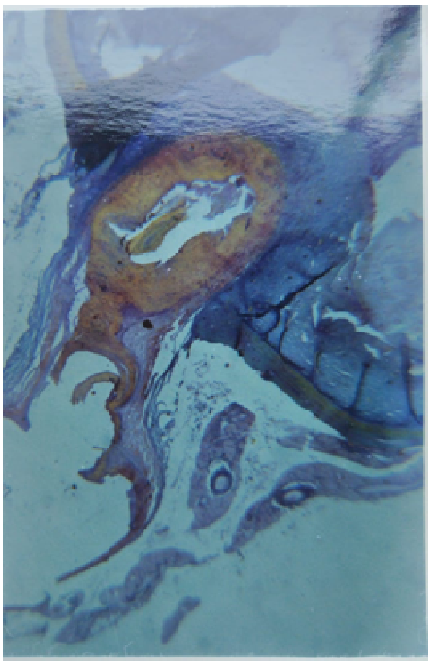

Fig. 3. Formation of fibrous capsule

Fig. 4. Pressure Necrosis

Pomphorhynchus species were deeply embedded with their proboscis and so much entangled in the intestinal tissue that these could only be separated with much difficulty. These parasites were seen to have penetrated through the intestinal wall with ensheathed ends floating freely in the coelom and the part of trunk lying in the lumen of the intestine. The intestinal wall was completely disrupted at the point of penetration. As a result of perforation a tunnel was formed in which lies the neck of parasite. There was no contact between the neck and the tunnel, however, a small gap was left in between (Fig. 1,2,3 and 4). The mucosa, submucosa, muscularis and serosa were completely destroyed at the site of perforation. The whole organization of the normal intestine was found to be disrupted. The neck and proboscis were surrounded by a layer of compact rounded fibroblasts and scattered connective tissue fibers.

These layers extended across the entire gut wall and into the capsule that enclosed proboscis outside the gut wall. Fibers which stain blue with Mallory`s triple stain, obviously of collagen, were found present in the region of perforation along with much of fibrin, which stained reddish pink with the same stain (Fig. 3). The formation of fibrous capsule evoked by the penetration of intestine by *Pomphorhynchus* species as reported by Chaicharn Bullok (1967) and Robual (1993) were confirmed in the present studies. The presence of large amount of fibrin at the site of perforation may be due to reaction of the host.

Conclusion

We conclude that *Pomphorhynchus* species of Acanthocephala is one of the most significant parasites responsible for the fish morbidity and mortality especially that of indigenous carp species – *Schizothorax* of river Jehlum in Kashmir. Destruction of host's tissue is one of the most common effect of this parasite either by mechanical action or when the organ of attachment (proboscis) are inserted into host intestinal tissue. Acute inflammation and pressure necrosis was also observed due to increase in size of parasite (Fig 4). A layer of compact rounded fibroblasts and scattered connective tissue fibres were surrounding the neck and proboscis of the parasite. Prevention and control of this infection in fishes has tremendous potential for growth and production of fishes in various water bodies in Kashmir with consequential economic impact.

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