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HISTOPATHOLOGICAL STUDY OF FRESHWATER FISH *CHANNA PUNCTATUS* (BLOCH, 1793) INFECTED WITH ACANTHOCEPHALAN PARASITES FROM RIVER GOMTI, LUCKNOW, UTTAR PRADESH (INDIA)

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ABSTRACT
The thorny or spiny headed Acanthocephalan parasites infects the intestine of freshwater fish, *Channa punctatus*. The intestinal wall was completely disrupted at the point of penetration. Heavy infections with the parasites were observed in the posterior region of the intestine, almost blocking the lumen. The histopathology of the fish tissues shows different pathological conditions. This parasite brought severe histopathological changes in the intestine includes mucosa and submucosa are completely disrupted, thickened lamina propria, inflammation, necrosis, hyperemia, edema, damage of epithelial cells, mucosa folds clumped. The intestinal villi of the mucosa shrinked, infected intestine often enlarged and slightly inflamed. Increase in the thickness of the muscular layer may be considered as an adaptation in the presence of parasite. However, uninfected intestine showed mild pathology. The present study describes acanthocephalan parasites infection and histopathological changes in the intestine of freshwater fish *Channa punctatus.*

KEYWORDS: Acanthocephalan, *Channa punctatus*, Freshwater fish, Infection, Parasites

INTRODUCTION

In fishes parasite infection constitutes one of the most important problems and challenges in throughout world. Recent studies indicate that of 750 species of freshwater fish species found in India, a large number of them are familiar only to the local population. Intestinal parasitic helminths (Olurin and Somorin, 2006) have a serious impact on fish health, productivity, quality and quantity of meat. Various report are available on the harmful effects of many acanthocephalan parasites on the digestive tract and associated organ of different fish species (Abidi, 2002). The acanthocephalans are parasitic worms belonging to phylum platyhelminthes. Their parasitic mode of life has brought about a specialized development of organ for attachment and reproduction. The acanthocephalan parasites cause infection and diseases of fishes in both freshwater and marine ecosystem. (Gupta and Verma, 1980). Fishes serve as major source of animal protein in India. Most of the food fishes carry infection of helminth parasites which cause damage to fish production and quality of food value and economic loss (Bullock, 1962). Destruction of host's tissues is one of the most common effects of parasitism. Acanthocephalan leads to acute inflammation and apparently is capable influencing the growth rate of small fishes (Nickol, 1995).

The pathogenicity of parasitism has been reported to cause extensive damage to the host leading to the lower production of the fish (Rai, 1970). Acanthocephalan attach to the host intestinal wall using its hooked proboscis, causing extensive damage and potential in various vertebrates (Nickol and Crompton, 1985). The infected fish intestine suffer from irreversible mechanical damage due to the attachment of acanthocephalan armed proboscis which also affects the nature of the intestinal structure and leads to pathological changes (Ahmed, 1981). The present study was therefore undertaken to determine the morphology of the parasite and pathological changes in the intestine of naturally infected *Channa punctatus* with acanthocephalan as well as to establish the host's responses against the parasite, which may be helpful in understanding the host parasite relationship. (Gupta and Agarwal, 1983a).

MATERIALS AND METHODS

For present study, freshwater fish *Channa punctatus* (Figure 1) were collected from the River Gomti, Lucknow (Uttar Pradesh) and brought to the laboratory. The collected fishes were kept in well aerated recirculating aquarium for several days to remove the undigested food and debris from gut. The fish were anesthetized with trichloro - tertiary - butyl - alcohol and then dissected. The intestines were removed, opened longitudinally and examined for any alternation as well as presence of parasites. In the present study, only heavily infected fish intestine with acanthocephalan were selected for histopathological studies. Small pieces of both uninfected and infected intestine with

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attached acanthocephalan were fixed in Bouin's fixative for 6 - 8 h, dehydrated in graded series of ethanol, cleared in xylene and embedded in paraffin wax with a melting point of 58 °C. The specimens were serially sectioned at about 7 µm on a rotary microtome, stained with the haematoxylin – eosin and pathological changes were studied under light microscope (Nikon Eclipse 80i, Tokyo, Japan and photomicrographs were taken.

Figure 1. freshwater fish *Channa punctatus*

RESULTS AND DISCUSSION

The examination of the intestine of *Channa punctatus* was exposed the presence of heavy infection by acanthocephalan (Figure 2). It is a thorny headed worm whitish to slightly yellow in colour having wrinkled body. The anterior most structure is proboscis, cylindrical in shape, bearing rows of spines that serve to attach the worm to the gut of the host. This proboscis can be usually withdrawn into a proboscis receptacle or proboscis sac. The sac extends into the body cavity from the neck region, there are ligament sacs, that extend from the proboscis sheath adjacent to the body wall and form as tubes around the reproductive organs. The protonephridia serve as excretory organs. They consist of flame bulbs and collecting tubules. The nervous system consists mainly of a ganglion to proboscis sheath and of nerves that connect the ganglion to other organs and tissues of the body. Sense organs are found in the proboscis and in the male reproductive organs. Male reproductive organs consist of a pair of testes, one behind the other, and a common sperm duct formed by the union of a duct from each testis. There is cluster of large cement glands. Female reproductive organs consist of an ovary fragmented into ovarian balls that lie in the ligament sac.

The distribution of acanthocephalan parasites along the alimentary canal of several species of fishes has been studied both in natural and experimental infections **(**Obano *et al*., 2010). Shedding of host's tissue and yellowish white fibrous nodules was observed macroscopically at the host parasite interface which was more pronounced in heavy infection. The extension of nodules on the external surface of the infected intestine is an indication for the presence of parasite. In heavy infection, the proboscis of acanthocephala was found to perforate the intestine therefore widening of intestinal lumen (Figure 3) and caused damage to the adjoining tissue of liver and pancreas (Dezfuli, 1991).

Acanthocephala was found to have well developed hooked proboscis and 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 (Figure 4) (Honma and Yoshihary 1995). Comparison of the structure between uninfected (Figure 5) and infected intestine (Figure 6) revealed the damage of intestinal tissues in infected intestine shows shortening of villi (Figure 7) therefore total loss of absorptive surface area. Intense cellular infiltrations were noticed at the site of attachment which gave a granuloma like appearance and the cells were identified as plasma cells, neutrophils and fibroblasts. Infected intestine showing the erosion of the tips of villi, necrosis and hyperplasia (Figure 8) (Abdelmonem *et al*., 2010).

Generally acanthocephalans cause more damage to the intestinal fold and muscular layer (Figure 9) induce more complex host response, mainly, due to deeper penetration into the gut mucosa and worm burdens (Bullock, 1963). Over secretion of mucous at the host-parasite interface may be a consequence of host reaction for defence, as mucous layer

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on intestinal mucosa acts as a physical barrier for microorganisms, parasites and their toxins (Lamont, 1992; Bosi *et al.*, 2005) and therefore prevents secondary infection. Excess mucous secretion and significant increase in the number of mucous cell (Figure 10) has been reported in the infected fish with acanthocephalans as well as in infected mammals with other parasites. Infection of acanthocephalan damage the digestive and absorptive efficiency of fish intestine by which general health and growth of fish was affected.

Figure 2. *Channa punctatus* intestine showing heavy infection of acanthocephalan

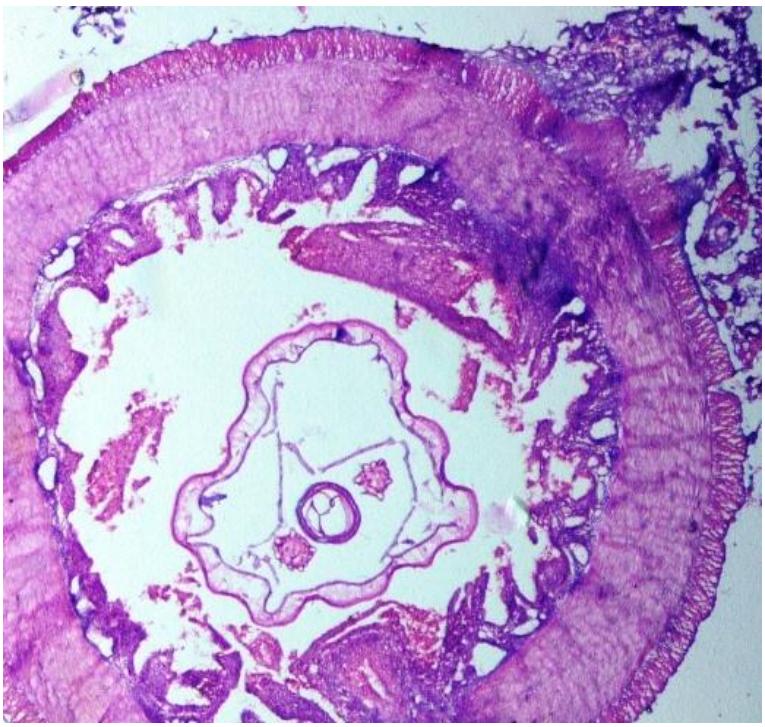

Figure 3. T.S. of infected intestine showing the widening of the intestinal lumen

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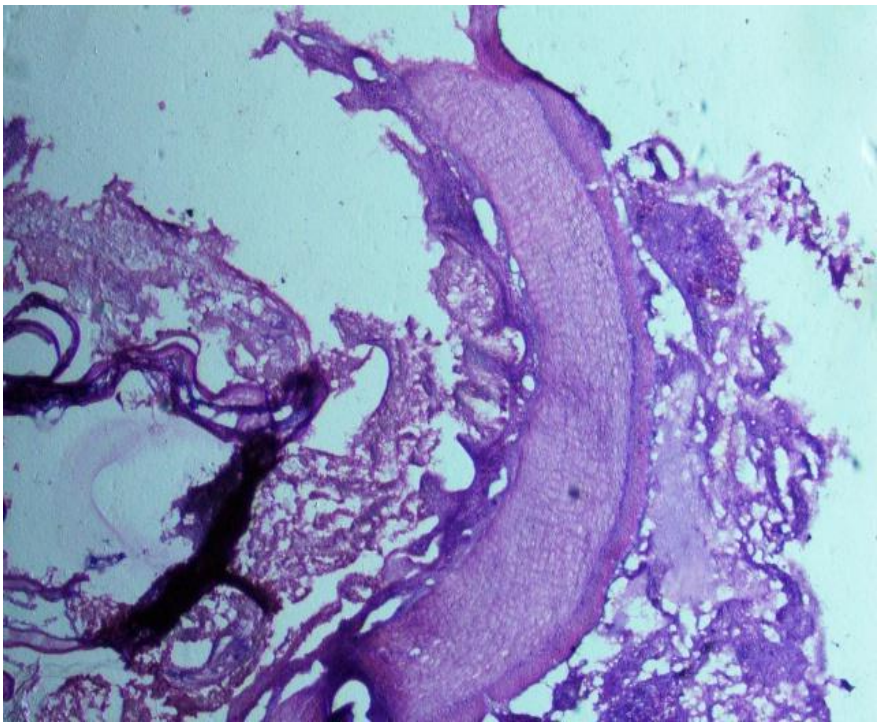

Figure 4. T.S. of infected intestine showing destruction of villi and epithelial layer

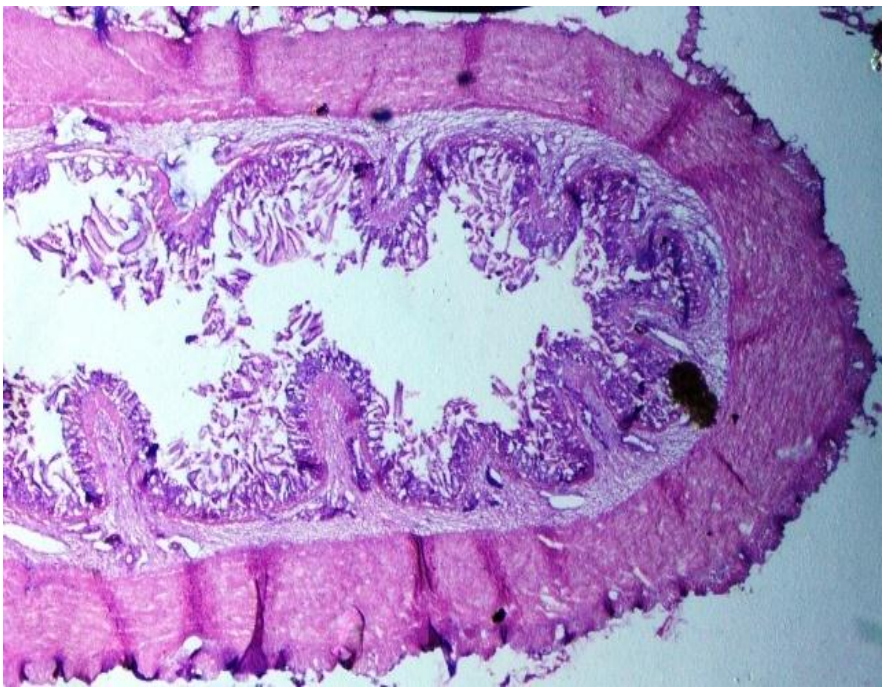

Figure 5. T.S. of Uninfected intestine of *Channa punctatus*

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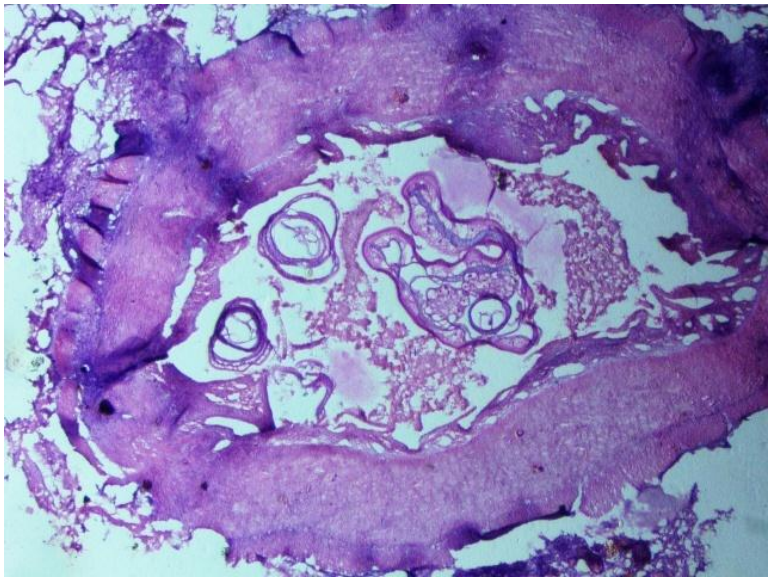

Figure 6. T.S. of infected intestine of *Channa punctatus* with parasite

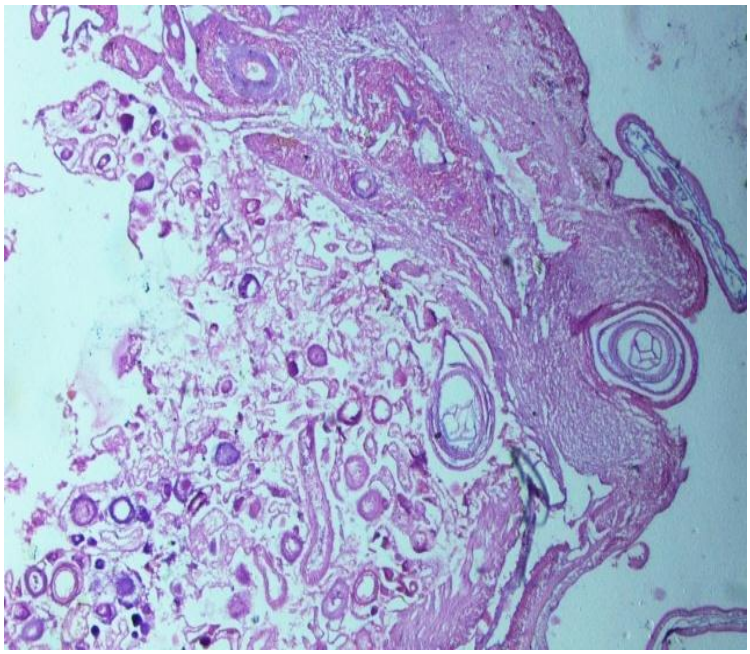

Figure 7. T.S. of infected intestine shows shortening of villi

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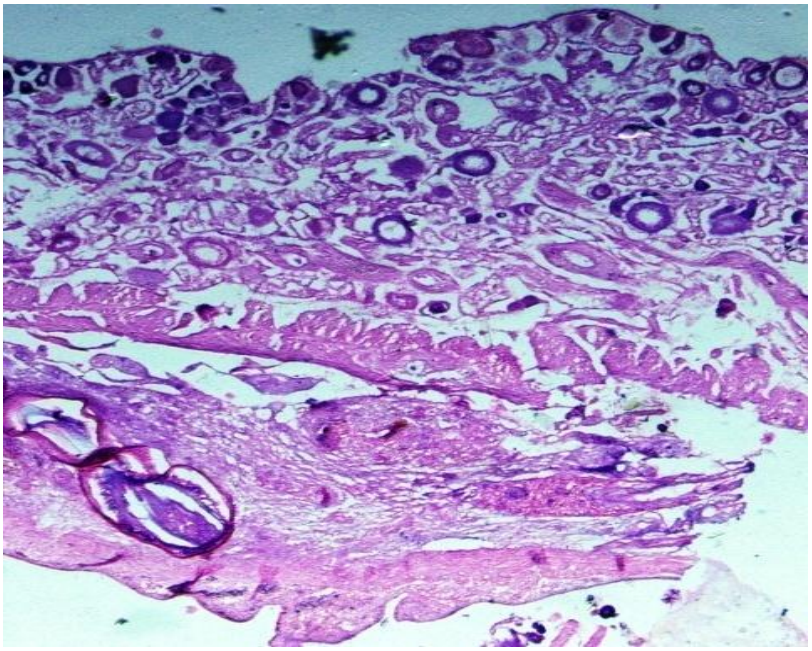

Figure 8. Showing the erosion of the tips of villi, degeneration and necrosis, hyperplasia

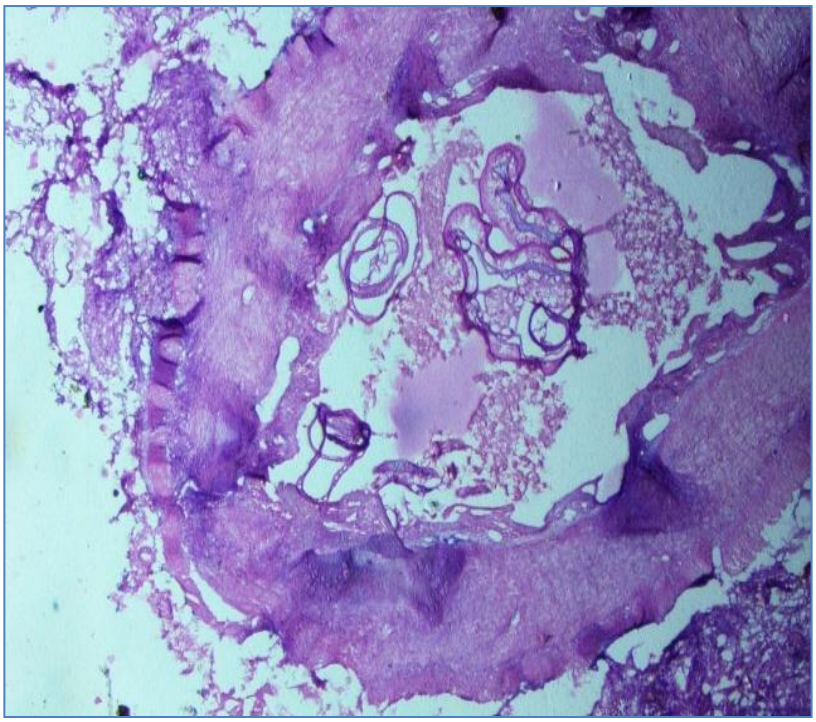

Figure 9. Cross section of the intestine showing the extent of tissue damage to the intestinal fold and muscle layer

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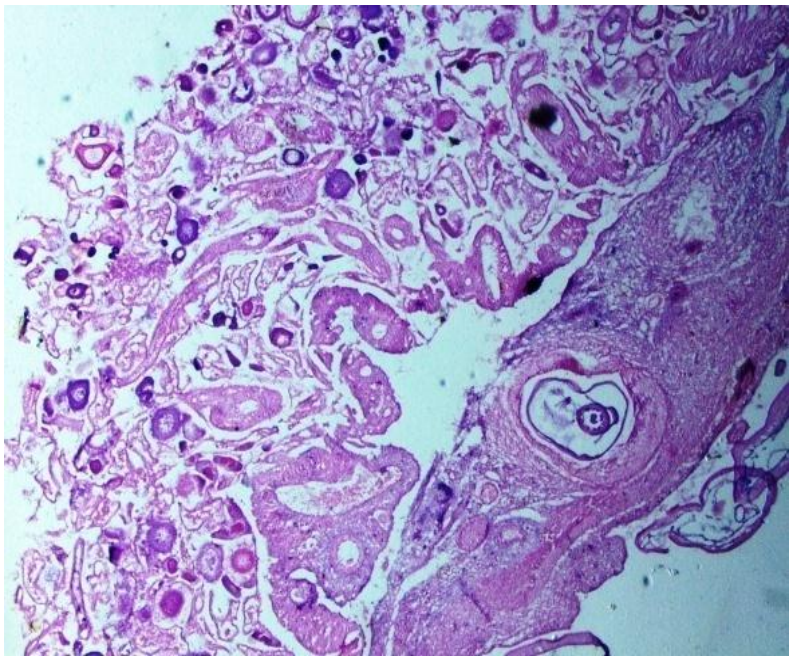

Figure 10. Showing the increase in the number of mucus cells

CONCLUSION

In the present study it has been found that acanthocephalan parasites occurs as an adult in the alimentary canal, particularly in the intestine of *Channa punctatus*. The association of host and parasite resulted in the pathogenicity of the host. The effects on the host tissues are very much conspicuous. Primarily these pathological processes are brought alone by the attachment of the parasite in between the intestinal villi. The acanthocephalan infection greatly affected the anatomy of the intestine. Microscopically the effects were observed in the epithelium and in the underlying lamina propria. There was destruction of the epithelium which became very much degenerated. Total destruction of mucosal epithelium occurred at the point of attachment. The acanthocephalan infections interfere with the digestion and absorption of food material causing metabolic disorders. The excretory products and the metabolic end products excreted by the parasite in to the intestine produce toxicity. These abnormal conditions in the infected tissue alter the quality and the secretory nature of various chemical substances.

The present study, therefore emphasizes the changes that take place in the fish intestinal epithelium during infection period. The effect noted on the fish and the histopathology observed, both indicate that this worm seriously impairs the health of the fish.

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