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ORIGINAL RESEARCH

Histopathological Study of Acanthocephalan Parasite *Pallisentis* of C*hanna marulius (Hamilton, 1973) Fish* with S*em Morphology*

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Abstract

Specimens of the freshwater carnivorous fish *Channa marulius*, were collected from the Gomti River, Lucknow. The present study investigated the histopathological alterations in the intestine of *C. marulius* induced by the acanthocephala parasite. Dissection and examination of the fish revealed acanthocephalans firmly attached to the intestinal wall. Histopathological analyses were conducted to assess tissue damage, while Scanning Electron Microscopy (SEM) was employed to examine parasite morphology. The results demonstrated severe disruption of the intestinal mucosa and submucosa. The acanthocephalan proboscis penetrated deep into the intestinal wall, extending through the lamina propria of the mucosal epithelium and into the external muscularis layer. The marked compression and degeneration of the intestinal villi were also observed, leading to villus shortening and extensive structural damage.

Keywords: *Channa marulius*, Infestation, Histopathology, Acanthocephala, SEM.

INTRODUCTION

Parasitic infestations in fish are one of the most serious problems and challenges faced by fish industry (Woo, 1995). According to recent research by Verma *et al.,* (2018), a large number of the freshwater fish species found across India are known only to the local population. Intestinal parasitic helminths have a negative impact on fish farming, economic output, meat quality, and quantity (Olurin, 2006). Numerous studies have extensively documented the pathological effects of acanthocephalan infections on the digestive tract and associated organs in a wide range of fish species (Abidi, 2002, Verma *et al.,* 2018). The parasitic lifestyle has resulted in the development of specialised organs for adherence (Vishwakarma *et al.,* 2022). Fishes are an important source of high-quality protein (Raizada, *et al.,* 2012). Acanthocephalan parasites infect a wide range of commercially important (food) fish species in both marine and freshwater ecosystems (Gupta,1980). These infections adversely affect fish production, reduce food quality, and lowers the economic value of fisheries (Bullock, 1962). One of the most common pathological consequences of acanthocephalan infection is the destruction of host tissues, resulting in significant damage to affected organs and impairment of normal physiological functions (Obano, *et al.*, 2010). Acanthocephalan causes inflammation and badly influence the growth rate of the freshwater fish *C. morulius* (Ali, *et al.*, 2013). The pathogenicity of endo-parasitic infections has been observed to induce substantial damage to the host, resulting in lower fish production (Rai, 1986). Acanthocephalans use their hooked proboscis to attach to the host gut lining, causing significant damage in a variety of vertebrate species (Bosi, *et al.,* 2005). The attachment of the hooked eversible proboscis of acanthocephala causes irreversible mechanical damage and physical stress to the infested host intestine, which also badly influences the nature of the gastrointestinal structure and results in pathological changes in the intestine (Ahmed, 1981). In order to better understand the host-parasite relationship, the current study was conducted to investigate the morphology of the parasite

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using SEM and determine the host responses against the parasite (Bodhe, and Wadhai, 2017).

MATERIAL AND METHOD

Freshwater snakehead fish, *C. morulius* (Figure 1), have been taken to the lab from the River Gomti of Lucknow for the current study. After that, the fish were dissected. Subsequently, the fish were dissected, and the intestines were carefully removed and placed in a Petri dish. The intestines were then longitudinally cut open and examined thoroughly for the presence of parasites. Only heavily infected intestines harbouring acanthocephalans (*Pallisentis* sp.) were selected for histopathological analysis (Figure 2). For histopathological examination, small tissue samples were excised from the most severely parasitized regions of the intestine. Intestinal tissues from fish that do not have parasitic infestations in their gut were collected and preserved as controls. Tissue samples were fixed, processed using standard histological procedures, sectioned at a thickness of 6 mm using a rotary microtome, and stained with haematoxylin and eosin. The stained sections were examined and photographed under a Nikon Eclipse 80i light microscope (Nikon, Tokyo, Japan) to assess pathological alterations. For scanning electron microscopy (SEM), the recovered parasites were initially fixed in 2.5% glutaraldehyde, followed by post-fixation in 1% osmium tetroxide. The specimens were then dehydrated through a graded acetone series, critical-point dried, and sputter-coated with platinum. Finally, the samples were examined and photographed using a JEOL JSM-7610F scanning electron microscope (JEOL India Pvt. Ltd.) operated at an accelerating voltage of 8 kV.

Figure 1: Freshwater fish *C. marulius.*

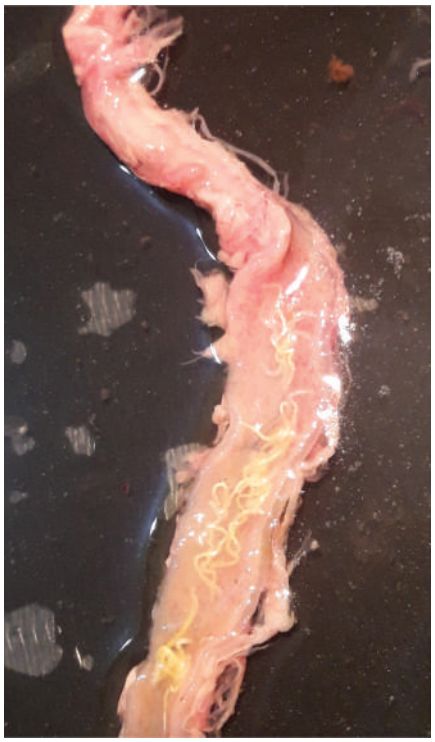

Figure 2: Longitudinally opened intestine of *C. morulius,* showing Acanthocephalan parasites that look like white threads adhered to the intestine.

RESULTS AND DISCUSSION

An extensive acanthocephalan infestation was discovered during the examination of the intestine of *C. morulius*' (Figure 2). The parasite has an eversible proboscis and a pale-to-white body (Mcdonough, *et al*., 1981). The anterior part of the parasite consists of a proboscis armed with four rows of hooks (Figure 3) (Lamont, J. T. 1992). These rows of hooks help the parasite attach itself to the host tissue (Gupta and Agarwal, 1983). The parasite has a collar armed by 14–16 rows of hooks. In addition to these collared hooks, this parasite also has hooks covering half of its trunk, indicating that it is a member of the genus *Pallisentis* (Yamaguti, 1935). These acanthocephalans are characterised by a special feature of their proboscis, which is eversible (Bhattacharya, 2007). At the host-parasite interface, macroscopically, shedding of intestinal epithelium and pale-yellow nodules were observed, which were more evident in areas of heavy infestation (Kabata, 1985). Thus, the presence of parasites is indicated by the fibrous nodules on the outer side of the intestine. In severe infections, the acanthocephala proboscis was reported to perforate the intestine, thereby widening the intestinal lumen and causing damage to the intestinal tissue (Dezfuli, 1991). Acanthocephala have a well-arranged, hooked proboscis that firmly attaches to the host intestine. They pierce the host tissues with their proboscis and cause damage to the villi (Figure 6). (Sanil,

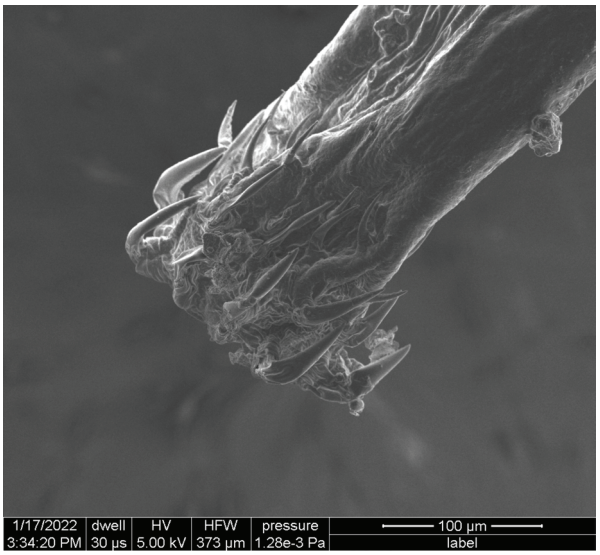

Figure 3: SEM image of the acanthocephalan parasite showing proboscis.

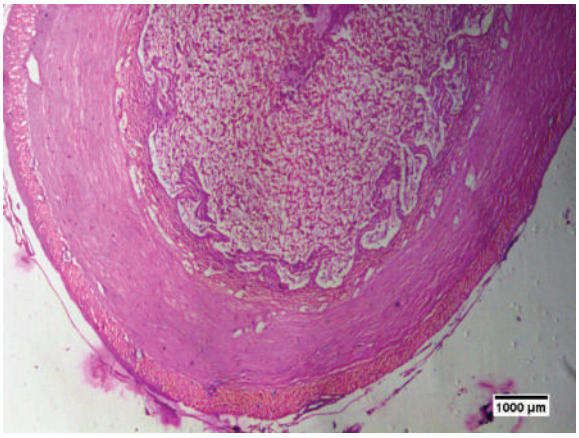

Figure 4: T.S. of uninfected intestine of *C. morulius.*

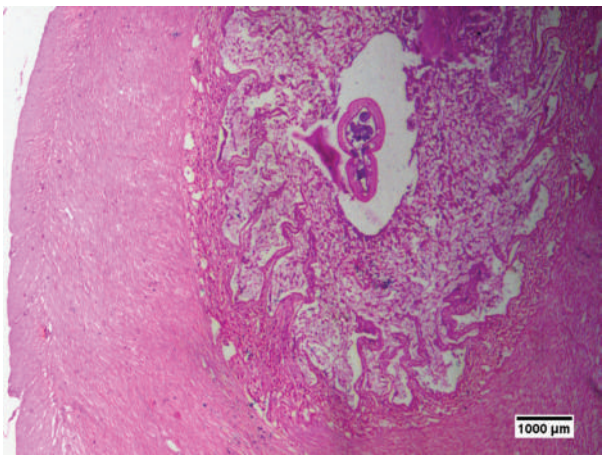

Figure 5: T.S. of infected intestine of *C. morulius* showing Acanthocephalan parasite in the centre of the lumen.

et al., 2011). When the structures of the uninfected (Figure 4) and infected (Figure 5,6) intestines were compared, it was seen that the damaged intestinal tissues in the infected

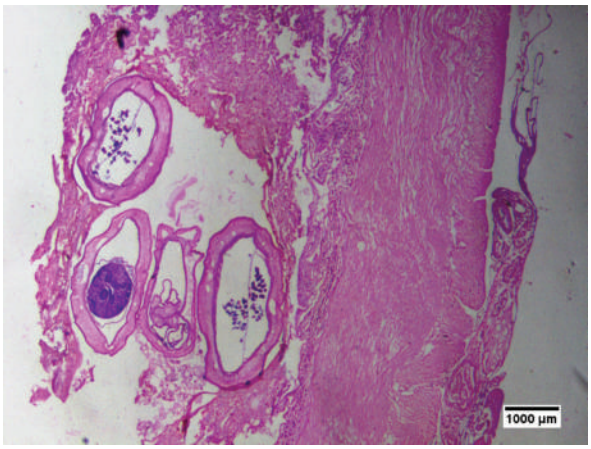

Figure 6: Depicts a T.S. view of an infected intestine with four acanthocephalan parasites presents in the lumen of the intestine. This demonstrates destruction of the villi, along with deterioration of the mucosal layer.

intestine had lost all of their villi structure (Figure 6), which means that the intestine had lost all of its ability to absorb food (Abidi, 2002). The site of attachment showed intense cellular infiltrations that resembled a granuloma (Irshadullah and Mustafa, 2012), the cells were recognised as fibroblasts, neutrophils, and plasma cells. Changes in an infested gut include hyperplasia (Figure 5), necrosis, and erosion of villi tips (Figure 6) (Abdelmonem *et al.,* 2010). The intestinal fold and muscle layer are generally more severely damaged by acanthocephalans, (Verma and Saxena, 2018) (Figure 6) and elicit a more complex host response, owing to their deep penetration into the intestinal mucosa (Bullock, 1963). Excessive mucous secretion and a notable rise in cells of mucous (Figure 5) have been observed in both mammals and fish with acanthocephalan parasite infection (Dua and Kumar 2006). The digestive and absorptive capabilities of intestine are badly damaged by the parasite, which has a negative impact on fish growth and health (Abidi, 2002).

CONCLUSION

Based on the findings of the present study, it can be concluded that the acanthocephalan parasite *Pallisentis* infects the intestine of *C. marulius* and induces severe pathological alterations in the host tissue. The parasite–host interaction resulted in an irreversible marked structural damage to the intestinal wall, particularly at the sites of parasite attachment. The pathogenic effects are primarily associated with the firm anchorage of the parasite to the intestinal villi, leading to extensive tissue disruption. Histopathological examinations revealed significant alterations in the intestinal structure, including degeneration of the mucosal epithelium and lamina propria. The epithelial lining at the attachment sites was severely damaged, with complete destruction observed in some regions. Such damage is likely to impair normal digestive and absorptive functions of the intestine, thereby affecting the nutritional status and overall health of the host

fish. In addition, the release of metabolic and excretory products by the parasite may contribute to local toxicity and further exacerbate tissue damage. These pathological changes can interfere with the normal secretory and physiological activities of the intestinal epithelium, potentially leading to metabolic disturbances in the host. The present study highlighted the detrimental effects of *Pallisentis* infection on the intestinal integrity of *C. marulius* and demonstrated that acanthocephalan infestation can have serious consequences for fish health. Overall, the histopathological evidence clearly indicated that *Pallisentis* exerted a significant adverse impact on its host.

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