

## A Study of the Histopathological Alteration in the Intestine of the Fish *Channa gachua* (Hamilton, 1822) (Channidae) by Acanthocephala

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### Abstract

The goal of the present study is to determine how pathogenic indices affect the freshwater fish *Channa gachua* (Hamilton, 1822) Channidae. *C. gachua* is a fish with a high and good protein content and a good economic value. Intestines of infected and uninfected fish were stored separately and histological alterations were studied. *C. gachua* has serosa, muscularis, submucosa, and mucosa as intestinal layers. In order to examine the changes in the intestine's histopathology, the intestines of infected and uninfected fish were preserved in 10% formalin and double stained with eosine and haemotoxilin, and then the slides were thoroughly examined. Infected intestines are found to be severely damaged. Infected fish have pathological lesions in their intestines. Infected intestines show changes in lamina propria and villi. Intestinal villi and serosa layers, along with tunica muscularis in the T.S. of infected intestine, seemed damaged. The T.S. also shows deep damage in the lamina propria., indicating that acanthocephalans severely harm the host intestine. These changes badly affect digestion, absorption of nutrients, storage, and secretion ability of the intestine. This is the first report of histological changes in *C. gachua* caused by an acanthocephalan parasite of the genus *Pallisentis*.

**Keywords:** Histopathology, *Channa gachua*, *Pallisentis*, Acanthocephala, Intestine, histology.

### Introduction

Acanthocephala are helminth parasites that employ vertebrates as their intermediate hosts<sup>[9]</sup>. A variety of helminth parasites are infested by *Channa gachua*. Due to its small size, *Channa gachua* is also known as a dwarf snakehead. In India, *C. gachua* is known as a scrumptious fish dish<sup>[25]</sup>. Mital and Lal (1976)<sup>[17]</sup> reported the presence of acanthocephalan parasites in *C. gachua*. One of the primary factors contributing to high rates of mortality in aquatic species

is the presence of parasites<sup>[20, 25]</sup>. Several kinds of helminths, including acanthocephalans, cestodes, trematodes, and nematodes, can be observed in *C.gachua* but are considered invasive in their natural environments. Scientists have found that parasites not only cause terrible infestations and diseases, but they also damage a wide range of host tissues<sup>[1,14,15,24]</sup>. When a parasite comes into contact with a host, the host responds by triggering an inflammatory response at the cellular level. It is assumed that the host can identify self-material apart from non-self-material<sup>[12]</sup>. The management of fish health and the development of aquatic crops are being increasingly threatened by parasitic illnesses, which are on the ascent. As a result, scientists must devote significant attention to it in order to ensure long-term aquaculture productivity. If a human unintentionally consumes the fish while it is still raw or only partially cooked, the parasite will attach itself to the oesophagus of the human and cause illness. Fish diseases is mostly caused by intestinal wall thickening and haemorrhage. They might impede digestion and induce tissue damage, which would be detrimental to the fish's health. The protruding proboscis of acanthocephalan parasites serves as the attachment organ. They consume food by absorbing pre-digested food from the host intestine<sup>[16, 18]</sup>. The alkalinity or other physiological characteristics of a fish's intestine may provide a favourable site for a specific species metabolism, depending on the host. The host's diet has a significant impact on the development of helminth parasites. According to Gaikwad *et al's* <sup>[8]</sup> study, these parasites consume nutrients from the host, which prevents healthy normal growth and damages the host's gastrointestinal tissue by causing lesions and atrophy.

### Materials and Methods

The *Channa gachua*, (Hamilton, 1822) a freshwater fish, was procured from the ponds of Kevalhar and Gadhi near Malihabad, Lucknow, India. The *Channa gachua* were then brought to the lab, first superficially examined and, afterwards dissected and observed internally by removing the gut in 0.9% physiological saline. The gut was longitudinally cut opened, and the parasites are examined thoroughly. In (fig 1b), the acanthocephalan parasites are shown attached to the host's intestinal tract. The acanthocephalan parasites were preserved overnight in 2.5% glutaraldehyde solution and then subjected to additional processing for Scanning Electron Microscopy examinations. In order to do histopathological research, the infected portion of the intestine that was infested with the acanthocephalan parasite was left undisturbed and fixed in 10% formalin for the next 24 hours. However, for

comparison, uninfected intestine was also stored in 10% formalin for a day. After 24 hours of formalin preservation, sections were cut, embedded in paraffin wax, and stained using the Haematoxylin and Eosin (H and E) stain method [7,2]. The slides were chosen, examined, and photographed.

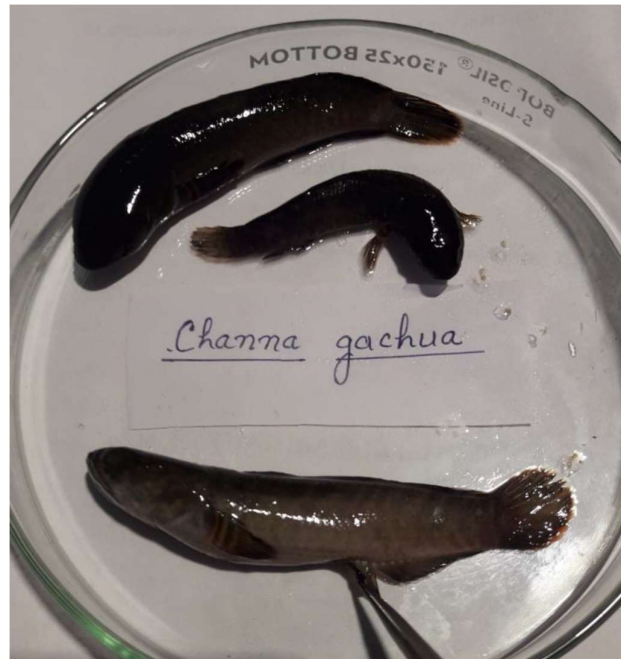


Fig. 1a. Fish *Channa gachua*



Fig. 1b: Longitudinally cut intestine of *C. gachua* with attached acanthocephalan parasites.

## Results

The results shows that *Pallisentis* first adhere to the host fish's intestine via hooks on the proboscis (Fig. 2a and 2b shows the hooks). Acanthocephalan *Pallisentis* were found attached to the gut of the host as long white threads (shown in Fig. 1b). On comparing the infected and uninfected intestines, pathological alterations were observed. Fig. 3a depicts T.S of uninfected intestine, while Fig. 3b, 3c, and 3d depict T.S. of infected intestines. Villi atrophy (Fig. 3d), perforated serosa (Fig. 3c), as well as an uneven villi shape are further signs of infestation in the intestine (Fig. 3b). The acanthocephalan parasites influence the host's circulatory system, internal secretory glands, nervous system, digestive system in addition to changing the shape of the infected intestine. Additionally, they interfere with the host's neurological system and the alimentary canal's secretory functions. All these detrimental consequences may cause the host to become ill or perhaps die. The parasite's ability to adhere to the intestinal mucosa determine the damage and level of pathogenicity in host. The primary pathogenic changes in the host are aberrant intestinal layer or atrophy and gut cell damage or haemorrhage (Fig. 3d). The tissue injury is extremely noticeable. Epithelial necrosis was widespread in the gut (Fig 3b). The villi are shrinking, which causes the intestinal lumen to enlarge, resulting in destruction of the gastrointestinal folds (Fig. 3c and 3d). The intestine also exhibits fibrosis linked to hyperplasia and metaplasia as histological alterations. (Fig 3d). The degeneration of the intestine's distinct layers is caused by the proliferation of submucous cells. The pathogenic consequences include thickening and mucosal injury. Reduced size of mucosal and submucosal layer is a shows acanthocephalan infections.<sup>[19]</sup> The acanthocephalan infestations in fishes has been thoroughly researched, but knowledge on the pathogenic implications, especially in freshwater fish species, is still relatively scant.

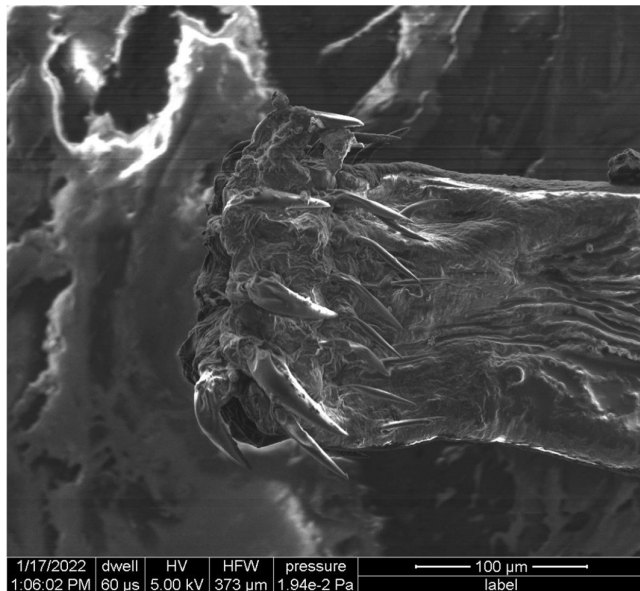


Fig. 2a. Proboscis of Acanthocephala of the genus *Pallisentis* showing 4 rows of hooks.

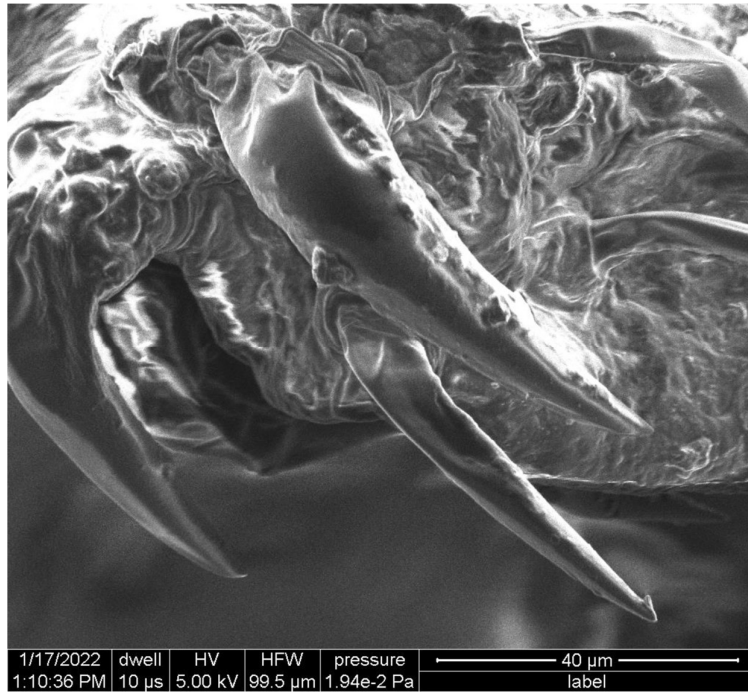


Fig. 2b. First and second row hooks are shown here.

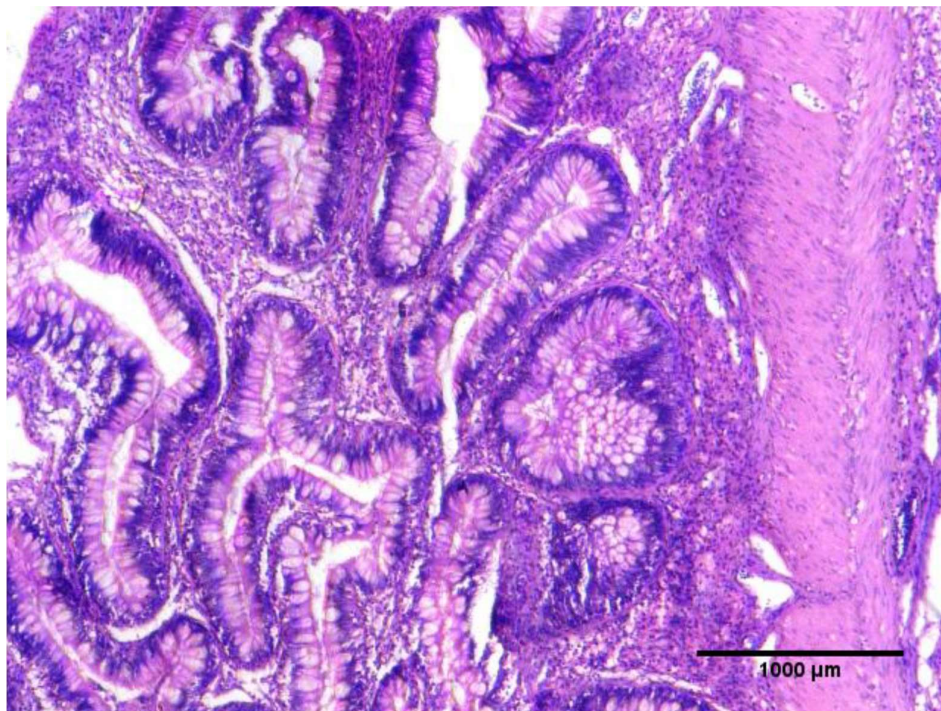


Fig 3a: TS. showing uninfected Intestine of fish *Channa gachua*

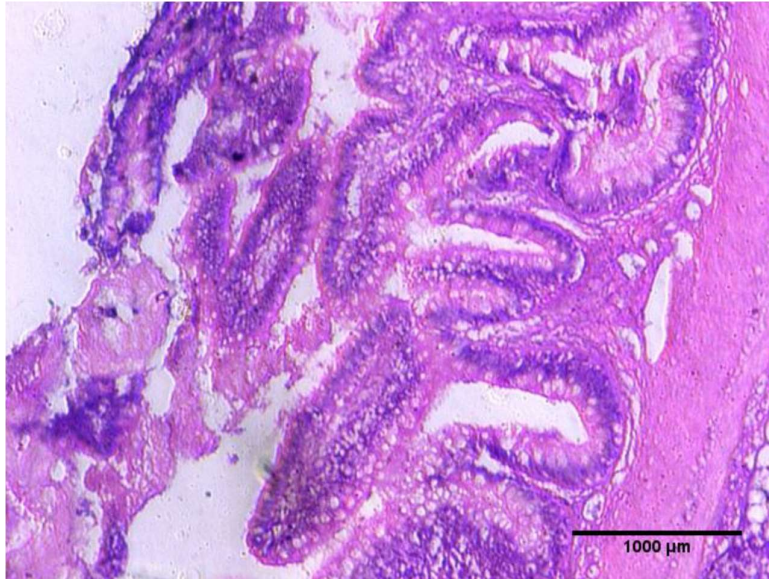


Fig 3b: T.S. showing Infected Intestine of fish *Channa gachua* demonstrating villi breakdown, uneven villi morphology, creation of thick circular and longitudinal layers, and epithelial necrosis

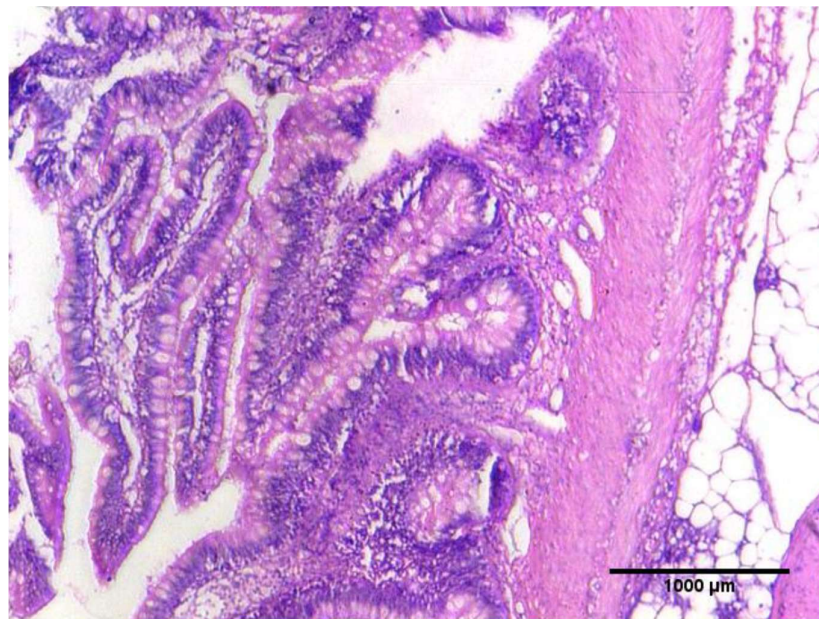


Fig 3c: T.S. showing Infected Intestine of *Channa gachua* with hyperplasia and ruptured serosa layers



Fig 3d: The T.S. of an infected *Channa gachua*'s intestine exhibits a perforated mucosal layer, villi degradation, fibrosis accompanied with hyperplasia, and metaplasia.

## Discussion

Parasitic helminths disrupt physiology of host by entering and infesting in the intestine, affecting not only the shape of the intestine but also severely interfering with the host's metabolism and nutritional ability. There is a reciprocal relationship between parasites and hosts that results in host pathogenicity. As these fishes are major sources of high-quality protein for humans, the consequence of the parasitic infection on the fish hosts is of enormous significance. Benarjee *et al*<sup>[3,4,5]</sup> studies the patho-physiology of fish intestinal trematode infection. There have been numerous research on fish acanthocephalans, but few of them have focused on the histological alterations. Bose and Sinha (1979)<sup>[6,2]</sup> studied the histopathology of *Channa gachua* (Ham) infested with the d trematode *Genarchopsis goppo*, but no research has yet been done on the histopathology of this fish infected with the acanthocephalan parasite. This is the very first paper to address the *Channa gachua*'s histopathological changes by *Pallisentis*. The mucosa, submucosa, muscularis, and serosa layers of the infected intestine have endured substantial damage, which is clearly visible in the histology of the tissue. The intestine had a layer of columnar epithelium containing

microvilli, significant villous folding, and a profusion of Goblet cells (Fig. 3a). Compact connective tissues and many blood vessels composed the lamina propria, particularly at the villi's extremities. The pathogenic impact manifests as villus degeneration, broken serosa layers, and villus irregularity (fig 3b,3c and 3d).

As a result, the parasite comes into contact with the host tissue and uses its nutrients for survival and growth. This weakens the host, stunts its growth, and damages the host's intestinal tissue, as shown by the extrusion of villi and the swelling of intestinal layers. The diseased stage of the host undoubtedly modifies the amounts of different metabolites throughout the body, changing the host's physiological and metabolic processes. The impact of parasitic infestation on the host results in a cascade of interactions that eventually slow down digestion and other metabolic functions. The villi with serosa layer of the intestine are damaged when acanthocephalan parasites use their hooked proboscis to enter the innermost layer of the intestine (Fig. 2a and 2b). Benarjee and Laxma Reddy (2006)<sup>[3]</sup> noted comparable tendencies; In the present article, we have examined into several histopathological alterations spurred on by acanthocephalan parasites of the genus *Pallisentis* that naturally infested the host *C. gachua* intestine. These histological alterations, such as aberrant tissue, cellular hypertrophy, cytoplasmic degeneration, and sinusoid, were also noted in *Channa punctatus* by *Clinostomum complanatum* infestation by Shareef and Abidi (2015)<sup>[25]</sup>. Acanthocephalan, nematode, and trematode parasites are been found in the lumen of intestine of the *C. gachua*, infesting the intestinal layer and causing harm to the villi (Fig. 1b), which is similar to the findings of Gaikwad et al. (2016) on the *C. gachua* in which they confirmed changes in intestinal wall and mucosa prompted by the cestode. Reddy and Benerjee (2014) also observed villi destruction, inflammation, and necrosis in the intestine of *C. punctatus* as a result of the helminth infection<sup>[24]</sup>.

## Conclusion

Eating fish has a direct impact on the health of humans. The destructive components of the parasitic infestations are what cause infectious illnesses and high rates of host fish mortality. These fish are more likely to transfer zoonotic infections than other fish. Fish parasite research is required because parasites lowers fish productivity, resulting in a decrease of economic returns and protein sources. According to the outcomes of this study, *Channa gachua* is infested with the acanthocephalan parasite *Pallisentis*, which uses

host nutrients and alters the metabolites level in the body, resulting in a change in physiological and metabolic activities of host. It will have a negative impact on the host's economic or nutritional quality<sup>[22]</sup>.

### Declaration of interests

Chandni Fatima Naqvi reports financial support was provided by University Grants Commission. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Acknowledgement

The authors are thankful to the Head, Department of Zoology, at the University of Lucknow for providing the research facilities and King George Medical University for providing facilities for SEM.

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