Intestinal Histopathologies due to infestation of *Bothriocephalus acheilognathi* in the common carp, *Cyprinus carpio* (Linn. 1758)

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**Abstract**

The present investigation was undertaken to study the intestinal histopathologies due to infestation of helminth parasite, *Bothriocephalus acheilognathi* in the *Cyprinus carpio*. Only symptomatic and moribund samples of adult diseased fishes of *Cyprinus carpio* were collected and were brought to the laboratory for patho-morphological and patho-anatomical examinations. The main histopathological lesions and changes were seen in the intestine. The prominent cells were shrinking of nucleus indicating pyknosis gradual loss of parts and mucosal and submucosal cells, excessive mucus secretion and lymphatic infiltration in lamina propria. Further edema and extreme of necrosis as apparent from cells undergoing process death was another important pathology induced by *B. acheilognathi*. In addition to these findings, shorting atrophy and villi almost complete loss of normal architecture changes were found histopathologically important in intestine of *C. carpio*. No changes were noticed in other organs of the affected fishes. In severe infestations the fishes showed growth retardation.

**Keywords:** *Bothriocephalus acheilognathi*, histopathology, cestode, intestine, symptom, *Cyprinus carpio*

**Introduction**

Helminths constitute one of the major and important group of parasites of fish and cause a severe loss in fish production (Jha, *et al.* 1992) [9]. Like other parasites, helminthes also take nutrition from their hosts thereby depriving them of required nutrients and growth retardation resulting into morbidity and mortality with consequent economic losses (Marcogliese, 2001) [8]. It is important to mention here that the parasitic infestations are reportedly playing a major role in disease occurrences (78%) in Indian freshwater aquaculture. There are around 21% production loss due to diseases, poor farm management practices and impaired growth.

Fish play the most significant role as host in helminths life cycle. The helminth parasites induce pathological lesions or histological damages in tissues, thereby greatly reducing their nutritional value and become potential to human health due to consumption of such infected fishes (Camargo and Martinez, 2007) [2]. Histological changes are used as indicators of the health of overall population in the ecosystem (Ramdu and Dash, 2015) [9].

So the objective of the present study was to investigate the exerted profound effects on histology of intestine in common carp, *Cyprinus carpio* by cestode, the Asian fish tapeworm, *Bothriocephalus acheilognathi* (Yamaguti, 1934) [10] infestation.

**Materials and Methods**

Frequent incidences of naturally occurring *Bothriocephalus acheilognathi* infestation was recorded in the cultivated ponds/tanks/rivers in Darbhanga, Bihar during the period of observation (2017-2019). Only juvenile and adults of common carp parasitized with *B. acheilognathi* were brought to the laboratory for Patho-anatomical examinations. After that small bits of tissues (3-4 mm thick) from the intestine etc. of moribund or freshly killed diseased fish (common carp) samples were collected and fixed in ten percent Neutral Buffered Formalin for 18-24 hours. Fixed tissue samples were then processed and paraffin embedded blocks of all the tissues were prepared using the standard histological methods (Luna, 1968) [6]. Calcified tissues like skin and gills were decalcified in ten percent Nitric Acid which helped in getting perfect and unbroken serial sections of these tissues during microtomy.
Tissue blocks were cut into serial sections (5-7 thick) by a rotary microtome. For routine staining of the histological sections, Ehrlich’s Haematoxylin (H.) and alcoholic Eosin (E.) stains were prepared and used according to Luna (1968) [6]. Photomicrographs of the most characteristic regions of histopathological lesions in the stained tissues of diseased fish samples were taken.

Result
This disease has been found to occur predominantly in the in the large fish culture ponds. The disease is caused by a cestode, parasite B. acheilognathi which attracted particularly the intestine of the fishes.

Fish Species affected: juvenile / adults of Cyprinus carpio, (Linn.1758) has been found to be affected by this disease.

Clinical Symptoms and Gross pathology: Highly affected fishes showed growth retardation, weight loss, lethargic swimming behaviour, loss of appetite and tendency to take shelter near pond margin. Histopathological examination of the intestine of Cyprinus carpio was infested parasitized B. acheilognathi. The parasite has a ribbon-like body measuring between 35.0 to 80.0 mm in length and 2.5 to 4.0mm in width, inverted heart shaped scolex. Its body consists of flattened segments or proglottids.

Histopathology
The intestine of the normal C. carpio exhibited well ordered arrangement of the usual four layers i.e., serosa, muscularis, submucosa and mucosa (Figure-1). The outer most thin vascular covering is the serosa. The mucosa is formed of columnar epithelial cells thrown into a number of folds or villi. Intestinal histopathology in C. carpio due to infestation of B. acheilognathi following alteration found, the intestinal cells were observed to have shrinking nucleus, a symptom of pyknosis and gradual loss of parts of the cells (mucosal as well as submucosal), edema, and extreme condition of necrosis denoting cells undergoing process of death (Figure-2). Besides, excessive mucus secretion, lymphatic infiltration in bothrial lamina propria observed.

The parasites attachment to gut the host fish was observed to engulf the intestinal folds which compressed the mucosal epithelium, exerted localized pressure and induced necrosis and hemorrhage (Figure-3). The formation of pits were extending almost up to muscularis due to compression exerted by the bothria for firm attachment of scolex in gut wall also apparent and this also induced loss of brush border (Figure-4). Again thinning of the intestine at the point of attachment of the parasite was also obvious.

Diagnostic histopathological lesions identified: The intestine was greatly obstructed and weakened due to infestation of the parasite as apparent from the distention and compression of illi and highly pronounced thinning of intestinal wall. Again, there was almost complete loss of normal architectural plan of the intestine besides congestion, compression, necrosis, thinning and shortening or atrophy of the villi (Figure-5). Other vital organs of the affected samples did not show any histopathological changes.

Fig 1: T. Section of intestine of normal Cyprinus carpio. H. & E., X 150.

Fig 2: Due to infestation of B. acheilognathi in intestine of Cyprinus carpio showing (→) very high degree of intestinal compression with necrosis and complete loss of epithelium. H. & E., X 150.

Fig 3: Due to engulfment of intestine by scolex of B. acheilognathi showing compression of mucosa (→) localized haemorrhage (*). H. & E., X 150.
Bothriocephalus acheilognathi in the common carp is a matter of concern as this parasite has the ability to adjust and multiply in new habitat/ region in diverse type of fishes. The significant histopathological changes includes hyperplasia and hypertrophy of intestinal villi, vacuolation in submucosal layer and proliferative changes leading to degeneration of various layers of the intestine infected with parasite.

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