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Research Article

FIRST REPORT ON FISH-BORNE ZOONOTIC CESTODE LARVAE OF *DIBOTHRIOCEPHALUS* LÜHE, 1899 IN FRESHWATER FISH, *OREOCHROMIS NILOTICUS* (LINNAEUS, 1758), FROM THE HEMAVATI RIVER, KARNATAKA (INDIA)

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ABSTRACT

The Broad Tapeworm, *Dibothriocephalus* Lühe, 1899 is a widespread cestode parasite infecting freshwater fishes worldwide and is the causative agent of zoonotic disease Diphyllobothriasis. Freshwater food fish, *Oreochromis niloticus* (Linnaeus, 1758), is of immense commercial importance and consumed all over the world due to its affordability and palatable nature. The present study records the occurrence of *Dibothriocephalus* larvae in the intestine of *Oreochromis niloticus*, collected from the Hemavati River, Hassan district, Karnataka and forms the first report of *Dibothriocephalus* larvae in *Oreochromis niloticus* and also forms the first report from Karnataka, India.

Keywords: *Diphyllobothrium*, Nile tilapia, Procercoid, Zoonosis.

INTRODUCTION

Dibothriocephalus Lühe, 1899 (Syn. *Diphyllobothrium*) infections have been reported throughout the world from fishes, cats, dogs and humans. Fish eating mammals including humans serve as definitive hosts of the parasite whereas aquatic copepods and one or more freshwater fishes serve as intermediate hosts (ANSES, 2012). Four parasite species belonging to Family Diphyllobothriidae are known to infect humans: *Dibothriocephalus latus* (Syn. *Diphyllobothrium latum*), *D. nihonkaiensis* (Syn. *Diphyllobothrium nihonkaiense*, *D. klebnoviskii*), *Adenocephalus pacificus* (Syn. *Diphyllobothrium pacificum*) (Dupouy-Camet, 2004; WORMS).The majority of tilapia are freshwater fish that live in lakes, ponds, rivers, and small streams. They are less frequently seen in brackish water. Tilapia are now the second most significant farmed fish in the world, after carps (Fitzsimmons and Watanabe, 2010).

Oreochromis niloticus (Linnaeus, 1758), commonly known as Nile tilapia has a wide natural distribution ranging from the Nile River basin in the south through the Eastern and Western Rift Valley lakes in East Africa, and through the Lake Chad, Niger, Benue, Volta, Gambia and Senegal river basins in the west (Trewevas, 1983). Its introduced range has now widened, covering at least 85 countries of tropics, subtropics and temperate environments (Lowe *et al.*, 2012). On a global scale, it is the most important tilapia species in aquaculture, supporting major capture fisheries (Genner *et al.*, 2018). Nile tilapia constitutes the majority of tilapia currently being produced in India (Fitzsimmons and Watanabe, 2010).

Oreochromis niloticus (Linnaeus, 1758), has become extremely popular in fish culture systems across India because of its ease of maintenance and profitable yield in response to the rising demand for fish. It is widely used as an inexpensive and convenient source of animal protein across the nation. The presence of infective *Dibothriocephalus* larvae in *Oreochromis niloticus* is an alarming situation for both public health and commercial viability, given the fish's widespread consumption and availability in fish markets.

MATERIALS AND METHODS

The host samples (*Orechromis niloticus*) were collected in early October 2023, from Hemavati River (12°49'52" N,

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7603'15" E) flowing through Hassan district in the southern part of Karnataka. Two of the samples were dissected in order to study the presence of helminth parasites. Numerous procercoid larvae were visible on the outer surface of the intestinal wall, of which 10 were collected from each host. The larval samples were initially kept in normal saline and later they were pressed between a slide and a cover slip for better visibility of morphological characters under a microscope. After fixation in FAA (formaldehyde, alcohol, acetic acid), the specimens were kept in 70% alcohol for further processing. Then they were stained using Borax Carmine and dehydrated through graded alcohol series from 70 % to absolute alcohol and finally in rectified Xylene. After cleaning with clove oil, permanent slides were made using Canada balsam as mounting medium. The specimens were studied under the Microscope Leica DM 1000.

RESULTS AND DISCUSSION

The recovered procercoid larvae of *Dibothriocephalus* were elongated in shape, measuring 550-900µ in length and about 150-310µ wide. The earlier stages were shorter, exhibiting cercomer with hooklets (each about 30µ long) and a distinct cephalic invagination. The later stages were longer with a retracted scolex-like structure forming a ridge at the anterior end (Figure1).

Figure1. *Dibothriocephalus sp.* a-c. Developing stages of procercoid larvae (Hl.:hooklets, Cr.:cercomer, Ci.:cephalic invagination, R.:ridge).

The introduction of *Oreochromis niloticus* in Indian aquaculture dates back to1987 (Singh and Lakra, 2006). In India, it has been reported from several states including Andhra Pradesh (Jesintha *et al*., 2020), Telangana (Laxmappa, 2016), Karnataka (Naik *et al*., 2013), Tamil Nadu (Sathish *et al*., 2021), Kerala (Raj *et al*., 2016), Madhya Pradesh (Johnson *et al*., 2020), Chhattisgarh (Raghav and Dixit, 2009), Maharashtra (Gorghate *et al*., 2021), Gujarat (Boussou *et al*., 2024), Uttar Pradesh (Singh *et al*., 2021), Bihar (Gunasekar and Isaac, 2017), West Bengal (Behera *et al*., 2018) and the North East (Munilkumar and Nandeesha, 2007). Reports are also available from different river systems of the county including the Ganga river (Singh *et al*., 2014) and its

tributaries (Dwivedi *et al.*, 2015), from the Yamuna river (Alam *et al*., 2014) and its tributaries (Dwivedi *et al.*, 2017; Mayank and Dwivedi, 2017).

Orechromis niloticus has been reported as the intermediate host of several helminth parasites from different parts of the world (Ranzani-Paiva *et al.*, 2005, Ashade *et al*., 2013, Hussein and Jossy, 2015, Hung *et al*., 2015, Paredes-Trujillo *et al*., 2016, Sinaré *et al*., 2016, Arguedas *et al*., 2017, Dao *et al.*, 2017, Adugna, 2020). However, reports of *Dibothriocephalu*s (Syn. *Diphyllobothrium*) infection in *Orechromis niloticus* are relatively fewer and are available from Nigeria (Edeh and Solomon, 2016, Omeji *et al*., 2022), Kenya (MjakaKhamis *et al*., 2017), Ethiopia (Sorsa *et al*., 2019) and Bangladesh (Aunamika *et al.*, 2021). Although Kumari *et al*. (2021) have reported the presence of *Diphyllobothrium* in Tilapia from India (Madhepura region of the River Kosi), the species has not been mentioned. Therefore, the present study constitutes the second report of *Dibothriocephalus* larvae in Tilapia from India, and the first report of the parasite in *Oreochromis niloticus* from Karnataka, India.

Diphyllobothriasis, a zoonotic disease in mammals is caused by the ingestion of raw or partially cooked fish containing the plerocercoid larvae of *Dibothriocephalus*. Zoonosis is an animal disease communicable to humans by several modes of transmission (Pal, 2005). The life cycle of the parasite involves definitive hosts such as humans and other fish-eating mammals and usually two intermediate hosts including a planktonic crustacean and one or more freshwater fishes. When environmental conditions are favourable, the eggs released in freshwater with the faeces of the definitive host, complete their maturation and then hatch into a ciliated embryo, the coracidium. The coracidium develops into procercoid larvae when ingested by the crustacean host within their body cavity. When a fish consumes the infected crustacean, the parasitic larva develops into the next stage, called plerocercoid. The plerocercoid takes approximately one month to lay the first batch of eggs which are released with faeces (ANSES, 2012).

Diphyllobothriasis is associated with eating raw fish and is endemic to Serbia, Scandinavia, North America, Japan, and Chile (King, 2002). Although there have been numerous reports of Diphyllobothriasis in humans throughout the world, they are comparatively rare from India. It was reported for the first time in India by Pancharatnam *et al*. (1998), followed by Devi *et al*. (2007), Ramana *et al*.(2011), Sahoo and Devi, (2013) and Ashrafulla *et al*.(2017), all from South India. The common symptoms include weakness, dizziness, salt craving, diarrhoea, abdominal discomfort, and reduced vitamin B12 absorption (Baily, 2003). Measures for prevention of infection in humans include educating the population to abstain from consuming raw or undercooked fish , treating the existing carriers of the pathogen to prevent contamination of the environment , cooking fish to 56° C for 5 minutes or freezing it to -10° C for 48 hours to kill the infective plerocercoids (Pal *et al*., 2014).

CONCLUSION

The popularity of Tilapia as a food fish in India warrants due awareness regarding its potential to act as a reservoir of the infective stages of cestode parasite *Dibothriocephalus*, responsible for causing Diphyllobothriasis in humans. Moreover, cestode parasites of fishes are known to interfere with the metabolic processes of fishes, hindering optimum growth and causing economic losses in the fish industry. Also, cultured species like Nile tilapia are more susceptible to such infections due to overstocking and poor water quality management (El-seify *et al*. 2011). The presence of *Dibothriocephalus*, a zoonotic cestode parasite in food fish *Oreochromis niloticus* requires urgent attention as it has both economic implications and significant health risk.

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