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ORIGINAL ARTICLE

Studies on Infection Prevalence of Parasitic Helminthes in Gastrointestinal Tract of *Clarias batrachus* L.

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ABSTRACT

The present investigation deals with prevalence of two genera of parasitic helminthes viz. Lytocestus Cohn 1908 (Cestoda: Caryophyllidea) and Dichelyne Jägerskiöld 1902 (Nematoda: Rhabditida) isolated from the gastrointestinal tract of freshwater walking catfish, Clarias batrachus L. (Siluriformes: Clariidae) collected from the Western Uttar Pradesh during August-December 2024. The live fish hosts were collected from ponds of district Meerut region and river Yamuna of district Shamli region of Uttar Pradesh, India. An overall average cestodes and nematodes infection prevalence (IP %) 36.66 % and 43.33 % was enumerated in the selected fish hosts during study. Our study aimed to provide a comprehensive understanding of these parasitic infections and their implications for fish health and aquaculture management.

Keywords: *Cestodes, Nematode, Catfish, Lytocestus, Dichelyne, Clarias, Parasitic helminthes*

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INTRODUCTION

Fish is considered one of the healthiest sources of dietary protein, with approximately 25% of the global population's animal protein intake derived from fish. Recent studies highlight its significance as an affordable and nutritious option for meeting protein requirements [1-2]. Fishes are an important part of the world's ecosystem since they are a diversified group of animals that live in a variety of watery habitats. Fish play a crucial role in maintaining ecological balance and supporting human survival. According to the Food and Agriculture Organization of the United Nations, aquaculture now significantly contributes to global nutrition [3-4]. *Clarias batrachus* L. (Siluriformes: Clariidae) commonly known as the walking catfish or Asian catfish, holds a significant ecological and socio-economic value in freshwater ecosystems across the Meerut and Shamli region. The fishes of these regions *batrachus* are vulnerable to a range of parasitic diseases, which can have a substantial effect on fish health.

Parasitism is a type of symbiotic relationship in which the smaller one (parasite) utilized the larger one (host) for the purpose of food, shelter, site of reproduction. The parasites are adapted and equipped structurally (morphologically and anatomically) and physiologically very efficiently for this way of life [5-9]. The parasitic organisms as causative agents to various diseases in their hosts are primarily grouped as Protozoa, Helminthes and Arthropoda [10-14]. An efficient parasite did not conspicuously kill their hosts but they utilize hosts to grow, reproduce by stabbing organ systems that build their hosts sick physically, physiologically and behaviorally, resulting as a warning sign of parasitic infection [15-18]. The helminthes are invertebrates with distinct multicellular, triploblastic, acoelomate/ pseudocoelomate

characteristics and most commonly called as worms including flukes (trematodes), tapeworms (cestodes), thorny-headed worms (acanthocephalans) and roundworms (nematodes) [19-21]. Parasite can have a wide range of impact on the ecology of their hosts in terms of health [22]. After acquiring infection, fish may perform certain types of simple or complex behavior [23]. According to Leong and Holmes [24], the richness and diversity of fish parasite communities depend on the number of related hosts in the respective habitat, on the sizes of host specimen and of host populations. The present study deals to comprehensive examination of parasitic helminthes found in the gastrointestinal (GI) tract of *C. batrachus* that can negatively impact the fish health, vitality and management of aquaculture.

MATERIAL AND METHODS

The *Clarias batrachus* (Walking Catfish) purchased from local market fisherman of Meerut and Shamli region of Uttar Pradesh, India. The gastrointestinal tract was teased and examined carefully with the help of Binocular microscope to extract the endoparasitic helminthes. All the living and non-living parasites picked up using fine glass dropper and thoroughly washed in the lukewarm water to remove debris. Prior to prepare temporary or permanent mounts, the worms were observed under dissecting and bionocular microscopes to identify the taxonomic group of parasitic helminthes. The cestodes were relaxed and fixed in hot 4% formaldehyde, stained in aqueous solution of Mayer's Haemalum, dehydrated using a series of alcohols, cleared in xylene and mounted in Canada balsam. The nematodes were relaxed and fixed in a standardized mixture of hot ethanol and glycerine for overnight, cleared in lactophenol, and provisionally mounted in glycerol for microscopic observation. The microphotographs were captured using Image Analyzer unit "MOTIC" through Biovis Image Plus software and Nikon Trinocular Computerized microphotography unit. The infection prevalence (IP %) was enumerated using standard statistical formula as suggested by Malhotra [25].

RESULTS AND DISCUSSION

A sum of 30 fish (15 males and 15 females) collected during the period of study (August-December, 2024). There were two types of parasitic helminthes (cestodes and nematodes) were recovered from the infected hosts.

Generic Diagnosis

The generic diagnosis of cestode specimens was done based on the elongated, flat body without segmentation and bluntly tapering anterior extremity with undifferentiated smooth, unarmed scolex followed by short neck [26]. The body proper was divisible into outer cortical (comprising dispersed vitellaria) and inner medullary (comprising reproductive structures like testes and ovary) zones by the longitudinal muscle lining ascertains the inclusion of the worms in the family Lytocestidae. Further, the postovarian yolk glands absentia, thick coating of accompanying cells around uterine coil and ejaculatory duct enclosed within a compact parenchymatous bulb, confirmed the recovered cestode specimens as to the genus *Lytocestus* Cohn 1908 (Caryophyllidea: Lytocestiidae) [27] (Fig. 1).

The recovered parasitic nematodes were identified on the basis of 'Key to the Fish Nematoda' and CIH Keys to the Nematode Parasites of Vertebrates' as a genus *Dichelyne* Jägerskiöld 1902 [28] (Fig. 2). The worms diagnosed with slit of mouth perpendicular to body axis, laterally narrowed pseudobuccal capsule, three small oral papillae, and peribuccal cuticularized frame with few cuticularized plates, large dumbbell shaped oesophagus divisible into muscular and glandular part, distinct dorsal intestinal caecum running anteriorly and excretory system with lateral canals lined with cuticle. The male worms characterized with pre-anal sucker without rim, uneuqal paired spicules, gubernaculums, and eleven pairs of caudal papillae. The female roundworms comprised post-equatorial vulva, didelphic ovaries, oviparous and eggs non-embryonated without polar plug.

Taxonomic Summary

Class: Cestoda
Order: Caryophyllidea
Family: Lytocestiidae
Genus: *Lytocestus* Cohn 1908 [27] (Fig. 1)

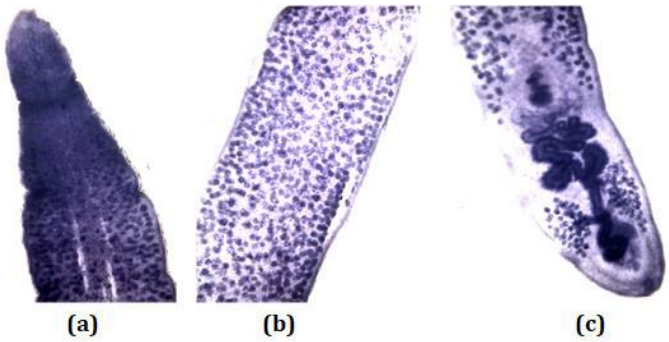

Fig. 1: *Lytocestus* sp. recovered from gastrointestinal tract of *Clarias batrachus* (figures not to scale bar). (a) anterior end with unarmed scolex , (b) body proper, (c) posterior end reproductive structures.

Class: Nematoda
Order: Rhabditida
Family: Cucullanidae
Genus: *Dichelyne* Jägerskiöld 1902 [28] (Fig. 2)

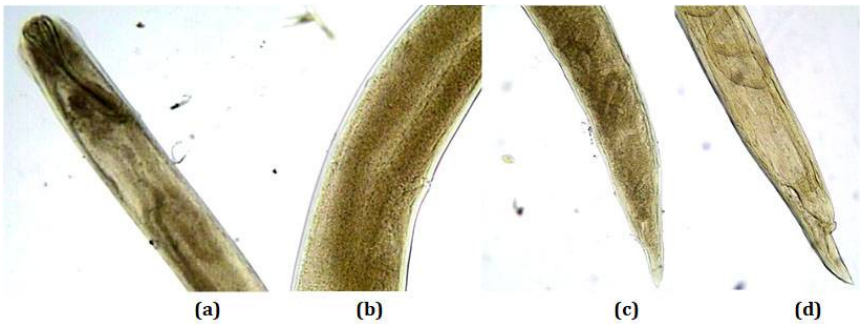

Fig. 2: *Dichelyne* sp. recovered from gastrointestinal tract of *Clarias batrachus* (figures not to scale bar). (a) anterior end with dumbbell-shaped oesophagus , (b) body proper of female with vulva, (c) posterior end female, (c) posterior end male with gubernaculums and spicules.

Infection Prevalence

The total average infection prevalence (IP%) of *Lytocestus* sp. was observed 36.66% during the period of investigation. Amongst infected hosts, the parasitic prevalence of *Lytocestus* sp. was comparatively higher in the female fish (40.00%) than the male host fish (33.33%) as illustrated by bar graph (Fig. 3a). However, the overall average infection prevalence (IP%) of *Dichelyne* sp. was recorded 43.33% during the study period. Amongst all the infected hosts, the nemic prevalence (IP%) of *Dichelyne* sp. was comparatively lower in male (40.00%) than female host fish (46.66%) as presented by bar graph (Fig. 3b).

Fig. 3: Infection prevalence (IP%) of *Lytocestus* sp. (a) and *Dichelyne* sp. (b) in *Clarias batrachus*. Where: IPLT, Infection prevalence of *Lytocestus* sp. in total fish; IPLM, Infection prevalence of *Lytocestus* sp. in male fish; IPLF, Infection prevalence of *Lytocestus* sp. in female fish; IPDT, Infection prevalence of

Dichelyne sp. in total fish; IPDM, Infection prevalence of *Dichelyne* sp. in male fish; IPDF, Infection prevalence of *Dichelyne* sp. in female fish.

Lytocestus sp. was parasitic caryophyllaeid cestodes that commonly inhabiting in the gastrointestinal tract of cyprinoid and siluriod freshwater fishes including *Clarias batrachus* [29-35]. As per the review report published by Upadhyay and Baita [36] a sum of 61 species of *Lytocestus* Cohn, 1908 **known** so far recovered from different vertebrate hosts including 50 species from India and 11 species from other countries. The average infection prevalence of *Lytocestus* sp. in total fish hosts during current study was recorded comparatively higher in comparison to the earlier reports published by the Gupta [37] (28.0%); Chandra et al. [38] (33.14%); Arora et al. [39] (28.0%); Borde and Jawale [40] (22.7 %). The host specific occurrence of this infection found to be significantly influenced by physiological, ecological and dietary factors [41-42].

The infection prevalence of *Dichelyne* sp. in female fish was documented comparatively higher than the male fish hosts during present study exhibited sex-biased trends of nemic infestation. The trends of nemic infection in present study corroborated to the patterns reported by the Skorping [43], Niyogi et al. [44], Ibiwoye et al. [45], Alam et al. [46], Hassan et al. [47]. However, Ahmed [48], Willis [49-50] stated that the sex of host did not offer significant host's sex biased variation in infection.

CONCLUSION

The air-breathing walking catfish, *Clarias batrachus* L. (Siluriformes: Clariidae) is a native species that is farmed for economically significant as food fish. Every parasite is harmful to its host, and the more are the parasites in a host the larger the adverse effects. In the above study by observing the gastrointestinal tract of *Clarias batrachus, there were two genera of parasitic helminthes* isolated and *viz. Lytocestus (Cestoda: Caryophyllidea) and Dichelyne (Nematoda: Rhabditida)*. The random distribution of parasitic helminths within the selected fish population revealed a tendency toward sex-biased infections. Gaining deeper insights into these parasitic patterns can lead to more effective planning, development, and implementation of strategies for preventing and controlling such diseases, ultimately promoting sustainable freshwater aquaculture and benefiting societal well-being.

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CONFLICT OF INTEREST

The authors claim no conflicts of interest.

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