

High Burden of Gastrointestinal Helminth Parasites in Catfishes: *Clarias gariepinus* and *Heteropneustes fossilis*

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Research note

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Abstract

Objective: Catfishes harbour a greater variety and occurrence of larval helminth parasites because they are exposed to more infective helminth larvae in their diet due to their predatory habit which makes them more susceptible to higher parasitic burden. This study was conducted at department of zoology in Post Graduate Campus, Biratnagar, Nepal to determine the prevalence of helminth parasites in the gastrointestinal tract of two species of catfishes i.e *Clarias gariepinus* and *Heteropneustes fossilis* collected from the different water resources of Biratnagar, Eastern Nepal.

Results: Out of 280 fish examination, 264 (94.28%) fishes were found to be infected with helminths parasites. *Clarias gariepinus* infection rate was 84.0% with three species of parasites, one each of nematode i.e. *Procamallanus laevionchus*, cestode i.e. *Proteocephalus* species, and trematode i.e. *Allocreadium* species. *Heteropneustes fossilis* have prevalence rate of 100% with five species of helminth parasites i.e. two nematode species namely *Procamallanus heteropneustes* and *Eustrongyloides* species, one cestode namely *Lytocetus indicus*, one trematode i.e. *Phyllodystomum folium* and an acanthocephalan i.e. *Pomphorhynchus* species were detected.

Introduction

Catfish belongs to the order Siluriformis which are basically found to be bottom dwellers with feeding habit of almost all kinds of aquatic plant and animals as a natural food [1]. Catfishes are cultivated widely because of its high market value and due to its attractive benefits such as high growth rate, easy to cultivate as it consume artificial food easily and have less chance of losses due to its high resistant power to different diseases and environmental change. Catfishes are also considered as one of the most common and affordable source of animal proteins [2]. Due to air-breathing nature of catfishes, they can survive low aerated water bodies and at commercial level, its production can be achieved without artificial aeration cost [3]. *Clarias gariepinus*, commonly known as African catfish, is found in all from of freshwater and their importance has been increased in aquaculture for its high growth rate and low production cost with a cheap source of animal protein in human diet [4]. *Heteropneustes fossilis* is also known as stinging catfish. This fish is also has a high consumer demand due to its good taste as it has fewer intramuscular spine with higher resistant to low oxygen content which makes it easy for cultivation [5].

Nowadays, parasitic infection has been considered as one of the important factor for economic and production losses in the fish culture due to fish mortality, reduction in fish growth and fecundity as well as increasing the vulnerability of fish to other diseases [6]. Luque and Poulin have also stated that catfishes harbour a greater variety and occurrence of larval helminth parasites because they are exposed to more infective helminth larvae in their diet due to their predatory habit which makes them more susceptible to higher parasitic burden [7]. Only few studies have been carried out on helminth parasites of fresh water fishes of Nepal and in my knowledge no studies have been conducted on burden of gastro-intestinal helminth parasites of catfishes found in Nepal. Therefore, this study was designed to detect the

occurrence and burden of helminth parasites present in the gastrointestinal tract of two catfishes i.e. *Clarias gariepinus* and *Heteroponeustes*.

Methods

This study was carried out in the Department of Zoology, Post Graduate Campus, Tribhuvan University, Biratnagar, Nepal over a period of six months (May 2017 to October 2017). Biratnagar is the capital city in Eastern Nepal having geographical location 26°28'60"N 87°16'60"E. It lies 399 km east of Nepal's capital, Kathmandu and 6 km north of the border of the Indian state, Bihar. The fishes were collected from different fresh water ponds and rivers near Biratnagar area. Catfishes were also randomly collected from local fish market of Biratnagar. The fishes were washed properly in clean water and then transported in a clean plastic bag to the Zoology Laboratory of Post Graduate Campus, Biratnagar for further study.

The fishes were dissected and the gastrointestinal tract was separated from the visceral mass of the body and kept in the Petri dish. The food tract was cut into pieces of one centimetre each for observation of helminths. The cut parts were placed in Petri dishes containing saline water. Each piece of the intestine was further carefully slit opened for the emergence of any adult parasites. The gut content was further observed under microscope by simple wet mount preparation for search of various helminth parasites. The remaining gut content was preserved in formalin in vials. The external and internal morphological characters of each worm were recorded and identified by using standard keys [8–10].

Data were analyzed using statistical package for the social science (SPSS) version 16.0 and interpreted according to frequency distribution and percentage. Data were recorded regarding the prevalence of helminth parasites in two catfish. The prevalence of helminth parasites was calculated according to Margolis et al [11], where, prevalence (p) = the number of infected host with one or more individuals of a particular parasites species divided by number of hosts examined (expressed in percentage).

Results

In this study, a total of 280 catfishes were examined for gastrointestinal helminth parasites which included *Clarias gariepinus* (n = 100) and *Heteroponeustes fossilis* (n = 180). Out of 280 catfishes included in the study, 264 (94.3%) were found infected. Among the two species of catfish examined for their gastrointestinal helminth parasites, *Clarias gariepinus* was found to be infected by nematodes, cestodes and trematodes while *Heteroponeustes fossilis* was infected by all four groups of helminth parasites (Table 1).

Table 1
Infection of catfish with gastrointestinal helminth parasites

Fish species	Group of helminth parasites detected			
	Nematode	Cestode	Trematode	Acanthacephalan
<i>Clarias gariepinus</i>	+	+	+	-
<i>Heteroponeustes fossilis</i>	+	+	+	+
+ (present); - (absent)				

Among 100 *Clarias gariepinus* examined, 84 of them were found to infected with some helminth parasites having prevalence of 84.0%. Three parasites, one each of nematode i.e. *Procamallanus laevionchus*, cestode i.e. *Proteocephalus* species, and trematode i.e. *Allocreadium* species, were detected from the gut content of *Clarias gariepinus* with highest number of fish infected with *Procamallanus laevionchus* (46.0%). Similarly, all of the *Heteroponeustes fossilis* (180 out of 180) were found to contain some helminth parasites in their gastrointestinal tract having prevalence of 100%. Five parasites were detected from gut content of *Heteroponeustes fossilis*. Two nematode species namely *Procamallanus heteropneustes* and *Eustrongyloides* species, one cestode namely *Lytocestus indicus*, one trematode i.e. *Phyllodystomum folium* and an acanthocephalan i.e. *Pomphorhynchus* species were detected (Table 2).

Table 2
Distribution of helminth parasites in the gastrointestinal tract of catfish

Fish species	Number of fish examined	Number (%) of fish infected	Parasites detected	
			Species	Number (%)
<i>Clarias gariepinus</i>	100	84 (84.0)	<i>Procamallanus laevionchus</i>	46 (46.0)
			<i>Proteocephalus</i> species	21 (21.0)
			<i>Allocreadium</i> species	17 (17.0)
<i>Heteroponeustes fossilis</i>	180	180 (100)	<i>Procamallanus heteropneustes</i>	68 (37.8)
			<i>Eustrongyloides</i> species	54 (30.0)
			<i>Lytocestus indicus</i>	39 (21.7)
			<i>Phyllodystomum folium</i>	43 (23.9)
			<i>Pomphorhynchus</i> species	180 (100)

Multiple infections of catfishes with helminth parasites were common observation in this study. Among 100 *Clarius gariepinus* examined, *Procamallanus laevionchus* and *Proteocephalus* species were concurrently detected from 15.0% *Clarius gariepinus*. Multiple infections by the helminth parasites was also common in *Heteroponeustes fossilis*. Among 180 fish examined, 37.8% was infected by both *Pomphorhynchus* species and *Procamallanus heteropneustes* and 8.3% were infected by both *Pomphorhynchus* species and *Eustrongyloides* species. Similarly, *Phyllodystomum folium* and *Pomphorhynchus* species were concurrently detected from 23.9% fish. From few *Heteroponeustes fossilis*, three helminth parasites i.e. *Lytocestus indicus*, *Pomphorhynchus* species and *Eustrongyloides* species were concurrently detected (Table 3).

Table 3
Multiple infection of *Heteroponeustes fossilis* with helminth parasites

Parasites detected	Number (%) of fishes with multiple infection		Number (%) of multiple infection
	<i>Pomphorhynchus</i> species	<i>Eustrongyloides</i> species	
<i>Procamallanus heteropneustes</i>	68 (37.8)	-	165 (91.7)
<i>Eustrongyloides species</i>	15 (8.3)	-	
<i>Phyllodystomum folium</i>	43 (23.9)	-	
<i>Lytocestus indicus</i>	39 (21.7)		

Discussion

Parasitic diseases of fish result in great economic loss due to effect on normal health conditions of fishes, reduction of growth, abnormal metabolic activities and even death. The factors that directly influence the parasitic fauna of fishes are age, diet, abundance of fishes, independent number of a parasite within fish and season. The characteristic of any water body can influence and determine its parasitic fauna and when environmental conditions become suitable for mass reproduction of parasites, the parasitic diseases may spread very quickly [12]. Thus, proper identification of fish parasites, their prevention and correct therapy for treatable infestations dramatically improve the health and productivity of affected fish. In the present study, two species of catfish found in Biratnagar area of Nepal were examined for occurrence and burden of gastrointestinal helminth parasites.

Among 100 *Clarias gariepinus* examined, 84.0% were found to be infected with helminth parasites. Three parasites were detected from gut content of this fish i.e. one nematode species, one cestode and one digenean trematode. This result is in conformity with some other studies. Dan-kishiya and Zakari [13] reported nematode, cestode and trematode in wild *Clarias gariepinus* in Gwagwalada, Nigeria. Aliyu and Solomon [14] and Salawu et al [6] also detected some nematodes, cestodes and trematodes from *Clarias gariepinus*. The prevalence was 75.0% in study of Salawu et al [6], 59.4% in the study of Aliyu and Solomon [14], and 67.5% in the study of Kawe et al [4]. Difference in prevalence of parasites in fish may be due to many factors. Williams and Jones [15] suggested that parasitism is determined by the interaction between both biotic and abiotic factors and differs in various aquatic ecosystems. Reports have shown that helminths are generally found in all freshwater fishes, with their prevalence and intensity dependent on factors of parasite species, host and its feeding habits, hygiene of the water body, and presence of intermediate hosts for the parasites [4].

In the current study, nematode species i.e. *Procamallanus laevionchus* was detected from 46.0% *Clarias gariepinus* and have higher burden than cestode namely *Proteocephalus* species (21.0%) and digenean trematode i.e. *Allocreadium* species (17.0%). The higher incidence of nematodes than cestodes and

trematodes revealed that nematodes were the commonest cause of parasitic infection in *Clarias gariepinus* and this is in conformity with the findings of Kawe et al [4] and Aliyu and Solomon [14]. Kawe et al [4] also detected *Allocreadium* species from 3.6% and *Procamallanus laevionchus* from 32.5% of *Clarias gariepinus*. Barson and Avenant-Oldewage [16] reported *Proteocephalus* species from 14% of *Clarias gariepinus*. Multiple infections by the helminth parasites was commonly seen in *Clarias gariepinus*. Among total *Clarias gariepinus*, *Procamallanus laevionchus* and *Proteocephalus* species were concurrently detected from 15.0% fish. Ajala and Awole [17] also reported multiple infections of helminth parasites in the gastrointestinal tract of *Clarias gariepinus*.

The catfish culture in Nepal is of great significance because of highly nourishing and easy source of protein. Parasites attack the fish and destroy them and/or produce disease in their bodies, thus making them unedible. The stinging catfish i.e. *Heteroponeustes fossilis* was also examined and all of them were found to contain some helminth parasites in their gastrointestinal tract with prevalence of 100%. Five parasites were detected from gut content of this fish. Two nematode species namely *Procamallanus heteropneustes* and *Eustrongyloides* species were detected from 37.8% and 30.0% fishes respectively. One cestode namely *Lytocestus indicus* (21.7%), one trematode i.e. *Phyllodystomum folium* (23.9%) and an Acanthocephalan i.e. *Pomphorhynchus* species (100%) were detected from the *Heteroponeustes fossilis*. Other studies from different countries also reported variable prevalence of various parasites from gastrointestinal tract of *Heteroponeustes fossilis*. Yadav SN [9] also detected *Pomphorhynchus* species from gastrointestinal tract of 100% of *Heteroponeustes fossilis*, which is similar to the result of current study. In the study of Nimbalkar et al [18], the prevalence of *Eustrongyloides* larvae was 50% in this fish. Similarly, Ningthoukhongjam et al [19] identified cestode parasites from intestine of 50% of *Heteroponeustes fossilis* and Gupta R [20] reported *Procamallanus heteropneustes* from 31.3% and *Lytocestus indicus* from 5.7% of *Heteroponeustes fossilis*. Puinyabati et al [21] clearly discussed that the species and feeding activity of the fish host and the preference and composition of the food play an important role in the diversity of the helminth parasites in the gastrointestinal region of fishes.

The present findings confirm that helminth parasites are widespread in the gastrointestinal tract of catfish found in the Biratnagar area of Nepal and the prevalence of helminth parasites is higher with heavy parasitic burden. Since it has been stated that helminth parasitic infection of fish affects its productivity, marketability, palatability and death of a good number of fishes, it is necessary to detect the parasites and develop their effective control measures.

Limitations

This study is limited only to detection and identification of helminth parasites infecting gastrointestinal tract of two catfishes i.e. *Clarias gariepinus* and *Heteropneustes fossilis*. Parasites were identified only on the basis of morphological characteristics and genetic analysis of the observed parasites could not be determined. Also, seasonal variation of helminth parasitic infection in the gastrointestinal tract of catfishes were not observed.

Declarations

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Competing interests

The authors declare that they have no conflict of interest relevant to the publication of this paper.

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Authors' contributions

GS conceptualized and designed the study, involved in data collection, analysis and interpretation, first and final draft of the manuscript preparation. SNS conceptualized and designed the study, involved in the manuscript revision and edits. All authors read and approved the final manuscript.

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