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High Burden of Gastrointestinal *Helminth Parasites* in Catfishes: *Clarias gariepinus* (Burchel, 1822) and *Heteropneustes fossilis* (Bloch, 1794) in Nepal

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Research Article

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ABSTRACT

Feeding on all kinds of aquatic plants and animal makes, cat fishes expose them to more infective *helminth larvae* through their diet. This study was conducted to examine the prevalence of *helminths parasites* in the gastrointestinal tract of two species of catfishes, *Clarias gariepinus* (n=100) and *Heteropneustes fossilis* (n=180). Fish were examined after isolating the contents of the gastrointestinal tract and observed for the presence of helminths using microscope. Results show that out of 280 fishes, 264 (94.28%) fish were found to be infected with the *helminths parasite*. *C. gariepinus* infection rate was 84% with three species of parasites, one each of nematode. *Procamallanus laevionchus*, *cestode, Proteocephalus* species, *and trematode, Allocreadium* species. *Heteropneustes fossilis* have a prevalence rate of 100% with five species of five *helminths. Procamallanus heteropneustes* and *Eustrongyloides* species, *Lytocestus indicus, Phyllodystomum folium* and *Pomphorhynchus* species were detected.

INTRODUCTION

Catfish belongs to the order Siluriformes which are found to be bottom dwellers with feeding habits of almost all kinds of aquatic plant and animals as a natural food playing a vital role in transferring energy[1]. Catfishes are cultivated widely because of their high market value and attractive benefits such as high growth rate, ease to cultivate as they consume artificial food easily, and have less chance of losses due to their high resistant power to different diseases and environmental change. Catfishes are also considered as one of the most common and affordable sources of animal proteins[2]. Due to the air-breathing nature of catfishes, they can survive in low aerated water bodies and at the commercial level and their 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 the 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 a fewer intramuscular spine with higher resistance to low oxygen content which makes it easy for cultivation[5].

With the increasing demand for catfishes, their culture has been intensified but the pisciculturists are having losses due to the diseases resulting from parasitic infections. Nowadays, the parasitic infection has been considered as one of the important factors 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 harbor 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]. Besides these, several *helminth parasites* are being transmitted to humans through fishes[8].

Proper identification, prevention, and correct therapy for treatable infestations dramatically improve the health and productivity of affected fishes. However, only a few studies have been carried out on *helminth parasites* of freshwater fishes of Nepal and to my knowledge, no studies have been conducted on the burden of gastrointestinal *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 fossilis* found in the eastern region of Nepal.

MATERIALS AND METHODS

Study design and setting

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.

Collection of fish samples

The catfishes, *Clarias gariepinus* and *Heteropneustes fossilis*, were collected from different freshwater ponds and rivers near the Biratnagar area. Catfishes were also randomly collected from the local fish market of Biratnagar. Mostly the live fishes were collected from surrounding rivers and ponds with the help of local fishermen. 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.

Examination for gastrointestinal helminth parasites

Small fishes were killed by pitching and larger specimens by hitting on the cranium. The killed fish 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 1cm 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 and iodine mount preparation. For this, about one gram of gut content and a drop of normal saline or iodine solution was placed on a clean, dry glass slide and mixed to make a smear and a coverslip was kept, and the preparation was then observed under the light microscope (first under 10X and then 40X magnification) for the 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[9-11].

Data processing and analysis

Data were analyzed using a 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[12], where, prevalence (p)=the number of the infected host with one or more individuals of a particular parasite species divided by the 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). 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 gastro-intestinal helminth parasites).

Group of *helminth parasites*				
Fish species	**Nematode**	**Cestode**	**Trematode**	**Acanthocephalan**
Clarias gariepinus	+	+	+	-
Heteroponeustes fossilis	+	+	+	+
***Note.** + (present); - (absent)				

Among 100 *Clarias gariepinus* examined, 84 of them were found to be infected with some *helminth parasites* having a prevalence of 84.0%. Three parasites, one each of nematode, *Procamallanus laevionchus, cestode, Proteocephalus* species, *and trematode, Allocreadium* species, were detected from the gut content of *Clarias gariepinus* with the 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 a prevalence of 100%. Five parasites were detected from the gut content of *Heteroponeustes fossilis*.

Two nematode species namely *Procamallanus heteropneustes and Eustrongyloides* species, one cestode namely *Lytocestus indicus*, one *trematode*, *Phyllodystomum folium*, and an *acanthocephalan*, *Pomphorhynchus* species were detected (Table 2).

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

Fish species	Number of fish examined	Prevalence of infection	Parasites	
			Species	Number (%)
Clarias gariepinus	100	84.00%	*Procamallanus laevionchus*	46 (46.0)
			Proteocephalus species	21 (21.0)
			Allocreadium species	17 (17.0)
Heteroponeustes fossilis	180	100%	*Procamallanus heteropneustes*	68 (37.8)
			Eustrongyloides species	54 (30.0)
			Lytocestus indicus	39 (21.7)
			Phyllodystomum folium	43 (23.9)
			Pomphorhynchus species	180 (100)

Multiple infections of catfishes with *helminth parasites* were common observations 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* were also common in *Heteroponeustes fossilis*. Among 180 fish examined, 37.8% were 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% of fish. From a few *Heteroponeustes fossilis*, three *helminth parasites*, *Lytocestus indicus*, *Pomphorhynchus* species, and *Eustrongyloides* species were concurrently detected (Table 3).

Table 3. Multiple infections of *Heteroponeustes fossilis* with *helminth parasites*.

Parasites observed	Number of fishes with multiple infections		Number of multiple infections
	Pomphorhynchus species	*Eustrongyloides* species	
Procamallanus heteropneustes	68 (37.8%)	-	
Eustrongyloides species	15 (8.3%)	-	

Phyllodystomum folium	43 (23.9%)	-	
Lytocestus indicus	39 (21.7%)		165 (91.7%)

DISCUSSION

Parasitic diseases of fish result in great economic loss due to the 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, an 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[13]. 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 the 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 the gut content of this fish i.e. one *nematode* species, one *cestode*, and one *digenean trematode*. This result conforms to some other studies [14]. Dan-kishiya & Zakari reported *nematode*, *cestode*, and *trematode* in wild *Clarias gariepinus* in Gwagwalada, Nigeria. Aliyu and Solomon and Salawu also detected some *nematodes*, *cestodes*, and *trematodes* from *Clarias gariepinus*[15,16]. The difference in the prevalence of parasites in fish may be due to many factors. Williams and Jones 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[17-19].

In the current study, *nematode* species, *Procamallanus laevionchus* was detected from 46.0% *Clarias gariepinus* and have a higher burden than *cestode* namely *Proteocephalus* species (21.0%) and *digenean trematode, 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 also detected *Allocreadium* species from 3.6% and *Procamallanus laevionchus* from 32.5% of *Clarias gariepinus*[20]. Barson and Avenant-Oldewage reported *Proteocephalus* species from 14% of *Clarias gariepinus*. Multiple infections by the *helminth parasites* were commonly seen in *Clarias gariepinus*. Among total *Clarias gariepinus*, *Procamallanus laevionchus*, and *Proteocephalus* species were concurrently detected from 15.0% of fish[21]. Ajala & Awole 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 its 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, *Heteroponeustes fossilis* was also examined and all of them were found to contain some *helminth parasites* in their gastrointestinal tract with the prevalence of 100%. Five parasites were detected from the 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*, *Phyllodystomum folium* (23.9%), and an *Acanthocephalan Pomphorhynchus* species (100%) were detected from the *Heteroponeustes fossilis*. Other studies from different countries also reported variable prevalence of different parasites from the gastrointestinal tract of *Heteroponeustes fossilis*. Yadav also detected *Pomphorhynchus* species from the gastrointestinal tract of 100% of *Heteroponeustes fossilis*, which is similar to the result of the current study, the prevalence of *Eustrongyloides larvae* was 50% in this fish. Similarly, identified *cestode parasites* from the intestine of 50% of *Heteroponeustes fossilis* and Gupta reported *Procamallanus heteropneustes* from 31.3% and *Lytocestus indicus* from 5.7% of *Heteroponeustes fossilis*[22,23].

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. Hence, further investigation of the gastrointestinal *helminth parasite* is very much necessary to explore more information regarding fish parasites as well as the parasitic diseases of fish in the entire country.

CONCLUSION

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 the heavy parasitic burden. The presence of *helminth parasites* in fish of the reservoir may be the result of poor water quality, crowding, and other problems that give suitable habitats for those parasites and intermediate hosts. The possibility of multiple and concurrent infections of different species of parasites in a fish was established and may pose a health risk of zoonotic transmission to consumers. 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 the detection and identification of *helminth parasites* infecting the gastrointestinal tract of two catfishes. Also, seasonal variation of *helminth parasitic* infection was not observed.

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CONFLICT OF INTEREST

None declared

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