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Rhabdochona hospeti Thapar, 1950: A Natural Parasite in *Tor putitora*

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Abstract

Rhabdochona Railliet, 1916 is a predominant intestinal parasite in fresh water fish all over the world. This study, aimed to investigate the infection level (prevalence, mean intensity and abundance) of nematode *Rhabdochona hospeti* Thapar, 1950 in golden mahseer (*Tor putitora*) in Mahakali River, Nepal, was conducted from September 2022 to August 2023. A total of 146 golden mahseer were collected from the two sites of the Mahakali River by using gill nets. Nematode parasites were retrieved and processed using standard helminthological methods. All sized and both male and female fish were found infected year-round. Overall, the prevalence, mean intensity and abundance of the *Rhabdochona hospeti* in golden mahseer were 90.41%, 7.48 and 6.77 respectively. But there was 100% prevalence in more than 150 gm weight fish in the months of September, January, February and April. The parasitic burden (mean intensity and abundance) was higher in more than 20 cm sized (8.29 and 7.48) female host fish (8.45 and 7.89) in the months of October (15.5 and 13.29) and autumn season (10.84 and 10.05). Statistically, the prevalence, mean intensity and abundance of the *Rhabdochona hospeti* were insignificant ($p > 0.05$) with the body size and sex of the host fish, months and season of the year. This study reveals stable high infection of the *Rhabdochona hospeti* as a natural parasite in golden mahseer fish in new locality and will be the one of the natural cause of fish decline from the river in near future.

Keywords: *Rhabdochona hospeti*, prevalence, mean intensity, abundance, golden mahseer (*Tor putitora*)

Introduction

Nematode *Rhabdochona* Railliet, 1916 belongs to the order Spirurida and family Rhabdochonidae (Hodda, 2022). It comprises nearly 95 species mostly in the intestine of freshwater fishes (Moravec & Yooyen, 2011) and a few in amphibians (Paulino de Alcantara et al., 2021) and reptiles (Moravec, 1983). This nematode may be obligatory or facultative or paratenic (Moravec et al., 2012) and has significant economic importance in natural water body fisheries.

The golden mahseer, categorized as endangered species (Jha et al., 2018), is the most important fish species in the Mahakali River due to its sovereignty in the river (Joshi & Joshi, 2021) and high demand in the local markets (Nautiyal, 2014). There is little information about the parasitic fauna in the fish of Mahakali River (Joshi & Joshi, 2023). Studies have revealed that fish of natural water body get more infected than those from cultivated system (Nnadi et al., 2011) due to the frequent visit of the piscivorous birds acting as definitive hosts for some helminths (Barson & Marshall, 2004; Caffara et al., 2011; Murugami et al., 2018; Ortega-Olivares et al., 2008; Rosser et al., 2018; Schmidt, 1972). Further, mostly taxonomic studies are carried on *Rhabdochona* to systemize the species of this parasites (Caspeta-Mandujano et al., 2020; González-Solís et al., 2014; Kuchboev et al., 2021; Mejía-Madrid et al., 2007; Moravec, 2010; Moravec et al., 2010, 2013; Moravec &Jirků, 2014; Moravec &Yooyen, 2011; Moravec et al., 2012; Saraiva& Moravec, 1998).There is little information regarding infection level of this nematode in the fish (Lebanan et al., 2023). In this study, the infection level of one of the species of *Rhabdochona hospeti* Thapar, 1950 was examined in golden mahseer (*Tor putitora)* in Mahakali River, Nepal in terms of size and sex of the host fish, months and seasons of the year. This study will become the basis for further investigations of fish parasites in aquaculture studies in future and to examine are the fish parasites likely threatening native fish biodiversity in the river and potential risk to public?

Research Methodology

Fish Sampling, Processing and Parasite Identification

Specimens of *Tor putitora* (n=146) were collected randomly using gill nets from Brahmdev (29º37''49.8'N 80º77''26.16'E) and Bhujela Ghat (28º58''45.44'N 80º69''48.96'E) in Mahakali River, Nepal monthly between September 2022 to August 2023. All the morphometric measurements, sex determination and processing of the fish specimens were carried in the laboratory of Central Department of General Science, Far Western University, Nepal. For parasite recovery, first external body surface of the fish were examined by magnifying glass, then skin, gill, nostril and fin smears were prepared and observed according to Thatcher (2006) and Whittington and Chisholm (2008) and finally fish were dissected through the ventral surface of the abdomen. The

alimentary canal was removed out of the body, cut into parts (stomach and intestine), put into separate Petri dish containing physiological saline solution, split longitudinally, cleaned several times by decantation method and examined thoroughly with magnifying glass and light microscope (model: Tech+). Further, the surfaces of the internal organs and mesenteries were examined by magnifying glass for the presence of parasites (Joshi & Joshi, 2023). The retrieved nematode parasites were killed in hot 70% ethyl alcohol and preserved in the mixture of 95% ethyl alcohol and 5% glycerin. They were mounted first in glycerin and then Canada Balsam for identification of the parasite as described in Thatcher (2006). The nematode parasites were identified on the basis of shape of the prostom, number and arrangement of prostomal teeth, length of vestibule and esophagus, position of vulva and shape of the eggs in female, spicules in male and tail in both the sexes (Moravec et al., 2010; Thatcher, 2006).

Data Analysis

Infection level (prevalence, mean intensity and abundance) was determined as below explained by Margolis et al. (1982) and Bush et al. (1997). The statistical significance of infection of the *Rhabdochona hospeti* with body size and sex of host fish, month and season of the year were analyzed at 5% with the help of Fisher's Exact test. IBM SPSS Statistics Version 25.0 (IBM Corp, 2017) was used to compute Fisher's Exact test.

$$\text{Prevalence} = \frac{\text{Total number of hosts infected} \times 100}{\text{Total number of hosts examined}}$$

$$\text{Mean intensity} = \frac{\text{Total number of parasites recovered}}{\text{Total number of infected host examined}}$$

$$\text{Abundance} = \frac{\text{Total number of parasites recovered}}{\text{Total number of hosts examined}}$$

Results and Discussion

A total of 132 (out of the 146 examined) golden mahseer fish were found infected by *Rhabdochona hospeti* nematode. Nine hundred eighty-eight *Rhabdochona hospeti* nematode were recovered from the stomach, intestine and gall bladder of the infected fish. Over all, the prevalence was 90.41%, mean intensity was 7.48 and abundance was 6.77 (Table 1). All sized fish were found infected with *Rhabdochona hospeti.* But the mean intensity and abundance of the nematode were higher (8.29 and 7.48) in large sized fish (Table 1).

Table 1

Host size-wise infection level of Rhabdochona hospeti

Size of the examined fish (cm)	Number of fish examined	Number of infected fish	Number of parasites recovered	Prevalence (%)	Mean intensity	Abundance
Up to 20	44	40	225	90.91	5.63	5.11
More than 20	102	92	763	90.2	8.29	7.48
Total	146	132	988	90.41	7.48	6.77

Nearly, all the fish of more than 150 gm weight were found infected by *Rhabdochona hospeti* with higher mean intensity and nematode abundance (Table 2). Both male and female fish were found with *Rhabdochona hospeti.* But the prevalence, mean intensity and abundance of the nematode was higher in female host fish (Table 3).

Table 2

Host weight-wise infection level of Rhabdochona hospeti

Weight of the examined fish (gm)	Number of fish examined	Number of infected fish	Number of parasites recovered	Prevalence (%)	Mean intensity	Abundance
Up to 50	9	8	29	88.89	3.63	3.22
51- 100	66	58	365	87.88	6.29	5.53
101-150	33	29	219	87.88	7.55	6.64
151-200	15	15	135	100	9	9
201-250	14	14	156	100	11.14	11.14
More than 250	9	8	84	88.89	10.5	9.33

Table 3

Host sex-wise infection level of Rhabdochona hospeti

Sex of the examined fish	Number of fish examined	Number of infected fish	Number of parasites recovered	Prevalence (%)	Mean intensity	Abundance
Male	70	61	388	87.14	6.36	5.54
Female	76	71	600	93.42	8.45	7.89

Infection of the *Rhabdochona hospeti* was observed year-round in all the seasons with highest mean intensity and abundance in October (15.5 and 13.29) and lowest in May (3.11 and 2.33) (Table 4). The prevalence of the nematode was highest (96.88%)

in the winter season and lowest (80.65%) in the summer season. Similarly, the mean intensity and abundance of the nematode were highest in autumn (10.84 and 10.05) and lowest in summer season (4.92 and 3.97) (Table 5). Contrast to this, Kassem and Bowashi (2015) reported higher parasitic infection in spring in other fish species due to favourable temperature.

Table 4

Month-wise infection level of Rhabdochona hospeti

Month and Year	Number of fish examined	Number of infected fish	Number of parasites recovered	Prevalence (%)	Mean intensity	Abundance
September 2022	11	11	116	100	10.55	10.55
October 2022	14	12	186	85.71	15.5	13.29
November 2022	16	15	110	93.75	7.33	6.88
December 2022	14	13	76	92.86	5.85	5.43
January 2023	6	6	44	100	7.33	7.33
February 2023	12	12	98	100	8.17	8.17
March 2023	24	23	185	95.83	8.04	7.71
April 2023	6	6	22	100	3.67	3.67
May 2023	12	9	28	75	3.11	2.33
June 2023	10	9	34	90	3.78	3.4
July 2023	14	11	46	78.57	4.18	3.29
August 2023	7	5	43	71.43	8.6	6.14

Table 5

Seasonal infection level of Rhabdochona hospeti

Season	Number of fish examined	Number of infected fish	Number of parasites recovered	Prevalence (%)	Mean intensity	Abundance
Autumn	41	38	412	92.68	10.84	10.05
Winter	32	31	218	96.88	7.03	6.81
Spring	42	38	235	90.48	6.18	5.6
Summer	31	25	123	80.65	4.92	3.97

Statistically, there was no significant difference ($p > 0.05$) between the prevalence of the *Rhabdochona hospeti* with the size, weight and sex of the host fish and with months and seasons of the year at 5% significance level indicating equal chance of infection in the defined groups (Table 6). This result agreed with Olurin et al. (2012). In contrast to this, some studies have shown the parasitic infection is increased with increasing size and weight of the host fish due to ageing regardless of host sex (Hagras et al., 1995; Kassem & Bowashi, 2015; Tekin-Özan et al., 2008; Valero et al., 2006; Yakhchali et al., 2012; Zargar et al., 2012). In this study, the apparent higher prevalence and parasitic burden of the nematode *Rhabdochona hospeti* in more than 20 cm sized and more than 150 gm weight female host fish might be due to more feeding habit (Brouder, 1999), variations of diet with size (Valero et al., 2006) or increasing the surface area of internal organs for the attachment of the parasites (Hagras et al., 1995). The variations in diet composition of *Tor putitora* size and season wise was reported by various researchers (Dasgupta, 1991; Mahasetha, 2016).

Table 6

Fisher's Exact Significance value for prevalence of Rhabdochona hospeti

Categorical parameters for prevalence of *Rhabdochona hospeti*	Exact Sig. (2-sided)
Host fish size	1.000
Host fish weight	.580
Host fish sex	.263
Month	.269

Season .198

In this study, the monthly and seasonally differences in prevalence and burden of *Rhabdochona hospeti* were accomplished by variations in the secondary copepod host (Košuthová et al., 2015; Marcogliese & Esch, 1989) due to fluctuation of physico-chemical parameters of the river water (Marcogliese, 2008) and frequent visiting of seasonal migrating piscivorous birds to the river. This needs further investigation. El-Tantawy et al. (2023) also reported the occurrence of nematode infections throughout year with seasonal variation in other fish species. The inconsistence of results of present study and others are due to host specificity of the parasites (Barger & Janovy, 1994) and influence of the ecological factors on the host and thereby on parasites (Santoro et al., 2020).

In the present study, the nematode parasites were collected from the various parts (the stomach, intestine and gall bladder), mostly confined in the intestine of the infected fish. More than 100 nematodes were recovered in the intestine of heavily infected fish. Moravec et al. (2010) and Lebanan et al. (2023) reported this nematode only from the intestine of the fish due to their study limited to taxonomy. The presence of the nematode in the all-sized male and female fish in all the seasons year-round with high prevalence rate indicates the *Rhabdochona hospeti* is natural parasite in golden mahseer or vice versa.

Conclusion

The present study documents the infection of *Rhabdochona hospeti* in the golden mahseer (*Tor putitora*) in Mahakali River, Nepal first time. There was high prevalence, mean intensity and abundance of the nematode in the golden mahseer fish and will be the one of the cause of fish decline from the river in near future. Although this nematode species has narrow host-specificity but frequent visit of piscivorous birds between the river and unfenced nearby fish farms of the Kanchanpur district would increase the risk of dissemination of nematodes to the cultivated cyprinid fish. This needs further intensive investigation.

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Conflicts of interest

The authors declare no conflict of interest.

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