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Endo-parasitism with seasonal rate of infestation in *Schizothorax niger* in River Jhelum at Anantnag, Jammu & Kashmir, India

Ashaq Hussain Bhat and Samiea Hussein

Abstract
A thorough study was conducted to check the different parasitic infestations in different seasons in Jhelum River at Anantnag, Jammu and Kashmir, from Sep. 2019-Sep.2020. Three sites were chosen for the whole study viz. as, Khanabal, Bijbihara and Sangam. A total no. of three helminth parasitic species were recovered from the specimens of *Schizothorax niger*. (27.47%) were found to harbour the *Pomphorhynchus kashmirensis*, (30.63%) were found to harbor the *Bothriocephalus acheilognathi* parasite, and (32.43%) were found to be infected with the *Adenoscolex oreini*. Mean intensity of different endoparasites at different locations shows that *Pomphorhynchus kashmirensis* was 6.08% at Khanabal, 7.63% at Bijbihara and 7.09% at Sangam. *Bothriocephalus acheilognathi* was 9.84% at Khanabal, 6.56% at Bijbihara and 4.10 at Sangam. *Adenoscolex oreini* was 9.16% at Khanabal, 8.16% at Bijbihara and 7% at Sangam.

Keywords: Jehlum, *Pomphorhynchus kashmirensis*, *Bothriocephalus acheilognathi*, *Adenoscolex oreini*

Introduction
Waterbodies in Kashmir Valley (Jammu and Kashmir), situated at an altitude of 1550 to 1595 m, are the major Coldwater fishing water bodies in the Asia. In both types of water bodies (Lentic as well as Lotic) there is an effective fisheries system, based on exotic and indigenous fish species. The Jehlum is the largest and longest river of the sub-Alpine region of Asia's Switzerland. Its source is the spring of Verinag. The river is rich in Ichthyofauna throughout its flow containing both the exotic as well as indigenous fishes i.e., Carp and *Schizothorax* species. River Jehlum in Kashmir Valley have an average annual fish yield of 20.5 kg ha^{-1}. This river in Kashmir Valley is rapidly ageing due to encroachment of agricultural practices on its margins and by aquatic plant growth, enhanced by pollution from the surrounding lands. These abiotic environmental factors at different times and under different conditions beyond carrying capacity cause a wide range of fish diseases. *Schizothorax niger* is infected by a number of parasites belonging to Protozoans, Platyhelminthes, Nematoda and Acanthocephalans. About 20,000o 30,000 helminth species have been reported worldwide, which cause heavy losses to the fish industry [8]. Dhar (1972) [9] reported 31 species of helminth parasites from Kashmir valley which cause severe damage to the fish production and population. The present study was undertaken to study the incidence of helminth parasites in *Schizothorax niger* with special reference to water quality parameters and to correlate the incidence of parasitic prevalence (if any) and various physicochemical parameters of river Jehlum.

Early studies on the water bodies of Kashmir were mainly on the biology and the geographical distribution of the various species; to these were added, in the 80s, the evaluation of pollutant loads from the atmosphere and their possible effects in terms of acidification or the enrichment of lake waters with nitrogen compounds. Limnological research in the Himalayas has been carried out since the beginning of the century (Sars 1903; Hutchinson 1937). Up to the seventies, studies were sporadic (Hirano 1955; Hirano 1963; Ueno 1966; Loffler 1969; Zutshi & Vass 1970) and oriented towards characterising the biotic communities in lakes and comparing the tropical areas affected by a monsoon climate (Troll 1959; Loffler 1964, 1968) with temperate zones. Recent studies have been focused on the physico-chemical and biological features, and particular emphasis on fish production. As per the latest report of the Fisheries department of Kashmir, the fish production in the waterbodies are depleting day by

day So keeping these things in mind current study was made to study the main Physico-chemical characteristics of this river, prevalence of Helminth parasites with their seasonal rate of infestation and to see its impact on the fish production.

Materials and Methods

Study Area

River Jhelum (Vyeth in Kashmiri, Vetesta in Sanskrit and Hydaspes in Greek) originates from a magnificent spring called "Chashma Verinag". Jhelum River flows from Verinag→Dooru→Khanabal→Bijbihara→Sangam→Awantipora→Srinagar→Wular lake. There are about 147 glaciers in the Jhelum basin covering an area of about 75 sq. km. The total geographical area of Jhelum basin up to Indo-Pakistan border is about 34775 Sq. Kms. with a total length of 402 Kms. But the length of Jhelum in India up to existing ceasefire line is about 165 Kms. With a catchment area of about 17622 Sq. Kms., and lies 32°-58'-42"to 35°-08'-02" north latitude and 73°-23'-32"to 75°-35'-57" east longitude and is mainly confined within the Kashmir Valley in India. Our study area was at Khanabal, Bijbihara and Sangam.

Fish collection and Identification

Schizothorax niger were collected on monthly basis in each season from three sampling sites like Khanabal, Bijbihara and Sangam by the help of local fishermen and some fish were also collected from local market. After collection they were given serial no.'s. Fish were identified according to the standard keys described by Mirza and Sandhu (2007), Talwar and Jhingran (1992) [17]. Sexes of the collected host fish were also determined. The abdomen of each fish specimen was pressed for the extrusion of whitish milt (for males) or eggs (for females). This strategy was used if the fish was in ripe or mature stage. The collected fish specimens were also dissected for sex identification. The presence of testes indicated male sex while the presence of ovary confirmed female sex. The standard length (SL) of each specimen was recorded from snout to the caudal peduncle with the help of China tape and steel scale while the body weight (BW) was noted with the help of precisa balance model No.18220 Switzerland.

Parasite Collection and Identification

Each sample of fish in the lab was investigated for external as well as internal parasites with the help of magnifying glass/binocular microscope. Eyes, nostril, mouth, fins, alimentary canal, Stomach, Intestines, Visceral organs and Body cavities were examined for the presence of parasites (if any). cestodes was carefully and slowly dislodged from the intestinal wall, ensuring that it remained intact. They were transferred to a clean sampling bottle containing normal saline solution, which was then shaken vigorously for a few minutes to dislodge debris and induce muscle fatigue in the helminths, which in turn deters strong contraction of the scolices and relaxes them. While swirling the sampling bottle, an equal amount (equal to the amount of saline solution already present in the sampling bottle) of a hot alcohol-formaldehyde-acetic acid (AFA) solution was added to kill and fix the specimens and stored in 70% alcohol. The cestodes were stained with Grenacher's borax carmine stain and identified. Acanthocephalans were removed from the host without any form of treatment prior to preservation except those acanthocephalans were relaxed in tap water so that specimens with proboscis fully everted were produced. In case the anterior end was deeply bored in the mucosa of the intestine, a few crystals of methanol were added to the normal saline, containing the parasites adhered to the intestinal wall. This led to immobilization of the parasites and loosening of the grip on the intestinal wall and facilitated the detachment of proboscis in case of acanthocephalans without causing any distortion in the arrangement of hooks. The identification of different helminth parasites in the host fish were carried out with the help of keys described by Eiras *et al*. (2000), Martins *et al*. (2007), Tavares-Dias *et al*. (2001) [18] and Yamaguti (1961, 1963) [19, 20].

Statistical analysis

The prevalence, mean intensity and relative density of infection was calculated by the formula given by Ayaz *et al*. (2011) as:

Prevalence rate (PR) = Number of host fish infected x 100 / number of host fish studied,

Mean Intensity (MI) = Total number of parasites recovered/ Total number of infected hosts examined,

Relative Density (RD) = Total number of parasites recovered / Total number of hosts examined. The relationship between the fish samples examined and that of infected was calculated by applying the GrapPad Prism Version 5. The value less than 0.05% at 95% CI was considered significant.

Results

The present study was carried out from September 2019 to September 2020 on seasonal basis. 21 fishes in each season from different collection sites i.e., 7 from each site (Khanabal, Bijbihara and Sangam) of *S. niger* were collected randomly and were examined for the presence of Endoparasites. A total of three helminth parasitic species were recovered from the 84 examined specimens of *Schizothorax niger*. (27.47%) were found to harbour the *Pomphorhynchus kashmirensis*, (30.63%) were found to harbor the *Bothriocephalus acheilognathi* parasite, and (32.43%) were found to be infected with the *Adenoscolex oreini*.84 specimens were examined from River Jehlum. Mean intensity of different endoparasites at different locations shows that *Pomphorhynchus kashmirensis* was 6.08% at Khanabal, 7.63% at Bijbihara and 7.09% at Sangam. *Bothriocephalus acheilognathi* was 9.84% at Khanabal, 6.56% at Bijbihara and 4.10 at Sangam. *Adenoscolex oreini* was 9.16% at Khanabal, 8.16% at Bijbihara and 7% at Sangam.

Abbreviations used in these Tables: *Pomphorhynchus kashmirensis* (PK) *Bothriocephalus acheilognathi* (BA) *Adenoscolex oreini* (AO)

Table 1: Prevalence % age of different end parasites in *S. niger* at first collection site (Khanabal) in different seasons from September 2019-September2020.

Season	Parasite Name	No. examined	No. infected	Prevalence (%)	No. of parasites	Mean intensity	Abundance	*p* value
Spring	PK	21	05	23.80	12	2.4	0.57	>0.05
	BA	21	11	52.38	13	1.18	0.61	<0.05
	AO	21	06	28.57	06	0.33	0.28	>0.05
Summer	PK	21	10	47.61	13	1.3	0.61	>0.05
	BA	21	12	57.14	22	1.83	1.04	>0.05
	AO	21	08	38.09	17	2.12	0.80	>0.05
Autumn	PK	21	09	42.85	08	0.88	0.38	>0.05
	BA	21	06	28.57	11	1.83	0.52	>0.05
	AO	21	07	33.33	12	1.71	0.57	>0.05
Winter	PK	21	02	09.52	03	1.5	0.14	<0.01
	BA	21	03	14.28	15	5.0	0.71	<0.01
	AO	21	03	14.28	15	5.0	0.71	<0.01

Table 2: Prevalence % age of different end parasites in *S. niger* at 2nd collection site (Bijbihara) in different seasons from September 2019-September2020.

Season	Parasite Name	No. examined	No. infected	Prevalence (%)	No. of parasites	Mean intensity	Abundance	*p* value
Spring	PK	21	06	28.57	13	2.1	0.61	>0.05
	BA	21	12	57.14	14	1.07	0.66	<0.05
	AO	21	07	33.33	07	1.00	0.33	>0.05
Summer	PK	21	08	38.09	12	1.5	0.57	>0.05
	BA	21	13	61.90	18	1.38	0.85	>0.05
	AO	21	07	33.33	09	1.28	0.42	>0.05
Autumn	PK	21	07	33.33	09	1.28	0.42	>0.05
	BA	21	09	42.85	14	1.55	0.66	>0.05
	AO	21	05	23.80	09	1.8	0.42	>0.05
Winter	PK	21	04	19.04	11	2.75	0.52	<0.01
	BA	21	06	28.57	17	2.83	0.80	<0.01
	AO	21	03	14.28	13	4.33	0.61	<0.01

Table 3: Prevalence % age of different end parasites in *S. niger* at 3rd collection site (Sangam) in different seasons from September 2019-September2020.

Season	Parasite Name	No. examined	No. infected	Prevalence (%)	No. of parasites	Mean intensity	Abundance	*p* value
Spring	PK	21	07	33.33	14	2.00	0.66	>0.05
	BA	21	13	61.14	15	1.23	0.71	<0.05
	AO	21	08	38.09	08	1.00	0.38	>0.05
Summer	PK	21	09	42.09	13	1.44	0.61	>0.05
	BA	21	14	66.66	19	1.35	0.90	>0.05
	AO	21	08	38.09	10	1.25	0.47	>0.05
Autumn	PK	21	08	38.09	10	1.25	0.47	>0.05
	BA	21	10	47.85	15	1.5	0.71	>0.05
	AO	21	06	28.57	10	1.66	0.47	>0.05
Winter	PK	21	05	23.80	12	2.4	0.57	<0.01
	BA	21	07	33.57	18	2.57	0.85	<0.01
	AO	21	04	19.04	14	3.5	0.66	<0.01

Discussion

In this research study a total of 84 host fish specimen were collected from different sites of River Jehlum. All the collected specimens of host fish were examined for the presence of endo-helminth parasites. After examination 61 out of 84 were found infected and total prevalence of 72.54% was calculated. Khan and Bilqees (1990) [8]; conducted a similar research study on helminth parasitic of fresh water fishes and calculated high prevalence rate for most of the helminth parasites. According to them some Cestodes have low prevalence rate but it is due to incomplete life cycle of these Cestodes and further transmission comes to an end. High prevalence rate 88.33% of helminth parasites was obtained during the moths of July and August while lowest prevalence rate of 41.66% and 33.33% was recorded during the months of January and February respectively. More finding were observed by Ahmad *et al.* (2014) [9] and Aydogdu *et al.* (2011). Ahmad *et al.* (2014) [9]; collected about 9 species of helminth parasites from 107 infected samples of S. plagiostomus and highest infection rate was noted for D. paradoxum which is parallel with the finding of present study. A similar research study was conducted by Parveen and Rahman (2000) [14]; maximum infection rate of 22.73% was noted in August and the lowest in February 4.55%. The finding of Khurshid and Ahmad (2014) [9], Leela and Rao (2014) [10]; are in accordance with the data observed in present study. The prevalence of infection during summer was 83.33%, 69.44% during autumn season, while 44.44% infection rate was observed during the winter season. Similarly, Khursheed and Ahmad, 2014 [9]; studied S. labiatus, and observed highest prevalence in summer 39.5%, followed by autumn 19% and least prevalence rate 3.8%, was calculated in winter respectively. Fish samples collected from lower reaches have highest prevalence71.79%, intensity 3.25 and relative density of 2.33 than the prevalence 52%, intensity 2.23 and relative density of 1.16 of fishes collected from

upper reaches. Similar finding was observed by Crisp *et al*. (2001) [6].

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