



A Report on The Incidence of Myxozoan Parasite in *Schizothorax Richardsonii* (Gray) from Uttarakhand, India

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Abstract: The present study deals with myxozoan parasites in *Schizothorax richardsonii* (Gray) from spring-fed rivers Khoh, Song and Henwal in Northwestern Himalaya, India. About 132 live specimens were collected and transported to the laboratory for further investigations and examined for the presence of plasmodia.

Measurements of all parameters were recorded and compared to previously available literature. The length of myxospore were found ranges between 10.87 to 11.36 μm . Though, width of spores was observed between 7.31 to 7.82 μm . The Myxozoan parasite found in the host fish belongs to the genus *Myxobolus* and was recognized as *M. richardsonii* sp.

Keywords: Parasites • Myxozoan • *Myxobolus* • Myxospore

Introduction

The hill stream fish *Schizothorax richardsonii* (Gray) is an important source of food and income for people living in the Himalayas and Sub-Himalayas. Fish culture depends on research in fish parasitological research for the purpose of increasing fish yields and it can achieve healthy fish stock. Parasites are a major causes of fish mortality and retarded growth (Omeji *et al.*, 2011 Mennerat *et al.*, 2010, and Blaylock and Bullard 2014). As a result, parasites create financial losses in fish culture. Myxozoans are economically viable types of small parasites, according to Kaur and Ahmed (2017).

According to Lom and Noble (1984), myxozoan parasites can display clinical signs when there is an imbalance among the host, parasite, and environment. Lom and Dyková (2013) listed more than 2,700 species of myxosporeans. Myxosporea is comprised of around 67 different genera, particularly *Myxobolus* Butschli, 1882 being the maximum species-diverse of those genera. According to Kalavati and Nandi (2007), there are 103

known *Myxobolus* species in India, while Kaur and Singh (2011) listed 130.

Myxosporeans can be found in practically organ and tissue of fish hosts (Mitchell 1977, Molnár, 2002, Lom and Dyková, 1992). Molnar (2002) distinguished between species that infect the gills of fishes and found that some myxosporean species are known to have an adverse effect on the gills. Myxosporean diseases continue to evolve and pose a global threat to the expansion of pisciculture. (Ahmed *et al.*, 2019).

Various workers conducted research on this group of parasites worldwide and also reviewed by (Grinham Cone 1990, Kaur 2014, Eiras *et al.*, 2021, Liu *et al.*, 2019, Fiala *et al.*, 2015, Okamura *et al.*, 2018). Some important contributions to the myxosporean study of Indian fishes have been made by Chaudhary *et al.*, (2018), Gupta & Kaur (2017a, 2017b, 2018, and Dar *et al.*, 2017a, 2017b). The review of literature shows that very little work has been done on the myxozoan parasites in hill stream fishes. The present investigation aims to explore myxozoan parasites infecting different organs of *Schizothorax richardsonii*



from Rivers Khoh, Song and Henwal in North West Himalaya, India.

Study Area

The study was conducted at three spring-fed rivers in north-western Himalaya namely; Song River (30° 28' NL/78° 08' EL) in Dehradun District, Khoh River (29° 73' NL/78° 52' EL) in Pauri Garhwal District and Henwal River (30° 21' NL/78° 23' EL) in Tehri District, Uttarakhand State– India. River khoh is the tributary of river Ramganga. The Henwal River, which originates in kaddukhal (near the Surkanda Devi Temple in Chamba, Uttarakhand) and flows for about 38 kilometres before joining the Ganga, is an important spring-fed tributary of the Ganga. The Song River is a river that flows through the Dehradun region of Uttarakhand, India. It is in charge of draining the central and eastern parts of the Doon Valley. From Dhanaulti, water flows towards Narendranagar, fed by springs on the southern slopes of the Radi Top of Mussoorie in the Himalayas. It is a tributary of the Sooswa river, which is a tributary of the Ganges.

Methodology

The fish, *Schizothorax richardsonii* were collected from the streams of Khoh, Song, and Henwal and 132 live specimens were then transported to the laboratory, where their gills, fins, and scales were examined for the presence of plasmodia.

Temporary preparation of myxospores: On a clean slide, a single plasmodium was burst apart using a needle in 0.85% normal saline, and the slide was subsequently examined under a light microscope to determine whether or not myxospores were present. After being treated with 8% potassium hydroxide, the polar filament (S) of the myxospores were extruded.

Permanent stained preparation of myxospores: Myxospore morphology was examined using the Giemsa stain following the

methodology provided by Kaur and Singh (2008). Giemsa staining indicated characteristics such as the number of sporoplasmic and capsulogenic nuclei, the shape of the myxospore shell, and if there was an intercapsular process. Measurements of all morphological parameters of parasites were recorded under Stereo Zoom microscope. All measurements were recorded in microns (µm). Measurements of Myxospores were taken with the help of guidelines given by Lom and Arthur (1989), Lom and Dykova (2006) and Kaur and Singh (2012a) keys were also used to identify myxospores. For identification of myxozoan parasites upto species level keys were used given by Eiras *et al.*, (2005), Kaur and Singh (2012a) and Eiras *et al.*, (2014).

Results

Current study carried out on 132 samples of *Schizothorax richardsonii* (Snow trout fish), 18 were found parasitic infected, which corresponds to an overall prevalence rate of (13.63%). The myxozoan parasites were found from gills of *Schizothorax richardsonii*.

Characteristics of parasite:

Host Name: *Schizothorax richardsonii* (Gray, 1832)

Common name: Snow trout

Locality: Kho, Song and Henwal river

Parasite: *Myxobolus richardsonii*, Shoab Ali Dar, 2016

Prevalence of infection: 9.68% (3/31) Kho, 20.93% (9/43), 10.34% (6/58) Henwal

Clinical symptomatology: Mucous laden

Description of Myxospore:

The length of myxospore were found ranges between 10.87 to 11.36 µm. Though, width of spores was observed between 7.31 to 7.82 µm. Polar capsule ranges between 5.82 to 6.28 µm in length and 1.76 to 2.06 µm in width respectively. Mean value of ratio in spore length and spore width was 1.47 µm (Table 1). The front view of a myxospore is ellipsoidal (11.11×7.51 µm), but the sutural view reveals



a characteristic lemon shape. There are two polar capsules, and they are equally sized and shaped like a pyriform pyramid that slightly converges at the back ($5.84 \times 1.83 \mu\text{m}$) in size. The polar capsule axis is parallel to the seven coils formed by the polar filaments. Existence of an intercapsular process (ICP).

Non-existent parietal folds. Homogeneous, agranular, and spherical sporoplasm. No iodophilus vacuole present (Fig. 1 & 2). The present specimens were compared to previously reported species in Wullar lake in Jammu and Kashmir (Table 2).

Table 1: Morphological parameters (μm) of *Myxobolus richardsonii*.

Parameters	Range	Mean values	SD
LS	10.87-11.36	11.11	0.206
WS	7.31-7.82	7.51	0.163
LPC	5.82-6.28	5.84	0.221
WPC	1.76-2.06	1.83	0.086
Ratio: LS/WS		1.47	
ICP		Present	
NC		7	
Parietal folds		Absent	

(LS= Length of Spore, WS= Width of Spore, LPC= Length of Polar Capsule, WPC = Width of Polar Capsule, ICP = Inter Capsular Process and NC = Number of Coils)

Table 2: Morphological comparisons based on the report of *M. richardsonii* with previous reported species. (Measurements in μm).

Species	Host	Infection site	Locality	Myxospore Size	Polar capsule size	ICP
<i>Myxobolus richardsonii</i> (Present Study)	<i>Schizothorax richardsonii</i>	Gills	Kho, Song & Henwal river (Uttarakhand)	11.11×7.51	5.84×1.83	Present
<i>Myxobolus richardsonii</i> (Shoaib Ali Dar, 2016)	<i>Schizothorax richardsonii</i>	Gills	Wullar lake (J&K)	11.19×7.66	6.12×1.95	Present



Fig.1: Infected fish and Fresh gill of *Schizothorax richardsonii* infected with myxozoan parasite.

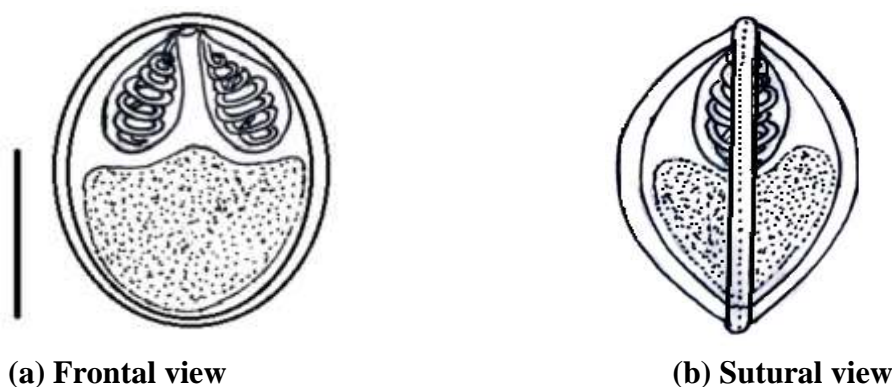


Fig. 2: Line drawing of *Myxobolus richardsonii*.

Discussion

Myxozoans are a large and diverse genus of fish parasites that have been extensively studied due to their complex life cycle (Okamura *et al.*, 2015). Some of the most studied fish parasites belong to the genus *Myxobolus* Butschli, 1882. There was a total of 856 different species of *Myxobolus* included in the synopsis that was produced by Eiras *et al.*, (2014), although their number has increased by approximately 120 additional species since then. The frequency of myxosporean parasites in Indian fishes has been the subject of an adequate quantity of research. Kaur and Singh (2012) documented 130 different species. To be more specific, *Myxobolus* species at least twenty new species have been found (Eiras *et al.*, 2021).

Dar *et al.*, (2016) reported new species, *Myxobolus richardsonii* in *Schizothorax richardsonii* from Wullar Lake, Kashmir, Himalaya. They observed size of myxospore was $11.19 \times 7.66 \mu\text{m}$ and polar capsule was $6.12 \times 1.95 \mu\text{m}$. In frontal view, the spore has the shape of an ellipsoid, while in sutural view, it has the shape of a lemon, shell valves symmetrical and thickness is $0.40 \mu\text{m}$. Ahmed *et al.*, (2019) reported *M. himalayaensis* sp. nov. in *Schizothorax richardsonii* from river Poonch in Northwest Himalaya. However, most of the research on myxozoan parasites in India is conducted on *Schizothoracine* sp. by

Dar *et al.*, 2016, 2017a, 2017b) in northwest Himalayas.

The present findings were observed very much similar with that of the previously available literature Dar *et al.*, (2016) except minor variation in size of myxospore. The size of myxospore were observed $11.11 \times 7.59 \mu\text{m}$ (LS and WS) with two equal and pyriform polar capsules $7.51 \times 5.84 \mu\text{m}$ (LPC & WPC). Polar capsules were present parallel to the axis and polar filaments coil existing with seven turns. Inter capsular process were present. Parietal folds absent. Iodinophilous vacuole is absent. Myxospores produced by *Myxobolus richardsonii* are distinguished by their pyriform shape. Frontal view shows an ellipsoidal shaped and sutural view shows lemon-shaped. In this aspect, it is similar to the species *M. cyprinicola*, *M. caudatus*, *M. macrocapsularis*, *M. margitae*, and *M. rotundus*. The study was conducted first time on the myxozoan parasites in *S. richardsonii* fish species found in snow-fed and spring-fed rivers of Uttarakhand state.

Conclusion

The measurements of Myxozoan parasite found in present study is close similar with connection to previous research articles. And with the assistance of identification keys, myxozoan parasites were identified as *M. richardsonii* sp., a species of the genus *Myxobolus*.



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