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Monogenean infestation of *Schizothorax esocinus* (Heckel, 1838) and its relation with size and sex of the host, with seasonal dynamics of parasitism

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Abstract

During the investigation of the diversity of the monogenean parasites in freshwater fishes of Kashmir valley carried from December 2010 to November 2012, 87 specimens (n=87) of *Schizothorax esocinus* were examined from three water bodies, Dal lake, Manasbal and River Jhelum. Two species of monogenean parasites viz., *Diplozoon kashmirensis* Kaw, 1950 and *Gyrodactylus elegans indicus* Tripathi, 1957 were reported with overall prevalence, mean intensity and abundance of 17.24%, 3.6 and 0.62 respectively. The infestation correlated with the seasonal changes and showed positive relation with size and negative relation with sex of the host.

Keywords: *Schizothorax*, monogeneans, *Diplozoon*, *Gyrodactylus*, Kashmir.

1. Introduction

Parasitism is recognized as a factor that influences animal communities [1, 2, 3]. Parasites can act directly on host survival and demography or have indirect effects on host physiology and behaviour that interfere with competition and predation [4, 5, 6]. The fishes are parasitized by large group of parasites both internally and externally, out of which monogeneans form the most important groups infecting fishes externally and damaging not only the important organs like gills and skin but also makes them prone to secondary infestations.

Monogeneans are the most ubiquitous and abundant group of helminth parasites in the aquatic environment [7]. Approximately 4000 species of Monogenea have been formally described worldwide but up to 25000 species are predicted to exist assuming that each fish species harbours a minimum of one species of monogenea [8]. They are the most important and most numerous helminth group parasitizing the external surfaces of fish [9]. They are predominantly ectoparasitic on gills and skin of fishes [10]. Monogeneans are diverse not only in their numbers but also in their morphology and ecology [11]. Besides this, monogeneans are quite host specific, i.e., each monogenean species infects only one or very few host species and are very narrow in their choice of a site on the host [12, 13].

The economic importance of fish parasites is related directly to the economic importance of the fish they affect. For proper management and development so as to increase fish production, it is necessary to study their parasites which cause disease in them and as a result hamper their growth pace as well as effect their quality and quantity. Knowledge of the local parasitofauna and their morphology and taxonomy is of great importance. Although a large number of studies have been made regarding helminth parasites but unfortunately, we are not well aware of the monogenean parasites and the damage caused by them in this region of J&K which is reflected by the scanty work done in this field.

The studies of monogenean diversity of India are comparatively recent starting from 1940s, and 1950s by workers of BS Chauhan, GS Thapar, SL Jain, RV Unnithan, K Ramalingam and YR Tripathi and only about 300 species of monogenea belonging to 120 genera under 30 families, are presently known from its marine and freshwater fishes, amphibians and reptiles. Although this number of species represents 10% of the described species of monogeneoidea worldwide, [14] it likely does not accurately reflect diversity of the group within the country. As there are about 950 species of freshwater fishes and more number of marine species and assuming that each species harbours a minimum of one species of monogenea, [15] the number of monogenean species presently known from India without doubt reflects a comparatively small proportion of those actually present in the country.

2. Materials and Methods

Kashmir valley is 100 kms wide and 15,520.3 kms² in area. It is situated between 32°-37' latitude and 73°-80' longitude at an altitude of 5,000 ft. above sea level. For present work three water bodies were selected viz., Dal lake, Manasbal lake and River Jhelum. A total of 87 (n=87) fish specimens belonging *S. esocinus* were collected and examined for monogenea infestation from different collection sites. Fishes were caught directly from collection sites or purchased from local fishermen and brought fresh to laboratory for examination. The fish specimens were measured (standard length (cm) and sexes were also determined.

During the screening, skin, fins, gill filaments, eyes mouth cavity and nostrils were examined in separate petridishes with physiological saline solution (0.65). Stereotype microscope was used to thoroughly examine different organs especially gills. The parasites collected were washed in normal saline, fixed in Carnoy's fluid and stained in aceto-alum-carmin. To study hard parts temporary slides were prepared in glycerine.

Measurements were taken with micrometer and expressed in

Table 1: Parasite wise prevalence, intensity and abundance in *Schizothorax esocinus*

Parasite Parameter	<i>Diplozoon kashmirensis</i>					<i>Gyrodactylus elegans indicus</i>						
	NE	NI	P (%)	TP	MI	A	NE	NI	P (%)	TP	MI	A
Value	87	11	12.64	36	3.27	0.41	87	4	4.59	18	4.5	0.20

4. Size related infection

The monogenean infestation in relation to size of host was analyzed. The fishes were selected between the length groups of 10 to 30 cm, the range in which infection was found. The table 2 illustrates size related variations in the infection of different fish species examined from different water bodies. The prevalence of infection among the different length groups varied significantly ($\chi^2 = 11.4$). The highest prevalence (33.33%) was recorded in length group 21 – 25 cm while as the lowest prevalence (0%) was recorded in length group 10 – 15 cm (Fig. 1).

Table 2: Length wise prevalence, intensity and abundance of two monogenean parasites.

Parameter	10 – 15cm	16 – 20cm	21 – 25cm	26 – 30	Total
NE	15	23	27	22	87
NI	0	3	9	3	15
P (%)	0	13.04	33.33	13.03	17.24
MI	0	3.6	3.7	3	3.6
A	0	0.47	1.25	0.13	0.62

($\chi^2 = 11.4$, df = 3 p = 0.009)

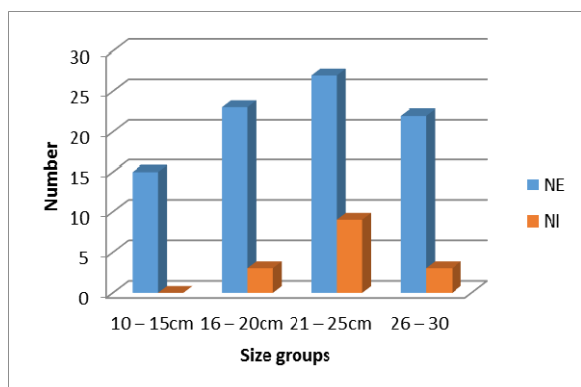


Fig 1: Length wise monogenean infection level

mm. The parasites were identified [16, 17, 18, 19] and so were the hosts [20]. For prevalence, intensity and abundance, the nomenclature given by Bush *et al.*, 1997 was followed [21]. Statistical analyses were performed using the statistical program like Microsoft Office Excel 2007 and SPSS. Chi square test was used. Significance was taken at $p < 0.05$.

3. Results and Discussion

During the present investigation of the diversity of the monogenean parasites in freshwater fish of Kashmir valley carried from December 2010 to November 2012, 87 specimens (n=87) of *Schizothorax esocinus* were examined from three water bodies, Dal lake, Manasbal and River Jhelum. Two species of monogenean parasites viz., *Diplozoon kashmirensis* Kaw, 1950 and *Gyrodactylus elegans indicus* Tripathi, 1957 were reported. It was found that out of 87 piscine hosts examined, 11 were found infected by *Diplozoon* and 4 were found infected by *Gyrodactylus* with prevalence, intensity and abundance of 12.64%, 3.27 and 0.41 and 4.59%, 4.5 and 0.20 respectively. Out of the 15 infected hosts, 54 parasites were recovered with 36 *Diplozoon* and 18 *Gyrodactylus* (Table1).

5. Sex related infection

The monogenean infestation in relation to sex of host was analyzed. Here both male and female specimens were analyzed separately and the infection level was checked. Although the infection rate varied in different sexes but Chi Square analyses showed negative relation between sex and infection (Table 3).

Table 3: Sex wise prevalence, intensity and abundance of two monogenean parasites.

Sex	NE	NI	P (%)	TP	MI	A
Male	41	6	14%	19	3.1	0.21
Female	46	9	19%	32	3.5	0.36
Total	87	15	17.24%	51	3.4	0.58

($\chi^2 = 0.6$, df = 1 p = 0.04)

6. Seasonal dynamics of Infection

The present investigation reveals a definite seasonal trend of monogenean infection in *S. esocinus* from the three water bodies (Table 4). The infection level was lowest during the winter followed by autumn. It was at its peak in summer followed by spring.

Table 4: Season wise prevalence, intensity and abundance of two monogenean parasites.

Season	P (%)			TP	MI	A
	NE	NI	% age			
Winter	18	0	0.00	0	0	0
Spring	23	4	17.39	17	4.25	0.74
Summer	26	8	30.77	28	3.50	1.08
Autumn	20	3	15.00	9	3.00	0.45
Total	87	15	17.24	54	3.60	0.62

($\chi^2 = 8.73$, df = 3 p = 0.067)

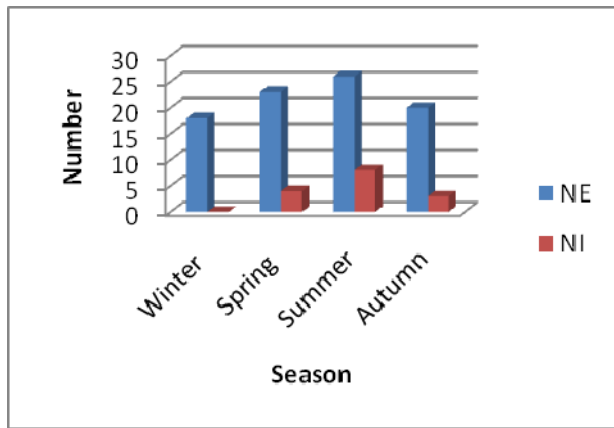


Fig 2: Seasonal change in monogenean infection

7. Discussion

The prevalence of monogenean infections correlates with fish length which in turn corresponds to fish age [22]. The prevalence of infection among the different length groups varied significantly. The probable reason for difference in prevalence of infection between the juvenile and the adult fish as related to their standard length may be due to change in diet from weeds, seeds, phytoplanktons and zooplanktons to insect larvae, snails, crustaceans, worms and fish in both juveniles and adulthood respectively [23]. The length groups 26 – 30 cm recorded decreased prevalence of infection. This may be attributed to the possible random selection of the specimens and the possible high level of immunity in larger sized fish specimens [23]. The high incidence of infestation obtained in adult fish is an indicator that size of the fish is important in determining the parasite load compared to juveniles. With the increase in host size the abundance of parasites also increases [24, 25, 26, 27]. Also the number of parasites and its diversity increase with age of fish [29]. The prevalence is found to increase as the fish grows, and that could be attributed to the longer time of exposure to the environment by body size [29].

The various studies conducted to find relation between sex of host and infection level, revealed that parasitic infections sometimes correlate [30] and mostly does not [31, 32, 33, 34, 35, 36] with sex of fishes. The present observations revealed that the prevalence of monogenean infection in fish species examined do not show much difference and there was insignificant relationship between sex of the host and monogenean infection.

The reason behind variation in the infection level during different months of the year can be temperature conditions. Temperature is the most important environmental factor, influencing population dynamics of the parasites [38, 39, 40, 41] and controls a strict seasonality because it has a direct role in rate of reproductive and developmental process. Population growth rate is sensitive to temperature [42, 43] as is evident in the present study.

8. Abbreviations

NE (number of fishes examined); NI (Number of fishes infected); TP (total number of parasites recovered); P (Prevalence); MI (Mean Intensity); A (Abundance).

9. Conclusion

Monogenean infestation significantly varied with size of host and insignificantly with host sex. Seasonal dynamics of parasitism confirmed highest level of infection in summer and lowest in winter.

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