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SHORT COMMUNICATION

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On the epidemiology of helminth parasites in Hangul Deer *Cervus hanglu hanglu* (Mammalia: Artiodactyla: Cervidae) of Dachigam National Park, India

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Abstract: A one-year study conducted to ascertain the prevalence and risk factors associated with helminth infection in Hangul Deer *Cervus hanglu hanglu* at Dachigam National Park revealed that 40.45% (89 of 220 samples) were infected with four helminth species including *Heamonchus contortus*, *Trichuris ovis*, *Dictyocaulus viviparus*, and *Moneizia expansa*. The study signified that the infection was more prevalent during the dry season (summer and autumn) as compared to the wet season (winter and spring). The overall prevalence of *Heamonchus contortus* was the highest (23.18%) followed by *Trichuris ovis* (8.18%), followed by *Dictyocaulus viviparus* (5.45%), and *Moneizia expansa* (3.63%). The present study should be of importance in conserving the erstwhile state animal, listed as Critically Engendered in 2017 by IUCN.

Keywords: Conservation, Hangul, helminth infection.

Parasites are important natural components of ecosystems because they actively arbitrate in the ecological, demographic and life history processes of their hosts, impelling the structure and organization of free-living organism communities (Poulin & Morand 2000). The study of parasites provides information not only on the host's health but also on the evolutionary history and historical biogeography of the host-parasite relationships as well as the health of the ecosystem (Brook & McLennan 1993). Helminth's incursion of ruminants is one of the major problems worldwide. These infections are responsible a for large number of economic losses in the form of lower fertility, reduced capacity, involuntary culling and mortality in heavily parasitized animals (Carmicheal 1972; Akerejola et al. 1979). Gastrointestinal parasites especially the helminth infections are the main causal proxies of intestinal and extra-intestinal infections, however, the parasites in wildlife vertebrates are challenging to study. These parasites are the common cause of significant morbidity and mortality in wild animals especially the endangered ones. Hence, early detection and discrepancy of these parasites is important in the clinical management of wild animals. This, however, has been a major limitation in studying parasites of rare and endangered species like Hangul in Dachigam National Park.

Hangul, being the erstwhile State animal is a subspecies of the European Red Deer. Although more than 150 species of deer are recognized globally, Hangul is the only surviving race of the Red Deer family of Europe

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in the sub-continent. Before 1947, the number of Hangul Deer in Jammu & Kashmir was in thousands but due to poaching, parasitic infections, and lack of management, there has been a drastic waning in their number (Ahmad & Nigam 2014). In 2015, the total population size was estimated to be 110–130 individuals in Dachigam National Park with overall 150–200 individuals (the number of mature individuals presumably significantly smaller), thus declared as a Critically Endangered deer (Brook et al. 2017).

Parasitic infections are common in nature, but low intensity infections are often asymptomatic and intensify with anthropogenic changes, which may result in loss of stability associated with altered transmission rates, host range, and virulence (Anderson & May 1979). The prevalence of these parasitic infections in the Red Deer *Cervus elaphus* is widespread across the world (Watson & Charleston 1985). The proper identification of the helminth infection is vital to address this issue. The data concerning the gastrointestinal infection of Hangul Deer in Dachigam National Park is scarce and fragmentary. Therefore, the study will add to the existing knowledge and will help to devise appropriate control and prophylactic strategies for helminthiasis of the last surviving species of European Red Deer.

Material and Methods

A total of 220 fresh faecal samples were collected from various feeding sites of Hangul Deer at Dachigam National Park. The samples were stored in sterile vials containing 10% formalin solution in order to avoid contamination and to preserve the parasites. The preserved samples were examined at Microbiology Research Laboratory, CORD, University of Kashmir using various qualitative and quantitative techniques. Simple flotation technique was used for the separation of nematode and cestode eggs by concentrating them by means of flotation fluid with appropriate specific gravity. Sedimentation technique was used to detect trematode eggs as this technique concentrates them in a sediment (Sloss et al. 1994; Urquhart et al. 1996). Many nematodes eggs are alike and species like *Heamonchus*, *Oesophagostomum*, *Ostertagia*, and *Cooperia* cannot be differentiated. Therefore, for proper identification, faecal culture was done for hatching and development of these helminth eggs into infective stage (L3). The larvae were then recovered by using Bearmann's technique. Identification of eggs and larvae was done on the basis of various morphological and morphometric characters (Sahai & Deo 1964; Soulsby 1982; van Wyk et al. 2004).

Results

Out of the total 220 samples, 89 (40.45%) samples were found infected with one or more helminth species -- *Heamonchus contortus* (Image 1A), *Trichuris ovis* (Image 1B), *Dictyocaulus viviparus* (Image 1C), and *Moneizia expansa,* however, no acanthocephalan was detected during the study. Table 1 indicates the overall prevalence of helminthiasis in Hangul Deer: *Heamonchus contortus* (23.18%) followed by *Trichuris ovis* (8.18%) and *Dictyocaulus viviparus* (5.45%). *Moneizia expansa* was seen least (3.63%). There were significant differences in the prevalence of parasitic infestation with respect to the season. Table 2 and Figure 2 clearly depicts that the infection was higher in dry season as compared to the wet.

Discussion

The current epidemiological study of helminth parasite infection in Hangul Deer revealed that the bulk of work has been done on gastrointestinal parasitic infestation of ruminants of Kashmir region (Dhar et al.

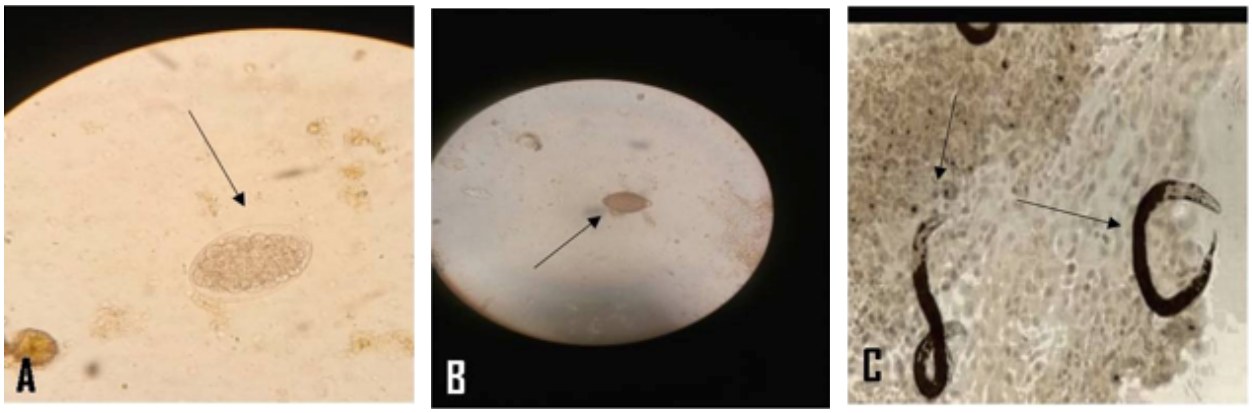

Image 1. A—*Heamonchus contortus* | B—*Trichuris ovis* | C—*Dictyocaulus viviparus.* © Naziya Khurshid.

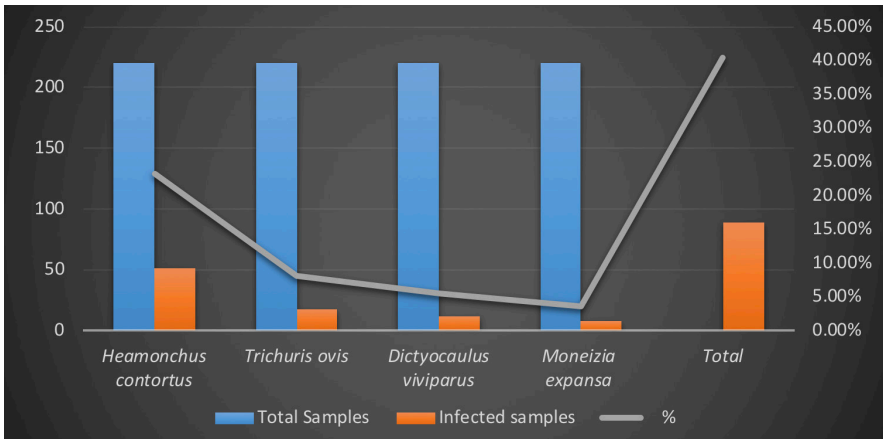

Figure 1. Overall prevalence of helminth infection in Hangul Deer.

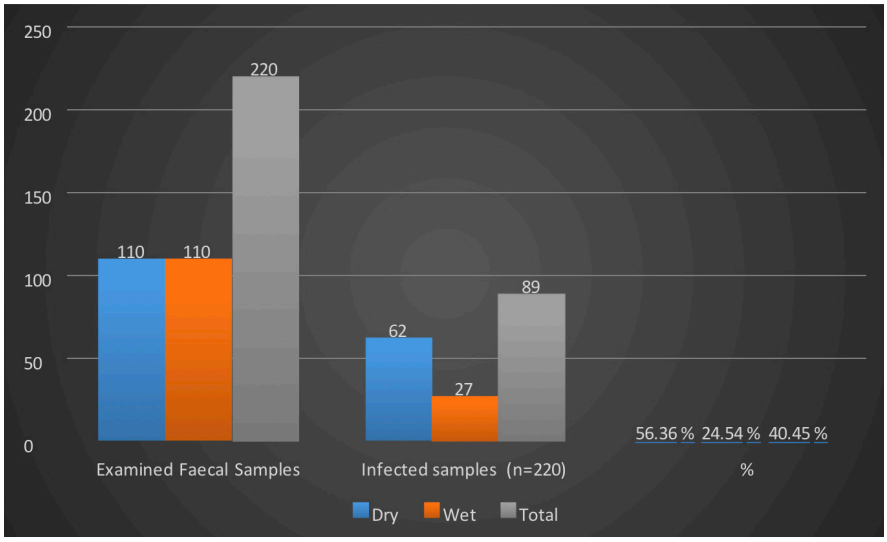

Figure 2. Prevalence of helminth infection across seasons.

Table 1. Overall prevalence of helminth infection in Hangul Deer.

Parasite Species	Infected samples (Total 220)	Percentage (%)
Heamonchus contortus	51	23.18%
Trichuris ovis	18	8.18%
Dictyocaulus viviparus	12	5.45%
Moneizia expansa	8	3.63%
Total	89	40.45%

1982; Tariq et al. 2008a,b,c; Lone et al. 2012) but other wildlife of the region remains poorly studied. The current examination revealed four different helminth species in the faecal samples of Hangul deer. Of these three were nematodes, viz., *Heamonchus contortus* (23.18%) followed by *Trichuris ovis* (8.18%) and *Dictyocaulus viviparous* (5.45%). *Heamonchus contortus*, a tropical and sub-tropical parasite already prevalent in Kashmir Valley was found in the highest numbers. The increase in temperature due to global climate alterations can be one of the possible reasons for the occurrence of this parasite in the temperate climate zone. One cestode species *Moneizia expansa* was seen in least count (3.63%). Out of 220 samples (Table 1 and Fig. 1), 89 (40.45%) samples were found infected. The prevalence of infection was found higher in dry season which included summer and autumn (56.36%) than the wet season which included winter and spring (24.54%) (Table 2, Figure 2). The reason of this reduction could be the hypobiosis of nematodes in host and unavailability of hosts (Ogunsuri & Eysker 1979; Gibbs 1986) during the wet season. The data however, presents overall low intensity of infection possibly due to grazing break during winter season and also the relocation of sheep breeding farm outside the park in 2017, may have contributed to the lower infestation. The incidence of infection in this study was

Table 2. Prevalence of helminth infection across seasons.

Season(s)		Examined faecal samples	Infected samples	Percentage (%)
Dry season	Summer	55	49	89.09%
	Autumn	55	13	23.64%
	Total	**110**	**62**	**56.36%**
Wet season	Winter	55	11	20%
	Spring	55	16	29.09%
	Total	**110**	**27**	**24.54%**
Overall		**220**	**89**	**40.45%**

lower as compared to earlier studies (Nashiruddullah et al. 2005, 2007; Lone et al. 2014).

Conclusion

The present study has revealed that the Hangul deer is infested with helminth infection and infection is influenced by seasonality, however, more information is required about these parasites and their transmission to effectively control helminthiasis in the Hangul Deer. We believe that the present study would provide baseline data for further studies.

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