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Livestock Helminth Infestation as A Potential Threat To Wild Ungulates In Hirpora Wildlife Sanctuary

Rouf Ahmad Bhat[1], Hidayatullah Tak[1], Bilal A.Bhat[1], Mustahson F. Fazili[1], Hameem Mushtaq Wani[1], Iqram ul Haq[1], and Riyaz Ahmad[*2]
[1]Department of Zoology University of Kashmir Srinagar- 190006
[2]Wildlife Trust of India Noida- UP, India
[*]**Corresponding author's Email:** riyaz@wti.org.in.

ABSTRACT

The gastrointestinal helminths are known to have high potential for transmission through feco-oral route and may transmit from livestock to wild ungulates with an impact on their health and reproduction. We lack studies on prevalence of gastrointestinal helminth parasites in domestic livestock sharing habitat with wild ungulates of Hirpora Wildlife Sanctuary. As the domestic sheep and goat constitute more than 90% of livestock population, we therefore, collected faecal samples of domestic sheep (n=281) and goat (n= 226) in the sanctuary from June to October of two consecutive years (2018 and 2019) for qualitative examination of gastrointestinal helminth parasites by centrifugal sedimentation and floatation methods.The present study reveals the prevalence of 77.22% and 72.12% of gastrointestinal helminth parasites in domestic sheep and goat respectively with an overall prevalence of 74.67%. A total of seven species of gastrointestinal helminth parasites were recorded which are arranged in the descending order of their overall prevalence as *Haemonchus contortus* (60.93%), *Trichuris ovis* (52.68%), *Nematodirus* sp. (40.82%), *Trichostrongylus axei* (39.89%), *Moniezia expensa* (34.96%), *Strongyloides papillosus* (33.63%) *and Fasciola hepatica* (31.51%).
Key words: *Helminth parasites, Prevalence, Potential hosts, Livestock, Hirpora*

INTRODUCTION

Livestock presence in protected areas poses a threat to wild animals by acting as potential hosts of gastrointestinal helminth parasites (Correa *et al.,* 2001 ; Obanda *et al*., 2019).Parasites can become a source of infection for wild animals besides causing morbidity and mortality in domestic animals (Randall *et al.,* 2006). Anthro-pogenic factors, advancement in agriculture and increase in cattle-raising bring domestic animals in close proximity with wild animals in natural habitats facilitating spread of infectious agents to new hosts (Correa *et al.,* 2001). Gastrointestinal parasites affect the survival and reproduction of different hosts directly by causing tissue damage, blood loss, abortion and congenital malformations besides making them immunologically weak and causing death in severe cases (Thawait *et al.*, 2014). One of the major threats which has a significant effect on the wellbeing of wild animals is the infectious diseases arising from gastrointestinal parasites (Opera *et al.,* 2010). Helminths and their diverse hosts co-exist as interacting ecological communities in natural ecosystems and the host habitat overlap influences infection patterns within those communities (Ezenwa, 2003; Johnson *et al.*, 2013).Transmission of helminths through feco–oral route readily occurs between species inhabiting same area (Waruiru *et al.,* 1995).The quantification of transmission risk of

infectious agents needs better understanding of different factors like temperature, rainfall, humidity and host abundance impacting such transmission among different hosts (Osofsky, 2005). The contact and inter-action among the individuals of a single species is one of the important factor responsible for intraspecific transmission (Cote and Poulin 1995; Altizer *et al.*, 2003). Increase in interaction among the inter-specific individuals increases the opportunities of transmission (Altizer *et al.*, 2003; Vander Waal *et al.,* 2014) and parasite prevalence, intensity, and diversity are correlated with intra specific variation in group size (Rubenstein and Hohmann, 1989). This implies that for these infectious agents, spatial overlap rather than physical contact between different hosts inhabiting particular habitat is probably sufficient for cross-species transmission (Ezenwa, 2003; Ocaido *et al.*, 2004; Howells *et al.*, 2011; Archie and Ezenwa, 2011).

Occurrence of different hosts in the same habitat seems to nurture parasite adaptive traits which facilitate host shifts, defined as movement of a parasite from its traditional host to a new one (Antonovics *et al.*, 2002).Thus parasites of domestic animals sharing habitat with wild animals may pose a threat to the wellbeing of the later. These parasites have a role in population regulations of different wild ungulates (Gulland, 1992) and have detrimental health effects on wildlife (Falvey and Bambridge, 1975). The transmission of in-fectious diseases between wild and domestic animals is becoming an essential aspect of major interest, as it is an important issue for the conservation of threatened fauna (Thompson *et al.*, 2010). The present study ascertains the gastrointestinal helminth parasitic prevalence in domestic sheep and goat constituting the major portion of livestock population in Hirpora wildlife sanctuary. This will facilitate better understanding of one of the possible ecological threats posed by domestic hosts to wild populations of markhor and musk deer.

MATERIAL AND METHODS

Study area:

Hirpora wildlife sanctuary (33 º 39′55″ N and 73º39′40″E) is located at a distance of 70 kilometers south of Srinagar at an altitude of 2546mts (Ahmad *et al*., 2014) (Fig. 1). It is bounded on north by lake Gumsar and on south by lake Saransar. The steepness of the slopes varies from moderately steep on the eastern side and very steep on the northern and western aspect. Hirpora wildlife sanctuary is characterized by different vegetation types like mixed coniferous forests, deciduous sub-alpine scrub forests and sub-alpine pastures. Coniferous forests mainly consist of Kail pine (*Pinus wallichiana*) with spruce (*Picea smithiana*) and fir (*Abies pindrow*). West Himalayan sub- alpine forests are dominated by fir and deciduous sub-alpine scrub is dominated by Himalayan birch (*Betula utilis*), Juniper (*Juniperus communis*), wild rose (*Rosa macrofolia*) and Kail pine (Ahmad *et al*., 2011).The sanctuary harbors various large mammalian species like brown bear, black bear, leopard, wolf, musk deer and Pir Panjal markhor (Ahmad *et al*.,2014). A large number of domestic animals like sheep, goat, cow, and buffalos are found grazing in the Hirpora wildlife sanctuary from late May upto November with higher densities from June to October (Ahmad *et al*., 2011). In year 2018, livestock of 70,000 was found to occupy the Hirpora WLS with domestic sheep and goat constituting more than 90% of the

population (WTI, 2018 unpub). These domestic animals belong to nomads and local shepherds who use this sanctuary for the grazing purposes.

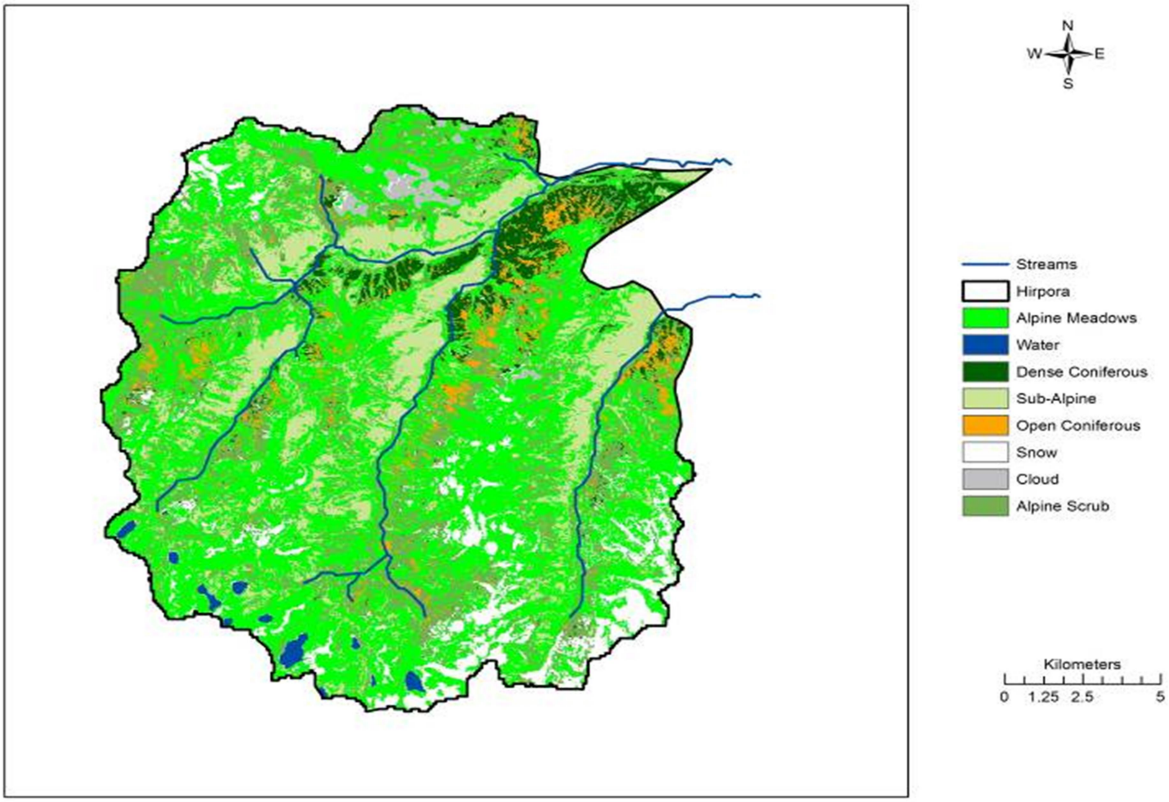

Fig.1.Study area showing habitat types of Hirpora Wildlife Sanctuary.

Methodology

During the period of investigation systematic surveys were done in Hirpora WLS. Fresh faecal samples were collected from different areas of the sanctuary. A total of 507 feacal samples of goat and sheep were collected during the study from June to October (2018 and 2019) as the domestic animals brought from different areas predominate in the wildlife sanctuary during these months.

For qualitative analysis, centrifugal sedimentation and floatation techniques were used to isolate trematode, cestode, and nematode eggs (Soulsby, 1982). For screening of trematodes and cestodes eggs sedimentation technique is employed in which a small quantity usually 3gm of faecal sample were gently meshed with a pestle followed by mixing it well with 15 ml of water by using stirring rod to form the suspension. Coarse particles were removed by passing the mixture through a strainer. Filtrate was then taken in a centrifuge tube and centrifuged at 2000 rpm for 5 minutes. The supernatant was discarded and the sediment was taken on a clean glass slide which was examined under Olympus BX60 microscope.

For examination of nematode eggs whose specific gravity is less than the floatation fluid, floatation technique was used on the similar lines as mentioned above and sediment was then mixed with saturated salt solution in a test tube upto the top, till upper meniscus was formed and the test tube was left undisturbed for 10 minutes so that the eggs will rise to the top of the test tube. The top of the tube was gently touched with a cover glass and then placed on a glass slide for microscopic examination. Morphological distinct features such as shape, size and color of eggs and oocysts were used for identification (Soulsby, 1982).

RESULTS AND DISCUSSION

Our study revealed the occurrence of mixed infection of various helminth parasites in goat and sheep being brought from different areas of Jammu and Kashmir (Rajouri, Poonch, Shopian, Budgam, Pulwama and Kulgam) for grazing purposes within Hirpora wildlife sanctuary (Ahmad *et al*., 2014).The prevalence of gastrointestinal parasites in faecal samples from sheep (n=281) and goat (n=226) were 77.22% and 72.12% respectively. Nematodes were most prevalent in both the species of ruminants. The highest prevalent nematode was *Haemonchus contortus* (60.93%) and lowest prevalence was of *Strongyloides papillosus* (33.63%) in both the hosts. The other nematodes recorded were *Trichuris ovis* (52.68%), *Nematodirus sp.* (40.82%), *Trichostrongylus axei* (39.89%) and *Strongyloides papillosus* (33.63%).The ruminants were also infected with *Fasciola hepatica* (trematode) and *Monezia expensa* (cestode) with prevalence of (31.51%) and (34.96%) respectively (Table 1). The monthly variation of prevalence recorded in these hosts was highest in July and least in October (Table 2).

Table 1. Prevalence of different parasites in two hosts (Sheep and Goat) from June to October (2018 and 2019) in Hirpora Wildlife Sanctuary

S.No.	Parasites	Class	Prevalence in Sheep	Prevalence in Goat	Overall prevalence
1	*Haemonchus contortus*	Nematodes	74.43%	47.43%	60.93%
2	*Trichuri sovis*		61.56%	43.80%	52.68%
3	*Nematodirus sp.*		46.26%	35.39%	40.82%
4	*Trichostrongylus axei*		46.61%	33.18%	39.89%
5	*Strongyloides papillosus*		36.29%	30.97%	33.63%
6	*Moneizia expensa*	Cestode	38.07%	31.85%	34.96%
7	*Fasciola hepatica*	Trematode	37.36%	25.66%	31.51%

Table 2. Monthly variation of parasitic prevalence in sheep and goat from June to October (2018 and 2019) in Hirpora Wildlife Sanctuary

Host	Sheep		Goat	
Month	**Total samples examined**	**Positive samples (prevalence)**	**Total samples examined**	**Positive samples (prevalence)**
June	56	44(78.57%)	46	34(73.91%)
July	60	50(83.33%)	48	36(75%)

August	59	45(76.27%)	50	36(72%)
September	53	40(75.47%)	44	31(70.45%)
October	53	38(71.69%)	38	26(68.42%)

The domestic animals shared same species of gastrointestinal parasites with varying levels of infection. The more number of hosts may increase the abundance and prevalence of parasites (Arneberg *et al*., 1998; Morand *et al*., 2000; Arneberg, 2001). In our study, *Haemonchus contourtus* was most prevalent in sympatric hosts which is in close agreement with several workers (Wambwa *et al.*, 2004, Muoria *et al*., 2005) which reveals that contamination of habitat by infective stages of helminths provides a chance of cross-transmission (Apio *et al.,* 2006). *Haemonchus contortus* frequently found in the domestic live-stock can infect some species of deer (Anderson, 2000).The more frequently associating species in the same habitat, likely share different helminth taxa (Cote,1995). Domestic cattle which are allowed to graze in HirporaWLS being infected with helminth parasites contaminate the habitat which is shared by wild animals as well. This may threaten the survival of wild ungulates in the sanctuary through parasitic transmission as there is every possibility that parasites recorded in domestic livestock may transmit to wild ungulates as reflected by the previous study carried out in Mburo National Park, Uganda in which 80% of same parasite taxa were found in both wild and domestic ungulates sharing the habitat (Ocaido *et al*., 2004). The parasite richness in an individual increases with increase in the number of ungulate species, which suggests that habitat overlap may play a significant role in cross-transmission of parasites (Ezenwa, 2003).

Cross-transmission of different pathogens depends on relative abundance of different hosts, besides the extent of overlap of their grazing areas (Morgan *et al*., 2004). The *Strongyloides* disperses its infectious agents with faecal matter, which accumulate in the soil and on the vegetation for a prolonged period of time (Hoberg *et al.,* 2001). Generalist parasites have the potential to move from traditional hosts to new ones and may threaten the various wildlife species (Begon & Bowers, 1995; McCallum & Dobson, 1995). It is also possible that the wild animals get infected with *Trichuris sp*. from the eggs which are being shed by the infected animals in the past because eggs of *Trichuris sp*. can remain infective upto four years (Peregerine *et al*., 2009). The severity of infection by different helminthes leads to general weakness in livestock resulting in considerable loss to livestock owners and reducing fitness in wildlife (Horak *et al*., 1968; Hudson, 1986). The increase in prevalence of parasites in June and July is due to increase in temperature which increases the rate of development of free-living infectious agents besides shifting their life histories from multi-year to single year cycles by making the environment favourable for the maturation and propagation of infectious agents (Kutz *et al.*, 2001; Hoberg *et al.*, 2002; Dobson *et al.*, 2003).

CONCLUSION

The prevalence of gastrointestinal parasites in domestic sheep and goat grazing in Hirpora WLS poses the potential threat to wild ungulates such as Markhor and Musk deer which are under Near Threatened (NT) and Endangered (E) categories respectively as per IUCN Red data list. The faecal examination of wild ungulates will further reveal

the true picture of parasitic sharing and possible mode of transmission between domestic and wild ungulates which needs further investigation. Proper immunization of livestock shall reduce this infestation and the threat thereof.

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