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***RESEARCH PAPER***

# GASTRO INTESTINAL PARASITES OF MUSK DEER (*MOSCHUS CHRYSOGASTER* HODGSON, 1839) IN LANGTANG NATIONAL PARK, NEPAL

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## ABSTRACT

This study was carried out to determine the prevalence of gastrointestinal parasites of musk deer in Langtang National Park, Nepal. A total of 9 fecal samples were collected systematically and analyzed using standard procedures during May-June, 2014. Overall 7 species of parasites including 4 nematodes, 1 cestode, 1 trematode and 1 protozoan parasite were recorded. Prevalence of *Ascaris* sp. was high (88.89%) followed by *Eimeria sp.* (77.78%), *Trichuris* sp. (66.67%), *Strongyloides* sp. (55.56%), *Moniezia* sp. (44.44%), Strongyle (44.44%) and *Paramphistomum* sp. (44.44%). Most of the samples had heavy parasitic infestation and multiple parasites were also observed in same individual. The high parasitic prevalence might have adverse health impact on musk deer. The possibility of cross-transmission of parasites between livestock and wildlife in Langtang National Park should be studied in future.

**Key words:** Wild animal, Gastrointestinal parasites, *Ascaris*, Mixed infection, Prevalence

## INTRODUCTION

Musk deer (*Moschus chrysogaster*) is a globally threatened species listed as "Vulnerable" in IUCN Red Data Book (Wang & Harris 2008). As per national status, it is an endangered species and is listed in appendix I of CITES (Wang & Harris 2008, Jnawali *et al.* 2011). In Nepal, musk deer is found in Api Namppa Conservation Area, Khaptad National Park, Rara National Park, Shey Phoksundo National Park, Dhorpatan Hunting Reserve, Annapurna Conservation Area, Manaslu Conservation Area, Langtang National Park, Makalu Barun National Park and Kanchanjunga Conservation Area (Baral & Shah 2008, Aryal *et al.* 2010, Aryal and Subedi 2011, Jnawali *et al.* 2011). Its population is declining due to anthropogenic activities such as habitat loss, habitat degradation and poaching (Wang & Harris 2008, Jnawali *et al.* 2011). Disease is another possible detrimental factor for population declining of mammal (Pedersen *et al.* 2007) because these are reservoirs of several parasites. For examples, red fox (*Vulpes vulpes*) harbors different intestinal nematodes and trematodes (Richards *et al.* 1995) and rodents like *Microtus oeconomus* and *M. agrestis* have *Babesia microti* (Karbowiak *et al.* 1999). Interaction of these animals in common ecosystem may play significant role for transmission of parasites among different species (Bengis *et al.* 2002, Smith *et al.* 2009). The role of parasites in wildlife population decline is not well documented. However, parasites occurrence, mode of infection and possible impacts in wildlife are documented, mostly using samples from dead animals and from zoo samples (Polley 2005, Zhang *et al.* 2008, Bertelsen *et al.* 2010, De Craeye *et al.* 2011, Veronesi *et al.* 2016). In Nepal, only few baseline surveys on wildlife are documented so far on parasite prevalence and interaction with livestock. In particular, parasitic prevalence in rhesus monkey (*Macaca mulata*), Assamese macaque (*Macaca assamensis*), red panda (*Ailurus fulgens*), interaction of red panda and livestock and cross-infection of *Schistosoma* between elephant and rhinoceros are reported (Jha *et al.* 2011, Byanju *et al.* 2011, Devkota *et al.* 2012, Shrestha & Bindari 2013, Tachibana *et al.* 2013, Pokheral & Maharjan 2014, Lama *et al.* 2015, Sharma *et al.* 2016). These studies opened the possibilities of conservation threats to wild animals in Nepal from parasites related mortalities reported elsewhere in red wolf (*Canis rufus*), grey wolf (*C. lupus*), wolverine (*Gulo gulo*), brown bear (*Ursus arctos*), primates, and giant panda (*Ailuropoda melanoleuca*) (Custer & Pence 1981, Phillips & Scheck1991, Chapman *et al.* 2006, Morner *et al.* 2005, Zhang *et al.* 2008). So far, we do not have any baseline data of parasitic prevalence in globally threatened rare species-the musk deer of Nepal. Hence, this study was aimed to determine the prevalence of gastrointestinal parasite in musk deer of Langtang National Park, Nepal.

## MATERIALS AND METHODS

### Study area

This study was carried out in May-June of 2014 in Langtang National Park (LNP) of central Nepal. LNP (28° 10′ 25″ N, 85° 33′ 11″ E) covers the area of 1,710 $km^2$ and was established in 1976. It has vegetation like birch (*Betula utilis*), rowan (*Sorbus microphyla*), oak (*Quercus semecarpifolia*), fir (*Abies spectabilis*), juniper (*Juniperus recurva*), maple (*Acer caudatum*, *A. pectinatum*), rhododendron spp., bamboos (*Himalaya calamus falconeri*, *Thamno calamus aristatus*) and wildlife fauna such as Himalayan black bear (*U. thibetanus*), common leopard (*Panthera pardus*), musk deer (*M. chrysogaster*), goral (*Nemorhaedus goral*), Himalayan tahr (*Hemitragus jemlahicus*), red panda (*A. fulgens*), wild boar (*Sus scrofa*), wild dog (*Cuon alpinus*), snow leopard (*Uncia uncia*). Human settlement is common practice inside the park and the intensity of human activities, including livestock grazing, made it an ideal study site to explore anthropogenic influences on host-parasite dynamics in musk deer.

### Sample collection and lab process

A total of 9 fecal samples were collected in this study. For sample collection, four horizontal transects were established starting from 3,000 m and with an interval of 200 m up to 3,600 m of elevation. Approximately 20 gm of fresh fecal samples, covered with moist mucous, were collected in each sampling. A minimum distance of 300-400 m was maintained in subsequent sampling to avoid collecting samples from same individual. Samples were collected in a 50 ml sterile vial containing 10% ethyl alcohol and then transported to the laboratory of Central Department of Zoology, Tribhuvan University, Kathmandu and stored at 4°C before processing. Samples were processed by standard zinc salt sedimentation-floatation technique (Soulsby 1982). Eggs and cysts were identified as mentioned in Yamaguti (1961), Soulsby (1982) and Zajac and Conboy (2012). Data were analyzed using descriptive statistics in MS-Excel, 2007. The parasitic prevalence was determined as the number of species found in samples divided by total number of samples observed. Similarly, the intensity of parasitic prevalence as light, mild, medium and heavy was determined based on the number of eggs or oocysts observed per microscopic field.

## RESULTS

Of all the tested samples, 88.89% samples were positive for gastrointestinal parasites in this study. Four species of nematodes (*Ascaris* sp., strongyle, *Strongyloides* sp. and *Trichuris* sp.), one cestode (*Moniezia* sp.), one trematode (*Paramphistomum* sp.) and protozoa (*Eimeria* sp.) parasites were observed in feces of musk deer (Fig. 1). *Ascaris* sp. was the most prevalent parasite observed in 88.89% samples. Both of the *Eimeria* (with micropyle and without micropyle) had the equal prevalence of 77.78%. Similarly, *Trichuris* sp., *Strongyloides* sp., strongyle, *Moniezia* sp. and *Paramphistomum* sp. had percentage prevalence of 66.67, 55.56, 44.44, 44.44 and 44.44 respectively. All of the nine samples revealed eggs/cysts of two or more parasites (Table 1). Heavy infection was considered if the sample containing five or more than five eggs or oocysts were observed per field. *Strongyloides* sp., *Trichuris* sp., *Moniezia* sp. and *Paramphistomum* sp. showed the light infection in most of the samples (Table 2).

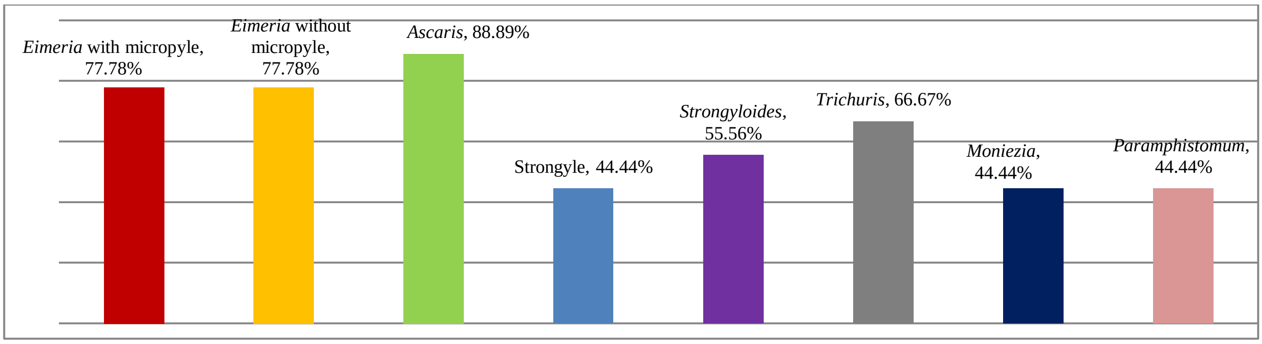


***Fig 1: Species wise prevalence of gastrointestinal parasites in musk deer.***

**Table 1: Combination of multiple gastrointestinal parasites observed in feces of musk deer**

| Name of the parasites | No. of case | Prevalence (%) |
|---|---|---|
| *Eimeria, Ascaris, Trichuris,* strongyle, *Strongyloides* | 3 | 33.33% |
| *Eimeria, Ascaris, Trichuris,* strongyle, *Paramphistomum* | 2 | 22.22% |
| *Eimeria, Ascaris, Trichuris,* strongyle | 4 | 44.44% |
| *Eimeria, Ascaris, Moniezia,* strongyle | 2 | 22.22% |

**Table 2: Intensity of parasitic prevalence in feces of musk deer**

| Name of Parasite | + (Light) | ++ (Mild) | +++ (Medium) | ++++ (Heavy) |
|---|---|---|---|---|
| *Eimeria* with micropyle | 1 | 1 | 2 | 3 |
| *Eimeria* without micropyle | - | 2 | 1 | 4 |
| *Ascaris* sp. | - | 4 | 1 | 3 |
| Strongyle | - | 2 | - | 2 |
| *Strongyloides* sp. | 2 | - | 3 | - |
| *Trichuris* sp. | 4 | 1 | 1 | - |
| *Moniezia* sp. | 3 | - | 1 | - |
| *Paramphistomum* sp. | 2 | - | - | 2 |

## DISCUSSION

The parasitic prevalence was 88.89 % in this study. Heavy infestation was observed for *Ascaris* and *Eimeria* sp. *Eimeria* sp. can be a severe problem because it causes bloody diarrhea in herbivore (Mass 2007). Sharma *et al.* (2016) previously documented high prevalence of coccidian parasites in chauri (Hybrids of Yak and cow) from this area. Since this study area also belongs to the livestock grazing sites, occurrence of *Eimeria* may be due to mutual transmission between livestock and musk deer or vice versa. In this study, prevalence of nematode was found to be higher compared to cestode and trematode, which was similar to earlier reports in roe deer of lower Silesia (Pacon 1994) and in red deer and fallow deer in Spain (Santin *et al.* 2004). Similar to musk deer, higher prevalence of *Trichuris*, *Ascaris* and coccidian were reported previously in spotted deer (Varadharajan & Kandasamy 2000). The high frequency of nematodes may cause iron deficiency anemia and abdominal disorders, which can have significant impact on rare species like musk deer (Roche 1988). Prevalence of *Paramphistomum* sp. was 44.44% in this study, which was slightly less than the report of Rehman *et al.* (2014) where they showed 36.5% prevalence in 21 herbivore zoo species in Bangladesh. *Paramphistomum* generally occurs in rumen, reticulum and small intestine and cause intestinal wall erosions, haemorrhage, oedema and necrosis of ruminal papillae (Love & Hutchinson 2003).The infection of *Ascaris* sp. may be through soil intake by grazing animals. The thick outer shell of *Ascaris* sp. facilitates up to 15 years survival in soil and causes diarrhea, malnutrition and obstruction of intestine (Hagel & Giusti 2010). However, the presence of multiple parasites in an individual increases parasitic load and can have adverse impact on health. Prevalence of *Strongyloides*, which causes diarrhea, anorexia, weight loss, variable anaemia and dyspnoea, has been reported in deer in several previous reports (Ezenwa 2003, Meshram *et al.* 2008, Gupta *et al.* 2011). *Strongyloides* prevalence may be due to wet, muddy conditions of pasturing land. Strongyle was also prevalent in musk deers which can cause inappetence, intermittent watery diarrhoea and weight loss.

## CONCLUSION

This study showed that musk deer in Langtang National Park, Nepal have high prevalence of gastrointestinal parasites including nematodes, trematodes, cestodes and protozoa. For most of the parasites the parasitic load was high and each musk deer was infested with multiple parasites. The high prevalence of multiple parasites might have significant health impact in musk deer and possibly play direct or indirect role in its population decline. The cross transmission of parasites between livestock and wildlife is possible in LNP which should be explored in future studies.

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