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SHORT COMMUNICATION

PARASITE COMMONALITY AT SWAMP DEER (MAMMALIA: ARTIODACTYLA: CERVIDAE: *RUCERVUS DUVAUCELII DUVAUCELII*) AND LIVESTOCK INTERFACE

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Parasite commonality at Swamp Deer (Mammalia: Artiodactyla: Cervidae: *Rucervus duvaucelii duvaucelii*) and livestock interface

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Abstract: Interactions between wildlife and livestock have increased over time with increased anthropogenic pressure on limited available natural habitats. These interactions have resulted in sharing of pathogens between the species resulting in impacting the wild animals' fitness and reproduction and further influencing their abundance and diversity. The spatial overlap between Swamp Deer and livestock was studied at Jhilmil Jheel Conservation Reserve (JJCR), Uttarakhand and Kishanpur Wildlife Sanctuary (KWLS), Uttar Pradesh in India, having different levels of interaction with livestock. The prevalence, load and commonality of gastro-intestinal parasites in the species was studied through coprological examination. Parasitic ova of *Strongyle* sp., *Trichostrongylus* sp., *Fasciola* sp., and *Moniezia* sp. *Amphistomes* were encountered in swamp deer and livestock from both the sites. The parasitic species richness and prevalence however, varied between JJCR and KWLS. The study recorded significant differences between the parasitic load in Swamp Deer with the eggs per gram of 487.5±46.30 at JJCR and 363.64±49.97 at KWLS at varying levels of livestock interactions.

Keywords: Coprology, eggs per gram, helminth, Jhilmil Jheel Conservation Reserve, Kishanpur Wildlife Sanctuary, wildlife.

BACKGROUND

Interactions between livestock and wildlife has increased in the recent past due to increased sharing of natural habitats resulting from increased demand for agriculture, grazing, water, and a diverse array of anthropogenic activities (Dobson & Foufopoulos 2001). These negative interactions result in competition for food, provide opportunity for pathogen sharing and may result in species hybridization (Foufopoulos et al*.* 2002; Lafferty 2003). Around 77% of livestock pathogens are multi-host with a majority affecting wild ungulates (Cleaveland et al. 2001). Parasitic infections and diseases in wildlife and at the livestock-wildlife interface have the potential to hamper conservation efforts by intensifying the ranges of host species (Dobson & Hudson 1986). A majority of these pathogens are opportunistic (Dobson & Foufopoulos 2001) with the ability to infect an unusually large number of host species. Though parasites rarely play a direct role in host extinction, they can significantly alter populations in conjunction with precipitating factors like habitat loss, habitat degradation, and climatic change (Purvis et al. 2000). There is mounting

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Image 1. Swamp Deer (*Rucervus duvaucelii duvaucelii* G. Cuvier, 1823) at Kishanpur Widllife Sanctuary.

theoretical and empirical evidence that parasites play an important role in influencing host populations through impacts on survival, reproduction, and trophic equilibria (Grenfell 1992).

Three subspecies of Swamp Deer, viz., *Rucervus duvaucelii duvaucelii* distributed in northern India, *R.d. branderii* in Kanha National Park in central India, and *R.d. ranjitsinhi* distributed in Assam (Poudel 2007; Sankaran 1990) have been recorded. The Swamp Deer is one of the most vulnerable species of deer from the Indian subcontinent as well as in the world, and is presently found only in isolated localities in northern and central India as well as in south-western Nepal (Qureshi et al. 2004). The population status is between 3,500 and 5,100 animals among which several meta-populations are found in patches in protected areas and outside where presence is not secure (Nandy et al. 2012).

The study focussed on Swamp Deer (Image. 1), a representative of specialized habitats and an important species of the swamp. The species is under threat due to loss of habitats, poaching, diseases etc. The habitat preference and seasonal movement pattern places the species in close proximity to livestock that results in sharing of pathogens and resultant disease. The species, like other cervids, is vulnerable to infection by gastro-intestinal parasites.

Methods

A rapid reconnaissance survey was carried out at Jhilmil Jheel Conservation Reserve (JJCR) and Kishanpur Wildlife Sanctuary (KWLS) to identify the intensive study are based on the presence of Swamp Deer and probable interaction with livestock. For the intensive study, Jhilmil Jheel area (JJ) of JJCR (Figure 1), and Jhadi Tal (JT) of KWLS (Figure 2) were selected where they had varying levels of interactions with livestock. JJ is considered as an area with high Swamp Deer-livestock interaction and more than 1,300 livestock have been reported to use JJCR on a daily basis (Tewari 2009). JT of KWLS on the other hand, is assumed to have minimal interaction between Swamp Deer and livestock as human settlement is present only in the northeastern side and the western side is bounded by the Kheri Branch canal of the Sharada canal system (Midha 2005). The population estimation of Swamp Deer conducted by Tewari & Rawat (2013) and Midha & Mathur (2010) included 320 and 400 individuals at JJ and JT, respectively.

Early morning dung pellet samples were collected from resting areas of Swamp Deer after they moved away for grazing at both the study sites. Simultaneously, random sampling was also performed to collect dung samples from livestock in both the study areas.

The sample size was calculated according to Thrusfield (1986) by considering 20% expected prevalence and 5% accepted error at 95% confidence interval using this formula: N=1.962 *Pexp (1 - Pexp)/ d2; where, N=required sample; Pexp=expected prevalence; d=desired absolute precision. A total of 246 individual dung piles of Swamp Deer were selected by simple random sampling method whereas 20% of livestock population was sampled as suggested by Bogale et al. (2014). The inter-sample distance for Swamp Deer samples was maintained at 50cm distance, to ensure unique individual samples (Bogale et al. 2014). To determine the effective sample size for parasitic infection/ disease, the species accumulation curve (Cain 1938) was drawn by plotting the number of parasites present against the number of total samples collected for each study species at each study area. Randomization for the collected data was done on MS Excel followed by counting the number of parasite species present for each five samples.

Before collection, pellets were visually assessed for consistency and appearance. Six to eight fresh pellets weighing 20–30 g from each dung pile were collected in sample collection vials and preserved in 10% formaldehyde for further laboratory examinations. Pellets were observed qualitatively for consistency, color, odor, presence of mucous, blood, and parasite segments and observations made for each sample were recorded. Coprological examination for parasitic ova and the load was carried out using qualitative tests (employing floatation and sedimentation techniques) and quantitative tests (employing modified Mc master technique to assess the eggs per gram (EPG) of dung) as

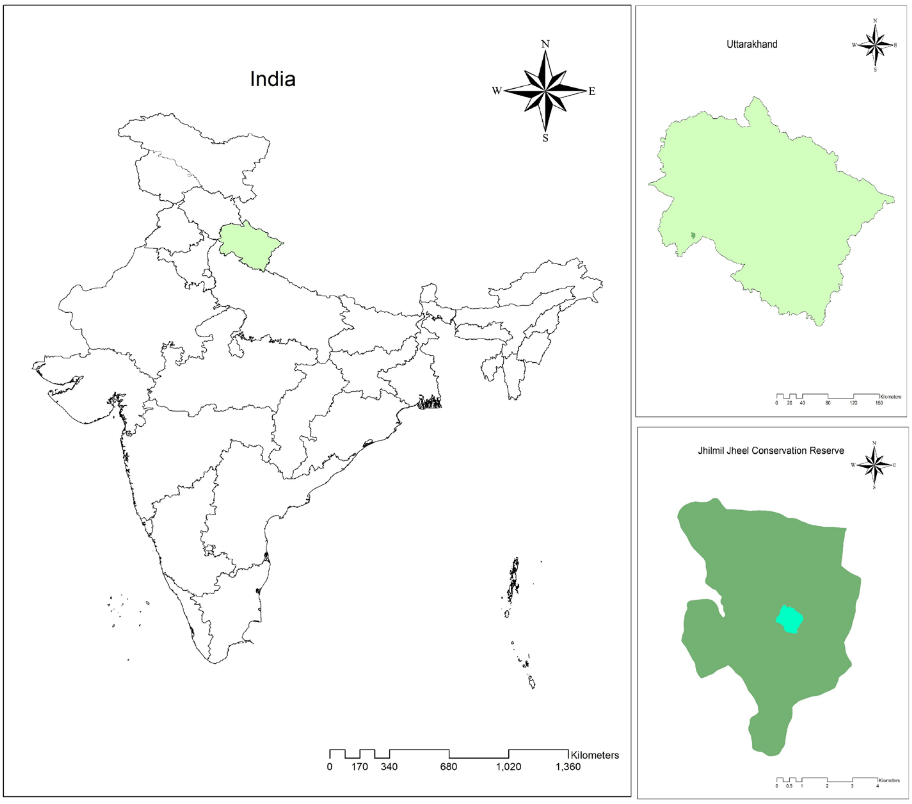

Figure 1. Map showing the location of Jhilmil Jheel Conservation Reserve in Uttarakhand.

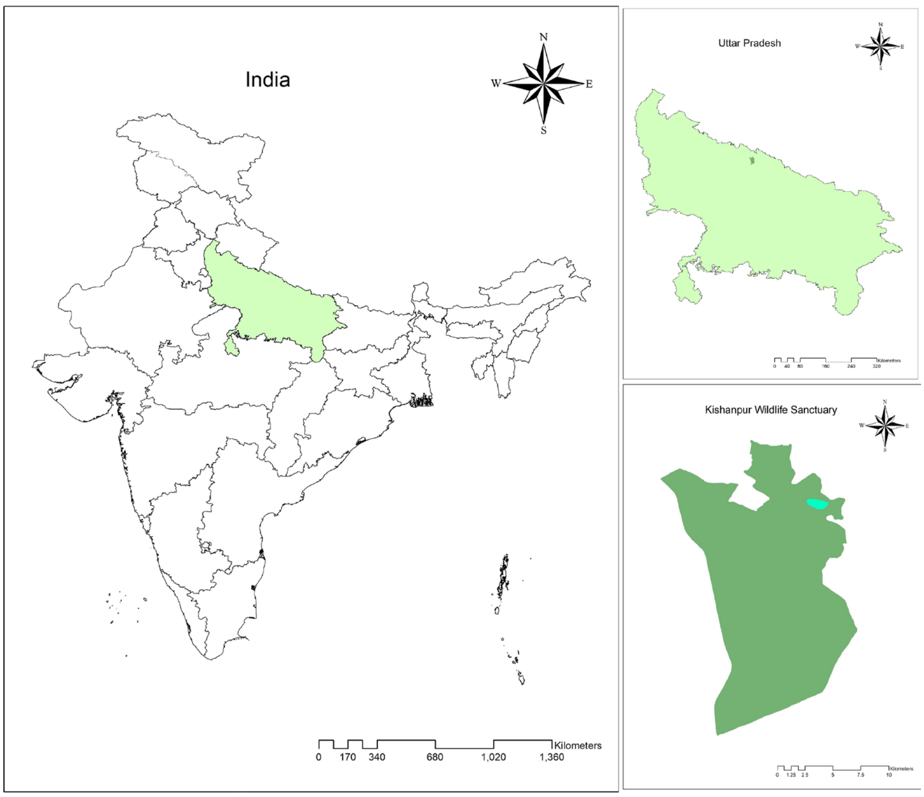

Figure 2. Map showing the location of Kishanpur Wildlife Sanctuary in Uttar Pradesh

described by Soulsby (1982). Parasite egg identification was based on Soulsby (1982). The entire study period was for six months from December 2014 to May 2015.

The prevalence of parasitic infection was calculated in the two populations as the number of individuals infected in the total individuals sampled in a given area and calculated as

Prevalence percentage = (Number of positive sample (Individuals)/Number of samples tested) X 100 (Thrusfield 1986).

The species-wise parasitic prevalence in total Swamp Deer and livestock population was derived as

Species-wise parasitic prevalence = (Individuals infected with particular parasite/Total positive sample) X 100.

The parasitic load was estimated as eggs per gram (EPG) of dung and the egg count for positive samples were multiplied with 200 for nematode and cestode, and by 50 for trematodes and later, average mean EPG was calculated for each studied species at both study areas (Soulsby 1982; Shrivastav & Singh 2004). Significant difference between the average parasitic load of Swamp Deer in between the population of JJ and JT was tested using Mann-Whitney U test by software SPSS (SPSS Inc. Released 2009. PASW Statistics for Windows, Version 18.0. Chicago: SPSS Inc).

Results and Discussion

Of the total samples collected and screened for parasitic ova, the overall prevalence of parasitic ova in the Swamp Deer population at JJ and JT were 15.38% and 12.69%, respectively, whereas the overall parasitic prevalence in livestock population at JJ and JT were 95.41 % and 60%, respectively. The overall prevalence rate observed in the study for Swamp Deer (15.28 in JJ and 12.69 in JT) was less as compared to those reported by Tiwari et al. (2009) (51.03%) for the study carried out at Kanha Tiger Reserve and Chakraborthy & Islam (1996) (21.85%) for the study in Kaziranga National Park. These may be attributed to sampling restricted to a shorter period (winter months) with environmental conditions that limit survival of parasites outside the host.

Based on the laboratory analysis, the presence of nematode, trematodes, and cestodes was confirmed from Swamp Deer as well as livestock in both the areas and represented parasitic ova belonging to group *Strongyle*, *Trichostrongyle*, *Moniezia*, *Fasciola*, and *Amphistome* (Image 2). The commonality of genus of parasites observed in Swamp Deer also correlated with the observations made by Tiwari et al. (2009) who carried out a similar study in Kanha Tiger Reserve.

In JJ, the *Strongyle* group was the most prevalent parasitic ova (67%) followed by *Amphistomes* (28%) and *Fasciola* (5%) for Swamp Deer and *Amphistome* were the most prevalent at 91%, followed by *Strongyle* (6%) and *Trichostrongyle* (1%), *Moniezia* (1%), *Fasciola* (1%) in livestock.

In JT, *Amphistome* was the most prevalent at 45%, followed by *Strongyle* (45%), *Fasciola* (5%), *Moniezia* (5%) and *Trichostrongyle* (3%) in Swamp Deer whereas *Strongyle* was the most prevalent at 49%, followed by *Amphistome* (41%), *Moniezia* (4%) and *Fasciola* (2%) in livestock.

The findings of the present study varied from those reported by Tiwari et al. (2009) who documented the prevalence percentage of *Strongyle* sp. to be maximum at 98.71% followed by *Amphistomes* (88.65%), *Strongyloides* (32.21%), *Trichuris* sp. (18.55%), *Moniezia expansa* (11.85%), *Coccidia* (7.47%), and *Moniezia benedeni* (4.63%) in Barasingha in Kanha Tiger reserve.

The load of different parasitic ova in the Swamp Deer population at both sites revealed an overall mean EPG of 487.5±46.30 at JJ and 363.64±49.97 at JT. There was a significant difference in parasitic load between the two study sites ($p<0.01$, Mann–Whitney U test). The mean EPG of dung for *Strongyle* sp. was 642.85 ± 33.10 and 544 ± 53.15 at JJ and JT, respectively. Though *Trichostrongylus* sp. *and Moniezia* sp. were absent in JJ, the EPG of 200 was recorded for both the species at JT. The overall mean EPG for *Fasciola* was 100 ± 28.86 and 50 at JJ and JT, respectively, whereas the mean EPG for *Amphistome* was 109.09 ± 6.09 and 96.87 ± 5.53 at JJ and JT, respectively. The higher values of EPG at JJ may be attributed to higher livestock presence and interaction. Although the Swamp Deer sampled in this study visibly appeared healthy, the high prevalence of some of the studied pathogens may have significant consequences for their population dynamics.

Conclusion

There have been only sporadic reports and reviews of parasitic diseases in cervids and limited systematic studies have been carried out to establish the cause and spread of disease (Watve & Sukumar 1995; Dharmarajan et al. 2003, 2004, 2005; Jog & Watve 2005). This study provided an overview of the prevalent parasites in the wild and domestic animals at the wildlife-livestock interface limited to a grassland system. The parasitic infection in swamp deer and their sympatric livestock appeared qualitatively and quantitatively parallel denoting the fact that the infection is being maintained in the environment through interaction between these

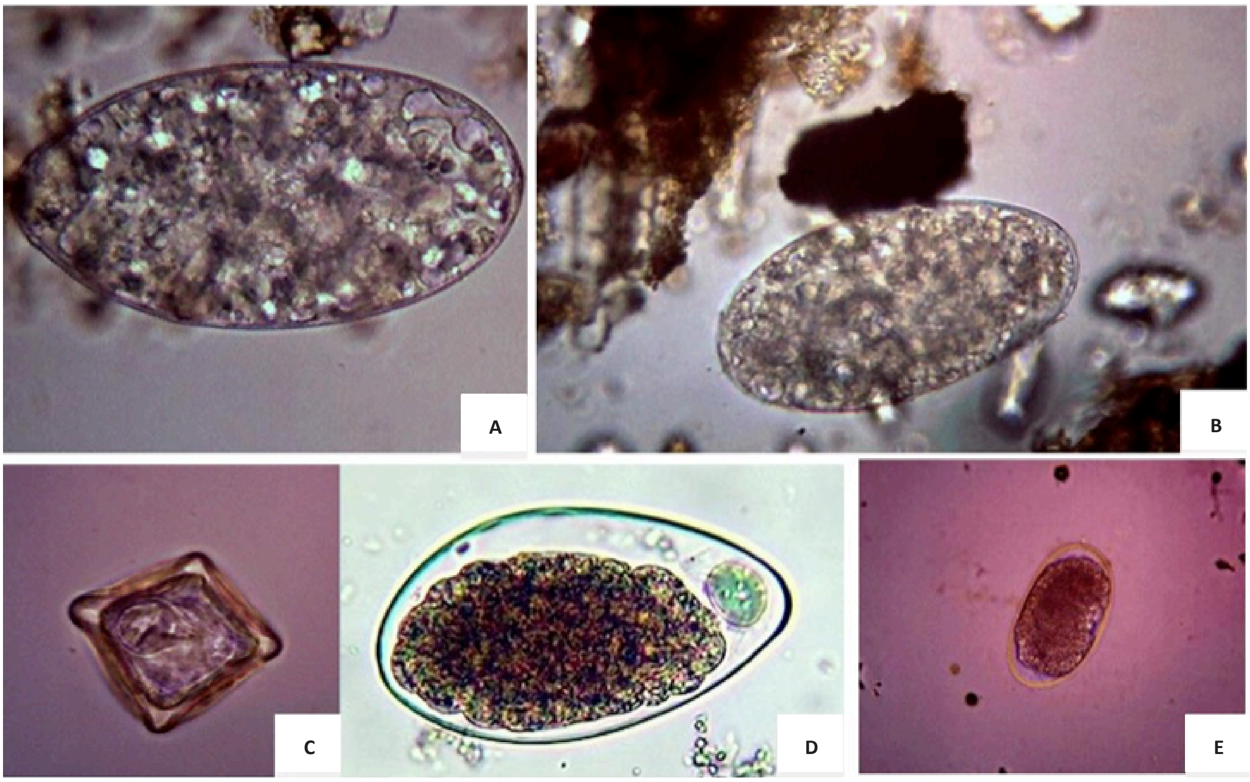

Image 2. Helminth eggs under microscope. Parasitic ova encountered during the study: A—*Fasciola* (10X)| B—*Amphistome* (10X)|, C—*Moniezia* (40X) D—*Trichostrongyle* (40X) | E—*Strongyle* (40X).

animals. These parasitic infections may be exposing the Swamp Deer to a number of other diseases and may be one of the factors contributing to decline in their population. Even though the study was conducted only for a short period of time, it could highlight the presence of parasitic diseases at the interface.

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