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A SURVEY OF GASTROINTESTINAL PARASITES OF WILD AND ORPHAN GREATER ONE-HORNED RHINO (*RHINOCEROS UNICORNIS*) IN KAZIRANGA NATIONAL PARK, ASSAM, INDIA

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Abstract: Wild greater one-horned rhinos (*Rhinoceros unicornis*), orphaned juveniles in human care, and orphaned calves from Kaziranga National Park, Assam, India were surveyed coprologically for gastrointestinal parasites. Parasite infections were present in 100% of wild rhino samples, 96% of orphaned juvenile samples, and 27% of orphaned calf samples. In wild rhino, observed parasite ova were primarily of trematodes *Paramphistomum sp.* (100%), followed by those of strongyle nematodes (94%) and the cestode *Anoplocephala* sp. (56%). Orphaned juvenile and calf samples were positive only for strongyles. Total fecal parasite egg counts were recorded in wild rhino (mean 64 eggs per gram [epg], range 0–270), orphan juveniles (mean 43 epg, range 0–145), and orphan calves (mean 2 epg, range 0–10). Results suggest that parasite infection in rhinos in this setting is common, though more extensive sampling would provide further information on epidemiology and potential impacts on individual health and population viability.

Key words: Conservation, parasitology, rehabilitation, rhinoceros.

BRIEF COMMUNICATION

Kaziranga National Park is home to over 70% of the world's population of wild greater one-horned rhinoceros (*Rhinoceros unicornis*), which is classified as Vulnerable by the International Union for Conservation of Nature.[9] The total global population was estimated to be 3,557 in 2015, and rhinos are vulnerable to poaching, habitat loss, and disease outbreaks.[7] Population vulnerability is potentially exacerbated by a fragmented distribution. During the annual monsoon floods in Kaziranga National Park, rhino calves that have become separated from their dam are rescued and rehabilitated at the Centre for Wildlife Rehabilitation & Conservation (CWRC), situated on the outskirts of the Park until release at age 3–4 yr. Scant information is published about the parasite fauna of greater one-horned rhinos, and although previous studies have identified winter parasite infection in wild rhino, the present survey is the first to attempt to quantify infection intensity as opposed to just prevalence.[4] Parasites can have significant deleterious effects on wild animals at both individual and population levels.[1] Baseline information on parasite diversity and abundance could therefore help to assess potential impacts on health and hence to guide rhino management.

The gastrointestinal parasites of three groups were surveyed over a 3-wk period in September 2017: wild rhino in the Eastern and Central Ranges of Kaziranga National Park, juveniles under rehabilitation at CWRC (14-mo–3-yr old) and calves under rehabilitation at CWRC (3–4-mo old). The juveniles received 1.5 g per 300 kg bolus of Fenbendazole (Panacur® 1.5 Vet, MSD Animal Health India, 33 Samrat Ashok Rd., Sakore Nagar, Viman Nagar, Pune, Maharashtra 411014, India) on feed 3 mo before the start of this study. The calves had not received anthelmintics while in human care. Rhinos use a communal latrine area, and discrete, fresh fecal samples were collected and refrigerated at 4°C until processed. Samples from wild rhinos were collected from a wide area and resampling of individuals was considered unlikely; repeat sampling of the orphaned young rhino might have occurred but is unlikely to much affect observed group mean. For each discrete fecal sample, 10 subsamples were taken and mixed, and a 5-g aliquot examined. Fecal parasite egg counts (FEC) were carried out using the mini-FLOTAC method, with detection limit of five eggs per gram (epg).[5] The number of each morphological egg

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Table 1. Parasite ova found in wild, orphaned juvenile, and orphaned calf greater one-horned rhino (*Rhinoceros unicornis*) fecal samples. Egg counts in eggs per gram of feces (epg): average, followed in brackets by median and interquartile range. Paramphistome eggs were not counted. For prevalence, see text.

Group	Strongyles	Tapeworms
Adult (wild)	53 (38, 15–70)	12 (5, 0–21)
Juvenile (orphan)	43 (30, 10–65)	0
Calf (orphan)	1.7 (0, 0–2.5)	0

type present was recorded, and expressed as epg. Sample freshness and hence the validity of the FECs was monitored by the absence of hatched first-stage larvae in the samples, and three samples from juvenile rhinos were excluded from analysis for this reason. Presence or absence of flukes was assessed using a Flukefinder® device (www.flukefinder.com), which recovers trematode eggs within fecal suspension on a sieve for microscopic examination. Sampling for fluke commenced after the end of the study component on rhinos in human care, and so results are reported for the wild rhino samples only.

All (16/16) samples from wild rhinos were positive for ova of the trematode *Paramphistomum* sp., whereas 15/16 (94%) were positive for strongyle nematodes and 9/16 (56%) were positive for the cestode *Anoplocephala* sp. Of the 16 samples, 6% contained one species, 38% contained two species, and 56% contained three species. Mean total FEC for adult wild rhino was 64 epg (range 0–270). Strongyle nematodes were the only type of gastrointestinal parasite found in the samples from orphaned rhino: 23/24 (96%) of juvenile samples were positive for strongyle infection ($\bar{x} = 43$ epg, range 0–145). Of the calf samples, 3/11 (27%) were positive for strongyle ova ($\bar{x} = 2$ epg, range 0–10). FECs were significantly higher in juveniles than in calves (Mann–Whitney $U_{24,11} = 17$, $Z = 4.07$, $P < .001$) (Table 1).

The prevalence of strongyle infection was comparable between wild rhino and orphaned juvenile rhino, with no statistically significant difference between their respective FECs (Mann–Whitney $U_{16,24} = 160$, $Z = -0.86$, $P = 0.19$).

One previous study has reported parasites from wild greater one-horned rhino in Kaziranga National Park. Chakraborty and Islam[4] reported a 62% infection rate from 84 wild greater one-horned rhino samples during the winter of 1990 using fecal flotation and sedimentation. The parasite infections were primarily of trematodes *Paramphistomum* sp. (46% prevalence, by sedimentation), followed by strongyles. Low prevalence of coccidia and *Anoplocephala* sp. was also found. Chakraborty and Islam[4] did not quantify parasite infections but noted that *Paramphistomum* sp. infection ranged from "light to heavy" and strongyle FEC were "light to moderate," although these levels were not defined. The present study found 100% prevalence of parasite infection in wild rhinos in Kaziranga National Park, and also a higher prevalence of strongyle nematode infection than previously (94% cf. 20%), but found no evidence of coccidia. Differences between the studies might be related to sampling in different seasons, or to the greater sensitivity of the FLOTAC and Flukefinder methods in the present study.[2] The intermediate host of *Paramphistomum* sp. is a freshwater snail, with a free-living phase in water. Kaziranga National Park is heavily flooded during the monsoon season, which could explain the higher prevalence of *Paramphistomum* sp. reported in the present study, after the monsoon period. The population density of greater one-horned rhino in Kaziranga National Park is now estimated to be double what it was when the study of Chakraborty and Islam[4] was carried out, and this could also have led to a density-dependent increase in infection pressure and parasite burdens.

Capture and captivity of a wild animal may result in chronic stress and immunosuppressive effects, which may lead to an increase in parasite infection intensity. There was no difference in FECs between wild rhinos and juvenile orphan rhinos, however, which may suggest that the orphaned juveniles in human care may not be greatly immunosuppressed. Orphaned calves had low infection intensities, which may be due to the fact that they were being regularly bottle-fed milk and were not extensively grazing.

A postmortem study on greater one-horned rhino kept in an Indian zoo revealed the presence of the nematodes *Kililuma goodeyi*, *Chabertia* sp., *Necator americanus*, *Bunostomum* sp., as well as the cestodes *Anoplocephala* sp. and the presence of a hydatid cyst. The protozoan *Balantidium coli* was also present.[3] The schistosome *Bivitellobilharzia nairi*, previously thought to only infect elephants, has recently been found in wild greater one-horned rhino in Nepal.[6]

The sampling limitations in the present study prevent specific conclusions being made about the overall prevalence of parasites in Kaziranga National Park, but provide an indication of the

status of wild and orphan rhinos immediately after the monsoon season in Kaziranga. Stringer et al.[8] calculated that a minimum of nine samples was needed to accurately estimate mean parasite abundance in a host population of black rhino (*Diceros bicornis*). The present data are therefore likely to be broadly representative of parasite burdens in both wild and wild-born captive populations, and managers of rhino in human care may be able to use them to guide parasite management in this species, as well as a baseline for future comparison. Levels of infection in this study are considered to be moderate and unlikely to have a great impact on health or population viability, although the pathogenic impacts of helminths and especially *Paramphistomum* on rhino are unknown. It is not possible to identify most species of strongyle nematodes from their eggs alone, and further work could include larval cultures or molecular investigation to identify nematodes more precisely. More extensive sampling of rhinos would provide further information on parasite diversity, levels of infection, seasonal patterns of transmission, and potential impacts on individual health and population viability.

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