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Identifying the prevalence of endoparasitic infection in the Greater One Horned Rhinoceros (*Rhinoceros unicornis*) of Kaziranga National Park, Assam, India

Technical report

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Introduction:

The greater one-horned rhinoceros (GoH) (*Rhinoceros unicornis*) is an endemic wildlife species found in the Indian subcontinent. Historically, rhinoceros was once distributed in the floodplain and forest tracts in the Brahmaputra, the Ganges and the Indus river valleys. But its population gradually declined over the last 400 years as a result of habitat destruction, climatic changes, and poaching. By the 19th-century, rhino population survived only in Terai grassland of Northern Uttar Pradesh, Southern Nepal, Northern Bihar, Northern Bengal and the Brahmaputra valley of Assam. At present, around 3,500 individuals remain in the wild, and these are distributed in a limited range within the Terai, at the foothills grasslands of Eastern Himalayas and Brahmaputra Valley (WWF 2016). Even though the species is doing well in the state of Assam, it is found only in isolated pockets of the state and the population is highly threatened due to poaching and non-poaching threats. Of the Indian population of 2,873, about 92% (2650) of the rhinos are found in Assam and around 91% of these are found in Kaziranga National Park with a population of 2413 individuals as per the 2018 estimation.

Justification for the study:

Poaching and habitat destruction are the most important threat to the survival of the species but non poaching threat like disease and confinement of large population in a single area like Kaziranga NP are also not to be ignored. Threatened species may be particularly vulnerable to parasites, as many of the causes of the current biodiversity decline also expose hosts to a greater parasite burden (Smith *et al*., Chapter 1: 16 2009a). Habitat loss and fragmentation can restrict species dispersal, which in turn increases contact rates and parasite transmission which will ultimately increase parasite abundance (Scott, 1988). Habitat

fragmentation also often creates more extensive interaction between wildlife and human activity. Domestic livestock can act as high density reservoir-hosts for parasites of wildlife, leading to higher parasite abundance within wildlife (Lafferty and Gerber, 2002). It has been shown that wildlife more closely related to domestic animals is more likely to be threatened by parasitism (Pedersen *et al*., 2007). Threatened species are also more likely to suffer from inbreeding. A key effect of inbreeding is increased vulnerability to parasitism, which can ultimately increase mortality rates (Coltman *et al*., 1999). Conservationists must also be aware of a variety of conservation actions that can increase the susceptibility of individuals and populations to parasitism. Animal translocations, in particular, are situations in which the host-parasite population dynamic may be changed, especially in the relocated (reintroduced) or receiving (restocked) population. For instance, conservation translocations may introduce new parasites to an area, and may also introduce naïve translocated hosts to new parasites. This may be exacerbated by the stress caused by the translocation making individuals more susceptible to parasitism. Another potential influence of species reintroduction may be the introduction of a new reservoir host which would change the existing host-parasite population dynamics in the area (Cunningham, 1996; Jørgensen, 2014; Sainsbury and Vaughan-Higgins,2012).The death of two rhinos in Burachapori Wildlife Sanctuary translocated from Kaziranga in 2016 and few unanswered questions linked to their deaths like probable pathogens, triggering factors related to the disease outbreak and eventually death also makes it necessary to initiate studies on the diseases and pathogens of the greater horned rhinoceros. Moreover, the ever increasing livestock pressure on protected areas across the country makes it necessary to initiate a study whether domestic animal pathogens pose a threat to the current rhino population. Due to the lack of knowledge and baseline data on the disease aspects of the GOH Rhino, it has become up most important to plan and start the disease investigation study in the GOH Rhino population in the PAs of Assam. This will not only help us to

decrease the knowledge gap in rhino diseases but also equip us to address any such during a disease outbreak by means of effective treatment and prevention.

Objective:

This study was envisaged to ascertain whether parasitic infections prevailed and could be a cause of concern for the rhino population of Kaziranga National Park and also to document the parasitic fauna present in the GOH Rhino population of the park.

Methodology:

Rhino dung sampling was carried out in the month of June, 2018 wherein 61 dung samples from the four ranges of the park viz.-Kohora, Bagori, Agaratoli and Burapahar (**Table: 1, Fig: 1**) were collected. The following sampling method was carried out:

- 2 kms on each side of the boundary road was scanned for dung pile and samples collected.
- Towards the Northern direction, minimum 2 samples every 1 km were collected.
- Random sampling within the specified area was also done according to field conditions when samples were not obtained along the specified paths.

The sampling was done by veterinarians from WWF-India and Kaziranga NP and frontline staff from the four ranges of KNP while covering the respective range areas. Dung samples (minimum 200 gm) for parasitological examination were collected from the middle of the bolus and kept in plastic zip bags without any preservatives and immediately despatched for analysis. Only freshly voided dung samples not older than the previous night were collected. The selection was purely based on physical and visual parameters of the dung (moisture content, presence of maggots, dung beetles and external/surface fungal growth like mushrooms and toad stools). The dried samples with external fungal growth over the surface,

dung heaps scratched and dispersed by wild fowls, birds and wild boars were not picked up for the study. Selection of the dung heaps were randomly done and picked up as many samples as possible. Local knowledge of the forest staff was utilized to ascertain the rhino home range and avoid replication as far as possible. The samples were given the IDs and immediately dispatched to the Laboratory of the Department of Parasitology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam. Both salt floatation and sedimentation techniques were done as per standard protocols (Soulsby, 1982) to detect the presence of parasitic ova in the dung samples.

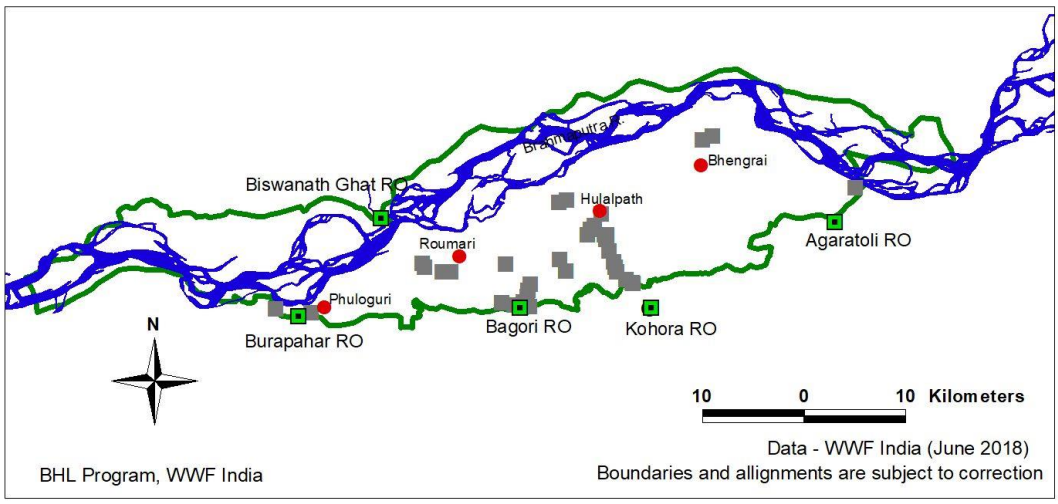

Fig: 1 Sampling location inside Kaziranga National Park.

Table: 1 Dung sample collection locations

Sl.No	Sample ID	Date	Range
1.	Debeswari 01	04-06-2018	Eastern (Agaratoli)
2.	Debeswari 02	04-06-2018	Eastern (Agaratoli)
3.	Debeswari 03	04-06-2018	Eastern (Agaratoli)
4.	Dhanbari 04	05-06-2018	Eastern (Agaratoli)
5.	Mihimukh 1	06-06-2018	Central (Kohora)
6.	Mihimukh 2	06-06-2018	Central (Kohora)
7.	Mihimukh 3	06-06-2018	Central (Kohora)
8.	Mihimukh 4	06-06-2018	Central (Kohora)
9.	Mihimukh 5	06-06-2018	Central (Kohora)
10.	Mihimukh 6	06-06-2018	Central (Kohora)
11.	Mihimukh 7	06-06-2018	Central (Kohora)
12.	Mihimukh 8	06-06-2018	Central (Kohora)
13.	Mihimukh 9	06-06-2018	Central (Kohora)
14.	Mihimukh 10	06-06-2018	Central (Kohora)
15.	Duflang 11	06-06-2018	Central (Kohora)
16.	Baruntika 12	06-06-2018	Central (Kohora)
17.	Baruntika 13	06-06-2018	Central (Kohora)
18.	Baruntika 14	06-06-2018	Central (Kohora)
19.	Baruntika 15	06-06-2018	Central (Kohora)
20.	Hulalpat 17	06-06-2018	Central (Kohora)
21.	Borbeel 18	06-06-2018	Central (Kohora)
22.	Borbeel 19	06-06-2018	Central (Kohora)
23.	Baishamari 16	06-06-2018	Central (Kohora)
24.	Monabeel 16	07-06-2018	Central (Kohora)
25.	Karasing 17	07-06-2018	Central (Kohora)
26.	Karasing 18	07-06-2018	Central (Kohora)
27.	Karasing 19	07-06-2018	Central (Kohora)
28.	Baruntika 5	07-06-2018	Central (Kohora)
29.	Baruntika 6	07-06-2018	Central (Kohora)
30.	Baruntika 7	07-06-2018	Central (Kohora)
31.	Kawoimari 9	07-06-2018	Central (Kohora)
32.	Kawoimari 10	07-06-2018	Central (Kohora)
33.	Kawoimari 11	07-06-2018	Central (Kohora)
34.	Kawoimari 12	07-06-2018	Central (Kohora)
35.	Kawoimari 13	07-06-2018	Central (Kohora)
36.	Kawoimari 14	07-06-2018	Central (Kohora)

37.	Kawoimari 15	07-06-2018	Central (Kohora)
38.	Mihimukh 1	07-06-2018	Central (Kohora)
39.	Mihimukh 2	07-06-2018	Central (Kohora)
40.	Mihimukh 3	07-06-2018	Central (Kohora)
41.	Mihimukh 4	07-06-2018	Central (Kohora)
42.	Singimari 1	08-06-2016	Western (Bagori)
43.	Goroimari 2	08-06-2016	Western (Bagori)
44.	Rowmari 3	08-06-2016	Western (Bagori)
45.	Rowmari 4	08-06-2016	Western (Bagori)
46.	Rowmari 5	08-06-2016	Western (Bagori)
47.	Bimoli 6	08-06-2016	Western (Bagori)
48.	Borbeel 7	08-06-2016	Western (Bagori)
49.	Tatibeel 8	08-06-2016	Western (Bagori)
50.	Amkathani 8	08-06-2016	Western (Bagori)
51.	Amkathani 9	08-06-2016	Western (Bagori)
52.	Amkathani 10	08-06-2016	Western (Bagori)
53.	Bagori 12	09-06-2018	Western (Bagori)
54.	Bagori 13	09-06-2018	Western (Bagori)
55.	Dunga 14	09-06-2018	Western (Bagori)
56.	Dunga 15	09-06-2018	Western (Bagori)
57.	Vitortangi 16	09-06-2018	Western (Bagori)
58.	Vitortangi 17	09-06-2018	Western (Bagori)
59.	Bholukajan 18	09-06-2018	Western (Bagori)
60.	Janata 1	10-06-2018	Burapahar
61.	Xorali 2	10-06-2018	Burapahar

Results and discussion:

A total of 61 rhino dung samples were collected from different locations (**Fig. 1**) inside the park and screened for parasitic load. Although Kaziranga National Park holds the highest population of the GOH Rhinos currently (2413, Rhino Estimation, 2018) there are a number of reasons behind collection of only 61 samples from the park. The dung collection in Kaziranga NP was carried out during the month of June for a period of 7 days continuously and the drive started from 5:30 am in the morning till noon and again in the afternoon hours. However, we could collect only 61 samples in the 7 days period, which can be attributed to the tall grassland during that period of study, very hot and humid weather forcing most of the rhinos into their wallowing holes and water bodies. We could observe most of the rhinos far

away using the water bodies throughout the day and hardly came out near the tracks (dandies) and forest roads to defecate. Most of the dung samples were collected from woodlands and few from the patrolling paths. Out of the 61 samples, 49 (80.32 %) samples were found to be positive for moderate to heavy parasitic infection, 30 samples (49.18 %) were positive for *Paramphistomum spp*., 19 samples (31.14 %) for *Strongyle spp*. and 10 samples (16.39 %) were positive for mixed infection with both *Paramphistomum* and *Strongyle spp*. respectively (**Table. 2**). Phukan (2013) during his study in Manas National Park found 33.33 % prevalence with *Paramphistomum spp***.** Chakraborty and Islam (1992) reported 46.42 % *Paramphistomum spp*. infection in GOH Rhinoceros from 11 different areas viz. Mihimukh, Kathpura, Tatibeel, Diphalu, Bagori, Amkathani, Rowmari, Bimoli, Borbeel and Baruntika area respectively of Kaziranga National Park within 84 dung samples collected in 1984.They could also detect the prevalence *Strongyle* (20.23%), *Anoplocephala* (2.38 %) and *Coccidia spp*. (3.57 %) infection from the same samples. The dung samples were collected from Post mortem examination of GOH Rhinoceros from the Assam State Zoo revealed infection with *Kiluluma spp., Paramphistomum spp., Chabertia spp., Bunostomum spp., Anoplocephala spp*. and *Balantidium coli* infection (Chakraborty and Gogoi, 1994). Post mortem reports of more than 350 rhinos from Kaziranga National Park revealed very scanty information regarding endoparasites and lack of laboratory reports regarding any pathogens responsible for the deaths. *Paramphistomum spp.* are found in a wide variety of domestic and wild herbivores and a light to moderate infection seldom causes any harmful effect on the host. There are number of species under the genus which effects wild herbivores like Elephants, Rhinoceros, Wild Buffaloes, Deer, Antelopes etc. to name a few. Infections of *Paramphistomum spp.* may be due to ingestion of metacercariae while grazing in contaminated pastures. Infection can be transmitted either from wild herbivores or domestic herbivores. The prevalence of *Paramphistomum sp.* in wild herbivores depends upon the factors determining the availability, development and survival of intermediate host in the

environment and influences the level and severity of the infections (Kusikula and Kambarage 1996).

Table: 2 Summarized results of the faecal examination with parasite strength.

Area	***Strongyle spp.* strength**			***Total***	***Paramphistomum spp.* strength**			**Total**	**Total**
	+	++	+++		+	++	+++		
Agaratoli	2	0	0	2	2	0	0	2	4
Kohora	4	5	4	13	5	10	0	15	28
Bagori	1	0	2	3	5	6	1	12	15
Burapahar	0	0	1	1	0	0	1	1	2
Total	7	5	7	19	12	16	2	30	49

Conclusion:

The findings from the current study indicate that the incidences of *Paramphistomum spp.* and *Strongyle spp.* predominates the rhino population in KNP. The direct effect of these parasites on the health of the rhinos is difficult to assess within the results of the current study as there is no baseline data to compare. This necessitates further screening of dung samples to gather more data and knowledge regarding the host-parasite interactions. Although no immediate threats towards the rhinos in the park seems to be there, but this study should be continued to cover seasonal aspects and over a few years to develop knowledge on the rhino population.

Recommendations from the study:

1. The park should establish a veterinary laboratory and carry out timely examination of faecal samples to screen the parasitic infections because they are one of the main threats for wild animals.
2. Thorough post mortem examination of wild animals should be carried out to detect the prevalence of any parasites.
3. Seasonal study of parasitic prevalence of wild and domestic animals in the fringe villages must be conducted to know the prevalence of parasites in a season wise pattern.

Acknowledgement

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Annexure-I

Detailed results of the dung study

+: Light infection; ++: moderate infection; +++ and above: Heavy infection.

SL.No	Sample ID	Range	Parasite
1.	Debeswari 01	Eastern (Agaratoli)	*Strongyle++, Paramphistomum spp.+*
2.	Debeswari 02	Eastern (Agaratoli)	*Strongyle++, Paramphistomum spp.+*
3.	Debeswari 03	Eastern (Agaratoli)	Negative
4.	Dhanbari 04	Eastern (Agaratoli)	Negative
5.	Mihimukh 1	Central (Kohora)	Negative
6.	Mihimukh 2	Central (Kohora)	*Strongyle++ Paramphistomum +*
7.	Mihimukh 3	Central (Kohora)	*Strongyle++, Paramphistomum spp.+*
8.	Mihimukh 4	Central (Kohora)	*Negative*
9.	Mihimukh 5	Central (Kohora)	*Strongyle++*
10.	Mihimukh 6	Central (Kohora)	*Strongyle++*
11.	Mihimukh 7	Central (Kohora)	*Strongyle++++*
12.	Mihimukh 8	Central (Kohora)	*Strongyle +++++*
13.	Mihimukh 9	Central (Kohora)	*Strongyle+++++, Paramphistomum spp.++*
14.	Mihimukh 10	Central (Kohora)	*strongyle+, Paramphistomum spp.++*
15.	Duflang 11	Central (Kohora)	Negative
16.	Baruntika 12	Central (Kohora)	Negative
17.	Baruntika 13	Central (Kohora)	*Paramphistomum spp.++*
18.	Baruntika 14	Central (Kohora)	Negative

19.	Baruntika 15	Central (Kohora)	Negative
20.	Hulalpat 17	Central (Kohora)	Negative
21.	Borbeel 18	Central (Kohora)	*Strongyle*++
22.	Borbeel 19	Central (Kohora)	*Strongyle*++
23.	Baishamari 16	Central (Kohora)	*Strongyle*++, *Paramphistomum spp.*+
24.	Monabeel 16	Central (Kohora)	*Paramphistomum spp.*++
25.	Karasing 17	Central (Kohora)	*Paramphistomum spp.*++
26.	Karasing 18	Central (Kohora)	*Paramphistomum spp.*++
27.	Karasing 19	Central (Kohora)	*Paramphistomum spp.*++
28.	Baruntika 5	Central (Kohora)	Negative
29.	Baruntika 6	Central (Kohora)	*Paramphistomum spp.*++
30.	Baruntika 7	Central (Kohora)	Negative
31.	Kawoimari 9	Central (Kohora)	Negative
32.	Kawoimari 10	Central (Kohora)	*Paramphistomum spp.*++
33.	Kawoimari 11	Central (Kohora)	*Paramphistomum spp.*++
34.	Kawoimari 12	Central (Kohora)	*Paramphistomum spp.*+
35.	Kawoimari 13	Central (Kohora)	*Paramphistomum spp.*+
36.	Kawoimari 14	Central (Kohora)	Negative
37.	Kawoimari 15	Central (Kohora)	*Strongyle*++++
38.	Mihimukh 1	Central (Kohora)	Negative
39.	Mihimukh 2	Central (Kohora)	Negative
40.	Mihimukh 3	Central (Kohora)	*Strongyle*++
41.	Mihimukh 4	Central (Kohora)	Negative
42.	Singimari 1	Eastern (Bagori)	Negative
43.	Goroimari 2	Eastern (Bagori)	*Paramphistomum spp.*+++

44.	Rowmari 3	Eastern (Bagori)	*Paramphistomum spp.*++
45.	Rowmari 4	Western (Bagori)	*Strongyle*+++, *Paramphistomum spp.*++
46.	Rowmari 5	Western (Bagori)	Negative
47.	Bimoli 6	Western (Bagori)	*Paramphistomum spp.*+
48.	Borbeel 7	Western (Bagori)	Negative
49.	Tatibeel 8	Western (Bagori)	Negative
50.	Amkathani 8	Western (Bagori)	Negative
51.	Amkathani 9	Western (Bagori)	*Paramphistomum spp.*++
52.	Amkathani 10	Western (Bagori)	*Strongyle*++++, *Paramphistomum spp.*++
53.	Bagori 12	Western (Bagori)	*Paramphistomum spp.*++
54.	Bagori 13	Western (Bagori)	*Paramphistomum spp.*++++
55.	Dunga 14	Western (Bagori)	*Paramphistomum spp.*++, *Strongyle* +
56.	Dunga 15	Western (Bagori)	*Paramphistomum spp.*+
57.	Vitortangi 16	Western (Bagori)	Negative
58.	Vitortangi 17	Western (Bagori)	*Paramphistomum spp.*++
59.	Bholukajan 18	Western (Bagori)	*Paramphistomum spp.*++
60.	Janata 1	Burapahar	*Strongyle*++++
61.	Xorali 2	Burapahar	*Paramphistomum spp.*++++