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Meenu Devi Verma
Department of Zoology, Dr. C.V. Raman University, Kargi Road, Kota, Chhattisgarh, India

RK Singh
Department of Zoology, Dr. C.V. Raman University, Kargi Road, Kota, Chhattisgarh, India

LK Verma
Veterinary Assistant Surgeon, Government Veterinary Hospital, Kasdol, Balodabazar, Chhattisgarh, India

Anish Sonwani
Veterinary Officer, Barnawapara Wildlife Sanctuary, Balodabazar, Chhattisgarh, India

Hemant Kumar
Subject Matter Specialist, Krishi Vigyan Kendar, Purnea, Bihar, India

Corresponding Author:
Hemant Kumar
Subject Matter Specialist, Krishi Vigyan Kendar, Purnea, Bihar, India

Study on gastro-intestinal parasites in wild herbivores animals of Barnawapara wildlife Sanctuary of Chhattisgarh

Meenu Devi Verma, RK Singh, LK Verma, Anish Sonwani and Hemant Kumar

Abstract
The present study was undertaken to assess the prevalence of gastrointestinal parasites in herbivores animals of Barnawapara Wildlife Sanctuary, Chhattisgarh. Four free range herbivores animal species namely- Gaur, Nilgai, Sambar, Chital and one captive Black buck species were selected for study. A total of 150 faecal samples having 30 samples from each animal species were collected and observed with direct, sedimentation and floatation method during summer, rainy and winter season. The overall prevalence was 56.0%. Seasonal prevalence was reported rainy (70%), winter (50.0%) and summer (48%). Among all species studied Sambar showed highest prevalence rate 70% of GI parasites followed by Gaur (63.33%), Chital (56.66%), Nilgai (50.0%) and Black buck (43.33%). During the study, an overall prevalence of *Strongyle* sp. 28.66%, *Amphistome* sp. 26.0%, *Fasciola* sp. 11.33% and *Trichuris* sp. 6.0% recorded. In winter season, the prevalence of *Strongyle* sp. was relatively higher than *Amphistome* sp., while the reverse was recorded in rainy season. *Strongyle sp*. was highest prevalence among Gaur, Nilgai, Chital and Black buck, and in contrary Sambar record *Amphistome* sp as dominated parasite.

Keywords: Barnawapara wildlife sanctuary, black buck, chital, gastrointestinal parasites, gaur, nilgai, sambar, seasonal prevalence

1. Introduction
Wild animals are integral parts of biological world. Continuous monitoring of wild animals is necessary to access the impact of wild animals on natural environment and human. Fluctuation in population size of particular wild animal species may alter the balance of ecosystem in nature (Jovanović and Orlić, 2003) [10]. A number of factors threaten the existence of wild animals in India including wild life diseases particularly those arising from gastro-intestinal parasites (Singh *et al*. 2009) [17]. The advance of agriculture and cattle-raising into natural areas, humans and their domestic animals have recently been coming into greater contact with populations of wild animals in their habitats. This closer contact facilitates the spread of infectious agents and parasites to new hosts and environments, thereby establishing new relationships between hosts and parasites, and new ecological niches in the disease transmission chain (Correa and Passos, 2001) [6]. Parasitic diseases have become a major concern in conservation of endangered species as they can lead to mortality, dramatic population decline, and even contribute to local extinction events (Aguirre *et al*. 2003 and Smith *et al*. 2006) [1, 18]. Animals affected with endo-parasites develop clinical symptoms such as diarrhea, inappetite, potbelly and detection of worm in dung. In addition, some parasites are zoonotic and pose a risk to human health (Maske *et al*. 1990) [14]. In animals living in natural state unconfirmed parasites are always present but usually in small numbers with balanced system, but change in environment, stress, nutrition and water intake level might increase sensitivity of animal with parasite infection (Correa and Passos, 2001) [6].
Parasitic loads in wild herbivores including Chital, Gaur, Sambar and domestic cattle was mentioned in post mortem findings of veterinary doctors of that Barnawapara Sanctuary (Verma, 2017, 2018) [23]. However, no any systematic study was carried out on GI parasites of wild animals at natural habitat in Chhattisgarh.

Faecal survey of parasitic prevalence plays an important role in wildlife management. Keeping that in view the present work was undertaken to study the prevalence of gastro-intestinal parasites and its relation with season in wild herbivores animals of Barnawapara Wildlife Sanctuary.

2. Materials and Methods

2.1 Study area, population, habitat and duration

The study was conducted at Barnawapara Wildlife Sanctuary in the Kasdol Block of Balodabazaar District in Chhattisgarh. This Sanctuary covers area of 245 sq. KM and located between 19.48° N'79.6"E to 21.36° N, 82.49" latitude and longitude with altitudes ranging between 265-400 mts. According to 2019 animal census this Sanctuary have 76 Leopard, 915 Gaur, 5110 Chital, 286 Sambar, 310 Neelgai, and many other animal populations. The material for this study comprises the faecal samples of Gaur (Bos *gaurus*), Nilgai (*Boselaphus tragocamelus*), Sambar (*Cervus unicolor*), Chital (*Axis axis*) and Blackbuck (*Antilope cervicapra*) in and around Barnawapara Sanctuary in period from March 2019 to February 2020 in different seasons *viz*, summer (March to June), rainy seasons (July to September) and winter (October to February).

2.2 Collection of Faecal Material / droppings and laboratory analysis

Fresh faecal samples were collected from the ground after defecation with the help of forest guard in the early morning. After collection of faecal samples, each sample of about 20-25 grams were kept in the separate clean interlocked polythene bags containing 10% formalin. The collected samples were subjected to detail routine parasitological analysis for the presence of parasitic eggs by direct smear examination, standard sedimentation and flotation techniques. The ova of different parasites were identified as per the morphology and morphometry as described by Soulsby (1982) [19].

2.2.1 Direct Method

To prepare the direct faecal smear, a drop of water was placed on a clean grease free slide. A small quantity of faeces was placed on the drop, stirred until the entire sample was suspended. Any fibers or particles were removed and the slide was covered with a clean cover slip avoiding any air bubble. Glass slide was then examined under low power microscope (lOx).

2.2.2 Sedimentation Method

About 1 gram of faeces was taken in a glass pestle and a little quantity of water was added to it and mixed well. Suspension was strained to remove the debris and poured into a centrifuge tube up to an inch below the brim. Then, centrifuged at 1000-1500 revolutions per minute (rpm) for 2-3 minutes. The supernatant was discarded and from the sediment, a drop was taken and examined under low power objective (10x) by covering with a cover slip. The presence of eggs was identified through their morphological characteristics (Bowman, 1999) [4].

2.2.3 Flotation Method

About 2 grams of faeces was taken in a glass pestle and little quantity of saturated solution of flotation fluid (magnesium sulphate zinc sulphate /sugar solution) was added and mixed well. Suspension was strained to remove the debris. The suspension was centrifuged at 1500 revolutions per minute (rpm) for 2-3 minutes. The surface layer was examined under low power microscope by covering with a cover slip. The presence of eggs was identified through their morphological characteristics (Bowman, 1999) [4].

3. Results and Discussion

3.1 Prevalence of gastro-intestinal parasites infection

In 150 samples, 84 were recorded for gastro-intestinal parasite positive, while 66 fecal samples were free from any observed parasites, which encountered overall 56.00% GI parasitic infectivity in herbivores animals of Sanctuary. Our overall findings were comparatively lower than the records of Varadharajan *et al.* (2001) [21] and Cordon *et al.* (2008) [5]. They reported an overall prevalence of 68.05 and 72.5 in wild animals of Thrissur Zoo Kerala and Almunear Zoological Garden respectively. In contrast it was higher than 31.10% GI prevalence observed in animals of Mysore Zoo (Muraleedharan *et al.* 1990) [15], 33.22% GI prevalence at MCZP, Chhatbir, Punjab (Singh *et al.* 2006) [16], and 46.20% prevalence at Nandan Kanan Zoo Raipur (Thawait *et al.* 2014) [20]. The observation of higher and lower prevalence of parasitic infection by earlier workers could be probably due to difference in geographical area, climatic conditions, easy access to egg larva.

Among animal species, Sambar was recorded highest 70.00%, while Black buck shows least only 43.33% GI prevalence. Sambar take to water readily and swim with the body submerged, which might have exposed them to infective stages of parasites leading to higher parasitic prevalence in the species. Similar trend reported with highest parasitic prevalence (39.45%) in Sambar, followed by Chital (38.19%), then Nilgai (36.84%) at Van Vihar National Park, Bhopal (Singh *et al.* 2009) [17]. Gupta *et al.* (2011) [8] also revealed a comparative parasitic prevalence in wild ruminants was 90% in Sambar, 86.67% in Nilgai and 80% in spotted deer around Jabalpur (M.P). Parasitic infection of Black buck in this study is closely related with recorded 46.75% infection in Black buck in different habitat of Thrissur district, Kerala (Jaya and Aja, 2018) [9]. Black Bucks were kept in closed enclosures. This enclosure has scanty grass, which the animals do not graze or occasionally graze. There was low chance of access for intermediate hosts of trematodes. Feed and fodder are supplied from outside source. Therefore, low incidence of the infection with GI parasites in Black buck. Present study recorded prevalence in Gaur was *Amphistome* sp 23.33%, *Fasciol*a sp. 16.66%, *Trichuris* sp. 10.0% and *Strongyle* sp. 36.66%. Similarly host-wise incidence of parasites infections of this study is summarized and illustrated in Table 1 and Fig 1.

Table 1: Prevalence of gastro-intestinal parasites infection in herbivores animals of Barnawapara Wildlife Sanctuary.

Name of Animal Species	*Fasciola* Sp.			*Amphistome* Sp.			*Trichuris* Sp.			*Strongyle* Sp.			Overall		
	P	A	Prev %	P	A	Prev %	P	A	Pre %	P	A	Prev %	P	A	Prev %
Gaur	5	25	16.66	7	23	23.33	3	27	10	11	19	36.66	19	11	63.33
Nilgai	4	26	13.33	8	22	26.66	3	27	10	10	20	33.33	15	15	50.00
Sambar	4	26	13.33	12	18	40.00	1	29	3.33	7	23	23.33	21	09	70.00

Chital	2	28	6.66	7	23	23.33	2	27	6.66	8	22	26.66	16	14	56.66
Black Buck	2	28	6.66	5	25	16.66	0	30	00	7	23	23.33	13	17	43.33
Total Parasite Sp. prevalence	17	133	11.33	39	111	26.00	9	141	06.0	43	103	28.66	84	66	56.00

P – Present, A – Absent, Prev % - Prevalence Percent. N= 30 animals of each animals

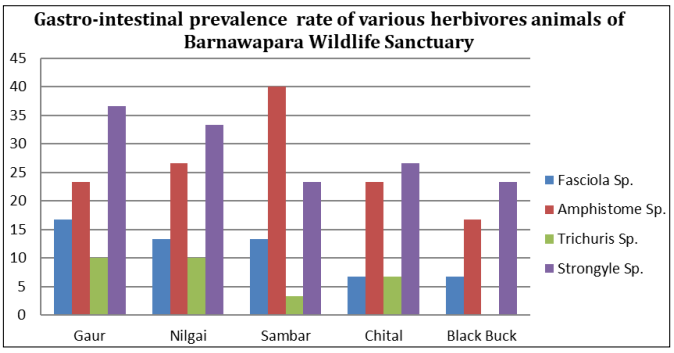

Fig 1: Overall prevalence percentages of gastro-intestinal parasites in herbivores animals of Barnawapara Sanctuary

In our overall study highest prevalence was recorded for *strongyles* (28.66%) followed by *amphistomes* (26.00%), *Fasciola* sp. (11.33%), and *Trichuris* sp. (6.00%) (Table.1), Which are in concordance with *Strongyles* (26.15%), *Amphistomes* (21.98%), *Coccidia* (6.20%), *Fasciola* sp. (2.64%), and *Trichuris* sp. (1.84%) at Van Vihar National Park, Bhopal (Singh *et al.*, 2009) [17]. Similar finding also recorded with maximum infection of *Strongyles* (41.67%), followed by *Amphistomes* (15.63%), *Fasciola* sp. (13.54%), *Strongyloides* sp. (11.46%) and *Ascaris* sp. (5.29%) in wild herbivores at Mudumalai Wildlife Sanctuary (Mandol *et al.* 2002) [13] and *Strongyles* (62.50%) and *Amphistome* (35.00%) at Nandanvan Zoo, Raipur (Khutey *et al.* 2020) [11].

3.2 Seasonal variations of gastro-intestinal parasites

This study recorded significantly prevalence ($P< 0.05$) by one-way ANOVA test, in rainy seasons with 70% (35/50) prevalence arte, followed by winter 50% (25/50) and least at summer with 48% (24/50) prevalence rate. Our observations also corroborate well with a higher incidence of helminthic infection in rainy season (Gupta *et al.* 2011 and Barmon *et al.* 2014) [8, 3]. In Gaur parasitic infectivity was highest during rainy period (70%) and summer and winter both 60%. Nilgai also recorded 70% prevalence in rainy season and 50% in summer and winter each. Similar result also confirms in Chital with highest 70% in rainy season followed by winter (50%) and summer (40%). In Black buck GI prevalence in rainy, winter and summer was 60%, 40% and 30% respectively. In contrary Sambar recorded highest GI prevalence during summer with 70%, followed by 60% in rainy and 50% prevalence in winter season. It noteworthy to mention that trematode prevalence was at peak in rainy season followed by summer, which is due to present study was conducted in hillocks and swampy meadows**,** where the snail population which serves as intermediate host for flukes is abundant around natural water sources, facilitating higher concentration of metacercaria, the infective stage. The scarcity of natural foodstuffs was seen during the summer season and animals congregate at the greens available around the periphery of water bodies and naturally acquire more infection.

Table 2: Comparisons of overall Gastro- intestinal Prevalence in three different seasons in herbivore animals

Season	*Fasciola*		*Amphistome*		*Trichuris*		*Strongyle*	
	No. infected	Prevalence %	No. infected	Prevalence %	No. infected	Prevalence %	No. infected	Prevalence %
Summer	03	06	14	28	03	06	12	24
Rainy	11	22	20	40	01	02	13	26
Winter	03	06	05	10	06	12	19	38

3.3 Species Wise prevalence of different Gastro-intestinal Parasites

When we came season wise parasitic sp. infection then it is observed *Amphistome* sp. was more prevalence during rainy season, while *Strongyle* sp. was dominated in winter (Table. 2). The high prevalence of nematode infection during post-monsoon and winter season might be due to conductive environment available for the development of infective stages of helminths. *Strongyle* infections were widespread in herbivores due to direct life cycle and survivability of the third stage larvae. *Strongyles* sp. are transmitted by feco-oral route through contaminated feed, soil and water and are able to accumulate in that environment. Single infection of *Amphistome* was higher in rainy season with 40% prevalence, which is similar with Mali (2016) [12], who reported 51.8% single infection of *Amphistome* during monsoon in captive spotted deer of Nandankanan Zoo and deer parks of Raj Bhawan and Tulasipur, Cuttack. The high prevalence of *Amphistomum* sp. in rainy season was also reported at Char Kukri Mukri in Bhola District, Bangladesh (Barmon *et al.* 2014) [3]. We recorded overall prevalence of *Fasciola* sp. 11.33% which is more than reports of Gupta *et al.* (2011) [8] and Barmon *et al.* (2014) [3]. They reported 6.7% and 8.66% in deer around Jabalpur and at Char Kukri Mukri, Bangladesh respectively. *Fasciola* sp. found in all species of wild herbivores. One reason for this could be that domestic animals are competing with the wild animals for grazing areas in the forests and force wild animals to graze in swampy areas thus exposing them to vegetation infected with metacercaria of *Fasciola*.

The infection was found throughout the year in present study, because favorable condition in rainy and winter and high stress in summer. Parasite richness was found to be high in Barnawapara Sanctuary, due to small in forest size, isolated and located in the middle of the human- dominated landscape, presence of villages within sanctuary area with domestic animals, presence of intermediate hosts in area, high rainfall, more number of animals, more stress on animals, situation of the sanctuary at low altitude, higher contamination with different stages of the parasites and low hygiene practices. Domestic animals which share the same grazing land with wild animals could act as vehicle. Cross transmission of parasites among the domestic and wild animals has been reported from different parts of India (Gaur *et al.* 1979 and Vardharajan and Pythal 1999) [7,21]. Parasitic loads in wild animals can also be reduced by regular mass deworming and vaccination in domestic animals around forest (Allwin *et al.* 2012) [2].

However, we have examined for only four helminthic species, so some animals were negative for observed parasite infections should not be considered free from all parasites. They may be infected with coccidian or cestode parasites.

4. Conclusion

The overall prevalence in wild herbivores animals recorded 56.0%. The occurrences of a high level of parasitism in free range herbivores animals correspond to the higher levels of contamination of grazing lands and intermediate host in Sanctuary forest. The result of present study suggests that regular screening of faecal samples of wild animals is required for qualitative and quantitative estimation of parasitic load of these animals. In this way proper diagnosis of parasitic infestation will help in saving ill effects of these parasites in wild animals. Our study provides a first overview on parasites in Barnawapara Wildlife Sanctuary, but much more studies are required on parasitic infection in livestock. Further studies also needed to find out parasitic infections in relation with age and sex.

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