

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(8): 528-532
www.biochemjournal.com
Received: 16-06-2026
Accepted: 19-07-2026

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Coprological assessment of gastrointestinal parasites in free-ranging Nilgai (*Boselaphus tragocamelus*)

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DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i8g.9647>

Abstract

The Nilgai (*Boselaphus tragocamelus*), the largest Asian antelope, is widely distributed across India, yet information on its gastrointestinal parasites in central India is limited. This study investigated the prevalence of gastrointestinal parasites in free-ranging Nilgai inhabiting the Gorewada landscape, Nagpur, Maharashtra, using a non-invasive coprological approach. Eighty fresh faecal samples were collected from 12 active communal midden sites and examined using direct smear and salt flotation techniques. Overall, 26 (32.50%) samples were positive for gastrointestinal parasites. Strongyle-type eggs were the predominant finding, occurring in 23 (28.75%) samples alone and in 3 (3.75%) samples as mixed infections with *Eimeria* spp. oocysts. *Eimeria* spp. was detected in 3 (3.75%) samples, while a mite was observed incidentally in one sample. The predominance of strongyle-type eggs suggests that these nematodes are the principal gastrointestinal parasites infecting Nilgai in the study area. The study also demonstrates that communal midden sites provide an efficient, non-invasive method for monitoring gastrointestinal parasites in free-ranging Nilgai. These findings provide baseline data for wildlife health surveillance and support future ecological and conservation studies in central India.

Keywords: Endoparasites, midden sites, ruminants, wildlife health

Introduction

India supports one of the world's richest assemblages of wildlife, with diverse ecosystems that sustain a wide range of herbivorous mammals and their associated parasite communities. Among these, the Nilgai (*Boselaphus tragocamelus*), the largest extant Asian antelope, is widely distributed across the Indian subcontinent and occupies habitats ranging from dry deciduous forests and scrublands to agricultural landscapes and protected areas (Dookia *et al.*, 2013; Chandra & Gupta., 2022) ^[5, 2]. Owing to its ecological adaptability, the species frequently occurs in landscapes influenced by both natural and anthropogenic factors, where it contributes to vegetation dynamics through selective browsing and grazing (Bisht, 2012) ^[1]. Nilgai are primarily mixed feeders, consuming grasses, leaves, shrubs, fruits, pods, and young shoots according to seasonal availability. They often cause financial losses to the agrarian communities due to crop raiding. Despite the conflict and financial losses, the species enjoys communal tolerance due to the belief that the species has descended from cows (Chandel *et al.*, 2025; Chauhan, 2011) ^[3, 4]. They exhibit a distinctive behavioural trait of repeatedly defecating at communal dung heaps, commonly referred to as midden sites. These sites function as centres of chemical communication, territorial marking, and social interaction, while also serving as repositories of faecal material that can provide valuable information on the health status, diet, and parasite burden of free-ranging populations through non-invasive sampling (Meena & Choudhary., 2019; Zoromski *et al.*, 2022) ^[10, 17]. Gastrointestinal parasites constitute an integral component of wildlife ecosystems, influencing host physiology, nutritional status, reproductive performance, and population dynamics. Although many parasitic infections remain subclinical under natural conditions, alterations in host density, environmental conditions, nutritional stress, and habitat disturbance may increase parasite transmission and disease susceptibility (Jaiswal *et al.*, 2014) ^[7]. In free-ranging herbivores, coprological examination has emerged as an effective, non-invasive approach for assessing gastrointestinal parasite diversity and prevalence without disturbing animals in their natural habitat.

Because Nilgai habitually deposit faeces at communal midden sites, these locations provide an efficient opportunity for systematic sampling and epidemiological surveillance (Zoromski *et al.*, 2022; Kozhayeva *et al.*, 2026) [17, 9]. Despite the broad distribution of Nilgai in India, information on their gastrointestinal parasite fauna remains limited for several regions, including central India. Therefore, the present study was undertaken to investigate the prevalence and diversity of gastrointestinal parasites in free-ranging Nilgai inhabiting the Gorewada landscape, Nagpur, Maharashtra, thereby contributing baseline information for wildlife health monitoring, parasite ecology, and conservation-oriented management.

Materials and Methods

Study Area

The present investigation was conducted in the surrounding landscape of the Gorewada Rescue Centre, Nagpur, Maharashtra, India, where a free-ranging population of Nilgai (*Boselaphus tragocamelus*) occurs. The study area comprises a mosaic of dry deciduous vegetation, scrubland, grass-covered patches, and open forest interspersed with anthropogenic influences, providing suitable habitat for the species. Nilgai inhabiting this landscape exhibit the characteristic behaviour of repeatedly defecating at communal dung heaps (midden sites), which facilitated non-invasive sampling for the present study.

Sample Collection

Fresh faecal samples were collected directly from identified midden sites during the early morning hours to minimize environmental contamination and ensure sample freshness. A total of 80 faecal samples were collected over a one-month study period from 12 active midden sites distributed across the study area (Fig. 1). Care was taken to collect only freshly voided faeces based on their physical appearance, moisture content, and absence of desiccation. Each sample was collected using sterile disposable gloves and transferred into individually labelled sterile collection containers. The samples were transported to the laboratory for parasitological examination under appropriate storage conditions and processed as early as possible after collection.

Parasitological Examination

Each faecal sample was examined qualitatively for the presence of gastrointestinal parasites using standard coprological techniques. Initially, direct faecal smear examination was performed to detect motile protozoa, helminth eggs, larvae, and other parasitic stages. Subsequently, the salt flotation technique was employed to concentrate parasite eggs and oocysts, thereby improving the detection of low-intensity infections. The recovered parasitic stages were identified based on their characteristic morphological features, including size, shape, shell morphology, colour, and internal structures, using standard parasitological identification keys.

Microscopic examination was carried out using a compound light microscope under 10× and 40× objective magnifications for routine screening and identification. Where required, observations under 100 × magnifications were performed to examine finer morphological details essential for accurate identification of parasitic ova and other developmental stages.

Results

A total of 80 fresh faecal samples were collected from 12 identified communal midden sites of free-ranging Nilgai (*Boselaphus tragocamelus*) over a one-month sampling period and examined using direct smear and flotation techniques. The samples were identified based on typical nature of the dropping and camera trapping exercise. Of the total samples examined, 26 (32.50%) were positive for one or more gastrointestinal parasites. Strongyle-type eggs were detected in all 26 positive samples; 23 were single infections and 3 occurred with *Eimeria* spp. *Eimeria* spp. was detected in 3 samples (3.75%). In addition, a mite was observed during direct smear examination of one faecal sample and was recorded as an incidental finding (Fig. 2). The distribution of parasitic stages detected during the study is presented in Table 1 & 2.

Discussion

The present study recorded an overall sample-level prevalence of 32.50% gastrointestinal parasites in free-ranging Nilgai (*Boselaphus tragocamelus*). Strongyle eggs were not identified to genus because morphological differentiation is not possible without larval culture or molecular methods. This prevalence was lower than that reported in Nilgai from Hisar, Haryana (Gupta *et al.*, 2018) [12], Barnawapara Wildlife Sanctuary, Chhattisgarh (Verma *et al.*, 2020) [16], and considerably lower than the prevalence documented in free-ranging herbivores of central India (Singh *et al.*, 2009) [14]. Variations in parasite prevalence among studies are expected because gastrointestinal parasite transmission is influenced by climatic conditions, habitat characteristics, host density, seasonal variation, forage availability, and sampling strategy (Singh *et al.*, 2009; Sengar *et al.*, 2017) [14, 11]. In the present investigation, samples were collected during a single month from communal midden sites using a non-invasive approach, which may also have contributed to the observed differences. The observed prevalence may be explained by the life cycle of gastrointestinal parasites and the environmental conditions favouring their development and persistence. The third-stage larva (L3) of the strongyle nematodes is infective and warm and moist conditions are conducive for the transmission of the parasite (Hoberg *et al.*, 2001) [6]. Similarly, coccidian oocysts also require suitable environmental temperature and humidity for sporulation before becoming infective. Factors such as warm temperatures, seasonal monsoon rainfall, and dense vegetation in the Gorewada landscape prolong the survival of the infective stages and also increase the probability of susceptible host infection. Furthermore, water sources, grazing patches, salt-lick sites and midden sites may themselves act as a source of infection (Utaaker *et al.*, 2023) [15].

Strongyle-type eggs constituted the predominant parasitic finding (28.75%). Similar observations have been reported in free-ranging Nilgai and other wild herbivores from Barnawapara Wildlife Sanctuary (Verma *et al.*, 2020) [16] and Panna Tiger Reserve (Sengar *et al.*, 2017) [11], where strongyle nematodes were among the most frequently encountered gastrointestinal parasites. The predominance of strongyle infections is consistent with the biology of these parasites, whose direct life cycle facilitates rapid transmission through contaminated pasture. Free-ranging

Nilgai regularly graze and browse on vegetation close to the ground, increasing their exposure to infective larvae present on herbage and soil. Previous studies have similarly suggested that grazing behaviour and continuous environmental contamination are major factors favouring strongyle transmission in wild herbivores (Singh *et al.*, 2009; Sengar *et al.*, 2017) ^[14, 11].

Eimeria spp. oocysts were detected in 3.75% of the examined samples, indicating a comparatively lower occurrence than strongyle nematodes. A relatively low prevalence of coccidial infection has also been reported in several coprological investigations of wild herbivores (Khutey *et al.*, 2020; Sengar *et al.*, 2017) ^[8, 11]. Differences in the occurrence of *Eimeria* among studies may reflect variation in environmental humidity, temperature, stocking density, faecal contamination of grazing areas, and the survival of sporulated oocysts. Although coccidial infections in adult wild herbivores are frequently subclinical, they remain epidemiologically important because they may affect young or immunocompromised animals under favourable conditions (Sofi *et al.*, 2026) ^[13].

Mixed infection involving strongyle-type eggs and *Eimeria* spp. was detected in 3.75% of the positive samples. Concurrent parasitic infections are commonly reported in free-ranging herbivores because multiple infective stages coexist within shared grazing habitats (Sengar *et al.*, 2017; Singh *et al.*, 2009) ^[11, 14]. Even when present at relatively low frequency, mixed infections may influence host

nutrition, immune responses, and overall health, highlighting the importance of continuous parasitological surveillance in wildlife populations. An important feature of the present study was the collection of fresh faecal samples from communal midden sites. Nilgai repeatedly use these sites for defecation, making them suitable for non-invasive monitoring of gastrointestinal parasites while minimizing disturbance to animals. Similar non-invasive faecal sampling approaches have been successfully employed in epidemiological investigations of free-ranging herbivores because they provide practical information on parasite circulation within wildlife populations without the need for capture or restraint (Sengar *et al.*, 2017; Singh *et al.*, 2009) ^[11, 14]. Nevertheless, repeated use of midden sites by multiple individuals should be considered when interpreting prevalence estimates, as the results represent sample-level rather than individual-level infection.

This study recorded the baseline sample-level prevalence of 32.50%. This study provides baseline information on gastrointestinal parasites of free-ranging Nilgai in central India. Strongyle-type nematodes dominated this study and *Eimeria* spp. occurred at a low prevalence rate. These findings demonstrate the usefulness of communal midden sites for non-invasive parasite surveillance. Further seasonal studies incorporating quantitative and molecular techniques are recommended to better understand parasite dynamics and their significance for wildlife health and conservation.

Table 1: Occurrence of gastrointestinal parasites detected in faecal samples of free-ranging Nilgai (*Boselaphus tragocamelus*) from the Gorewada landscape. Representative photomicrographs of the identified parasitic stages are presented in the corresponding figures.

Parasitic finding	Positive samples (n)	Percentage (%)
Strongyle-type eggs only	23	28.75
<i>Eimeria</i> spp.	3	3.75
Total positive samples	26	32.50

Table 2: Detection of gastrointestinal parasites from 12 monitored midden sites of free-ranging Nilgai (*Boselaphus tragocamelus*) during the one-month study period.

Midden Site	Total Samples Collected	Positive Samples	Strongyle	<i>Eimeria</i>	Mixed Infection
S1	7	3	3	0	0
S2	6	2	2	0	0
S3	7	2	2	0	0
S4	7	2	2	0	0
S5	8	4	3	1	Strongyle, <i>Eimeria</i>
S6	5	1	1	0	0
S7	7	2	2	0	0
S8	7	3	2	1	Strongyle, <i>Eimeria</i>
S9	6	1	1	0	0
S10	7	2	2	0	0
S11	6	2	2	0	0
S12	7	2	1	1	Strongyle, <i>Eimeria</i>
Total	80	26	23	3	3

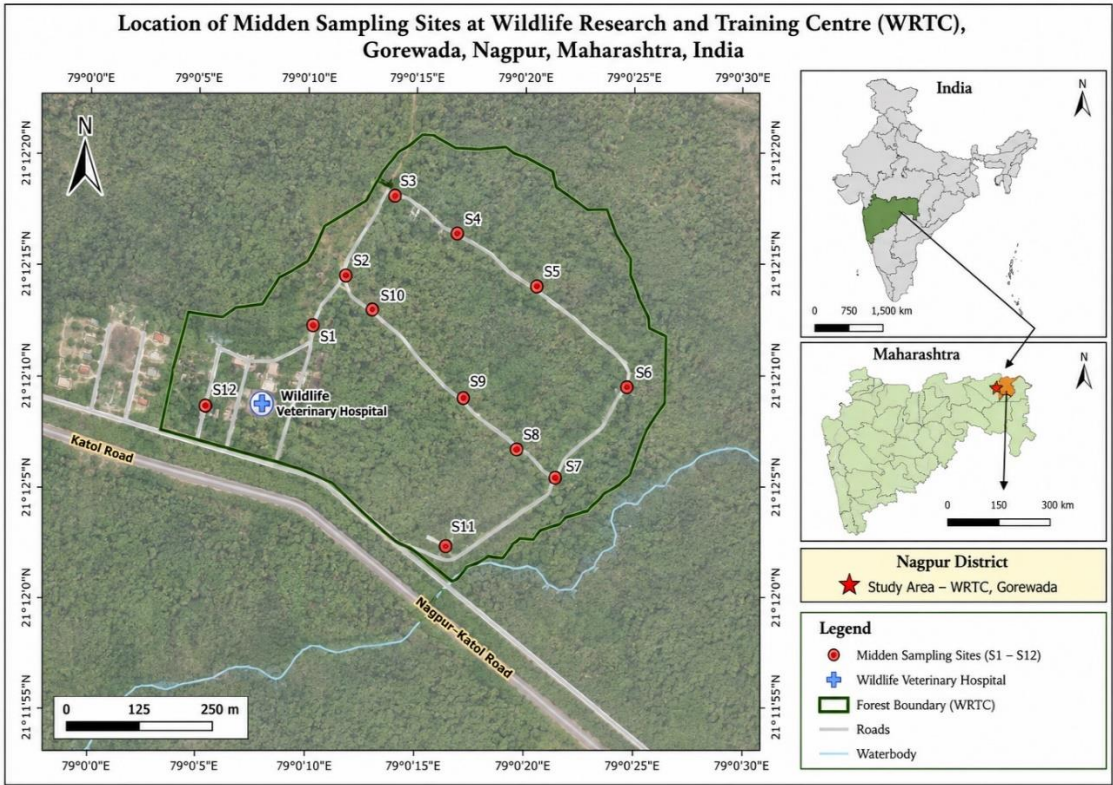


Fig 1: Sampling sites (Midden sites) used in the study at Gorewada Reserve Forest for the study

Strongyle-type eggs at different stages of embryonic development. (Fig A to M)			
Fig A	Fig B	Fig C	Fig D
Fig E	Fig F	Fig G	Fig H
Fig I	Fig J	Fig K	Fig L
Fig M	Fig N, O, P: Eimeria spp. oocysts detected in the study		

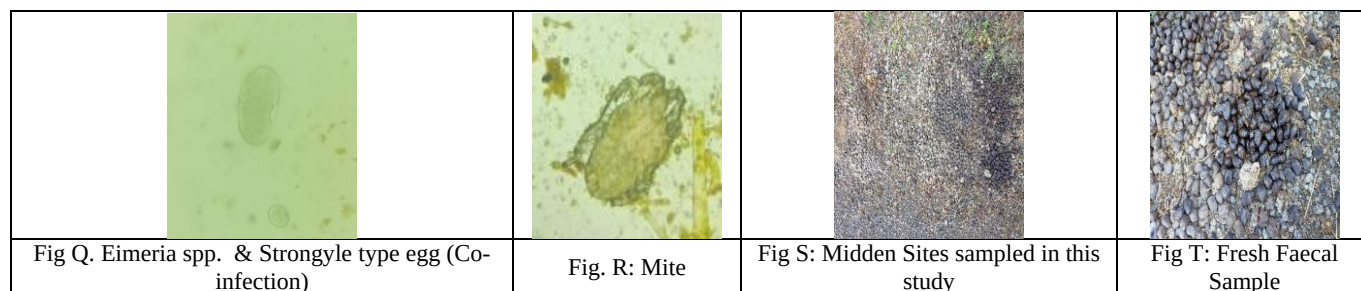


Fig 2 (A-T): Sampling sites and various eggs and oocysts found during the study

Conflict of Interest

Authors declare no conflict of interest.

Data availability

The dataset generated during research has been included in the manuscript.

Authors' contribution

P. K. Bhargale carried out the research work, laboratory investigations, data collection, and preparation of the initial manuscript draft. S. M. Kolangath conceived and designed the study, supervised the research, and critically reviewed and edited the manuscript. S. V. Upadhye was responsible for sample collection and field investigations. R. P. Kolhe performed the data analysis and contributed to the interpretation of the results. Shruti Patwa and Priyanka Mulmule assisted with laboratory investigations and provided technical support. All authors read, reviewed, and approved the final manuscript.

Ethical approval

The study involved non-invasive sample collection from free-ranging wild animals. No experiments were conducted on the animals and samples were collected for the health assessment of the animals.

Use of artificial intelligence tools

Grammarly tool was used for the language check and grammar improvement.

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