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Parasitic profiling of tigers and leopards of Maharashtra

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Abstract

Tigers (*Panthera Tigris*) and leopards (*Panthera pardus*) in India are highly vulnerable to endoparasitic infections, which impact their health, fitness, and survival both in the wild and in captivity. This study, conducted at the Wildlife Research & Training Centre in Gorewada, Nagpur, aimed to assess the prevalence of gastrointestinal parasites, focusing on *Sarcocystis* spp., among tigers and leopards in Maharashtra. A total of 12 tigers and 14 leopards presented to the center between 2021 and 2022 were screened for parasitic infections using fecal analysis by flotation methods. Results identified a range of parasitic infections, including *Sarcocystis* spp., *Toxocara cati*, *Spirometra* spp., and *Diphyllbothrium* spp., with *Sarcocystis* spp. detected in one tiger. Parasitic prevalence showed variation based on species, age, and sex, with a higher infection rate in female tigers compared to males. The most common parasites detected were nematodes and cestodes, known to cause gastrointestinal issues that can lead to malnutrition and, in severe cases, death. The study results align with findings from other global studies, highlighting that wild carnivores are often asymptomatic carriers of *Sarcocystis* spp. Nevertheless, infections may cause chronic health impacts, especially under stressful conditions, affecting an animal's fitness and reproductive success. This study underscores the importance of monitoring and managing parasitic infections to support the conservation of India's endangered big cats.

Keywords: *Sarcocystis* spp., Endoparasites, tigers, leopards, wildlife health, conservation

Introduction

In India, tigers (*Panthera Tigris*) and leopards (*Panthera pardus*) are vulnerable to a variety of endoparasitic infections, impacting their health, fitness, and survival in both wild and captive settings. Endoparasites, which include nematodes, cestodes, trematodes, and protozoa, often lead to digestive disturbances, nutritional deficiencies, respiratory problems, and, in severe cases, mortality. Nematodes, or roundworms, are some of the most frequently encountered parasites in tigers and leopards. Species such as *Toxocara cati* and *Toxascaris leonina* are gastrointestinal parasites that primarily infect felids through ingestion of contaminated prey or feces. Studies have documented significant nematode infections in both wild and captive felines, noting that these parasites can induce malnutrition, gastrointestinal distress, and, in severe cases, life-threatening obstruction of the intestines (Kumar & Khanna, 2008) [9]. Another nematode of concern is *Ancylostoma* spp., or hookworms, which anchor to the intestinal wall and feed on blood, leading to anemia, hypoproteinemia, and overall loss of body condition (Ravindran *et al.*, 2012) [2]. *Spirocerca lupi*, a nematode that resides in the esophagus and stomach, has been found in captive tigers, causing esophageal nodules and granulomas that may even transform into malignant tumours if left untreated (Veeraselvam *et al.*, 2019) [3]. Cestodes, or tapeworms, including *Taenia* spp. and *Echinococcus* spp., have also been reported in Indian big cats. These infections often result from consuming infected prey, highlighting the role of natural diets in parasite transmission. Tapeworm infestations may lead to chronic digestive issues, and in cases of *Echinococcus* infection, cysts form in organs like the liver and lungs, potentially leading to more severe health complications (Singh *et al.*, 2010) [4].

Although *Echinococcus* is more commonly associated with canids, instances in leopards underscore the zoonotic potential of this parasite, especially where wild felines come into contact with infected domestic animals or their carcasses (Jeyathilakan *et al.*, 2008) [5]. Trematode, or fluke, infections are less common but still significant. The lung fluke *Paragonimus spp.*, reported in various carnivores, including felines, affects the respiratory system, causing respiratory distress, coughing, and lung tissue damage due to cyst formation. In tigers and leopards, flukes such as *Opisthorchis spp.* and *Dicrocoelium spp.* may infect the liver and bile ducts, leading to jaundice and chronic liver disease (Babu *et al.*, 2011) [6]. This is particularly concerning for wildlife rehabilitation centers where these infections can cause chronic health issues, often difficult to diagnose without detailed post-mortem examinations.

Protozoan infections are also frequently encountered in Indian big cats, with species such as *Toxoplasma gondii* known to cause toxoplasmosis. *Toxoplasma*, which is spread through ingestion of oocysts in contaminated environments or via consumption of infected prey, can lead to varied clinical presentations, from asymptomatic infections to severe neurological, respiratory, and gastrointestinal symptoms, particularly in immunocompromised animals (Sharma *et al.*, 2013) [7]. Another significant protozoan is *Sarcocystis spp.*, which forms cysts within muscle tissue and can induce fatigue, weakness, and muscle pain. Additionally, *Giardia spp.* and *Cryptosporidium spp.*, two common intestinal protozoa, can cause severe diarrhoea, dehydration, and weight loss in infected animals (Gupta & Singla, 2012) [1]. These infections are particularly challenging to manage in young animals, which are more vulnerable to the nutritional deficits and dehydration caused by prolonged diarrhoea.

Routine diagnostic techniques such as faecal analysis remain essential to identifying and quantifying parasite load in both captive and wild populations. Faecal flotation and microscopy allow for the identification of nematode eggs, tapeworm

segments, fluke eggs, and protozoan oocysts. Polymerase Chain Reactions (PCR) based diagnostics and immunological assays have advanced the detection of protozoan infections, allowing for more accurate species identification (Sharma *et al.*, 2013) [7]. Studies have highlighted the importance of understanding these infections' lifecycle and transmission dynamics to develop effective control strategies that can be applied across conservation and captive management settings. Continued research is necessary to refine diagnostic techniques, expand treatment options, and enhance preventive measures, ultimately contributing to the health and survival of these majestic big cats in India.

Materials and Methods

A total of 12 tigers and 14 leopards that were presented from various parts of Maharashtra state to Wildlife Rescue Centre, Gorewada, and Nagpur during 2021-2022 were screened for the presence of gastrointestinal parasites by faecal examination. The samples were collected on reception of tigers/leopards to Wildlife Research & Training Centre, Gorewada, and Nagpur. The samples were processed for parasitic screening by floatation method employing saturated salt solution as described in the reference. The samples were screened in triplicates and were examined under 100X and 400 X magnifications using a light microscope.

Results

The study conducted at the Wildlife Research & Training Centre (WRTC) in Gorewada, Nagpur, screened 12 tigers (*Panthera Tigris*) and 14 leopards (*Panthera pardus*) for gastrointestinal parasites, with a specific focus on identifying *Sarcocystis* spp. among other parasitic species. Parasitic infections were confirmed through fecal examinations using flotation methods, revealing a variety of endoparasitic infections among the sampled animals. *Sarcocystis* spp. was identified in one tiger, signifying its presence among large felids in the region.

Sr. No.	Species	Sample ID	Sex	Age (Approximate)	Result	Identified parasite
1	Tiger	T1	M	12 years	Negative	
2	Tiger	T2	F	4 years	Negative	
3	Tiger	T3	F	5 years	Positive	<i>Toxocara cati</i>
4	Tiger	T4	F	4 years	Negative	
5	Tiger	T5	M	4 years	Negative	
6	Tiger	T6	M	2 years	Negative	
7	Tiger	T7	F	4 years	Negative	
8	Tiger	T8	F	8 years	Positive	<i>Toxocara cati</i>
9	Tiger	T9	F	3 years	Positive	<i>Spirometra</i> spp.
10	Tiger	T10	F	5 years	Negative	
11	Tiger	T11	F	5 years	Positive	<i>Sarcocystis</i> spp.
12	Tiger	T12	M	3 years	Negative	
13	Leopard	L1	F	8 years	Negative	
14	Leopard	L2	F	9 years	Positive	<i>Spirometra</i> + <i>Isospora</i> spp.
15	Leopard	L3	F	7 years	Positive	<i>Toxocara cati</i> + Unidentified
16	Leopard	L4	F	8 years	Negative	
17	Leopard	L5	M	12 years	Negative	
18	Leopard	L6	M	8 years	Negative	
19	Leopard	L7	M	10 years	Negative	
20	Leopard	L8	M	8 years	Negative	
21	Leopard	L9	F	6 years	Positive	<i>Spirometra</i> spp.
22	Leopard	L10	F	6 years	Positive	<i>Dipyllobothrium</i> spp.
23	Leopard	L11	F	6 years	Negative	
24	Leopard	L12	M	8 years	Negative	
25	Leopard	L13	M	8 years	Positive	<i>Spirometra</i> spp.
26	Leopard	L14	F	6 years	Negative	



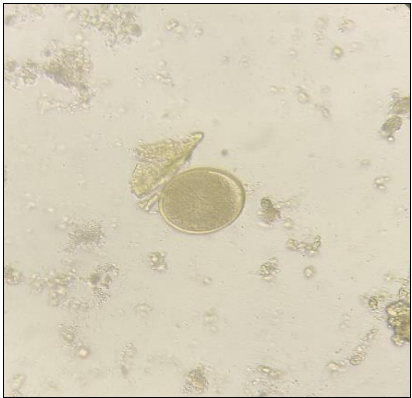
Spirometra sp



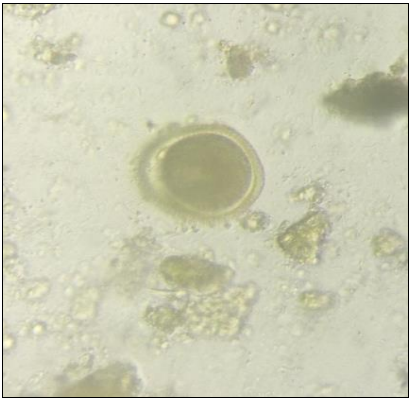
Toxocara cati



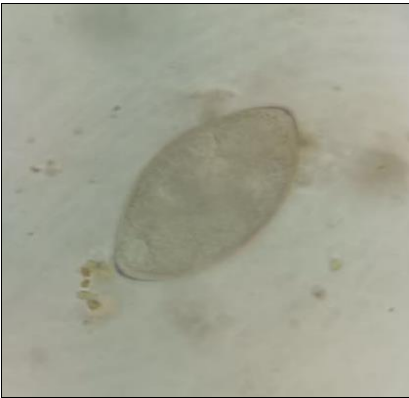
Oocysts of Sarcocystis species



Isospora oocyst unsporulated



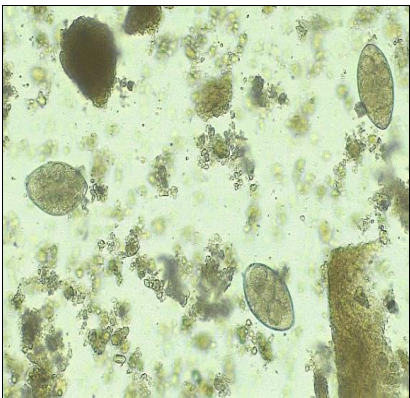
Toxacara cati



Spirometra sp.



Diphyllbothrium spp.



Diphyllbothrium spp.



Species unknown

	Parameter	Tigers (N=12)	Leopards (N=14)
Sex-wise Prevalence	Male	0/4 (0%)	1/6 (0%)
	Female	4/8 (50%)	4/8 (50%)
Age-wise Prevalence	0-3 years	1/3 (33.33%)	0/0
	3-6 years	2/7 (28.57%)	2/4 (50%)
	6-9 years	1/1 (100%)	3/8 (37.5)
	9 and above	0/1	0/2
Parasite-wise	Nematodes	2	2
	Trematodes	0	0
	Cestodes	1	4
	Protozoans	1	1

Discussion

This finding aligns with other global studies that identify *Sarcocystis* spp. as a common parasite in wild carnivores, often asymptotically infecting muscle tissue but potentially impacting fitness, particularly in stressed or immune-compromised animals (Dubey *et al.*, 2023)^[8]. In addition to *Sarcocystis* spp., the study detected *Toxocara cati*, *Spirometra* spp., *Diphyllbothrium* spp., and *Isospora* spp., indicating a

diverse range of parasitic infections. The most frequently detected parasites were nematodes and cestodes, notably *Toxocara cati* and *Spirometra* spp., which are known to impact health by causing gastrointestinal disturbances and, in severe cases, obstructions (Kumar & Khanna, 2008)^[9]. Among the tigers, 50% of females were positive for at least one parasitic infection, whereas no parasites were detected in male tigers. Among the leopards, both male and female

animals showed evidence of infections, particularly *Spirometra* spp. and *Diphylobothrium* spp. Parasite prevalence also varied by age, with younger animals (3-6 years) displaying higher rates of infection compared to older individuals, a trend possibly related to immune system development and behavioural exposure to pathogens. *Sarcocystis* spp. is commonly observed in a variety of wild and domestic animals worldwide, often manifesting in felids and other carnivores without significant clinical symptoms.

Studies on *Sarcocystis* infections in large felids, such as tigers, indicate that these parasites can be widespread yet underdiagnosed due to their often subclinical presentation. For instance, in a comparative study of *Sarcocystis* prevalence among North American wildcats, including bobcats and mountain lions, high infection rates were observed with minimal overt clinical signs (Dubey *et al.*, 2023; Chhabra & Samantaray 2013) [8, 10]. However, infections may lead to muscular fatigue, weakness, and in some cases, inflammatory responses in heavily infected animals, as has been observed in captive studies (Máca, 2020) [11]. The diet and habitat of wild tigers and leopards significantly contribute to parasite exposure, especially in cases of *Sarcocystis*, which commonly spreads through the ingestion of infected prey or environmental exposure to contaminated feces. In regions where domestic animals overlap with wildlife, such as livestock areas near reserves, the risk of *Sarcocystis* transmission increases. This scenario has been noted in studies where *Sarcocystis* spp. spread from domestic animals to large wild carnivores in both India and Africa (Gjerde *et al.*, 2020) [12]. In Maharashtra, India, habitat encroachment and the resulting human-wildlife interactions elevate the risk of parasite transmission between wildlife and domestic animals. Studies highlight that free-ranging wild animal, when captured or brought into care facilities, often present with higher parasitic loads, likely due to increased exposure to diverse pathogens in shared environments (Mahali *et al.*, 2010; Pradhan *et al.*, 2011) [13, 14]. This finding suggests that conservation and management practices need to account for environmental factors contributing to parasite transmission, with a focus on minimizing wildlife and domestic animal overlap.

While *Sarcocystis* infections may remain asymptomatic, they could affect tigers' physical endurance and immune function, especially under stress, disease, or environmental challenges. Chronic infections may compromise animal fitness and reproductive success, factors that are crucial for the conservation of endangered species like tigers and leopards. Research on the *Sarcocystis* life cycle reveals that the parasites form cysts within muscle tissues, often persisting long-term without immediate clinical effects but potentially affecting health over time (El-Kady *et al.*, 2018) [15]. Given the wide range of symptoms associated with *Sarcocystis* in stressed or immunosuppressed animals, conservationists are increasingly concerned about the impact on endangered populations in high-risk environments. Long-term studies are needed to establish clear correlations between parasitic load, health, and fitness in wild felid populations. This can inform intervention measures, such as health monitoring and strategic deworming, in both captive and free-ranging settings (Varghese *et al.*, 2016) [16].

The co-occurrence of other parasites, such as *Toxocara cati*, *Spirometra* spp., and *Diphylobothrium* spp., compounds the health challenges posed by *Sarcocystis* infections. *Toxocara cati*, for instance, is a gastrointestinal nematode that can cause malnutrition, intestinal blockages, and, in severe cases, organ

damage. In addition, *Spirometra* spp. are cestodes capable of migrating through tissues, which can lead to organ damage and secondary infections, posing risks to animal health, particularly in younger or immunocompromised animals (Veeraselvam *et al.*, 2019; Babu *et al.*, 2011) [3, 6]. Studies have shown that the immune response to one parasitic infection can influence susceptibility to others. This is particularly relevant in cases where wildlife is exposed to multiple pathogens through interaction with domestic animals or shared water and food sources (Jeyathilakan *et al.*, 2008) [5]. Such interactions underscore the importance of integrated parasite management strategies, focusing on reducing co-infections to enhance the overall health of wildlife populations.

Conclusion

The detection of *Sarcocystis* spp. and other parasites in tigers and leopards in Maharashtra underscores the pressing need for proactive health management in both captive and wild populations. The study demonstrates that wild felids are susceptible to a wide array of parasitic infections that could impact their health, especially when exposed to stressors like habitat fragmentation and human-wildlife conflict. Conservation efforts should prioritize health monitoring, habitat protection, and cross-species disease management strategies to ensure the survival and well-being of these iconic species. Enhanced diagnostic and management practices will be essential to mitigate the risks associated with parasitic infections, contributing to the conservation of endangered felid populations in India.

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Conflict of Interest

Not available

Financial Support

Not available

Reference

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