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Short Communication

PREVALENCE OF INTERNAL PARASITES IN BORNEAN SUN BEARS (*HELARCTOS MALAYANUS*) AT BORNEAN SUN BEAR CONSERVATION CENTRE, SABAH

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SUMMARY

A study conducted at the Bornean Sun Bear Conservation Centre in Sabah, Malaysia aimed to assess the prevalence of internal parasites in 45 captive Bornean sun bears, a species listed as vulnerable in the International Union for Conservation of Nature's Red List due to a declining population trend. Based on the coproscopic ova examination, the study found that 31 sun bears had a prevalence of internal parasites (overall 68.89%), with *Trichuris* sp. being the most prevalent (42.22%), followed by *Ancylostoma* sp. (31.11%), gastrointestinal protozoa (8.89%), *Strongyloides* sp. (6.67%) and cestode (4.44%). The presence of gastrointestinal parasites was significantly associated with group-living housing. Findings from this study improve our understanding of sun bear parasitism and facilitate strategies for parasite prevention.

Keywords: Bornean sun bear; gastrointestinal parasites; haemoparasites; captive; conservation

INTRODUCTION

Sun bears, the smallest species among eight living bears, are listed as vulnerable in the IUCN Red List and they are the only native bear species in Malaysia and can be divided into two subspecies, Malayan sun bear, found in Mainland Asia and Sumatra, and Bornean sun bear, found in Borneo (Scotson et al., 2017). Internal parasites, or endoparasites, are organisms that live within another organism, and they can cause health issues in captive wildlife (Taylor et al., 2015). These parasites can lead to secondary deficiencies and increased susceptibility to infectious diseases. The health of animals, including parasitism, is crucial in wildlife rehabilitation and conservation activities. Only one study found internal parasites in the Bornean sun bear species from 1916 to 2022, with six investigations dating over 30 years. Risk factors for parasitic infections in sun bears include inconsistent anthelmintic administration and lack of a quarantine system (Jenantika et al., 2019). The present study was conducted due to the lack of empirical data from research and reports pertaining to internal parasites of Bornean sun bears. Considering the vulnerable status of sun bears in the IUCN Red List, any possible pathogen such as parasitic infections poses a significant threat to the conservation of sun bears. The objectives of this study include (1) to analyse the prevalence of internal parasites in Bornean sun bears at BSBCC, and (2) to investigate the association between possible risk factors and internal parasitic infections.

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MATERIALS AND METHODS

The Bornean Sun Bear Conservation Centre (BSBCC) in Sandakan, Sabah, is the only world-wide sun bear conservation center. The study involved N=45 rescued sun bears, categorized into juveniles (<5 years old), subadults (6 to 10 years old), and adults (>10 years old). Most of the bears were able to venture outdoors during the day (n=32), while the rest stayed in indoor enclosures (n=13). Over half of the bears were housed in a group (n=28), while the others were housed individually (n=17). This study complies with the Sabah Biodiversity Council. A study collected 90 faecal samples 24 hours apart from 45 sun bears to improve identification sensitivity. Faecal samples were maintained at 4°C until further processing within 1 to 3 days. The body condition score was determined based on Polar Bear International (2016), and faecal scores were recorded daily based on a faecal score chart with nine scores. In-house faecal floatation and sedimentation were carried out in the BSBCC. Parasites were detected based on observable morphological features including their colors, sizes, shapes and the contents of their eggs. The ova were classified to the genus level using available taxonomic drawings and references. All results were verified by veterinary parasitologists. The parasitic burden grading used in the Veterinary Parasitology Laboratory, Faculty of Veterinary Medicine, UPM was utilised to describe parasitic load (Table 1). The data analysis involved descriptive statistics on prevalence and Fisher's Exact Test on SPSS version 29.0 to determine non-random associations between categorical variables of risk factors namely age, sex, management, and housing, and clinical manifestations like body condition score and faecal score.

Table 1. Parasitic load grading score for helminth ova and characterisation based on the number of ova present during microscopic examination

Grading score of ova burden	Characterisation*
1+	1 ovum present in some fields
2+	1 ovum present in almost all fields
3+	>1 ova present in almost all fields
4+	Too many to count

**Based on the thorough scanning all field of the glass slide under the x40 magnifications.*

RESULTS

The study found five types of gastrointestinal parasite eggs with an overall prevalence of 68.89% (95% CI: 53.35-81.83) with *Trichuris* sp. being the most prevalent (42.22%), followed by *Ancylostoma* sp. (31.11%), GIT protozoa (8.89%), *Strongyloides* sp. (6.67%) and cestode (4.44%). The morphological characteristics of these ova were shown in Figure 1. Out of 31 positive bears, 28 (90.3%) were graded as 1+, while 3 (9.7%) were 2+. Of these, 22 (71%) were single infection, and 29% were mixed infections. Mixed infections consisting of *Ancylostoma* sp. and *Trichuris* sp. were the most frequently detected (33.33%). The study found a significant association between gastrointestinal parasitic infections and housing, but not with sex, age, management, or body condition score (Table 2). *Trichuris* sp. parasitic infections were significantly associated with group-living housing (Table 3).

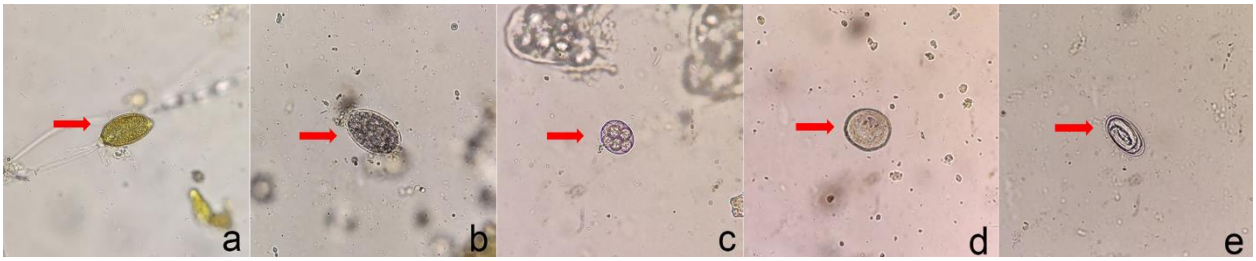

Figure 1. Morphological identification of gastrointestinal parasites in captive Bornean sun bear. (a) Ova of *Trichuris* sp; (b) Ova of *Ancylostoma* sp; (c) Protozoa oocyst; (d) Ova of cestode and (e) Ova of *Strongyloides* sp. All images were observed at 400x magnifications.

Table 2. Risk factors associated with the prevalence of gastrointestinal parasites in captive Bornean sun bear

Variables	Categories	Parasitic Infections		p-value
		Positive N (%)	Negative N (%)	
Sex	Male	12 (66.6)	6 (33.3)	1.0000
	Female	19 (70.4)	8 (29.6)	
Age	Juvenile: ≤5	7 (77.8)	2 (22.2)	0.7363
	Subadult: 6 to 10	7 (77.8)	2 (22.2)	
	Adult: >10	17 (63.0)	10 (37.0)	
Management	Indoor	7 (53.8)	6 (46.2)	0.2861
	Outdoor	24 (75)	8 (25)	
Housing	Individual	8 (47.1)	9 (52.9)	0.0210*
	Group	23 (82.1)	5 (17.9)	
Body Condition Score (BCS)	<3	24 (75)	8 (25)	0.2861
	≥3	7 (53.8)	6 (46.2)	

BCS (1-Skinny; 2-Thin; 3-Ideal; 4-Overweight; 5-Obese); N-Number of animals

Table 3. Association between housing and the prevalence of gastrointestinal parasites in captive Bornean sun bear

	Individual		Group		p-value
	Positive N (%)	Negative N (%)	Positive N (%)	Negative N (%)	
Ancylostoma sp.	5 (29.4)	12 (70.6)	9 (32.1)	19 (67.9)	1.0000
Trichuris sp.	1 (5.9)	16 (94.1)	18 (64.3)	10 (35.7)	0.0001*
Strongyloides sp.	0	17 (100)	3 (10.7)	25 (89.3)	0.2788
Cestode	1 (5.9)	16 (94.1)	1 (3.6)	27 (96.4)	1.0000
Protozoa	2 (11.8)	15 (88.2)	2 (7.1)	26 (92.9)	0.6262

The faecal scores of sun bears ranged from 2 to 3.5, with a mode score of 3. However, the distribution was highly skewed, making further statistical testing impossible due to limited dataset variability.

DISCUSSION

Parasitic infections in captive animals are largely due to stress due to limited space and changing living conditions, weakening their immune resistance. In the wild, animals have inherent resistance to parasitic infections, and a state of equilibrium between parasite and host rarely leads to severe infections (Mir et al., 2016). Humid and warm temperatures in Sabah also encourage the development and motility of nematodes (Stromberg, 1997). The present of wild macaques, orangutans, and pests near conservation centers may carry gastrointestinal parasites and possible transmission may occur. This study found that *Trichuris* sp. and *Ancylostoma* sp. are the most abundant parasites similar from the findings in the Indonesian Wildlife Park (Jenantika et al., 2019). These gastrointestinal parasites have a monoxenous life cycle, allowing direct transmission through fecal-oral routes. Despite their high prevalence, the parasite burden in most cases is low, possibly due to regular deworming practices in BSBCC, which occur once every 6 months. This could explain the absence of clinical signs related to parasitic infections. 29% of mixed infections in bears are due to shared environment, promoting parasite transmission. *Ancylostoma* sp. and *Trichuris* sp. are present in 5 out of 9 cases. The consequences of these infections in sun bears are not documented, however in general, low internal parasitism may show no symptoms but heavy burdens can cause diarrhoea, weight loss, unthriftiness, and anemia. *Trichuris* sp. infections is associated with the type of group-housing, as hardy eggs can persist for years and resist disinfection while overcrowding and competition for feed and water typically cause stress and decreased immunity, making animals more susceptible to parasitic infections (Singh et al., 2009). The only effective way to exterminate whipworm eggs from the environment is through desiccation or incineration (Dysko et al., 2002). The disparity in immune resistance towards parasites between hosts is attributed to competition between immune responses and host life-history traits. Sun bears, although not associated with sex, have been found to have more positive cases of parasitic infections, contrasting with studies indicating higher gastrointestinal parasitism in males (Liza et al., 2020).

CONCLUSION

The study reveals a 68.89% internal parasitic prevalence in Bornean sun bears, with nematodes being the predominant parasite. Further molecular studies could identify species-level parasites, providing valuable documentation for other sun bear populations, and examining them in the wild or captivity should be further explored.

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CONFLICT OF INTEREST

None of the authors of this paper has financial or personal relationship with other people or organisations that could inappropriately influence or bias the content of the paper.

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