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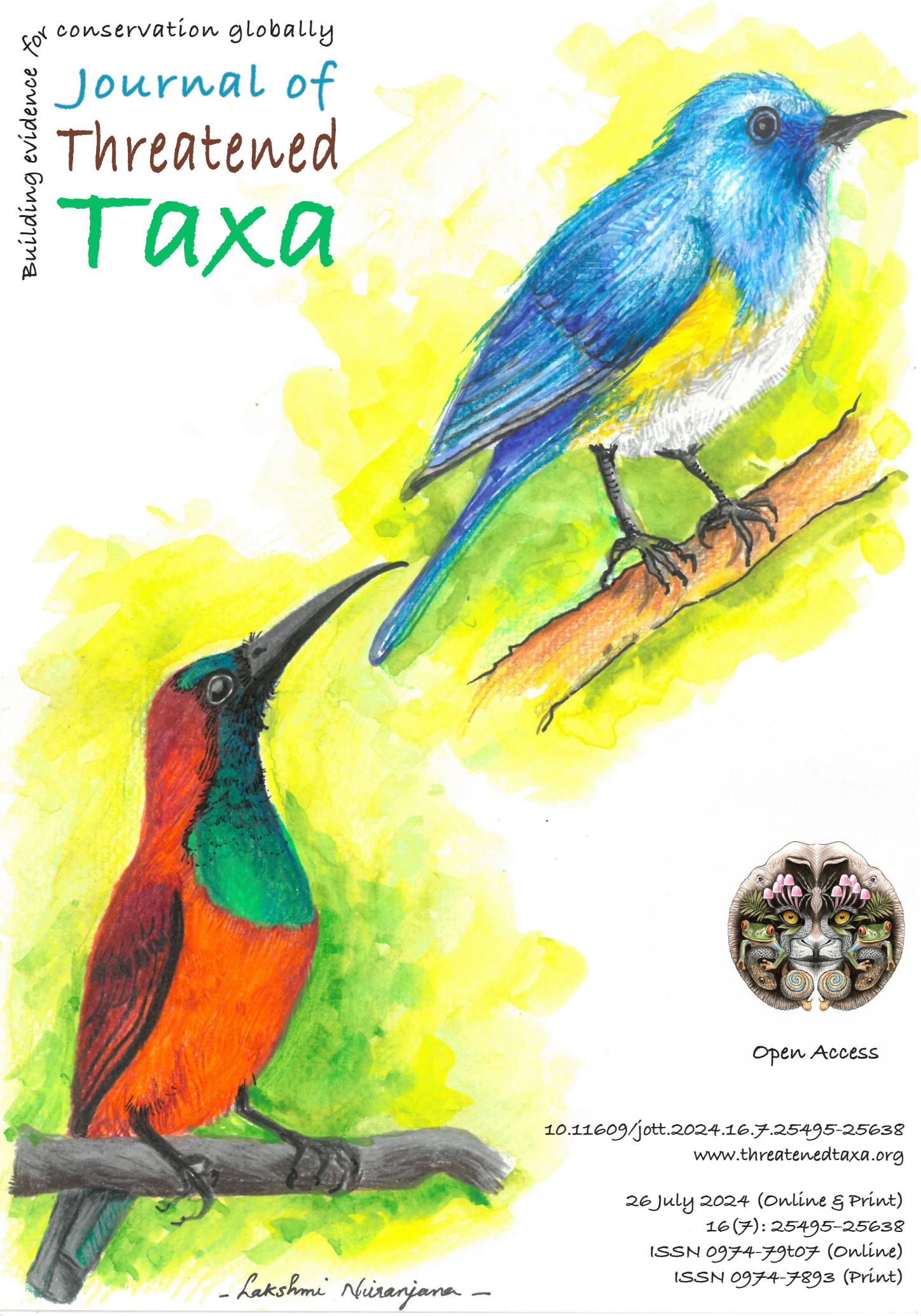

Open Access

10.11609/jott.2024.16.7.25495-25638
www.threatenedtaxa.org

26 July 2024 (Online & Print)
16(7): 25495-25638
ISSN 0974-7907 (Online)
ISSN 0974-7893 (Print)

ISSN 0974-7907 (Online); ISSN 0974-7893 (Print)

Publisher
Wildlife Information Liaison Development Society
www.wild.zooreach.org

Host
Zoo Outreach Organization
www.zooreach.org

43/2 Varadarajulu Nagar, 5th Street West, Ganapathy, Coimbatore, Tamil Nadu 641006, India
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Journal of Threatened Taxa | www.threatenedtaxa.org | 26 July 2024 | 16(7): 25590–25597

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

https://doi.org/10.11609/jott.8134.16.7.25590-25597

#8134 | Received 05 August 2022 | Final received 12 May 2024 | Finally accepted 23 June 2024

COMMUNICATION

Incidence and risk factors associated with parasitic infections in captive wild mammals and birds in Indian zoos

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Abstract: Present study was conducted to record the seasonal incidence and worm burden (eggs per gram of faeces) of helminthic infections and to evaluate the efficacy of deworming protocols followed for control of parasitic infections in captive animals (including birds) at the zoo. Freshly voided faecal samples were collected during winter, monsoon and summer from 150 captive animals including wild mammals (n = 95) and birds (n = 55) between 1–15 years of age kept at Rajiv Gandhi Zoo and Wildlife Research Centre Karaj, Pune (Zoo-I) and Nisargakavi Bahinabai Chaudhary Zoo, Pimpri Chinwad (Zoo-II) in Maharashtra, India. Samples were processed and examined by standard sedimentation and floatation methods to assess the prevalence of helminth infections. Faecal samples of positive animals were collected pre and post-treatment, and the efficacy of the drugs used was evaluated based on faecal egg count reduction test (FECRT). The overall seasonal prevalence of gastro-intestinal parasitic infection in mammals varied among seasons with the highest prevalence (29.50 %) in monsoon followed by winter (26.30 %) and lowest in summer (8.40 %), while the same was found non-significant in birds. Of 19 bird species screened, 25 % of peafowl were positive for *Ascardia* spp., 25 % of crested eagles for *Capillaria* spp., and 50% of brown fish owls for *Strongyloides* spp. Among mammals, 75 % of Black Buck, 50 % of Leopards and 25 % of Giant Malabar Squirrels were positive for *Strongyloides* spp., while all four Bonnet Macaques were positive for *Balantidium coli*. The range of eggs per gram (EPG) of faeces recorded was 50–300 in mammals and 100–350 in birds. At Zoo I (Rajiv Gandhi Zoo and Wildlife Research Centre Karaj, Pune), there was 85.89 and 77.36 per cent reduction in egg counts after treatment with fenbendazole @5 mg/kg in herbivores and birds, respectively. While in carnivoresthe reduction was 69.93 % after treatment with a drug combination@10 mg/kg (Praziquantel 50 mg + Pyrantelembonate 144 mg + fenbantel 150 mg). In Zoo II (Nisargakavi Bahinabai Chaudhary Zoo, Pimpri Chinwad) the reduction in EPG was 72.35 % in carnivores with drug combination @10 mg/kg (Praziquantel 50mg + pyrantelembonate 144 mg + fenbantel 150 mg) and 68.98% in birds with albendazole @10 mg/kg.

Keywords: FECRT, helminthic infections, prevalence, preventive management, worm.

Editor: Alok Kumar Dixit, College of Veterinary Science & A.H., Rewa, India. **Date of publication:** 26 July 2024 (online & print)

Citation: Das, N., P.D. Pawar, P.P. Mhase, V.G. Nimbalkar, R.V. Jadhav, V.S. Dhaygude, G. Furtado & L.D. Singla (2024). Incidence and risk factors associated with parasitic infections in captive wild mammals and birds in Indian zoos. *Journal of Threatened Taxa* 16(7): 25590–25597. https://doi.org/10.11609/jott.8134.16.7.25590-25597

Funding: Self-funded.

Competing interests: The authors declare no competing interests.

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Author contributions: Nikita Das (collection processing of samples along with history), P.D. Pawar (planning and execution of research plan as per objective), P.P. Mhase (compilation of all data), V.G. Nimbalkar (statical analysis of data), R.V. Jadhav (permission and support during collection of samples), V.S. Dhaygude (writing of manuscript), Gavin Furtado (help in collection of history and schedule deworming plan) & L.D. Singla (help in analysis of results and corrections in the manuscript).

Acknowledgements: Authors sincerely acknowledge the support provided by the Rajiv Gandhi Zoo and Wild life Research Centre Karaj, Pune and NisargakaviBahinabai Chaudhary Zoo, PimpryChinwad, and Department of Veterinary Pathology, KNP College of Veterinary Science, Shirwal, Maharashtra.

INTRODUCTION

India is the World's 8th most bio-diverse region with a 0.46 BioD score on the diversity index, including 1,02,718 species of fauna (ZSI 2021). The nation is unique in having immense natural beauty, rich, and diverse wildlife comprising mixed species of different types of animals. Many countries including India in different parts of the world have adopted the strategy to protect wild animals via the use of parks and the construction of zoological gardens (Parasani et al. 2001). The zoological gardens display wild animals for aesthetic, recreational, educational, and conservation purposes (Varadharajan & Pythal 1999). Wild mammals and birds act as reservoirs and amplifiers of emerging human and domestic livestock pathogens (including parasites) of public health significance which has gained considerable attention in recent years (Moudgil et al. 2015).

The mortality in animals in captivity has been reported to be at a higher rate due to a variety of factors, including various bacterial, viral, fungal, and parasitic infections (Rao & Acharjyo 1984). Knowledge on parasitic diseases of wildlife is still in infancy in India, and data is on the baseline to understand the epidemiology of parasitic diseases in wild fauna kept in Indian zoos (Singh et al. 2009). Only a few researchers have carried out basic work on the prevalence of parasites in captive wild animals in India (Singh et al. 2006; Gupta et al. 2011; Jaiswal et al. 2014; Mir et al. 2016) except for recent comprehensive studies on animals (Moudgil et al. 2020a,b) from Punjab state.

The parasitic control and prevention programs for wildlifemainly depend on different factors like financial resources, public health structures, reduction of parasitic load, action on the animal reservoirs & vectors, improved diagnostic tools, environmental & ecological changes, human behaviours, education of the people that are involved in the wildlife, and domestic animal chain (Chomel 2008).

Though we can achieve better animal health in zoological gardens by quarantining newly inducted animals, improving hygiene practices and enforcing policy for not allowing visitors to feed animals (Singh et al. 2006), however, the most important part is the implementation of strategic prevention and control programs for prevalent parasitic species in wild animals based on parasitological analysis. The present study was planned to record the seasonal incidence of helminthic infections, assess the worm burden based on estimation of the eggs per gram (EPG) of faeces, and evaluate the efficacy of regular scheduled anthelmintic treatment administered in zoo mammals and birds.

MATERIALS AND METHODS

Area of the study

The study was conducted in two zoos located at Pune, Maharashtra, India (18.5204 °N & 73.8567 °E),the first zoo (Zoo I) was Rajiv Gandhi Zoological Park and Wildlife Research Center (RGZP) andthe second zoo (Zoo II), Nisargakavi Bahinabai Chaudhary Zoo, Pimpri Chinchwad. Freshly voided faecal samples of 150 wild animals including Indian Peafowl (6), Pariah Kite (6), Brown Fish Owl (1), Shikra (2), Flying Fox (1), Eagle Owl (1), Brown Owl (1), Long-billed Vulture (2), Black Kite (2), Ring-neck Dove (1), Great Horn Owl (1), Painted Stork (1), Crested Eagle (2), LaggarFalcon (2), Amazon Parrot (4), African Grey Parrot (4), Plum-headed Paraket (1), Spot-billed Duck (4), Rose Ring Parakeet (1), Budgerigar (2), Cockatiel (2), Tiger (7), Leopard (6), Jungle Cat (16), Indian Wolf (1), Lion (2), Hyena (2), Jackal (5), Sloth Bear (2), Black Buck (4), Chinkara (2), Four- horned Antelope (5), Gaur (4), Indian Elephant (2), Barking Deer (2), Sambar (3), Spotted Deer (5), Blue Bull (4), Malabar Giant Squirrel (4), Bonnet Macaque (4), Rhesus Macaque (4), Trinket Snake (2), Bamboo Pit Viper (5), Reticulated Python (1), King Cobra (3), Common Krait (1), Banded Racer (1), Earth Boa (4), Indian Rat Snake (1), and Star Tortoise (1) were collected and examined.

A total of 450 faecal samples were collected during three different seasons, 150 each time (110 samples from Zoo I and 40 samples from Zoo II) throughout 2021. Along with the faecal sample, individual data regarding age, sex, and captivity were recorded separately. The data regarding the drug used for deworming, dose and period of deworming was also noted separately. Fresh faecal samples were collected randomly and pooled together from enclosures premises.

Coprological evaluations

The faecal samples were subjected to detailed parasitological analysis to confirm parasitic eggs /oocysts by direct smear examination. These samples were also subjected to standard sedimentation and floatation techniques (Soulsby 1982). Positive samples were further analysed quantitatively to indirectly calculate the parasitic load by eggs per gram of faeces (Gupta & Singla 2012).

Treatment given

The treatment at Zoo I was carried with fenbendazole

for herbivores @5 mg/kg body weight (BW) for two days (Table 7). The carnivores and reptiles were treated with a combination of praziquantel 50 mg, pyrantel-embonate 144 mg and fenbantel 150 mg @10 mg/kg BW for three days. Whereas, for the birds fenbendazole was given orally @5 mg/kg body weight (with restricted feed) once and repeated after 14 days during the study period.

The deworming zoo II in birds was carried out with albendazole@ 10 mg/kg as a single dose orally. The carnivores were treated with a combination of praziquantel 50 mg, pyrantel-embonate 144 mg and febantel 150 mg) @ 10 mg/kg BW for three days (Table 8).

The faecal samples of positive animals were collected before treatment and 14th day post-treatment. The efficacies of the above drugs were assessed based onthe faecal egg count reduction test (FECRT).

$$\text{Percent efficacy (FECRT)} = \frac{\text{(Pre-treatment mean EPG -Post-treatment mean EPG)}}{\text{Pre-treatment mean EPG}} \times 100$$

Statistical analysis

The data was processed in Microsoft Excel, and descriptive analysis was done using SPSS statistic software for Windows, Version 20 developed by IBM Company, USA. Parametric and non-parametric statistical tests including the Chi-square test, student t-test and faecal egg count reduction test was used to interpret the final results.

RESULTS AND DISCUSSION

Overall seasonal prevalence

The seasonal prevalence of gastro-intestinal parasitic infection in mammals varied significantly (P<0.01) with a higher prevalence (29.50%) in monsoon followed by winter (26.30%) and summer (8.40%). At the same time, the same was found non-significant in birds with a prevalence rate of 21.80, 20.00, and 18.80% in monsoon, winter, and summer, respectively (Table 1). During monsoon season, high humidity and suitable environmental temperatures can prolong the survival of infective parasitic stages (Singh et al. 2009) resulting in higher prevalence rate. Mammals had a higher overall prevalence (21.50%, CI: 16.8–26.6) than birds (18.80%, CI: 13.10–25.60). The findings are similar to Moudgil et al. (2020a), who reported a 25.5% prevalence of gastrointestinal parasitism in zoo animals. In contrast, Muraleedharan et al. (1990) and Singh et al. (2006) recorded a higher prevalence of gastrointestinal parasites. Similarly, in other previous studies, higher prevalence had been recorded from different states of India, i.e., Bihar (51.90%; Modi et al.1997a), Andhra Pradesh (46.59%; Kumar & Rao 2003), and Punjab (32.98%; Moudgil et al. 2020b). Comparatively lower prevalence in the present study could be associated with the adoption of better management practices including balanced feeding, regular deworming, regular screening and treatment of positive animals and daily cage and premises cleaning.

Prevalence based on sex and location

Sex and location (Table 2) based variation in prevalence rate was found non-significant during all three seasons. However, Kumar & Rao (2003) found a higher prevalence of parasitic infection in males than females kept in the different zoological gardens of Andra Pradesh (India) and Nekede Owerri (Southeast Nigeria).

Species based seasonal prevalence

All the omnivores were positive for gastrointestinal parasites during the winter (Table 3) followed by 28.60 % prevalence in herbivores, 16.70 % in reptiles, and 5.04 % (2/37) in carnivores. The observations are similar to Thawait et al. (2014). The prevalence was significantly higher (p<0.01) in omnivores during the winter and monsoon season. The prevalence during summer

Table 1. Overall seasonal prevalence of gastrointestinal parasitic infections in mammals and birds.

	Season	Examined (mammals + birds)	Positive mammals	Prevalence (%)	Positive birds	Prevalence (%)
1	Winter	150 (95+55)	25	26.30 (CI 17.8–26.30)	11	20.00 (CI 10.40–33.0)
2	Summer	150 (95+55)	8	8.40 (CI 3.70–15.90)	8	14.50 (CI 6.50–26.70)
3	Monsoon	150 (95+55)	28	29.50 (CI 20.60–39.90)	12	21.80 (CI 11.80–35.00)
	Overall	450 (285+165)	61	21.50 (CI 16.80–26.60)	31	18.80 (CI 13.10–25.60)
	$\chi 2$		20.86**		1.033^{NS}	

CI—95% Confidence Interval | *—significant at P<0.05 | **—significant at P <0.01 | NS—non-significance.

among different species was found lower than the other seasons, contrary to the studies from southeastern Nigeria that reported higher infections in the summer season in wild cats (Okoye et al. 2014). The hot and dry climate in the study region and clean surroundings on the premises might have attributed to the low parasitic infections during the summer season.

In the monsoon season, 10.80% of carnivores were found positive for gastrointestinal parasites. *Balantidium coli* cysts were most commonly found in lions (Image 5) and strongyle eggs and *Strongyloides* larvae in Hyena (Image 6). Among herbivorous animals, gaurs and blackbucks (Image 3 & 4) were found positive for *Strongyloides* species, whereas chinkara and nilgai were positive for *Trichuris* eggs (Image 1) and *B. coli* (Image 2), respectively. Similar findings were previously recorded by Cook et al. (1979). Among omnivores, *B.coli* cysts were seen in Bonnet macaque (Image 8) and *Strongyloides* species larvae in Malabar Giant Squirrel (Image 7). Prevalence was found higher in monkeys as they were kept in cages, which could have led to excessive stress, further leading to a 100% infection rate of gastrointestinal parasites. Thawait et al. (2014) also recorded a similar observation where the prevalence of different gastrointestinal parasites was found higher in monkeys (60%), followed by herbivores (45.6%) and carnivores (45.2%). In python, *Strongyloides* species eggs (Image 13) were abundant, whereas *B. coli* cysts were seen in Star back tortoise (Image 14). Similar observations were reported in Kerala by Akhila et al. (2018), i.e., overall *Strongyloides* species larvae were most prominently found accounting for 25.7%of all infections, followed by *Capillaria* species (22.8%) and strongyles (20.00%) in captive snakes.

Table 2. Seasonal prevalence of gastrointestinal parasites based on sex and location in different animals.

Variables	Sex		Location	
	Female	Male	Zoo I	Zoo II
Winter	8/29 (27.00)	4/25 (16.00)	24/85(28.20)	1/10(10.00)
χ2	8.38^{NS}		3.74^{NS}	
Summer	0/29(0)	4/25(16.0)	7/85(8.20)	1/10(10.00)
χ2	4.62^{NS}		0.48^{NS}	
Monsoon	9/29(31.00)	9/25(36.00)	26/85(30.60)	2/10(20.00)
χ2 value	1.05^{NS}		0.48^{NS}	

^{NS}—non-significance | Figures in parentheses indicate percentages | Zoo I—Rajiv Gandhi Zoological Park and Wildlife Research Center | Zoo II—NisargakaviBahinabaiChaudhary Zoo.

Seasonal prevalence in birds

In the monsoon season, adult birds showed a significant higher prevalence of gastrointestinal parasites compared to young birds. (Table 4). Similarly, a highly significant difference was observed in males during the monsoon season. The presence of *Ascaridia galli* was

Table 3. Seasonal prevalence of gastrointestinal parasites found in different species of animals.

Variables	Carnivores	Herbivores	Omnivores	Reptiles	χ2 Value
Winter	2/37(5.40)	8/28(28.60)	12/12(100)	3/18(16.70)	25.232**
Summer	2/37(5.40)	2/28(7.10)	2/12(16.70)	2/18(11.20)	1.72^{NS}
Monsoon	4/37(10.80)	8/28(28.60)	12/12(100)	4/18(22.20)	35.380**

*—Significant at P<0.05 | **—significant at P <0.01 | ns—non-significance. Figures in parenthesis indicates percentages

Table 4. Age, sex, location wise seasonal prevalence of gastrointestinal parasites in birds.

Variables /season	Age		Sex		Location	
	Adult	Young	Female	Male	Zoo I	Zoo II
Winter	11/40 (27.50)	1/15 (6.70)	4/18 (22.20)	2/14 (14.30)	8/25 (32.0)	4/30 (13.0)
χ2 value	2.77^{NS}		0 .71^{NS}		2.78^{NS}	
Summer	9/40 (22.50)	2/15 (13.30)	2/18 (11.10)	4/14 (26.60)	7/25 (28)	4/30 (13.0)
χ2 value	0.57^{NS}		1.57^{NS}		1.83^{NS}	
Monsoon	6/40 (15.00)	2/15 (13.30)	3/18 (16.70)	3/14 (21.40)	3/25 (12.0)	5/30 (16.70)
χ2 value	17.39**		46.54**		47.43**	

*—significant at P<0.05 | **—significant at P <0.01 | ^{NS}—non-significance. Figures in parenthesis indicates percentages.

commonly observed in peafowl (Image 9) and African Grey Parrots (Image 11), followed by *Capillaria* in Long-billed Vultures (Image 10) and Great Horn Owls (Image 12). Such observation is more or less similar to the findings of Parsani et al. (2007) in birds in Ahmedabad. Sahoo et al. (2010) reported a prevalence of 29.5%from Orissa at Nandankanan Zoo in wild birds. The birds in the zoo are often subjected to the stress of caged captivity, overcrowding and environmental conditions favorable for the development of parasites. As a result, the birds in captivity generally harbor more parasitic infections than their freely living counterparts.

Captivity based prevalence

Captivity based prevalence found significantly higher in herds (groups), i.e., 33.30% (95% CI = 25.60–41.80), followed by birds 18.80% (95% CI = 13.10–25.60) and individually enclosed animals 9.72% (95% CI = 5.40–15.80) (Table 5). At the beginning of the study, the birds showed the highest prevalence in monsoon, i.e., 32% (95% CI = 14.90–53.50), followed by winter with 28% (95% CI = 12.10–49.40) and summer with 12% (95% CI = 2.50–31.20) at Zoo I. The parasitic gastrointestinal infections in the mammals kept in herds (groups) were highest (45.70%) in the monsoons (95% CI = 30.90–61.00) followed by winter (45.60%) (95% CI = 30.90–61.00) and summer (8.7%) (95% CI = 2.40–61). Initially, in Zoo II, the captivity-based prevalence in birds and herds during the season of monsoon was 13.3% (95% CI = 3.80–30.70) and 100% (95% CI = 2.5–100), respectively. That could be because of overcrowding and competition for food and water, causing stress and lowered immunity, making them more vulnerable to parasitic illnesses (Dhoot et al. 2002; Singh et al.2009). The individual enclosed animals had a significantly lower prevalence than herd animals and birds, as they might get special care, management and appropriate anthelmintic treatment throughout the year (Table 5). Similar observations have been reported by Moudgil et al. (2020a) from Punjab from different zoos.

Seasonal EPG recorded in both mammals and birds

The mean EPG of mammals of both zoos during the pre-monsoon season was the highest (183.9±16.00). The EPG recorded in the positive herbivores was moderate (50–100) while it was more in carnivores (100–300).The mean EPG observed in the pre-winter and pre-summer seasons was (156±13) and post-winter andpost-summer was(20± 6.40) (Table 6). Similar results were shown by Modi et al. (1997b) from Bihar; Kumar & Rao (2003) from Andhra Pradesh and Moudgil et al. (2014) from Punjab, where the monsoon season has the highest prevalence,

Table 5.Prevalence of gastrointestinal parasites based on captivity.

Overall/ Captivity	Frequency of positive samples	Prevalence (%)	χ2
Birds	31/165	18.80 (CI 13.10–25.60)	24.858**
Individual enclosed	14/144	9.70 (CI 5.40–15.80)	
Groups (herds)	47/141	33.30 (CI 25.60–41.80)	

CI—95% Confidence Interval | *—significant at P<0.05 | **—significant at P <0.01 | NS—non-significance.

followed by winter while the summers had the lowest prevalence. During the study period, the intensity of parasitic infection was also recorded in captive birds at both zoos. The mean EPG recorded in birds was highest in the winter season (265±18.30), followed by monsoon (200±26.10) and summer (181.2±32.60).

Drug-wise efficacy study

The treatment was carried out for positive animals and birds in the present investigation as per Table 7 and 8. The faecal samples were collected two times (pre and post treatment) for the study from different animals and birds. At Zoo I (Rajiv Gandhi Zoo and Wildlife Research Centre Karaj, Pune), there was 85.89% and 77.36% reduction in eggs counts after treatment with fenbendazole @5mg/kg in herbivores and birds, respectively. In carnivores, the reduction was 69.93% after treatment with drug combination @10 mg/kg (Praziquantel 50mg + Pyrantelembonate 144mg + fenbantel 150 mg) (Table 7). In Zoo II (Nisargakavi Bahinabai Chaudhary Zoo, Pimpri Chinwad) the reduction in EPG was 72.35% in carnivores with drug combination@10mg/kg (Praziquantel 50mg + pyrantelembonate 144mg + fenbantel 150mg) and 68.98% in birds with albendazole @10mg/kg.

The drugs used were able to eliminate the development stages of the parasites in herbivores, carnivores as well as birds. Cent-percent efficacy was observed against *Trichuris* species and strongyle parasites for herbivores and carnivores, as eggs of these two species of parasites were not detected in the faeces post-treatment. Similarly, in birds, both albendazole and fenbendazole were able to eliminate *Ascaridia* sp., parasites, as no eggs of *Ascaridia* species were seen in the faeces post-treatment.

In the Nisargakavi Bahinabai Chaudhary Zoo, the faecal egg count reduction in mammals was 66.60–100 %. The average reduction in carnivores was 72.35%. The fecal egg count reduction in EPG birds was 76.20–56.30 % with an average of 68.98%. A highly significant reduction in the faecal egg count when compared to pre and post-

Table 6. Seasonal EPG recorded in both mammals and birds.

EPG	Mammals (Range)	Mean ± SE	Birds(Range)	Mean± SE
Pre-winter	50–300	156 ±13.00	150–350	265±18.30
Post-winter	0–100	20 ± 6.40	0–150	60±16.30
Pre-summer	50–300	156±13.00	100–300	181.2±32.60
Post-summer	0–100	20±6.40	0–150	56.2±17.50
Pre-monsoon	50–300	183.9±16.00	100–300	200±26.10
Post-monsoon	0–150	55.30±11.30	0–150	83.3±16.60

Table 7. Species-wise drug and dosing used for deworming at Zoo I.

	Species	drug used (contents)	Dosing	Pre- treatment EPG	Post-treatment EPG	Percentage reduction in EPG
1	Herbivores	5% suspension containing fenbendazole	@ 5mg/kg body weight once a day for 2 days.	156 ±13.00	20 ± 6.40	85.89%
2	Carnivores	Praziquantel 50mg + Pyrantelembonate 144mg +fenbantel 150 mg	@10mg/kg body weight for 3 days.	183.9±16.00	55.30±11.30	69.93%
3	Birds	5% suspension containing fenbendazole	@5mg/kg body weight for 1 day	265±18.30	60±16.30	77.36%

Table 8. Species-wise drug and dosing used for deworming at Zoo II.

	Species	Content of the drug used for deworming	Dosing	Pre- treatment EPG	Post-treatment EPG	percentage reduction in EPG
2	Carnivores	Praziquantel 50mg + pyrantelembonate 144mg + fenbantel 150 mg	@10mg/kg body weight for 3 days.	200±26.10	55.30±11.30	72.35%
3	Birds	Albendazole	@ 10mg/kg. body weight for 1 day	181.2±32.60	56.2±17.50	68.98%

treatment egg counts in both zoos may be due to proper dosing of drugs in animals according to body weight, good hygienic management practices, and individual care of wild animals and birds. It has been observed that confinement of wild animals in the zoo makes them prone to different parasitic infections despite providing adequate attention to feed, water, and maintenance of hygiene in captivity (Barmon et al. 2014). Despite regular deworming practices, the prevalence of parasitic infections varying from 25–95 % has been reported in zoo birds at various locations in India (Parasani et al. 2007). Besides proper dosing with specific and recommended drugs, in animals according to their body weight, good hygienic management practices and individual care of wild animals and birds in captivity is required for the management of these infections.

SUMMARY AND CONCLUSION

Climatic conditions during different seasons and captivity play a major role in the prevalence of parasitic infections in zoo animals. Captivity enhances the repeated exposure of the animals to the environment contaminated by the infective stages of the parasites. Furthermore, such environmental conditions can be favourable to the parasites' developmental stages being propagated as a result and the enclosure being contaminated. It is possible to infer from the study's findings that appropriate control methods, such as periodical examination, following the collection of faecal samples, and successful treatment is administered with anthelmintic. It may be suggested that cleaning the premises and proper disposal of excreta and refusals may minimize/avoid the associated losses.

Eggs of parasites observed in herbivores:

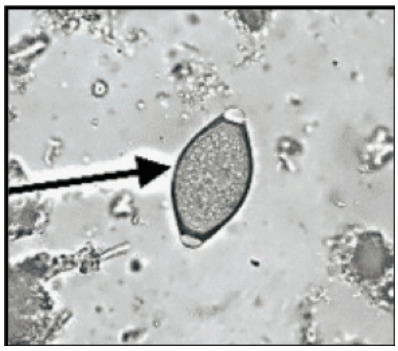

Image 1. *Trichuris* sp. (40X) in Chinkara.

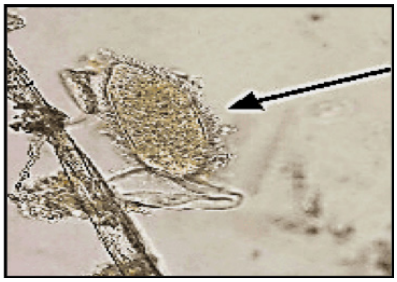

Image 2. *Balantidium coli* (40X) in Nilgai.

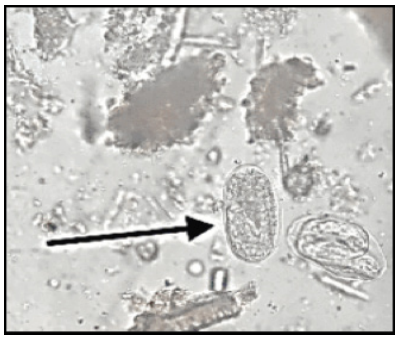

Image 3. *Strongyloides* (40X) in Gaur.

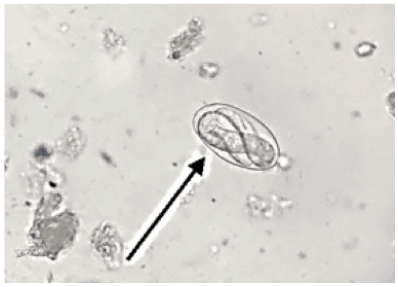

Image 4. *Strongyloides* (40X) in Black Buck.

Eggs of parasites observed in carnivores:

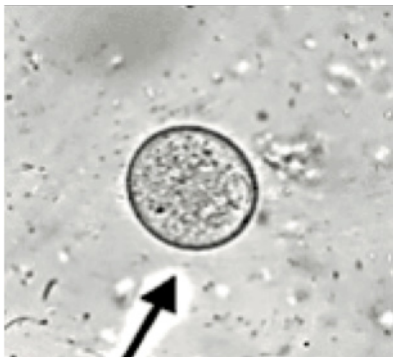

Image 5. Balantidium coli (40X) in African Lion.

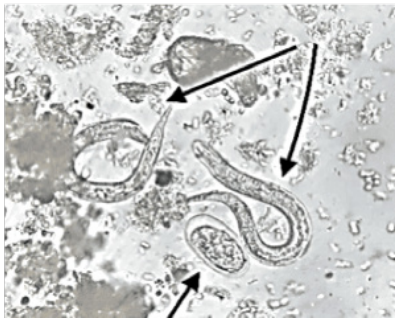

Image 6. *Strongyloides* (40X) in Spotted Hyena.

Eggs of parasites observed in omnivores:

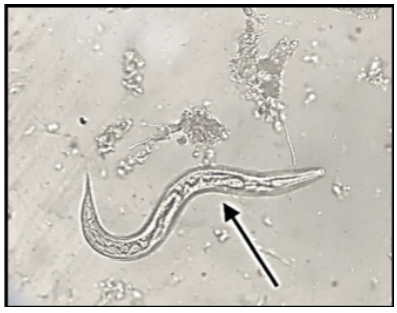

Image 7. *Strongyloides* (40X) in Giant Malabar Squirrel.

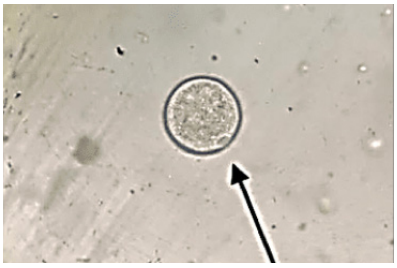

Image 8. *Balantidum coli* (40X) Bonnet Macaque.

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Eggs of parasites observed in birds:

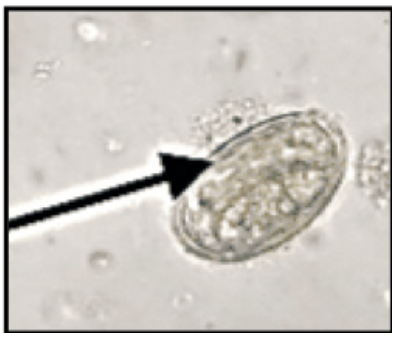

Image 9. *Ascaridiagalli* (40X) in Indian Peafowl.

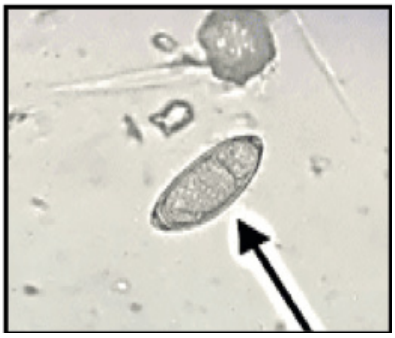

Image 10. *Capillaria* spp.(40X) in Long-billed Indian Vulture.

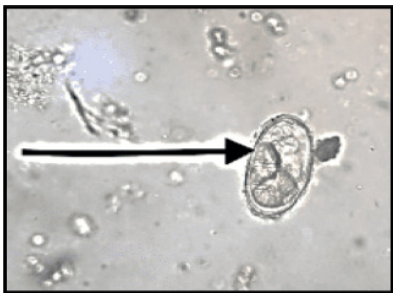

Image 11. *Ascaridiagalli* (40X) in African Grey Parrot.

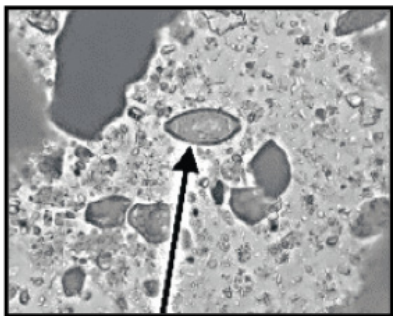

Image 12. *Capillaria* spp. (40X) in Great Horn Owl.

Eggs of parasites in reptiles:

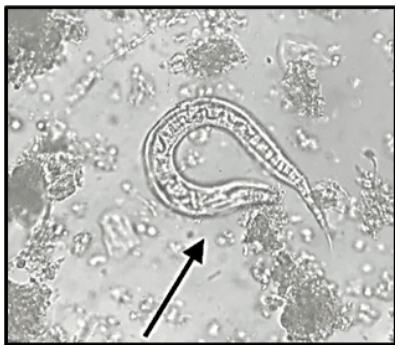

Image 13. *Strongyloides* (40X) in Reticulated Python.

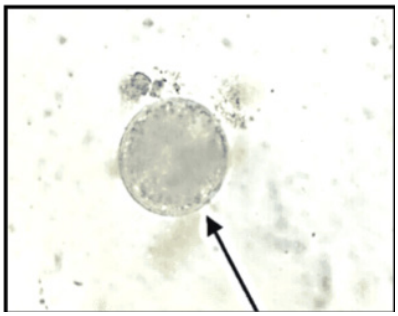

Image 14. *Balantidium coli* (40X) in Star Back Tortoise.

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NAAS rating (India) 5.64

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Journal of Threatened Taxa

www.threatenedtaxa.org

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

July 2024 | Vol. 16 | No. 7 | Pages: 25495–25638
Date of Publication: 26 July 2024 (Online & Print)
DOI: 10.11609/jott.2024.16.7.25495-25638

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