Vietnamese Journal of Primatology (2009) 3, 83-88

Gastrointestinal parasites of the Delacour's langur (*Trachypithecus delacouri*): Comparison between caged, semi-wild, and free-ranging individuals

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Key words: Gastrointestinal parasites, *Trachypithecus delacouri*, Colobinae

Summary

From March through May 2009, fecal samples were collected from caged, semi-wild, and free-ranging individuals of the Delacour's langur (*Trachypithecus delacouri*) to quantify the prevalence of gastrointestinal parasites. Helminth eggs and larvae were isolated by various diagnostic techniques. Helminth parasites were identified, and infection prevalence was determined for all individuals. Six nematode species (*Trichuris* sp., *Trichostrongylus* sp., *Oesophagostomum* sp., *Strongyloides stercoralis*, *Ancylostoma* sp., and *Physaloptera* sp.) were detected. The most prevalent nematodes in this study were *Trichuris* sp. and *Oesophagostomum* sp. Only one type of nematode was found in the free-ranging animals, this finding seems to support the theory that small isolated host populations harbor fewer parasite species.

Vật ký sinh trong hệ tiêu hóa của voọc mông trắng (*Trachypitecus delacouri*) sống nuôi nhốt, nuôi nửa hoang, và trong rừng

Tóm tắt

Từ tháng 3 tới tháng 5 trong năm 2009, mẫu phân của voọc mông trắng (*Trachypithecus delacouri*) sống nuôi nhốt, nuôi nửa hoang và trong rừng đã được thu lượm để xác định số lượng sự phổ biến của vật ký sinh trong hệ tiêu hóa. Trứng và ấu trùng của giun ký sinh đã được tách ra bằng nhiều phương pháp chẩn đoán khác nhau. Giun ký sinh đã dược nhận ra và sự phổ biến lây nhiễm được xác định tro voọc sống nuôi nhốt, nuôi nửa hoang và trong rừng. Sáu loài giun tròn (*Trichuris* sp., *Trichostrongylus* sp., *Oesophagostomum* sp., *Strongyloides stercoralis*, *Ancylostoma* sp., and *Physaloptera* sp.) đã được phát hiện. Loài giun tròn thường thấy nhất trong cuộc nghiên cứu này là *Trichuris* sp. và *Oesophagostomum* sp. Chỉ có một loài giun tròn đã được tìm thấy trong voọc sống trong rừng, cái khám phá này dường như ủng hộ cái lý thuyết là vật chủ sống cách ly với dân số nhỏ sẽ chứa chấp ít loài vật ký sinh.

Introduction

Vietnam is home to 22 primate species and of those; four are endemic to Vietnam and are listed as "Critically Endangered" by the IUCN "Red List of Threatened Species" (Southeast Asian Mammal Databank, 2006). Delacour's langur, *Trachypithecus delacouri*, which was first discovered in 1930 in Northern Vietnam (Osgood, 1932), is one of the "Critically Endangered" species. This species is only found in a restricted area in the Pu Luong – Cuc Phuong limestone range in Northern Vietnam. Survey indicated that populations of Delacour's langur have declined by 50-55% since 1992 (Nadler et al., 2002). Isolation of remaining subpopulations and intense hunting pressure pose the most severe short-term threat to their survival in the wild. Sixty percent of all known Delacour's langurs occur in isolated subpopulations, with a maximum of 20 animals per subpopulation. These small subpopulations are at severe risk of local extinction. The two largest subpopulations consist of only about 30 and 100 animals (Nadler et al., 2004).

Hopkins and Nunn (2007) global gap analysis of infectious agents in wild primates found that despite a growing importance of geo-referenced data for reducing disease risk, information on parasite threats are globally limited. In their study they utilized gap analysis to investigate the global distribution of parasite sampling in non-human primates and found that Southeast Asia as one of three regions in the world with the most deficient sampling.

Currently, there are no studies that look at the parasites in the critically endangered Delacour's langur. The most recent review of the Delacour's langur indicated that only 281-317 individuals remain in 19 small isolated subpopulations (Nadler, 2004). These small subpopulations are extremely vulnerable to environmental and human disturbance. A study on gastrointestinal parasites is important for the management of critically endangered primates and the safety of animal keepers in centers such as the Endangered Primate Rescue Center (EPRC) because many of these parasites are potentially zoonotic.

The study reported here was conducted with the aim of documenting some of the different gastrointestinal parasites found in the Delacour's langur and to compare the prevalence and types of parasites in caged, semi-wild and free-ranging animals.

Materials and Methods

Study Animals

Fecal samples from caged and semi-wild animals were collected at the EPRC, Cuc Phuong National Park, Vietnam. There are a total of 15 animals kept in cages and four animals in the semi-wild enclosure. Five of the confiscated animals are founders for the captive population at the EPRC (Table 1).

The semi-wild enclosure is two hectares and has various vegetation types that are eaten by the langur. Four individuals have been in the semi-wild enclosure for over five years, no food supplements are given except for one feeding of sweet potatoes every day in the morning to check the health of the animals.

Ten fecal samples from Van Long Nature Reserve (VLNR) were collected from two different groups in the reserve, each group was composed of about 10-18 individuals.

Sample Collection

Fifteen fecal samples were collected from 14 caged animals, and four fecal samples were

Table 1. Demographic data of caged and semi-wild animals.

Name	No.	Sex	Date Born	Sire	Dam	Source	Type
Short Tail	1-01	M	1990	Wild	Wild	Confiscated	Caged
M. Delacouri	1-03	F	Unknown	Wild	Wild	Confiscated	Caged
Marco	1-04	M	1993	Wild	Wild	Confiscated	Caged
Jonathan	1-07	M	21.02.98	1-01	1-03	Born EPRC	Caged
Franz	1-08	F	16.08.99	1-01	1-03	Born EPRC	Caged
Ella	1-09	F	03.04.01	1-01	1-03	Born EPRC	Caged
Hai	1-10	M	04.06.01	1-02	1-05	Born EPRC	Caged
Scott	1-12	M	07.12.02	1-01	1-03	Born EPRC	Caged
Johanna	1-13	F	09.07.03	1-02	1-06	Born EPRC	Caged
Joris	1-15	M	14.07.04	1-01	1-03	Born EPRC	Caged
Sascha	1-16	M	01.06.05	1-04	1-08	Born EPRC	Caged
Fritz	1-18	M	14.04.07	1-04	1-08	Born EPRC	Caged
Unnamed	1-20	M	30.01.08	1-10	1-09	Born EPRC	Caged
Jojo	1-21	F	29.07.08	1-07	1-13	Born EPRC	Caged
Longtail	1-02	M	1990	Wild	Wild	Confiscated	Semi-wild
Manu	1-06	F	28.07.96	1-01	1-03	Born EPRC	Semi-wild
Buschi	1-17	F	27.10.05	1-02	1-06	Born EPRC	Semi-wild
Gil	1-19	M	08.01.08	1-02	1-06	Born EPRC	Semi-wild

collected from the four animals in the semi-wild enclosure at the EPRC. Ten fecal samples from free ranging animals were collected at VLNR. Fecal samples were collected soon after defecation and examined macroscopically for adult nematodes and tapeworm proglottids. Samples collected from the EPRC were examined within an hour after collection. Samples collected at VLNR were divided into two parts: one part was preserved in a 25 ml vial in 10% formalin solution and the second part was refrigerated at 4°C. Refrigerated and preserved samples were examined within two days after collection.

Parasitological Techniques

Several diagnostic techniques were used to identify different parasites. Fecal smear, simple flotation, centrifugal flotation, and fecal sedimentation procedures were followed (Zajac & Conboy, 2006). Parasites were identified on the basis of egg color, shape, contents, and size (Foreyt, 2001; Roberts & Janovy, 2005; Zajac & Conboy, 2006). Measurements were made to the nearest 0.1 µm, using an ocular micrometer fitted to a compound microscope, and representatives were photographed (Fig. 1).

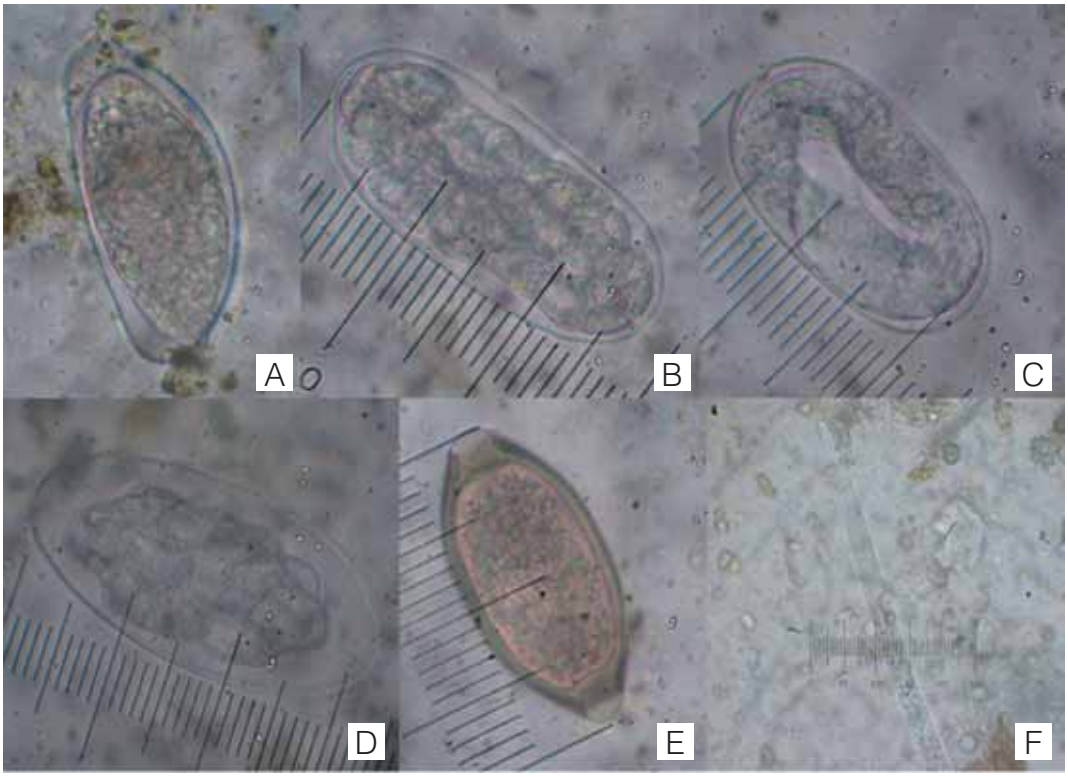

Fig. 1. A: *Ancylostoma* spp. egg (57.2 X 30 µm); B: *Oesophagostomum* spp. egg (73.6 X 31.6 µm); C: *Physaloptera* spp. egg (55.2 X 28.9 µm); D: *Trichostrongylus* spp. egg (63.2 X 42.1 µm); E: *Trichuris* spp. egg (55.3 X 28.3 µm); F: *Strongyloides stercoralis* larvae.

Results

Nematoda

Trichuroidea: *Trichuris* spp. were identified on the basis of egg size, barrel-shaped yellow-orange eggs, and bipolar plugs. Eggs were only found in feces of caged and semi-wild animals and measured 55.3 X 28.3 µm. The prevalence of *Trichuris* sp. was 100% in caged and 75% in semi-wild animals.

Strongyloidea: *Oesophagostomum* spp. were identified on the basis of egg size, elliptical eggs, a large dark cell in the morula, and non-larvated. Eggs were only found in feces of caged and semi-wild animals and measured 73.6 X 31.6 µm. The prevalence of *Oesophagostomum* sp. was 14% in caged and 24% in semi-wild animals.

Rhabditoidea: *Strongyloides stercoralis* was identified based on larvae size, presence of a rhabditiform esophagus, prominent genital primordium, and short buccal cavity. Larvae of S. stercoralis were only found in feces of caged animals and measured 473 µm in length. The prevalence of *Strongyloides stercoralis* was 7% in caged animals.

Spirurida: *Physaloptera* spp. were identified on the basis of egg size, elliptical eggs with a smooth cell wall, and coiled larva. Eggs were only found in feces of free-ranging animals and measured 55.2 X 28.9 µm. The prevalence of *Physaloptera* spp. was 10% in free-ranging animals.

Strongyloidea: *Ancylostoma* spp. was identified on the basis of egg size, elliptical eggs with a smooth cell wall, and grapelike cluster of cells. Eggs were only found in feces of semi-wild animals

and measured 57.2 X 30 μm. The prevalence of *Ancylostoma* spp. was 25% in semi-wild animals.

Trichostrongyioidea: *Trichostrongylus* spp. was identified on the basis of egg size, elliptical eggs with a smooth cell wall, and non-larvated. Eggs were only found in feces of caged animals and measured 63.2 X 42.1 μm. The prevalence of *Trichostrongylu*s spp. was 43% in caged animals.

Discussion

This is the first study of gastrointestinal helminth parasite infections in caged, semi-wild and free-ranging individuals of the Delacour's langur. The similarities of parasites found in both caged and semi-wild animals suggest that the parasite infections could be due to the close proximity of the semi-wild enclosure to the caged animals (Table 2). The five confiscated Delacour's langurs produced 15 animals in captivity. There are 19 in total kept by the EPRC, four in the semi-wild enclosure and fifteen in cages. It is very likely that the animals got the parasite infections before they were transferred to the semi-wild enclosure. *Ancylostoma* spp. was the only parasite found in the semi-wild animals and not the caged animals suggesting a new infection. The animals in cages also harbor two species (*Trichostrongylus* spp. and *Strongyloides stercoralis*) that were not found in the semi-wild animals. The 15 animals in cages are housed in five different enclosures with other species housed next to the Delacour's langur cages. The new parasite infections could transfer through the animal keepers.

Interestingly, only one type of parasite (*Physaloptera* spp.) was found from free-ranging animals.

Table 2. The prevalence (%) of gastrointestinal Helminth parasite infection in caged, semi-wild, and free-ranging animals. (Sample size is in parentheses.).

	Prevalence		
Parasite	Caged (15)	Semi-wild (4)	Wild (10)
*Ancylostom*a spp.	0	25	0
Oesophagostomum spp.	14	25	0
Physaloptera spp.	0	0	10
Trichostrongylus spp.	43	0	0
Trichuris spp.	100	75	0
Strongyloides stercoralis	7	0	0

A total of 10 samples from free-ranging animals were examined and only one sample contained *Physaloptera* spp. eggs. Common knowledge suggests that since the animals live in a natural environment the animals are exposed to more infectious agents and thus should be infested with parasites, but this was not the case with the free-ranging Delacour's langurs. Altizer et al. (2007) tested the theory of whether species richness and prevalence of parasites differed between threatened and non-threatened host species. Their results showed that total parasite species richness was lower among threatened primates. This small isolated population of Delacour's langur hosts few parasite species.

This is the first baseline study that looked at the gastrointestinal parasites of the "Critically Endangered" Delacour's langur and compared the prevalence between caged, semi-wild, and free-ranging animals. The sample sizes in this study are small, statistics on prevalence should be

looked at with caution. Future studies should sample all of the Delacour's langur groups at Van Long Nature Reserve and other regions to have a better understanding of the effects of parasites on small isolated populations.

Acknowledgement

The researcher thanks Truong Quang Bich, Director of Cuc Phuong National Park, and Tilo Nadler, Director of the Endangered Primate Rescue Center. Special thanks also go to Timo Gessner and all of the staff at the EPRC for their support, advice, and friendships. Finally, I thank Dr. Victoria Matey for her advice and expertise and the staff at SDSU MHIRT program. This project was funded by the SDSU MHIRT International Research Trainee Award.

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