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PARASITES OF SELECTED REPTILES OF THE NATIONAL ZOOLOGICAL GARDEN, SRI LANKA

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Abstract: The National Zoological Garden plays a vital role in conservation of reptiles in Sri Lanka. Since parasitic infestations of captive reptiles can impact their health, a survey for intestinal parasites and ectoparasites was conducted on 19 selected reptilian species (14 snakes, four chelonians, and one crocodilian) housed at the National Zoological Garden, Sri Lanka. Of the reptiles screened, 62% (N=139) were infected with parasites; 66% and 24% exclusively harbored intestinal and ecto parasites, respectively, while 10% carried both types of parasites. Three ticks (Ixodidae), two adult cestodes, plerocercoid larvae, and four nematode species were recovered during this survey. Three types of nematode ova and a single type of digenian ova, protozoan cysts, L3 nematode larvae, and a protozoan were detected in the feces. In this first systematic survey of reptilian parasites in Sri Lanka, four new host–parasite records are documented.

Key words: Sri Lanka, reptile conservation, National Zoological Garden, reptilian hosts, ectoparasites, intestinal parasites.

BRIEF COMMUNICATION

In Sri Lanka, reptile conservation is critical as population declines caused by over-killing, loss of habitat, and human interference has resulted in population reductions so severe that the survival of these species remains in jeopardy.[7] In Sri Lanka, reptile breeding facilities are nonexistent. Hence, the National Zoological Garden plays a critical role in reptile conservation. However, because of the close proximity of a variety of animals under zoo conditions, these animals may be prone to more infections.[4]

All free-living reptiles harbor parasites, but the parasite burdens to any given reptile host are very low. In captivity, however, as in a zoological garden, the concentration of parasites can be much higher and potentially more dangerous to these captive reptiles.[4] A stressed, captive reptile that is heavily parasitized is more likely to succumb to the disease than its wild counterpart.[4] Parasites affect all aspects of the captive rearing of reptiles. Parasitized reptiles have a shorter life span, are more susceptible to other diseases, have poor fecundity, elevated offspring mortality, and reduced growth rates.[4]

The parasites of reptiles include protozoans, helminths, and arthropods.[4] The study of the parasites of reptiles in Sri Lanka was initiated in the early 20th century and is restricted to a few studies.[1,2,6,9] The present study was thus undertaken to add to the existing knowledge database on reptilian parasites in Sri Lanka. Some selected reptiles housed in the National Zoological Garden of Sri Lanka were screened for both ectoparasites and intestinal parasites. Permission granted by the authorities (Document No. M/201/III) allowed for the evaluation of 19 reptile species housed in the reptilium (N = 139) at the National Zoo. These reptiles were screened for parasites from February to April 2005 (Table 1).

All animal experiments were conducted in accordance with the Helsinki convention[11] for animal experimentations.

Snakes were handled using the standard 'L' stick. The skin of each host was thoroughly observed under a hand lens (magnification ×10; L.T.E. Scientific Ltd., Oldham, OL3 7EN, United Kingdom) for ectoparasites. Ticks and mites were collected using standard methodology.[4] The count and microhabitat(s) of each parasite type on a single host were recorded. Parasites were stored in 70% ethanol (BDH Laboratory Suppliers, Poole, BH15 1TD, England) and were mounted using procedures described by Whitaker,[14] with modifications on the alcohol incubation times adjusted according to the specimen size. Identification of hard ticks was based on available taxonomic descriptions and keys[9] and confirmed by Professor Nixon Wilson, Emeritus Professor of Biology, University of Northern Iowa, Cedar Falls, Iowa.

All intestinal parasitic larvae stages were collected from feces via the Baermann technique.[5] Adult intestinal parasites were manually collected from specimens at necropsy and from the feces of hosts treated with an anthelmintic (Panacur;

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Table 1. Parasites of reptiles housed in the national zoological garden, Sri Lanka.

Order	Host species[a]	Number observed N	Parasite- free N(%)	Infected N(%)	Ectoparasites only N(%)	Intestinal only N(%)	Both ecto- and endoparasites N(%)
Squamata	*Boiga forstenii*[b]	7	5 (71%)	2 (29%)	2 (100%)	0	0
	Dendrelaphis tristis[c]	3	0	3 (100%)	0	3 (100%)	0
	Coeloganthus helena[c]	7	2 (29%)	5 (71%)	0	5 (100%)	0
	Ahaetulla nasuta[c]	1	0	1 (100%)	0	1 (100%)	0
	Chrysopelea ornate	2	2 (100%)	0	0	0	0
	Hypnale hypnale	10	10 (100%)	0	0	0	0
	Trimeresurus trigonocephalus	4	4 (100%)	0	0	0	0
	Daboia russelii[d,e]	11	3 (27%)	8 (73%)	0	8 (100%)	0
	Naja naja[b,f]	11	0	11 (100%)	11 (100%)	0	0
	Bungarus ceylonicus	2	2 (100%)	0	0	0	0
	Bungarus caeruleus	2	2 (100%)	0	0	0	0
	Python molurus[b,f,g]	15	3 (20%)	12 (80%)	11 (92%)	1 (8%)	0
	Python reticulus[h]	1	0	1 (100%)	0	1 (100%)	0
	Cylindrophis maculatus[i]	1	0	1 (100%)	0	1 (100%)	0
		77	33 (43%)	44 (57%)	24 (55%)	20 (45%)	**0**
Chelonian	*Geochelone elegans*[j,k]	17	0	17 (100%)	0	11 (65%)	6 (35%)
	Trachemys scripta	13	13 (100%)	0	0	0	0
	Lissemys punctata	15	15 (100%)	0	0	0	0
	Melanochelys trijuga	15	15 (100%)	0	0	0	0
		60	43 (72%)	17 (28%)	0	11 (65%)	6 (35%)
Crocodilian	*Crocodylus porosus*	2	2 (100%)	0	0	0	0
		2	2 (100%)	0	0	0	0

[a] Superscript letters b–k indicate parasitic species.
[b] *Aponomma gervaisi*
[c] Plerocercoid larval stage
[d] *Ophiotaenia russeli*
[e] *Kalicephalus viperae*
[f] *Aponomma varaneuse*
[g] *Bothridium pithonis*
[h] *Ophidascaris baylisi*
[i] *Kalicephalus novae-britanuiae*
[j] *Amblyomma clypeolatum*
[k] *Tachygonetria mocoaims*

Intervet, Inc., Worthington, Minnesota 56187, USA). Standard methodology was used for preserving and staining of these parasites.[4] Identification of adult parasites was based on several descriptions and keys available.[1,6,12] The identifications of nematodes and cestodes were confirmed respectively by Dr. Charles Bursey, Pennsylvania State University (University Park, Pennsylvania), and Dr. A. de Chambrier of Museum d'Histoire Naturella (Switzerland). Voucher specimens representing each ectoparasite and intestinal parasite species were deposited in the museum of the Department of Zoology, University of Colombo, Sri Lanka.

The method described by Klingenberg[4] was used for fecal collection, with modifications. In brief, fresh feces were collected into a 50-ml glass vial. The glass vial was labeled in the field with the date and name of the host animal. Direct smears from fresh feces and a fecal flotation, using saturated sodium chloride solution, were used for fecal analysis.[3]

Of the 139 individual reptiles screened, 62% (N = 86) were infested, of which 66% (N = 57) and 24% (N = 21) exclusively harbored intestinal and ectoparasites, respectively. The remaining reptiles (10%; N = 8) were infested with both types of parasites (Table 1). While the crocodilians were parasite free, the infestations of the squamata and chelonian are described in Table 1.

Nematodes were the most abundant (range: 58–267) parasites found, followed by hard ticks (67–198). The presence of cestodes (1–2) was uncommon.

Three species of hard ticks (family Ixodidae) were recorded. Large numbers of *Aponomma gervaisi* (voucher specimen No. PS/ZT/023) were collected from the rock python (*Python molurus*), cobra (*Naja naja*), and from *Bioga forsteni*. *Aponomma varaneuse* (PS/ZT/024) ticks showed mixed infections with *A. gervaisi* and were found on *Python molurus* and *N. naja*. *Amblyomma clypeolatum* (PS/ZT/025), comparatively large ticks, were collected from the soft skin exposed between the carapace and the fore and hind limbs of the star tortoise (*Geochelone elegans*).

Adult intestinal cestode, *Bothridium pithonis* (PS/ZC/030) was found in the large intestines of *P. molurus*, while *Ophiotaenia russeli* (PS/ZC/031) was harbored in the small intestines of a single Russell's viper (*Daboia russelii*). Plerocercoid larval stage (PS/ZC/032) that measured 2–9 cm in length with flat, distinct, and well-developed scolex was found subcutaneously in *Dendrelaphis tristis*, *Coelognathus helena*, and *Ahaetulla nasuta*.

Large numbers of intestinal nematodes were recorded. *Ophidascaris baylisi* (PS/ZN/053), were collected following anthelmintic drug treatment of *Python reticulus*. *Kalicephalus viperae* (PS/ZN/054) were collected during the necropsy of a *D. russelii*. *Kalicephalus novae-britanuiae* (PS/ZN/055) was collected from the stomach during the necropsy of a pipe snake (*Cylindrophis maculatus*). *Tachygonetria mocoaims* (PS/ZN/056) were collected in low numbers during the necropsy of a *G. elegans*.

Of a total of 103 reptile fecal samples collected, 86% (89 samples) were positive for one or more parasitic species; three types of nematode ova, strongyloide type, strongyle type, and ascarid type; a single type of digenian ovum; protozoan cysts; nematode third stage larvae (L3); and an intestinal parasitic ciliated protozoan, *Nyctotherus* species were recovered. Among the 139 individuals of reptiles screened, 43% (N = 61) were infected with at least a single species of either ectoparasite or intestinal parasite, indicating that a significant number of captive-bred reptiles housed in the National Zoological Garden, Sri Lanka, harbored parasites. A majority of these parasites were recovered from the intestines. Parasitized reptiles were associated with both the type and quality of food. Ectoparasites were relatively abundant in snakes that were clinically ill and/or those with concurrent bacterial or fungal infections (scale rot). A high density of animals, small-sized enclosures, unsuitable environmental and microhabitat features in the enclosures, and stress seem to enhance the incidence of parasitic infections. Screening of soil samples from the enclosures revealed a significant number of ticks.

In addition, the occurrence of *A. gervaisi* on a cobra is a first report for Sri Lanka. This tick was previously reported in Sri Lanka from *P. molurus*, *D. russelii*, and the monitor lizard (*Varanus cepidianus*).[9,10,13] The adult *A. varaneuse* tick recovered from the cobra is also a new host record in Sri Lanka. This tick has been previously reported from a *Varanus monitor*.[9,10] Adults of *A. clypeolatum* collected off *G. elegans* confirmed previous observations.[9,13]

This study recovered an intestinal cestode, *B. pithonis*, in *P. molurus* and is the first record of this parasite under captive conditions in Sri Lanka. This finding confirms previous records from the wild where this cestode seems to be confined to pythons.[12] The second cestode species recovered from this study, *Ophidascaris russeli*, on a *D. russelii* is a novel record for Sri Lanka. In

addition, the plerocercoid tapeworm larva was collected in large numbers from *D. tristis*, *C. helena*, and *A. nasuta*.

The ascarid *Ophidascaris baylisi* detected in *P. reticulatus* is the first report in this species in Sri Lanka in captivity. *Kalicephalus willeyi* harbored by *D. russelii* and the trinket snake (*Coelognathus helena*) have been reported in Sri Lanka.[1,8] Therefore, the present observation of *K. viperae* in the Russel's viper appears to be a new record for this host species. This species detected in the pipe snake, *T. mocoaims* collected from the star tortoise is a new record for Sri Lankan reptiles.

Intestinal parasitic ciliated protozoa, *Nyctotherus*, detected in the star tortoise during this study is also a first time record in Sri Lanka, though this protozoan is common in the feces of chelonians.[4]

Cage cleaning is important in housing with poor ventilation.[4] With excessive moisture, high ammonia levels and fungal growth will be promoted. Water and food dishes, if used, need to be washed and disinfected on a regular basis. Contaminated water is not only a possible source of parasitic exposure but is a common source of potential pathogenic bacteria.[4]

This study, based on reptiles housed in the National Zoological Garden, is the first systematic parasitic survey of reptiles of Sri Lanka and documented new scientific host-parasite records in the country. Four new host–parasite records and three novel records concerning the host were documented. The data thus accrued will provide a baseline for future studies on reptile parasites, under both captive and wild conditions in Sri Lanka.

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