



A Coprological Survey of Intestinal Parasites of Wild Lions (*Panthera leo*) in the Serengeti and the Ngorongoro Crater, Tanzania, East Africa

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TABLE I. Comparison of *Falcaustra* larvae from different fish hosts.

Host	<i>Etheostoma</i> spp.	<i>Cichlasoma cyanoguttatum</i>	<i>Lepomis</i> spp.	<i>Gambusia affinis</i>
Type of larvae	Type 1	Type 2	Type 2	Type 2
Body length	1.095–1.164*	1.122–1.137	1.017–1.068	0.945–0.966
Body width	0.039–0.042	0.033–0.036	0.036	0.030–0.033
Esophagus length	0.348–0.390	0.261–0.303	0.285–0.288	0.249–0.252
Length of posterior part of esophagus	0.168–0.180	0.096–0.099	0.099–0.105	0.090–0.093
Length of bulb	0.063–0.069	0.048–0.051	0.045–0.048	0.042–0.045
Width of bulb	0.021–0.024	0.015–0.018	0.018–0.021	0.015–0.018
Nerve ring	0.108–0.135	0.087–0.105	0.081–0.096	0.075–0.105
Excretory pore	0.249–0.324	0.180	0.189–0.195	0.207–0.213
Genital primordium from posterior end	0.405–0.432	0.423–0.426	0.375–0.390	0.354–0.360
Tail	0.171–0.180	0.147–0.150	0.141–0.147	0.126–0.129

* All measurements are in mm and represent ranges.

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A Coprological Survey of Intestinal Parasites of Wild Lions (*Panthera leo*) in the Serengeti and the Ngorongoro Crater, Tanzania, East Africa

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ABSTRACT: Fecal examination on 112 and a subset of 58 wild lions (*Panthera leo*) in the Serengeti National Park and the Ngorongoro Crater, Tanzania, East Africa revealed eggs, larvae, and protozoan cysts of 15 parasite taxa. The most prevalent were *Spirometra* sp. (63% prevalence), Taeniidae (58%), *Ancylostoma* sp. (56%), and a coccidian (53%). Three parasites were considered spurious. Of the hosts, 97.3% were infected with at least 1 species of parasite. Individual parasite taxa were aggregated among hosts.

Some information is available on the prevalence of parasites in free-ranging lions. Lion parasites have been recorded mainly anecdotally from dead wild lions (Leroux, 1958; Rodgers, 1974; Bwagamoi et al., 1990) with a few notable exceptions where a particular group of parasites has been studied, such as tapeworms (Dinnik and Sachs, 1972), or blood parasites (Averbeck et al., 1990), or where the results of veterinary examinations in a National Park (Young, 1975) have been reported. The parasites observed so far in wild lions are listed in Round (1968), Bwagamoi (1970), and Jooste (1990).

Knowledge of lion parasites stems mainly from zoo lions (Dittrich, 1958; Tscherner, 1974; Ghoshal et al., 1988; see Müller-Graf, 1994). However, the findings in zoos do not necessarily reflect the parasitological fauna of wild lions.

I report the findings of a study of lion parasites in the Serengeti National Park and the Ngorongoro Crater in Tanzania, East Africa. The parasitological study was undertaken in conjunction with a long-term demographic study of the lion populations (Schaller, 1972; Bertram, 1978; Packer, 1986; Packer et al., 1988, 1991). To my knowledge, this is the first study to describe prevalence of intestinal parasites in a population of wild lions.

Between spring 1991 and spring 1993, 168 fecal samples from 112 known individual lions, *Panthera leo*, in the Serengeti National Park (coordinates of Seronera, the research station in the center of the Serengeti, 34°50'E, 02°30'S) and the Ngorongoro Crater (35°35'E, 03°10'S), East Africa, Tanzania were collected and analyzed for the presence of parasite eggs, larvae, and cysts. Lions were individually distinguished by whisker-spot patterns,

and fecal samples were collected from lions observed defecating. Fecal samples were preserved in 10% formalin in situ, or at Seronera, the research station, and analyzed at the Department of Zoology, University of Oxford using the formol-ether method, which showed the best results in preliminary tests. Feces were broken down with glass beads, sieved, and centrifuged. One gram of feces was analyzed from the remaining pellet and infections reported in eggs per g of feces (e.p.g.). Most parasites were identified to genus level because only eggs, larvae, and cysts were analyzed. Trematodes, Trichostrongylidae, and *Trichuris* sp. were excluded from calculating parasite richness as they were spurious parasites, that is, parasites present in the lions' prey rather than genuine lion parasites. Two species of helminth larvae were combined in the overall prevalence because the larval tail (used for identification) was not always visible. Mean intensity of infection describes the mean number of eggs or larvae of 1 parasite taxon per infected host; abundance includes infected and uninfected hosts (Margolis et al., 1982).

Fifteen parasite taxa were found in the feces (Table I). However, 3 of these were spurious parasites. Of the 112 individuals examined, 97.3% were found to be infected with at least 1 species of parasite. The modal number of lion helminth taxa per animal was 3 (mean = 2.9, variance = 1.9) while the maximum number in any 1 animal was 6. Distribution of the individual parasite taxa among hosts was aggregated (variance > mean; Table I), with most individuals showing a low number of eggs per g of feces and few individuals showing a high number of eggs per g of feces.

Spirometra sp. was the most prevalent parasite (63.4%) and had the highest number of eggs per g of feces (median = 975; Table I). Eggs as well as proglottids were observed. Eggs had a fairly thin shell, were roughly oval shaped, and slightly pointed at the end, with an operculum on 1 side. Eggs were filled with cells and no worms could be distinguished inside. According to Round (1968), the species in lion is *Spirometra theileri*, whereas the species found in hyenas is generally accepted to be *Spirometra pretoriensis*. However, the morphology of a fragment of *Spirometra* found in my study was consistent with *Spirometra pretoriensis*. This suggests that both species may occur in lions. Taeniid eggs had the second highest prevalence and could belong to *Taenia regis*, *Taenia simba*, *Taenia gonyamai*, or *Echinococcus granulosus* (Dinnik and Sachs, 1972; Young, 1975). The taxonomic status of *Echinococcus* in lions is not resolved. The species has been reported as *Echinococcus granulosus felidis* (Nelson and Rausch, 1963; Nelson et al., 1965) or *Echinococcus felidis* (Macpherson, 1986). An immunodiagnostic test (Allan et al., 1990) carried out on a subset of samples preserved in 5% formalin (75 samples of which 33 were diagnosed to be infected with taeniids) showed only 4% (3) of the lions were infected with *Echinococcus* sp.

Hookworm eggs observed in the lion feces are most likely to be *Ancylostoma paraduodenale* or *Ancylostoma tubaeformae*, the species previously reported from lions (Round, 1968). The size of the *Toxocara* eggs here was consistent with *T. cati*, although *Toxocara canis* and *T. cati* have both been found in lions. Two species of helminth larvae were observed in the feces. The tail of 1 of them corresponds with *Ollulanus tricuspis* (Hasslinger et al., 1982) and the other 1 with *Aelurostrongylus* spp. (G. Avertebeck, pers. comm.), both of which have previously been observed in lions. The *Physaloptera* sp. found in 1 animal was

TABLE I. Prevalence of eggs, larvae, and cysts and intensity of parasite eggs and larvae and in fecal samples of wild lions.

Parasite	Number of hosts infected (%)	Sample size	Median intensity* per gram of feces (maximum p.g.)	Variance/mean ratio of abundances
<i>Spirometra</i> sp.	71 (63.4)	112	975.0 (83,350)	30,641.9
Taeniidae†	65 (58.0)	112	39.6 (6,850)	1,431.1
<i>Ancylostoma</i> sp.	63 (56.3)	112	50.0 (625)	208.2
Coccidia	59 (52.9)	112		
Trematoda‡	39 (34.8)	112	25.0 (3,700)	2,809.1
Helminth larvae§	33 (29.5)	112	2.3 (5,700)	2,493.0
<i>Sarcocystis</i> sp.	16 (27.6)	58		
Spirurida	27 (24.1)	112	16.7 (650)	77.7
Trichostrongylidae	9 (8.4)	112	16.7 (550)	233.4
<i>Trichuris</i> sp.	6 (5.4)	112	34.4 (200)	29.4
<i>Toxocara</i> sp.	5 (4.5)	112	8.3 (483)	72.0
<i>Giardia</i> sp.	2 (3.4)	58		
<i>Physaloptera</i> sp.	1 (0.9)	112		

* Intensity was determined by the mean result of the reading of three slides from the same sample. Protozoans were only scored for presence or absence.

† *Taenia* sp. and *Echinococcus* sp.

‡ Paramphistomatidae.

§ *Ollulanus tricuspis* and *Aelurostrongylus* sp.

|| Only a subset of the sample was checked for these protozoan parasites.

very likely *Physaloptera praeputialis*, the only *Physaloptera* species so far reported from lions (Leroux, 1958; Round, 1968; Bwangamoi, 1970). Three protozoan taxa were found. These included *Giardia* sp., *Sarcocystis* sp., and Coccidia; previously reported coccidian species in lions were *Isospora felis*, *Isospora leonina*, and *Eimeria felina* (Wenyon, 1923; Mandal and Ray, 1960; Pellerdy, 1974; Soulsby, 1982). The *Sarcocystis* cysts were ovoid and held 4 banana-shaped sporozoites with granules present. The wall was double-layered, smooth, and about 0.5–0.7 μm thick. The inner layer appeared colorless while the outer layer was light brown.

Spirurid and trematode eggs were also found in the feces. The trematodes were probably spurious parasites (parasites of the lions' prey only) belonging to Paramphistomatidae. Eggs of *Trichuris* sp. and Trichostrongylidae were also observed in the feces, but because of the heavy infection of the prey animals with these 3 parasites (Round, 1968; Sachs and Sachs, 1968; Bwangamoi, 1970; Sinclair, 1977; Horak et al., 1983; Jooste, 1990) and no previous recorded instances in lions, they are considered to be spurious parasites. Additionally, 26.8% (n = 30/112) of lions were found to be infected with unidentified helminth eggs and 8.6% (n = 5/58) with unidentified protozoan cysts.

The parasite community in wild lions in this study differed from the records of zoo lions. *Spirometra* was the most common parasite in wild lions, but has not been reported in zoo lions. *Toxascaris* was not found in wild lions, but appears frequently in zoo lions (Barutzki et al., 1985; Ghoshal et al., 1988; Tang et al., 1988). *Toxocara* was only found in 5 individuals in the wild population, but has been recorded several times from zoo lions (Ippen and Henne, 1982; Barutzki et al., 1985; Ghoshal et al., 1988). Taeniids were very common in the wild lions, but few records from zoo lions exist. In general differences in par-

asites between wild lions and lions in zoos may be explained by the differences in the meat zoo lions are fed and their close proximity to a wide variety of other host species.

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