



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

Author(s): Christine D. M. Muller-Graf

Source: *The Journal of Parasitology*, Vol. 81, No. 5 (Oct., 1995), pp. 812-814

Published by: The American Society of Parasitologists

Stable URL: <http://www.jstor.org/stable/3283987>

Accessed: 16/11/2009 12:44

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=asp>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



The American Society of Parasitologists is collaborating with JSTOR to digitize, preserve and extend access to *The Journal of Parasitology*.

<http://www.jstor.org>

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.

LITERATURE CITED

- ANDERSON, R. C. 1992. Nematode parasites of vertebrates. Their development and transmission. C.A.B. International, Oxon, U.K., 578 p.
- BAKER, M. R. 1985. *Falcaustra* species (Nematoda: Kathlaniidae) parasitic in turtles and frogs in Ontario. Canadian Journal of Zoology **64**: 228–237.
- . 1987. Synopsis of the Nematoda parasitic in amphibians and reptiles. Occasional Papers in Biology, No. 11. Memorial University of Newfoundland, St. John's, Newfoundland, 325 p.
- BARTLETT, C. M., AND R. C. ANDERSON. 1985. Larval nematodes (Ascaridida and Spirurida) in the aquatic snail, *Lymnaea stagnalis*. Journal of Invertebrate Pathology **46**: 153–159.
- BARUŠ, V., AND J. GROSCHAFT. 1962. *Megalobatrachonema terdentatum* (Linstow, 1890) Hartwich, 1960 (Nematoda, Subulascariidae) in Czechoslovakia, and its development. Helminthologia **4**: 67–78.
- PETTER, A. J., AND A. G. CHABAUD. 1971. Cycle évolutif de *Megalobatrachonema terdentatum* (Linstow) en France. Annales de Parasitologie Humaine et Comparée **46**: 463–477.
- SEY, O., AND F. MORAVEC. 1986. An interesting case of hyperparasitism of the nematode *Spirometra babei* Ha Ky, 1971 (Nematoda: Kathlaniidae). Helminthologia **23**: 173–177.

J. Parasitol., 81(5), 1995, p. 812–814
© American Society of Parasitologists 1995

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

Christine D.M. Müller-Graf, Department of Zoology, University of Oxford, South Parks Road, Oxford OX1 3PS, United Kingdom

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.

I thank the Tanzania National Parks, Serengeti Wildlife Research Institute, Ngorongoro Conservation Area Authority and Tanzania National Scientific Research Council for permission to carry out the research. I am grateful to E. O'Neill, P. Bell, S. Legge, and R. Heinsohn for help with the collection of the fecal samples and to A. E. Keymer, M. E. J. Woolhouse, M. Anwar, C. Packer, and J. Wearing-Wilde for comments. I am grateful to P. S. Craig for carrying out the immunodiagnostic tests for the detection of *Echinococcus*, A. Jones for the identification of *Spirometra pretoriensis*, and D. Gibson (Natural History Museum, London) and J.-L. Albaret (Museum National d'Histoire Naturelle, Paris) for the advice on the identification of the trematode eggs. I thank Rotary International, the E.P.A. Florey European Fund, the Studienstiftung des deutschen Volkes, the British Federation of University Women, and the Percy-Sladen Memorial Fund for support.

LITERATURE CITED

- ALLAN, J. C., G. AVILA, J. GARCIA NOVAL, A. FLISSER, AND P. S. CRAIG. 1990. Immunodiagnosis of taeniasis by coproantigen detection. *Parasitology* 101: 473-477.
- AVERBECK, G. A., K. E. BJORK, C. PACKER, AND L. HERBST. 1990. Prevalence of hematozoans in lions (*Panthera leo*) and cheetah (*Acinonyx jubatus*) in Serengeti National Park and Ngorongoro Crater, Tanzania. *Journal of Wildlife Diseases* 26: 392-394.
- BARUTZKI, D., M.-A. HASSLINGER, K. SCHMID, AND H. WIESNER. 1985. Situationsanalyse zum Endoparasitenbefall bei Zootieren. *Tierärztliche Umschau* 40: 953-961.
- BERTRAM, B. 1978. *Pride of lions*. Scribner, New York, New York, 253 p.
- BWANGAMOI, O. 1970. A checklist of helminth parasites of animals in Tanzania. *Bulletin of Epizootic Diseases of Africa* 18: 229-242.
- , D. ROTTCHER, AND L. WEKESA. 1990. Rabies, microbrositosis and sarcocystis in a lion. *Veterinary Record* 127: 411.
- DINNIK, J. A., AND R. SACHS. 1972. Taeniidae of lions in East Africa. *Zeitschrift für Tiermedizin und Parasitologie* 23: 197-210.
- DITTRICH, L. 1958. Kotuntersuchungen bei den Großkatzen des Leipziger Zoos unter besonderer Berücksichtigung der Schwankungen des Gehalts an Wurmeiern. *Archiv für experimentelle Veterinärmedizin* 12: 808-839.
- GAUR, S. N. S., M. S. SETHI, H. C. TEWARI, AND O. M. PRAKASH. 1979. A note on the prevalence of helminth parasites in wild and zoo animals in Uttar Pradesh. *Indian Journal of Animal Science* 49: 159-161.
- GHOSHAL, S. B., U. K. GARG, K. S. MISARAULIA, AND P. C. JAIN. 1988. Helminth parasites in zoo animals of Kamla Nehru Park, Indore (MP). *Livestock Adviser* 13: 34-36.
- HASSLINGER, M.-A., F. X. WITTMANN, H. WIESNER, AND W. RIETSCHEL. 1982. Zum Vorkommen von *Ollulanus tricuspis* (Leuckart, 1865) in Feliden des Zoologischen Gartens. *Veterinär-medizinische Nachrichten* H2: 220-228.
- HORAK, I. G., V. DE VOS, AND M. R. BROWN. 1983. Parasites of domestic and wild animals in South Africa XVI. Helminth and arthropod parasites of blue and black wildebeest (*Connochaetes taurinus* and *Connochaetes gnou*). *Onderstepoort Journal of Veterinary Research* 50: 243-255.
- IPPEN, R., AND D. HENNE. 1982. Zur Bedeutung des Parasitenbefalls bei der Aufzucht von Zoo- und Wildtieren. *Verhandlungsbericht des XXIV. Internationalen Symposiums über Erkrankungen bei Zootieren*, p. 25-32.
- JOOSTE, R. 1990. A checklist of the helminth parasites of the larger domestic mammals and wild mammals of Zimbabwe. *Transactions of the Zimbabwe Scientific Association* 64: 16-32.
- LEROUX, P. L. 1958. *Pharyngostomum cordatum* (Dies, 1850), *Galoncus perniciosus* (v. Linstow, 1885) and *Gnathostoma spinigerum* (Owen, 1836), infections in a lion in Northern Rhodesia. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 52: 14.
- MACPHERSON, C. N. L. 1986. *Echinococcus* infections in wild animals in Africa. In *Wildlife/livestock interfaces of rangelands*, S. MacMillan (ed.). Inter-African Bureau for Animal Resources, Nairobi, Kenya, p. 73-78.
- MANDAL, A. K., AND H. N. RAY. 1960. A new coccidium, *Isospora leonina* n. sp. from a lion cub. *Bulletin Calcutta School of Tropical Medicine* 8: 107-108.
- MARGOLIS, L., G. W. ESCH, J. C. HOLMES, A. M. KURIS, AND G. A. SCHAD. 1982. The use of ecological terms in parasitology (report of an ad hoc committee of the American Society of Parasitologists). *Journal of Parasitology* 68: 131-133.
- MÜLLER-GRAF, C. D. M. 1994. Ecological parasitism of baboons and lions. D.Phil. Thesis. University of Oxford, Oxford, U.K., 232 p.
- NELSON, G. S., F. R. N. PESTER, AND R. RICKMAN. 1965. The significance of wild animals in the transmission of cestodes of medical importance in Kenya. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 59: 507-524.
- , AND R. L. RAUSCH. 1963. *Echinococcus* infections in man and animals in Kenya. *Annals of Tropical Medicine and Parasitology* 57: 136-149.
- PACKER, C. 1986. The ecology of sociality in felids. In *Ecological aspects of social evolution: birds and mammals*, D. I. Rubenstein and R. W. Wrangham (eds.). Princeton University Press, Princeton, New Jersey, p. 429-451.
- , L. HERBST, A. E. PUSEY, J. D. BYGOTT, J. P. HANBY, J. S. CAIRNS, AND M. BORGERHOFF MULDER. 1988. Reproductive success of lions. In *Reproductive success*, T. H. Clutton-Brock (ed.). The University of Chicago Press, Chicago, Illinois, p. 363-383.
- , A. E. PUSEY, H. ROWLEY, D. GILBERT, J. MARTENSON, AND S. J. O'BRIEN. 1991. Case study of a population bottleneck: Lions of the Ngorongoro Crater. *Conservation Biology* 5: 219-230.
- PELLERDY, L. 1974. *Coccidia and coccidiosis*. Akadémiai Kiado, Budapest, Hungary, 959 p.
- RODGERS, W. A. 1974. Weights, measurements and parasitic infestation of six lions from southern Tanzania. *East African Wildlife Journal* 12: 157-158.
- ROUND, M. C. 1968. Checklist of helminth parasites of African mammals. Technical Communications of the Commonwealth Bureau of Helminthology no. 38, Commonwealth Agricultural Bureaux, Farnham Royal, U.K., 252 p.
- SACHS, R., AND C. SACHS. 1968. A survey of parasitic infestation of wild herbivores in the Serengeti region in northern Tanzania and the Lake Rukwa region in southern Tanzania. *Bulletin of Epizootic Diseases of Africa* 16: 455-472.
- SCHALLER, G. B. 1972. *The Serengeti lion*. Wildlife Behaviour and Ecology Series. The University of Chicago Press, Chicago, Illinois, 480 p.
- SINCLAIR, A. R. E. 1977. *The African buffalo*. The University of Chicago Press, Chicago, Illinois, 355 p.
- SOULSBY, E. J. L. 1982. *Helminths, arthropods and protozoa of domesticated animals*, 7th ed. Baillière Tindall, London, U.K., 809 p.
- TANG, L., Z. JIN, J. LU, AND K. TAN. 1988. Investigation of helminths in carnivorous animals in Lanzhou Wuquan Zoo. *Chinese Journal of Veterinary Science and Technology* 12: 20-21.
- TSCHERNER, W. 1974. Ergebnisse koprologischer Untersuchungen bei Raubtieren des Tierparks Berlin. *Verhandlungsbericht des XVI. Internationalen Symposiums über die Erkrankungen der Zootiere*, p. 77-89.
- WENYON, C. M. 1923. Coccidiosis of cats and dogs and the status of the *Isospora* of man. *Annals of Tropical Medicine and Parasitology* 17: 231-288.
- YOUNG, E. 1975. Some important parasitic and other diseases of lion, *Panthera leo*, in the Kruger National Park. *Journal of the South African Veterinary Association* 46: 181-183.