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Prevalence of Hematozoans in Lions (*Panthera leo*) and Cheetah (*Acinonyx jubatus*) in Serengeti National Park and Ngorongoro Crater, Tanzania

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ABSTRACT: Lions (*Panthera leo*) and cheetah (*Acinonyx jubatus*) from the Serengeti National Park and Ngorongoro Crater Conservation Area, Tanzania were examined for the presence of blood protozoans. Twenty-eight percent of the lions were infected with *Trypanosoma* sp. and the prevalence of trypanosome infection varied significantly between adjacent habitats. All of the animals were infected with *Hepatozoon* sp. and a *Theileria* sp.-like piroplasm that was morphologically indistinguishable from *Theileria felis*.

Key words: Lion, *Panthera leo*, cheetah, *Acinonyx jubatus*, *Hepatozoon* sp., *Theileria* sp., *Trypanosoma* sp., prevalence, survey.

The prevalence of trypanosomes in the African lion (*Panthera leo*) has been well documented (e.g., Baker, 1968; Bertram, 1971; Geigy et al., 1971; Geigy and Kauffmann, 1973; Sachs et al., 1967, 1971). However, little is known of the precise relationship between the prevalence of infection and the lions' exposure to tsetse flies (*Glossina* spp.). Few data are available on the hematozoan fauna of the cheetah (*Acinonyx jubatus*) from the same region (Sachs et al., 1971). We report here on the prevalence of three hematozoans in these two feline species and show that trypanosome infection in lions varies significantly with the habitat, but not with age or sex.

Between July and September 1985, 123 lions and eight cheetah were immobilized and examined for blood parasites. The ages and home ranges of the lions were all known due to their inclusion in a separate continuous long term study (Packer et al., 1988). The lions were sampled in three contiguous regions of the Serengeti National Park (central coordinates 34°50'E, 02°30'S: the central woodlands near Seronera, the adjoining woodland/plains border, and the southeastern plains (Schaller, 1972). In addition, lions were also sampled in the nearby Ngorongoro Crater (35°35'E, 03°10'S), 120 km southeast of Seronera. The cheetah were sampled in the Serengeti plains and the Ngorongoro Crater.

Blood samples were drawn from the saphenous vein. Thin blood smears were air dried and stained with Wright's stain. Two smears per animal were examined microscopically for the presence of protozoans. Representative specimens of *Trypanosoma* sp., *Hepatozoon* sp., and *Theileria*-like sp. were deposited in the U.S. National Parasite Collection (Beltsville, Maryland 20705, USA; accession numbers 80620 to 80622).

In the Serengeti, trypanosomes were present in 28% (32 of 113) of the lions and in none of the cheetah. Trypanosomes were not found in any lion or cheetah sampled in the Ngorongoro Crater. The small number and quality of trypanosome specimens examined, precluded identification to species. However, the geographical distribution of prevalences may answer questions regarding the transmission of trypanosomes to large carnivores in the Serengeti.

There was significant variation (χ^2 = 27.9, 3 df, $P < 0.001$) in the prevalence of trypanosome infections in lions sampled across the four different habitats (Table 1). The prevalences were the highest in lions from the Serengeti woodlands; there was no significant difference in prevalences across the remaining three habitats. Bertram (1971) sampled lions in woodlands 70 km to the north of Seronera and found that the prevalences of trypanosome infection were similar to those in the central woodlands. Within each habitat, we found no correlation between the prevalence of

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TABLE 1. *Theileria*-like sp. piroplasms, *Hepatozoon* sp. and *Trypanosoma* sp. from African lions and cheetahs from four localities in East Africa.

Host	Habitat[a]	Prevalence (%) of hematozoans		
		Theileria-like sp. piroplasms	*Hepatozoon* sp.	*Trypanosoma* sp.
Lion	NC	100 (10/10)[b]	100 (10/10)	0 (0/10)
	SP	100 (29/29)	100 (29/29)	7 (2/29)
	SW	100 (52/52)	100 (52/52)	50 (26/52)
	W/P	100 (28/28)	100 (28/28)	11 (3/28)
	U	100 (4/4)	100 (4/4)	25 (1/4)
	Total	100 (123/123)	100 (123/123)	26 (32/123)
Cheetah	S	100 (6/6)	100 (6/6)	0 (0/6)
	NC	100 (2/2)	100 (2/2)	0 (0/2)

[a] NC, Ngorongoro Crater; SP, Serengeti Plains; SW, Serengeti woodlands; W/P, Serengeti woodlands/plains border; U, lions of unknown history; S, Serengeti.

[b] % prevalence (number infected/number examined).

trypanosome infection and the age or sex of the lion host.

Two possible means for transmission of trypanosomes have been suggested. First, salivarian trypanosomes are dependent on tsetse flies (Hoare, 1972); thus, trypanosome infections should be restricted to tsetse areas. Tsetse flies are absent from the open plains of the Serengeti and the floor of the Ngorongoro Crater, but are very common in the Serengeti woodlands (see Ford, 1971). Fly density is relatively low at the woodland/plains border. This distribution closely matched the observed prevalence of trypanosome infection.

Second, mechanical transmission of trypanosomes also might be possible between predator and prey. Transfer of trypanosomes might occur during feeding on infected prey via wounds in the lions' buccal mucosa, or by mechanical transfer by other biting arthropods. Baker (1968) suggested that such non-cyclic transmission is a principal method of infecting lions and is one reason they had the highest prevalences of trypanosomes among all species of animals examined in the Serengeti. If true, nonmigratory lions which live outside the tsetse areas and feed on infected migratory prey could acquire trypanosome infections. Bertram (1971) reported 8% of prey animals infected with *T. brucei* in the Serengeti. The Wildebeest (*Connochaetes taurinus*), a favorite prey species of the lion (Schaller, 1972), frequently migrated through areas of heavy tsetse fly infestation and had a prevalence of 27% (six of 22) (Baker, 1968).

Mechanical transmission could explain the occasional trypanosome infection found in the non-tsetse areas of the Serengeti (Table 1). However, the Serengeti lions are occasionally nomadic when prey is scarce (Packer et al., 1990), and thus these individuals could have become infected during temporary forays into tsetse infested areas. Thus, it appears that non-cyclic transmission occurs rarely, if it occurs at all.

Cheetah prefer open habitats (Schaller, 1972); thus, they are only rarely exposed to tsetse flies. However, cheetah also are exposed to infected prey. Baker (1968) found 14% (one of seven) of Thomson's Gazelles (*Gazella thompsonii*) infected with trypanosomes. Geigy et al. (1971) reported prevalences of 50% (one of two) in *G. thomsonii* and 27% (three of 11) in *Gazella granti*. The absence of trypanosome infections in cheetahs also suggests that mechanical transmission does not occur; although this finding also may have been due to the small sample sizes.

Encapsulated gametocytes of *Hepatozoon* sp. were observed in all 123 lions and all eight cheetah. A single microschizont

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(30 μm × 23 μm), containing mature merozoites, was found in the heart muscle of a necropsied lion. Prevalence of *Hepatozoon* sp. in lions was comparable to that found by Geigy et al. (1971). All specimens observed were consistent with available descriptions of *H. canis* (McCully et al., 1975).

All of the lions and cheetah were also infected with intraerythrocytic *Theileria*-like sp. piroplasms. Previous studies of the Serengeti lions have reported conflicting prevalences of piroplasm infection. Sachs et al. (1971) reported a 6% prevalence (four of 68) whereas Geigy and Kauffmann (1973) reported 98% (42 of 43). It is not known if the low infection rates found by Sachs et al. (1971) reflect differences in parasite prevalence or diagnostic techniques. These past studies tentatively identified the lion piroplasm as *Nuttalia* sp., *Babesia* sp., and/or *Theileria* sp. The piroplasms found in this study were morphologically identical to descriptions of the intraerythrocytic stages of *Theileria felis* (Wagner, 1976; Wightman et al., 1977; Simpson et al., 1985). Sachs et al. (1971) found no piroplasms in the only Serengeti cheetah examined. A *Theileria*-like sp. has been found in erythrocytes of two healthy captive cheetahs in the United States that had previously been held in captivity in South Africa (Zinkl and McDonald, 1981).

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