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## Helminths of the Tsushima Leopard Cat (*Felis bengalensis euphilura*)

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**ABSTRACT:** Three Tsushima leopard cats (*Felis bengalensis euphilura*) in Japan were collected as road kills. Three species of trematodes (*Pharyngostomum cordatum*, *Paragonimus* sp. and Dicrocoeliidae gn. sp.), one species of cestode (*Spirometra erinacei*) and nine species of nematodes (*Arthrostoma hunanensis*, *Uncinaria felidis*, *Uncinaria* sp., *Ancylostoma tubaeforme*, *Molineus springsmithi*, *Toxocara cati*, *Capillaria aerophila*, *Capillaria felis-cati*, and *Capillaria* sp.) were found. Among these helminths, *Arthrostoma hunanensis*, *Uncinaria* spp., and *Molineus springsmithi* have not been reported previously in Japanese domestic cats.

**Key words:** Tsushima leopard cat, *Felis bengalensis euphilura*, wild cat, helminth, *Arthrostoma hunanensis*, *Pharyngostomum cordatum*.

The Tsushima leopard cat (*Felis bengalensis euphilura*), a wildcat found on the Tsushima Islands, Japan, is the smallest subspecies of *F. bengalensis* (Imaizumi, 1960). Yoneda (1990) estimated a population of less than 100 Tsushima leopard cats on the island for this endangered (Izawa and Doi, 1991) subspecies.

Our objective was to gain some insights into the parasitological status of these endangered Japanese wildcats.

The two Tsushima Islands (34°05' to 34°42'N, 129°10' to 129°30'E) are 120 km from the Japanese mainland and 50 km from the Korean Peninsula, and cover an area of 710 km<sup>2</sup>. Three Tsushima leopard cats were collected as road kills on the Tsushima Island and were transported with cooling by dry ice to the Laboratory of Veterinary Pathology, Faculty of Agriculture, Kagoshima University, in March (Cat 1), July (Cat 2) and October (Cat 3), 1988, respectively. Helminths obtained were all dead and some were decomposed. All worms were fixed in 5% phosphate buf-

fered saline formalin solution and cleared in a lactophenol solution. Cestodes and trematodes were flattened, stained with Grenacher's ammonium alum-carmines (Lillie, 1948) and examined morphologically. All measurements were in micrometers. All worms measured were mature.

Parasites obtained from the three Tsushima leopard cats were three species of trematodes, one species of cestode and nine species of nematodes (Table 1).

*Pharyngostomum cordatum* previously was reported in both Tsushima leopard cats (Kifune et al., 1967) and in Iriomote cats (*Felis iriomotensis*) (Hasegawa et al., 1985). This species was believed to be widespread in Tsushima leopard cats based on previous reports (Machida, 1970), and because of the wide distribution of intermediate hosts (Dubey, 1970) such as freshwater snails (*Polypylis hemisphaerula*), frogs, and snakes on the Tsushima Islands (Inoue, 1972).

A decomposed trematode encysted in the lung of one wildcat was considered to be *Paragonimus* sp. on account of the location of mouth sucker and acetabulum, the forms of ovary and testes and the size of eggs. While lung flukes occur among carnivores on the Japanese islands, there have been no previous reports in Japanese wildcats.

The few trematodes found in the pancreatic duct had characteristics of members of the family Dicrocoeliidae, based on their body size, location of two suckers, and egg sizes. They were not identified because of their advanced state of decomposition. *Concinnum okinawanum* is the only known fluke in Japan belonging to family Dicrocoeliidae; it occurs in domes-

TABLE 1. Helminths from three Tsushima leopard cats on the Tsushima Islands, Japan.

Helminths	Infected tissues	Number of helminths		
		Cat 1	Cat 2	Cat 3
Trematodes				
<i>Pharyngostomum cordatum</i>	Small intestine	0	400*	0
<i>Paragonimus</i> sp.	Lung	1	0	0
Dicrocoeliidae gn.	Pancreas	+ <sup>b</sup>	3	0
Cestodes				
<i>Spirometra erinacei</i>	Small intestine	0	3	1
Nematodes				
<i>Arthrostoma hunanensis</i>	Bile duct	6	9	27
<i>Uncinaria felidis</i>	Colon	3	0	34
<i>Uncinaria</i> sp.	Small intestine	0	0	1
<i>Ancylostoma tubaeforme</i>	Small intestine	0	6	0
<i>Molineus springsmithi</i>	Small intestine	0	0	3
<i>Toxocara cati</i>	Stomach	0	0	34
	Small intestine	0	2	37
<i>Capillaria aerophila</i>	Trachea	0	0	4
<i>Capillaria felis-cati</i>	Bladder	0	5	4
<i>Capillaria</i> sp.	Stomach	0	0	4

\* An approximation.

<sup>b</sup> +, Numbers not determined.

tic cats on the Japanese island of Okinawa (Hasegawa and Asato, 1983, 1984). Eggs of flukes belonging family Dicrocoeliidae are found also in the feces of Iriomote cats (Akuzawa et al., 1987). Other possible pancreatic flukes are *C. procyonis* (Burrows and Lillis, 1960) and *Platynosomum fastosum* (Leam and Walker, 1963), which have not been reported in Japan.

*Spirometra erinacei* was the only cestode found. This is a very common tapeworm in Japanese domestic cats and has previously been reported from both Tsushima leopard cats (Machida, 1970) and Iriomote cats (Hasegawa et al., 1985).

There are no reports of hookworms belonging to the family Ancylostomatidae, except *Ancylostoma tubaeforme* in Japanese domestic cats (Uga et al., 1983). However, *Ancylostoma caninum* is morphologically quite similar to *A. tubaeforme*. These two species are differentiated by the form of mouth and tail, and the arrangement of lateral bursal rays (Burrows, 1962).

The worm found in the bile duct was consistent with the description of *Arthrostoma hunanensis* that was once reported

from *Felis bengalensis* in China (Cheng and Shen, 1982). This was the only arthrostomatid hookworm found in the bile duct. To our knowledge there is no previous report on this worm in Japanese wildcats. All three wildcats examined had many such worms in the bile duct.

*Uncinaria felidis* was identified by the body size and the shape of bursa copulatrix and prevulvar flap. There were no previous reports of *Uncinaria* sp. in Japan except *U. maya* from Iriomote cats (Hasegawa, 1989).

Another *Uncinaria* sp. found in the ileum in one wildcat was similar to *U. felidis* but differed in the size and the form of head and prevulvar flap. It also resembled *U. maya* in shape but was different in the measurement of parts. No male worms for this *Uncinaria* sp. were available for species identification.

The *Molineus* sp. was similar to *Molineus springsmithi* from wildcats in Nepal (Inglis and Ogden, 1965) and *M. s. yayeyamanus* from Iriomote cats (Hasegawa, 1989). There have been no reports of *Molineus* sp. from Japanese domestic cats.

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