[Jpn. J. Parasitol., Vol. 39, No. 4, 415–417, August, 1990]

Research Note

Prevalence of Sarcocystis (Protozoa, Apicomplexa) in voles in Japan

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(Accepted for publication; July 24, 1990)

Key words: Cyst wall, *Sarcocystis, vole, Japan*

Twenty Sarcocystis species have been reported in voles, with the voles serving as intermediate hosts (Dubey et al., 1989; Levine, 1985, 1986; Levine and Ivens, 1981; Levine and Tadros, 1980). In Japan, Ohbayashi and Kitamura (1959) first reported *Sarcocystis clethrionomysi* in Bedford's red-backed vole, *Clethrionomys rufocanus bedfordiae,* in Hokkaido. However, there is no recent report about this parasite. The present paper deals with the detection of sarcocysts in voles.

This study was performed between September 1986 and November 1989. Two hundred and thirty five voles were caught with rat trappers and killed by cardiac puncture. The voles were obtained from Niigata Prefecture in central Japan, and from Hokkaido, the northern most island of Japan. Nine species of voles were identified, consisting of the Large Japanese field mouse, *Apodemus speciosus* (79 animals, Niigata 41, Hokkaido 38); the Small Japanese field mouse, *Apodemus argenteus,* (Niigata 22, Hokkaido 6); a subspecies of the Large Japanese field mouse, *Apodemus speciosus ainu,* (Hokkaido 29); the Sakhalin field mouse, *Apodemus peninsulae gillacus,* (Hokkaido 1); Bedford's red-backed vole, *Clethrionomys rufocanus bedfordiae,* (Hokkaido 89); Smith's Oriental vole *Eothenomys smithii* (Niigata 2); the Niigata red-backed vole, *Aschizomys* (*Eothenomys*) *niigatae,* (Niigata 1); the House mouse, *Mus musculus molossinus,* (Hokkaido 5); and the Long-clawed shrew, *Sorex unguiculatus,* (Hokkaido 1). The sarcocysts were collected from the muscles of the heart, tongue, oesophagus, diaphragm and skeletal muscle. The muscles were minced with scissors, a 0.5% (w/v) trypsin solution was added, and the mixture incubated at 37°C for 30 min. The suspension was homogenized at 1,000

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rpm for 30 sec, and the sarcocysts in the solution isolated under a light microscope. Squash preparations of small pieces of tissue were prepared from each sample for direct examination. In addition, a part of each organ was fixed in 10% (v/v) formalin, embedded in paraffin, thin-sectioned, and stained with hematoxylin and eosin (H-E), using routine laboratory procedures.

Sarcocysts were detected in 13 of the 41 large Japanese field mice caught in Niigata Prefecture (31.7%) and in 2 of 38 caught in Hokkaido (5.3%). The parasites were fibriform in shape, and over 2 cm in length. The cysts were thin-walled. The bradyzoites were crescent-shaped, and averaged $6.83 \pm 0.11 \times 1.83 \pm 0.04$ μm in size. This and other numerical date concerning numbers of animals examined, number positive, rate of infection, and a morphological description of the sarcocysts detected are presented in Table 1 and 2.

Two structurally distinct sarcocysts were found in the small Japanese field mouse and the Niigata red-backed vole, respectively. One of the 2 types of sarcocysts detected in the small Japanese field mouse was similar to those obtained from the Large Japanese field mouse. Matuschka (1986) attempted to infect various rodents with *Sarcocystis clethrionomyelaphis,* and succeeded in species belonging to the genera *Clethrionomys* and *Microtus.*

The sarcocysts detected by the authors were compared with the 3 species known in the rodent genera *Apodemus* and *Clethrionomys.* The sarcocysts detected in Bedford's red-backed vole

Table 1. Prevalence of sarcocysts detected from voles in Japan

Voles	Incidence of infection Number of voles examined No. positive/No. examined (%) Niigata	Hokkaido	Total No.	No. Sarcocyst isolates cyst wall thin	thick
Large Japanese field mouse *Apodemus speciosus*	13/41(31.7)	2/38(5.3)	15/79(19.0)	15	—
Small Japanese field mouse *Apodemus argenteus*	6/22(27.3)	0/6	6/28(21.4)	6	—
subspecies of the Large Japanese field mouse *Apodemus speciosus ainu*	—	1/29(3.4)	1/29(3.4)	1	—
Sakhalian field mouse *Apodemus peninsulae giliacus*	—	0/1	0/1	—	—
Bedford's red-backed vole *Clethrionomys rufocanus bedfordiae*	—	15/89(16.9)	15/89(16.9)	—	15
Smith's oriental vole *Eothenomys smithii*	0/2	—	0/2	—	—
Niigata red-backed vole *Aschizomys (Eothenomys) niigatae* (*Clethrionomys niigatae*)	1/1	—	1/1	1	1
House mouse *Mus musculus molossinus*	—	0/5	0/5	—	—
Long-clawed shrew *Sorex unguiculatus*	—	1/1	1/1	1	—

Table 2. Characteristics of sarcocysts detected in voles

Voles	Sarcocyst			Bradyzoite	
	cyst wall	shape	size	shape	size
Large Japanese field mouse *Apodemus speciosus*	thin	fibriform	>2 cm	crescent	$6.83 \pm 0.11 \times 1.83 \pm 0.04$ μm
Small Japanese field mouse	thin	fibriform	>2 cm	crescent	$6.83 \pm 0.11 \times 1.83 \pm 0.04$ μm
Apodemus argenteus	thin	oval	269.8–607.7 × 123.6–350.2 μm	crescent	8.5–11.0 × 2.5–4.0 μm
Subspecies of the Large Japanese field mouse *Apodemus speciosus ainu*	thin	long-elliptical elongated fusiform	$11.57 \pm 3.47 \times 3.39 \pm 0.82$ mm	crescent	$11.2 \pm 0.79 \times 2.0 \pm 0.4$ μm
Bedford's red-backed vole *Clethrionomys rufocanus bedfordiae*	thick	elongated fusiform	0.55–1.85 × 0.12–0.22 mm	oval	3.8–6.5 × 2.2–3.6 μm
Niigata red-backed vole	thin	long-elliptical	568.1 × 67.6 μm	crescent	$5.56 \pm 0.44 \times 1.79 \pm 0.71$ μm
Aschizomys (Eothenomys) niigatae (*Clethrionomys niigatae*)	thick	elongated fusiform	131.72–242.60 × 24.15–40.89 μm	crescent	$6.86 \pm 0.87 \times 2.38 \pm 0.42$ μm
Long-clawed shrew *Sorex unguiculatus*	thin	long-elliptical	548.85 × 38.53 μm	crescent	$8.84 \pm 0.78 \times 2.26 \pm 0.37$ μm

was similar to *S. clethrionomysi* in size and shape. This paper reports the prevalence of sarcocysts in voles in Japan, and the authors believe further study is warranted to elucidate the life cycle of each *Sarcocystis* species.

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