

Research Note

***Trichinella spiralis* in a Raccoon Dog, *Nyctereutes procyonoides viverrinus*, from Yamagata Prefecture, Honshu, Japan**

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The first finding of *Trichinella spiralis* in Japan was in 1957, when Satoh *et al.* (1957) and Ohbayashi and Satoh (1957) reported the parasite in a formalin-preserved specimen of an indigenous dog which had died four years earlier in Sapporo, Hokkaido. Since then, *T. spiralis* infection had been reported in imported animals such as mink from the United States (Konno *et al.*, 1957) and polar bears from the Netherlands and Scandinavia (Satoh *et al.*, 1960; Sakamoto *et al.*, 1969).

Spontaneous infections of *T. spiralis* in wildlife in Japan have been reported in sables, *Martes zibellina brachyura*, in Hokkaido (Makita *et al.*, 1963), a black bear, *Selenactos thibetanus japonicus*, in Iwasaki, Aomori (Yamaguchi, 1974) and a brown bear, *Ursus arctos yesoensis*, in Sapporo (Ohbayashi and Yamaguchi, 1980). The infections in the black bear and brown bear were responsible for the outbreak of human trichinellosis in Iwasaki and Sapporo.

There have been three outbreaks of human trichinellosis in Japan. The first one, which occurred in 1974 in Iwasaki, Aomori, was due to the consumption of raw meat of a black bear which had been shot locally by hunters on April

30. Of 20 villagers who ate the meat raw, 15 showed clinical symptoms of trichinellosis. This is the first recorded outbreak of human trichinellosis in Japan, and a strain of *T. spiralis* was isolated from the muscle of a dog which had been fed a piece of the infected bear meat. Thereafter, Yamaguchi *et al.* (1982) examined the wild animals captured in northern Japan from June 1974 to June 1982. Of 598 wild mammals consisting of 16 species and 20 birds consisting of 4 species, only 2 out of 29 Japanese black bears were found infected with *T. spiralis*. A survey of trichina infection among dogs revealed that 3 out of 4 were infected in Iwasaki. They had eaten bones or palms of the bear which caused human trichinellosis.

The second outbreak, which occurred in Sapporo, Hokkaido, in 1980, involved 12 persons who were diagnosed as positive on the basis of clinical symptoms and the results of serological tests. They all had eaten the raw meat of a brown bear served in a local restaurant. One of the patients, who was diagnosed in Tokyo, was infected during a tour of Sapporo and this is the only patient who has been found positive for larvae in muscle biopsy in Japan (Ozawa *et al.*, 1981).

The third outbreak was in 1982 in Mie Prefecture. Of the 434 people who had eaten raw bear meat in a local restaurant in Yokkaichi, 60 were diagnosed as positive for trichinellosis. The source of the bear meat was suspected to be Ohya-cho, Hyogo Prefecture.

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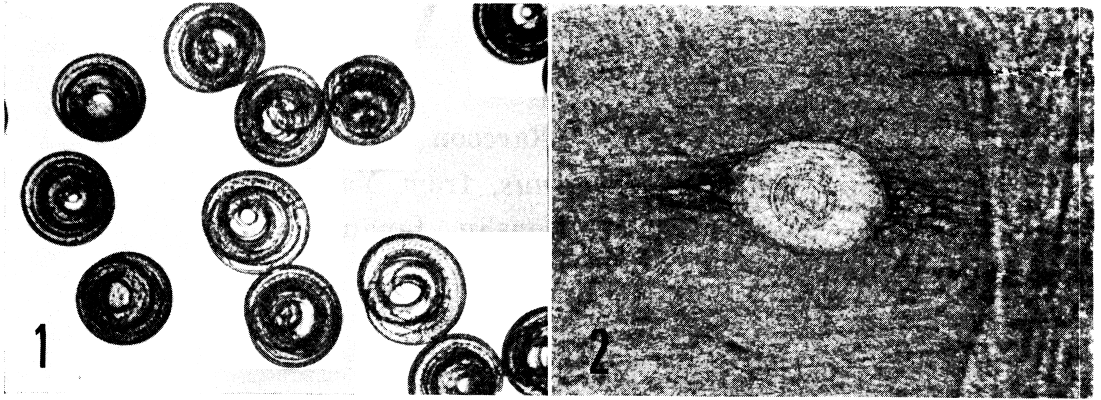


Fig. 1 Excysted and coiled larvae of *Trichinella spiralis* isolated by artificial digestion from the muscle of a raccoon dog.

Fig. 2 A larva of *Trichinella spiralis* encysted in the striated muscle fibers of a raccoon dog.

At present, however, it is uncertain because the restaurant owner obtained the meat from a wholesaler. This wholesaler, in turn, obtained the bear meat, wild boar meat, venison, etc., from various sources, including local hunters and also his father in Hyogo Prefecture. It happened that the Quarantine Section of the Kobe Port Authority, Hyogo Prefecture, did detect *Trichinella* infected bear meat imported from mainland China. Further investigation revealed that the importer of the infected bear meat was the father of the aforementioned wholesaler. Therefore, the imported bear meat from mainland China might have been involved in the outbreak, but there is no definite proof of this.

As noted above, bears have so far been thought to be the only animal to harbour *T. spiralis* and the meat to be the infection source of trichinellosis in Japan.

The present paper is concerned with the first record of natural infection of *T. spiralis* in a raccoon dog in Japan.

The male raccoon dog, skinned weight 1.95 kg, was killed on March 24, 1984 in a traffic accident on the mountain road named Kitsunegoe-kaido, which leads from the southwest border of Yamagata City to Shirataka Town. About 50 gms of muscle were collected from each part of the body, minced and digested for one hour at 37°C in artificial gastric juice consisting of 500 mg/ml pepsin (1:10,000) and 0.08N HCl. Observation

was made to detect the larvae under a dissecting microscope and many tightly coiled nematode larvae were found (Fig. 1). Meanwhile, encysted larvae were also found in the muscle by compression procedure (Fig. 2). The cysts were ellipsoidal in shape, and the size of 30 cysts measured was 260–420 (av. 349.2) μm in long axis by 204–299 (av. 249.1) μm in short axis. The cyst wall was very thin and many round fat cells were accumulated at both poles of the cyst, but no calcification was found in the cyst. Excysted larvae fixed in 70% hot ethanol were used for the measurement. The size of 20 larvae measured was 755–925 (av. 866.0) μm in length and 32–39 (av. 36.6) μm in maximum width. The females were somewhat longer than the males in body length. The oesophagus was slender and very long and measured 505–650 (av. 596.7) μm in length. The oesophagus, except for the anterior part, was covered with stichosomes (350–450 μm , av. 414.6 μm in length), a compact cord of linearly arranged gland-like cells called “stichocytes”. The oesophagus was followed by the midgut and then by the hindgut or rectum which measured 23–30 (av. 25.6) μm in length in females and 40–55 (av. 47.4) μm in males. The morphological characteristics as described above agree well with those of the intramuscular larvae of *Trichinella spiralis*.

The number of encysted larvae per gram muscle in each muscle found by the com-

Table 1 Distribution of *T. spiralis* larvae in the muscles of a raccoon dog* obtained in Yamagata City (March 24, 1984)

Muscles	No. larvae/g of muscle (%)	
Diaphragm	152	(5.9)
Fore limb (L)	300	(11.7)
Fore limb (R)	325	(12.7)
Hind limb (L)	308	(12.0)
Hind limb (R)	412	(16.1)
Masseter	59	(2.3)
Sarcospinal	162	(6.3)
Neck	291	(11.4)
Abdominal	164	(6.4)
Intercostal	140	(5.5)
Tongue	246	(9.6)

* Body length : 52 cm

Body weight skinned : 1.95 kg

L : Left, R : Right

pression procedure was: limbs, 300-412; neck, 291; tongue, 246; abdomen, 164; sarcospinal, 162; diaphragm, 152; intercostal, 140; and masseter, 59 (Table 1). This finding is fairly consistent with the data on raccoon dogs experimentally infected with *T. spiralis* (Huang, 1980).

Natural infection with *T. spiralis* in raccoon dogs in the USSR has been reported by Lukashenko and Brzesky (1962) in two regions, Tatar and Primorski Krai, and by Britov (1968) in the basin of the River Amur. However, they did not mention the distribution of the larvae in the muscle.

Yamaguchi (1982) considers that *T. spiralis* has long existed among wildlife in Japan, and the Japanese strain of trichina worm, the Iwasaki strain from the Japanese black bear showed lower infectivity in domestic animals than the European and USA strains. Konno *et al.* (1957), however, detected trichina larvae from a mink imported from the United States, so it cannot be denied absolutely that *T. spiralis* from the raccoon dog in Yamagata City may have originated from minks, which have been bred in Yamagata City.

From the present observation, it is concluded that an endemic area of *T. spiralis*

may exist in the suburbs of Yamagata City. Also, it is suggested that the trichina worm is more widely distributed than we expect among wild animals in Japan.

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短 報

山形市のタヌキから検出された旋毛虫について

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1984年3月24日、山形市の西南端、白鷹町に通じる狐越街道の山道で、交通事故に遭い死んだ雄タヌキ（毛皮なし体重1.95 kg）の筋肉から旋毛虫幼虫が発見された。筋肉1 g 当りの幼虫数は四肢が300~412で最も多く、以下、頸部291、舌246、腹部164、横隔膜152などの順であった。日本の哺乳類における旋毛虫の記録は北海道では

現地産の犬、エゾクロテン、ヒグマと外国産のミンク、ホッキョクグマがあるが、本州では今までに青森県2頭と兵庫県1頭のツキノワグマのみであった。今回、山形県のタヌキが追加されたことで、本州にも各種動物に、しかも各地に広く旋毛虫が分布している可能性が示唆された。