

Parasitic Helminths of Two Weasel Species (*Mustela itatsi* and *M. sibirica*) from Central and Western Japan

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中部および西日本産イタチ2種 (*Mustela itatsi* および *M. sibirica*) からの寄生蠕虫類

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ABSTRACT. In total, 70 Japanese weasels (*Mustela itatsi*) and 12 Siberian weasels (*M. sibirica*) were collected from 16 and six prefectures, respectively, in central and western Japan from 1982 to 2002. Their parasitic helminths were investigated. One trematode species, *Isthmiophora hortensis* (Asada, 1926), and three nematode species, *Gnathostoma nipponicum* Yamaguti, 1941, *Sobolyphyme baturini* Petrow, 1930, and *Dioctophyme renale* (Goeze, 1782) were obtained from *M. itatsi* collected in Gifu and Aichi Prefectures, Tokyo and Hyogo Prefectures, Ishikawa, Fukui, and Kyoto Prefectures, and Hyogo Prefecture, respectively. An acanthocephalan, *Centrorhynchus itatsinisi* Fukui, 1929 was also recovered from *M. itatsi* collected in Tokyo, Shizuoka, Ishikawa, Fukui, Gifu, Mie, Shiga, and Kagoshima Prefectures and from *M. sibirica* collected in Mie and Shiga Prefectures. The present detection of *S. baturini* is the first record of this nematode species from *M. itatsi*. Other cases of the present helminths are new locality records of these species.

Key words : Japan, *Mustela itatsi*, *Mustela sibirica*, parasitic helminths, *Sobolyphyme baturini*

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INTRODUCTION

Parasitic helminths of wild mammals, especially of the

order Carnivora, are of importance in not only natural history, but also zoonoses and wildlife medicine [1]. Two species of weasels, namely the Japanese weasel (*Mustela itatsi*) and

Siberian weasel (*M. sibirica*) are popular species with wide distribution in Japan, but studies on the parasitic helminths of these two species have been mostly limited to zoonotic species such as lung flukes [2] and gnathostomes [3, 4], which are inadequate in describing the helminths for the various importance. We investigated the parasitic helminths of these two host species based on 82 host individuals collected from central and western Japan.

MATERIALS AND METHODS

All 70 Japanese weasels and 12 Siberian weasels used in this study were captured using wooden box traps or wire mesh traps, or killed in traffic accidents in prefectures in Kanto, Chubu, Kinki and Kyushu-Okinawa Districts from 1982 to 2002 (Table 1). In total, 19 (2) esophagi, 71 (9) stomachs, 30

(2) intestines, 20 (3) urinary bladders, and 35 (4) mesenteries were frozen or fixed in 70% ethanol, transferred to Toyama University, and observed macroscopically (the numbers of Siberian weasels are in parenthesis). Their stomachs and intestines, and abnormal parts of other organs, were dissected under binocular microscope. A part of collected platyhelminths were softened in 10% acetic acid, flattened on glass slides, and stained with acetocarmine. The nematodes and acanthocephalans detected were preserved in 70% ethanol and cleared in lacto-phenol. Observation of morphological features and measurements were conducted under microscopes using micrometers and camera lucida.

RESULTS AND DISCUSSION

One trematode species, three nematode species, and one

Table 1 Number of weasels examined.

Species	Districts	Prefectures (Islands)	Number of animals	
			Males	Females
Japanese Weasels (<i>Mustela itatsi</i>)	Kanto	Tokyo (Izu-Oshima)*	7	0
		Chubu	Shizuoka	3
	Kinki	Nagano	1	0
		Toyama	1	0
		Ishikawa	4	0
		Fukui	4	0
		Gifu	9	1
		Aichi	18	3
		Mie	3	0
		Shiga	2	1
		Kyoto	3	0
		Osaka	2	0
	Hyogo	1	0	
	Kyushu-Okinawa	Nagasaki (Fukue)**	1	0
Kagoshima (Yaku and Nakanoshima)		4	0	
Okinawa (Zamami)*		2	0	
		Total	65	5
Siberian Weasels (<i>Mustela sibirica</i>)	Chubu	Gifu*	2	0
		Kinki	Mie*	4
	Shiga*		2	1
	Kyoto*		1	0
	Nara*		1	0
	Osaka*	1	0	
		Total	11	1
Total			76	6

* : Areas where weasels were artificially introduced.

** : Areas where weasels were not exactly native.

acanthocephalan species were detected from Japanese weasels. Only one acanthocephalan species was obtained from Siberian weasels. Representative specimens were donated to the Meguro Parasitological Museum, Tokyo (Accession Number: MPM Collection No. 20705-20719). Their morphological descriptions and remarks are provided below. All measurements are in mm.

1) *Isthmiophora hortensis* (Asada, 1926) (Fig. 1)

Host: 3 Japanese weasels (*M. itatsi*)

Localities (date; number of worms): Yamato, Gujo-gun, Gifu Prefecture (Sept. 25, 1999; 260), unknown, Gifu Prefecture (May 17, 2000; 9), and Tomioka, Inuyama City, Aichi Prefecture (Aug. 28, 2000; 76)

Site: Intestine

The trematodes had slender, flattened bodies 4.11-7.89 long and 0.49-0.91 wide. The oral sucker was small, 0.12-0.24 long, 0.14-0.26 wide, and had many oral spines. The oral spines were frequently lost, so their exact number remained unknown. The pharynx was 0.11-0.23 long and 0.11-0.20 wide, with the esophagus being 0.14-0.44 long. The acetabulum was large, being 0.40-0.73 long and 0.37-0.78 wide. The ovary was nearly round, being 0.10-0.20 long and 0.05-0.25 wide. The testes were arranged in tandem; both were spherical and equal size; the anterior one was pre-equatorial, 0.38-0.58 long and 0.25-0.46 wide, the posterior one was equatorial, 0.41-0.61

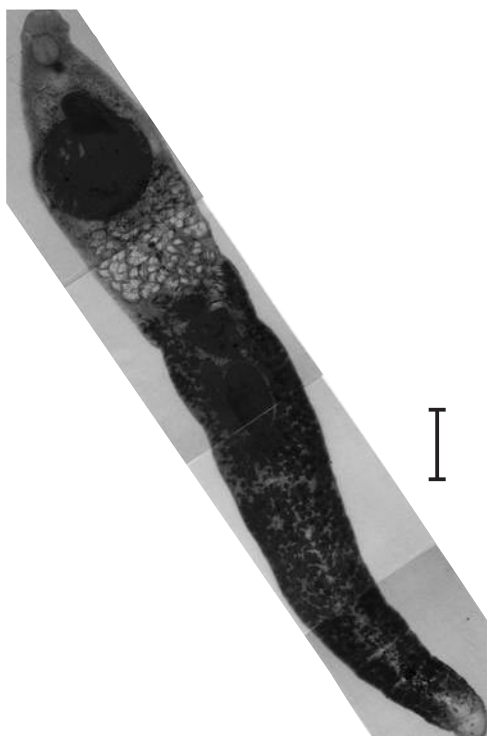


Fig. 1 *Isthmiophora hortensis* (Bar: 1.0 mm)

long and 0.22-0.36 wide. Eggs were oval and were 0.09-0.13 long and 0.04-0.09 wide.

Adult worms of this species (= *Echinostoma hortense*) have been recovered from brown rats (*Rattus norvegicus*) in prefectures such as Hokkaido (maybe partly from black rats (*R. rattus*), Aomori, Akita, Tokyo, Hyogo [5-10], and between Hokkaido and Aomori Prefectures (Sei-Kan Undersea Tunnel) [11], dogs (*Canis familiaris*) in Akita and Tokyo Prefectures [7], raccoon dogs (*Nyctereutes procyonoides*) in Aomori and Akita Prefectures [6], raccoons (*Procyon lotor*) in Wakayama Prefecture [12] and Japanese mustelids. The mustelids, namely the Japanese weasel from Hokkaido [13], Aomori [6], Akita [6, 7], and Kyoto [14] Prefectures, the Japanese marten (*Martes melampus*) from Tohoku Districts [6, 7, 15, 16], Japanese badger (*Meles anakuma*) in Akita Prefecture [6] and the American mink (*Neovison vison*) in Hokkaido Prefecture [17] are known as final hosts for this worm. Additionally, Japanese water shrew (*Chimarrogale platycephala*) has been recorded as a final host of the worm [18]. On the other hand, cercariae of this species are recovered from the snails *Lymnaea japonica* and *Austropeplea ollula* from prefectures extending from Hokkaido to Hiroshima [19]. A human infection by this species was reported in Akita Prefecture [20], and four cases of human infections of echinostomatid worms in Osaka and Hyogo Prefectures were presumed to have been caused by this species [21], which underscores the importance of being cognizant of its distribution in detail. Kostadinova and Gibson [22] proposed to incorporate this species as the genus *Isthmiophora*, based on some morphological features, such as position of testes and vitellarium.

2) *Gnathostoma nipponicum* Yamaguti, 1941 (Fig. 2)

Host: 2 Japanese weasels (*M. itatsi*)

Localities (date; number of worms): Oshima Island Park, Izu-Oshima Island, Tokyo Prefecture (Jan. 3, 2001; 2) and Kobe City, Hyogo Prefecture (June 17, 2001; 5)

Site: Esophagus

All five worms obtained were female. A large tumor developed on the lower esophagus of the host animal, and the worms penetrated their heads into the tumor.

The nematodes had cylindrical bodies that were 26.9-31.1 long and 1.41-1.45 wide, with a round head bulb 0.38-0.50 long and 0.62-0.89 wide. There were 38-64 spines arranged in one row on the surface of the head bulb, and ten rows were arranged from the anterior to posterior parts. Numerous cuticular spines covered the anterior half of the body. The esophagus was 3.35-4.33 long.

This species causes severe human gnathostomiasis, so its distribution in Japan has been researched in detail (reviewed

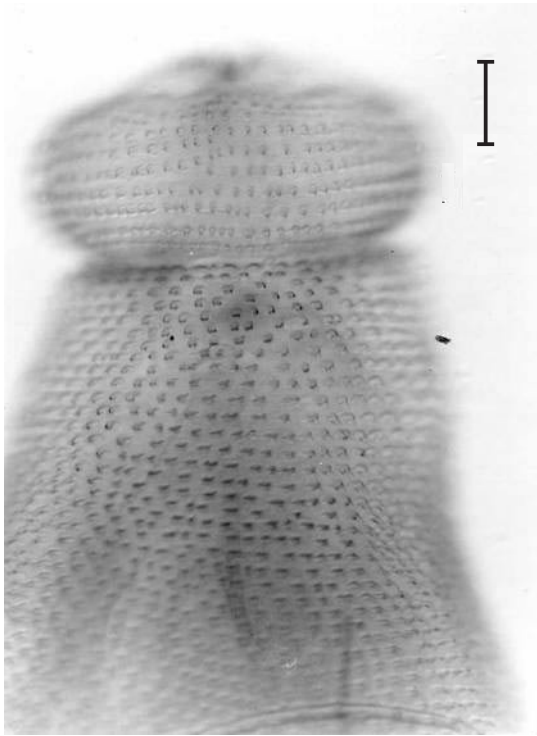


Fig. 2 Anterior end of female *Gnathostoma nipponicum* (Bar: 0.2 mm)

in Ando et al. [3]). Based on the review, the distribution areas encompass Tokoku, western Chubu, Kinki (including Hyogo Prefecture), Chugoku, Shikoku, and Kyushu Districts, i.e., almost all of Japan except for Hokkaido, eastern Chubu and Kanto Districts, and the Nansei archipelago.

3) *Sobolyphyme baturini* Petrow, 1930 (Fig. 3)

Host: 3 Japanese weasels (*M. itatsi*)

Localities (date; number of worms): Ohmichidani, Shiramine Village, Ishikawa Prefecture (Dec. 30, 2000; 3), Mihama, Mikata-gun, Fukui Prefecture (May 09, 2000; 1), and Ichinose, Kyoto City, Kyoto Prefecture (June 11, 1985; 1)

Site: Stomach

One immature worm, two males, and two females were obtained.

Slender nematodes had remarkably developed buccal capsules. Seven round esophageal glands surrounded the esophagus in the cervical portion. The bodies of the two males were 10.50 and 17.30 long and 0.64 and 0.76 wide, with esophagi being 2.63 and 3.23 long and 0.22 and 0.34 wide, and spicules being 3.13 and 3.35 long. The body of one female was 8.90 long and 0.42 wide, with the esophagus being 2.40 long and 0.22 wide, and the tail was 0.30 long. The body of the immature worm was 8.30 long and 0.44 wide, with the

esophagus being 2.50 long, 0.27 wide, and the tail being 0.35 long.

This species has been reported from various carnivores, including sable (*Martes zibellina*) [23, 24], red foxes (*Vulpes vulpes*), domestic cats (*Felis catus*) [23], American marten (*Martes americana*) [25, 26], Japanese marten (*Martes melampus*) [15, 16], American mink (*Neovison vison*) [26-28], and wolverines (*Gulo gulo*) [29, 30]. The present measurements resemble those of *S. baturini* in the studies cited. The measurements were also similar to those of *S. jamesoni* from the vagrant shrew (*Sorex vagrans*) from the USA [31], but *S. jamesoni* has at least 10 esophageal glands. In Japan, *S. urotrichi* has been reported from the greater Japanese shrew-mole (*Urotrichus talpoides*) from central Honshu [32], and *S. abei* has been detected from the long-clawed shrew (*Sorex unguiculatus*) and Laxman's shrew (*S. caecutiens*) in Hokkaido [33], but they differ from the present species based on a shorter spicule (*S. urotrichi*: 1.78-1.96; *S. abei*: approximately 1.8). In Japan, Sato et al. [15, 16] and Asakawa et al. [28] recorded the *S. baturini* from native Japanese martens and an alien American mink in eastern Honshu and Hokkaido, respectively. The present case is the first record of the Japanese weasel as a new host and the first locality record in central (Ishikawa and Fukui Prefectures) and western (Kyoto Prefectures) Japan of this nematode species.

4) *Diectophyme renale* (Goeze, 1782)

Host: 1 Japanese weasel (*M. itatsi*)

Localities (date; number of worms): Kobe City, Hyogo Prefecture (June 17, 2001; 1)

Site: Body cavity

One immature female was obtained.

The very large nematode had a cylindrical body ca. 150 long and ca. 3 wide, with small papillae arranged on lateral lines of the body. Observation of internal morphological features was difficult because of the body's extreme thickness.

This worm parasitizes various mammals, including carnivores, piscivorous rodents and ungulates [34]. This species, detected from weasels in Japan, had been distinguished as *D. renale* var. *yoshidai* Morishita, 1955 mainly based on the vulval portion and the shape of its eggs [35, 36]. Morishita [35], Miyazaki and Isobe [36] and Isobe [37] reported this species in dogs from Aichi, Mie, Kyoto, Nara, Osaka, Hyogo and Kumamoto Prefectures (precise localities are unknown except for Kumamoto Prefecture), and Gyoten and Nishida [38] identified this nematode in Siberian weasels in Kagawa Prefecture. Furthermore, this species was also detected in brown rats in Tokyo Prefecture [25, 39] and Kanagawa Prefecture [40]. Morishita [35] emphasized difference of

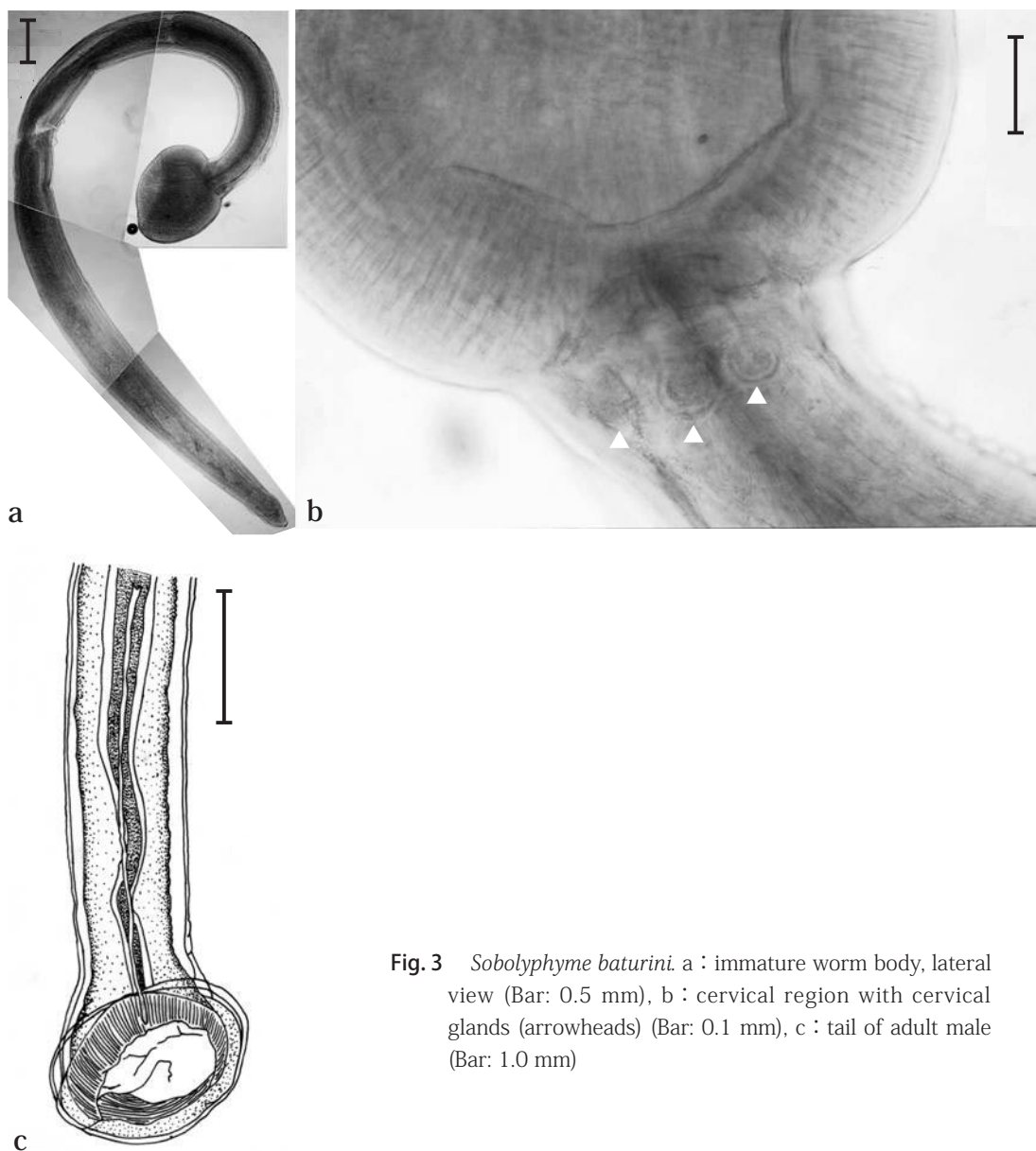


Fig. 3 *Sobolyphyme baturini*. a : immature worm body, lateral view (Bar: 0.5 mm), b : cervical region with cervical glands (arrowheads) (Bar: 0.1 mm), c : tail of adult male (Bar: 1.0 mm)

size and shape of eggs in the worms from Japanese weasels from those from domestic dogs, as a criterion of *D. renale* var. *yoshidai*, but similar difference was observed from the worms from *R. norvegicus* in the neighboring prefectures, Tokyo and Kanagawa [25, 39, 40]. Kobe City has been added as a new locality record for this species, although it has ever been found in Hyogo Prefecture [35].

5) *Centrorhynchus itatsinis* Fukui, 1929 (Fig. 4)

Host: 9 Japanese weasels (*M. itatsi*) and 3 Siberian weasels (*M. sibirica*)

Localities (date; number of worms) (*from *M. sibirica*):

<encysted larval forms and immature worms> Oshima Island Park, Izu-Oshima Island, Tokyo Prefecture (Feb. 23, and Mar. 14, 2001; 2 each), Kurematsu, Hamamatsu City, Shizuoka Prefecture (Jan. 10, 1989; 2), Ohmitsudani, Shiramine Village, Ishikawa Prefecture (Dec. 30, 2000; 8), Hirose, Torigoe Village, Ishikawa Prefecture (Apr. 06, 2000; 2), Tsuruga, Fukui Prefecture (Mar. 22, 2001; 1), Shinjo-Matsuya, Mihama Town, Fukui Prefecture (May 09, 2000; 32), Ochiai, Osaka Town, Gifu Prefecture (Feb. 08, 2000; 15), Neo Village, Motosu County, Gifu Prefecture (Oct. 19, 1998; 2), Roppa-no-Shinden, Touin Town, Inobe County, Mie Prefecture (Apr. 16, 2000; 18),

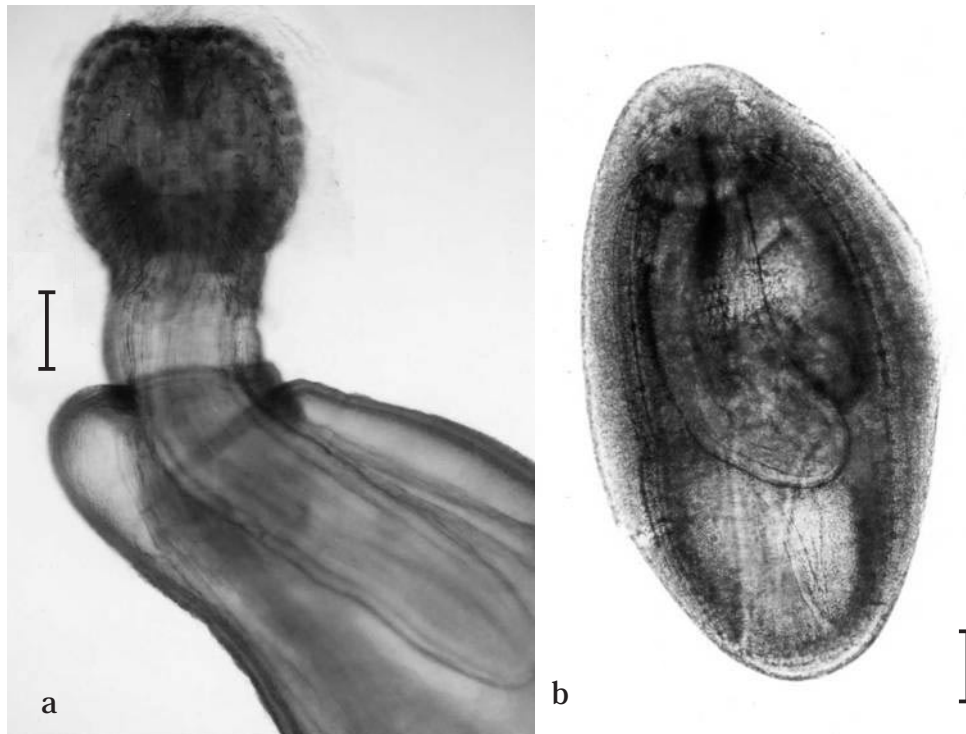


Fig. 4 *Centrorhynchus itatsinis*. a : immature worm with protruded rostrum (Bar: 0.2 mm), b : encapsulated worm body (Bar: 0.1 mm)

Ohgaito Town, Matsusaka City, Mie Prefecture (Mar. 20, 2001; 7)*, Kongouzaka, Meiwa Town, Matsuzaka City, Mie Prefecture (Mar. 21, 2001; 1)*, Komoo, Nabari City, Mie Prefecture (Oct. 17, 2001; 2), Koujin-yama, Hikone City, Shiga Prefecture (Mar. 17, 2000; 45), Tanakamisato-Line, Ohtsu City, Shiga Prefecture (Aug. 15, 2001; 13)*, Tomaigo, Kamiyaku Town, Yakushima Island, Kagoshima Prefecture (Mar. 17, 2000; 1), and Yoshida, Kamiyaku Town, Yakushima Island, Kagoshima Prefecture (Sep. 19, 1998; 1); <adult worms>Oshima Island Park, Izu-Oshima Island, Tokyo Prefecture (Feb. 23, 2001; 1) and Hirose, Torigoe Village, Ishikawa Prefecture (Apr. 06, 2000; 1)

Site: Mesentery (encysted juvenile forms), stomach, and intestine (immature and adult worms)

Two adult worms (one male and one female), many encysted juvenile forms, and immature worms were obtained.

The bodies of the male adult worms were slender, 19.8 long and 1.7 wide, with the necks being 0.26 long and 0.49 wide. The probosci were 0.35 long and 0.36 wide, with receptacles being 2.04 long and 0.30 wide. The number of longitudinal hook rows was 34, with each row consisting of 15 hooks. The testes were arranged in tandem, with the anterior one being 0.85 long and 0.45 wide, and the posterior one being 0.74 long and 0.38 wide.

The bodies of the female adult worms were slender, 27.3 long and 1.9 wide, with necks being 0.60 long and 0.50 wide. The probosci were 0.52 long and 0.38 wide, with receptacles being 1.92 long and 0.34 wide. The number of longitudinal hook rows was 34, with each row consisting of 14 hooks.

The bodies of the encysted juvenile forms were spherical, 1.41-5.28 long and 0.50-1.03 wide, with 32-34 longitudinal hook rows and 12-15 hooks in each row.

These measurements, numbers of hook rows, and hooks in each row were identical to those of adults [41] and encysted juvenile forms [40] of *C. itatsinis*. This species has been recorded in Shizuoka and Kagoshima Prefectures [41, 42], so the present findings add many new locality records for this species.

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要 約

日本の中央部および西部で1982～2002年に収集された70頭のニホンイタチ (*Mustela itatsi*) および12頭のタイリクイタチ (*M. sibirica*) の寄生蠕虫類を調査した。吸虫1種(浅田棘口吸虫 *Isthmiophora hortensis* (Asada, 1926)), 線虫3種(日本顎口虫 *Gnathostoma nipponicum* Yamaguti, 1941, *Soboliphyme baturini* Petrow, 1930 および腎虫 *Diocotophyme renale*(Goeze 1782)) がそれぞれ岐阜および愛知県, 兵庫県, 石川および福井県および京都府, 兵庫県産のニホンイタチから得られた。鉤頭虫の1種, イタチ鉤頭虫 *Centrorhynchus itatsinis* Fukui, 1929 が東京都および静岡, 石川, 福井, 岐阜, 三重, 滋賀および鹿児島県の各県産のニホンイタチおよび三重および滋賀県産のタイリクイタチから検出された。今回の *S. baturini* の検出は, 本種のニホンイタチからの, また中部および西日本からの初記録となった。他の種については新しい産地の報告となった。

キーワード : 寄生蠕虫, 日本, ニホンイタチ, タイリクイタチ, *Soboliphyme baturini*

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