

Parasitic Nematodes of Rodents on Kunashir and Sakhalin Islands

Mitsuhiro Asakawa, Marina V. Pavlenko, Irina V. Kartavtseva,
Kimiya Tsuchiya, Kazuo Moriwaki and Masashi Harada

Abstract. As a part of an insular zoogeographical research project, an analysis was made of the parasitic nematode fauna of 61 individuals of 5 rodent species, viz., *Apodemus speciosus* [abbreviated to As], *A. peninsulae* [abbreviated to Ap], *A. agrarius* [abbreviated to Aa], *Clethrionomys rufocanus* [abbreviated to Crf], *C. rutilus* [abbreviated to Crt], collected on Kunashir and Sakhalin Islands, plus our findings in Primorskiy Region, Russia. Among them following nematode species were obtained; *Syphacia agraria* [As, Ap, Aa], *S. montana* [Crf], *S. spp.* [Crf, Ap, Aa], *Heligmosomoides kurilensis* [As], *H. neopolygyrus* [Ap, Aa], *H. sp.* [Ap, Aa], *Heligmosomum (Parahelgmosomum) yamagutii* [Crf], *H. (P.) sp.* [Crt], *Heligmonoides speciosus* [As], *H. sp.* [Ap], *Rhabditis (Pelodera) orbitalis* (3rd-stage larva) [Crt], *Rictularia cristata* [Ap, Aa], *Heterakis spumosa* [Aa], *Toxocara apodemi* [Aa], *Eucoleus sp.* [Aa], Nematoda fam. gen. sp. (encysted larva) [Aa]. Although these nematode species have been reported from Hokkaido, this is the first report of *S. agraria* and *H. speciosus* on Kunashir Island, and of *S. agraria*, *H. neopolygyrus* and *R. (P.) orbitalis* on Sakhalin Island, respectively. *S. agraria*, *H. neopolygyrus*, *R. cristata* and *T. apodemi* have been reported from the Eastern Part of Chinese Continent. However, it is first that these nematode species were obtained from Primorskiy Region. Furthermore, *Heligmonoides sp.* obtained from *A. peninsulae* showed a close similarity with the nematode reported from *A. agrarius* in Shenyang, China. Hence, the main nematode fauna of *Apodemus spp.* of Primorskiy Region accorded almost with the fauna of the Eastern Part of Chinese Continent.

Several studies have dealt with the nematodes parasitizing voles (*Clethrionomys spp.*, Microtinae) and mice (*Apodemus spp.*, Murinae) on Sakhalin and Kunashir Islands (Sadovskaya, 1952; Yamaguti, 1954; Krotov, 1959; Nadtochi, 1966, 1970; Surkov, 1972; Surkov and Nadtochi, 1971). However, there has been no recent report on the field since the 1980's, although new species and/or new host records of the parasitic nematodes, especially belonging to the families Heligmosomidae, Heligmonellidae and Oxyuridae, have been obtained from the small mammals in its adjacent areas (i.e., Hokkaido and its off-shore islands, Northern and/or Eastern parts of China) (Asakawa, 1993; Asakawa and Yoshiyuki, 1992; Asakawa *et al.*, 1983, 1990, 1992, 1993, 1994).

In the present paper, we report the results of a nematode survey of the rodents collected on the 2 islands, plus our findings in Primorskiy Region, Russia.

Materials and Methods

Host animals. The host materials of the present survey were shown below; *Apodemus speciosus* (Temminck) ($N=15$) of Otradnoe, Kunashir Island (Coll. date: 31 Jul.-7th Aug., 1980); *Clethrionomys rufocanus* (Sundevall) ($N=9$), *C. rutilus* (Pallas) ($N=8$), and *A. peninsulae* (Thomas) ($N=7$) of Yuzhno-Sakhalinsk, Sakhalin Island (24 Jun.-4 Jul., 1993); *C. rutilus* ($N=2$) of Korsakov, Sakhalin Island (29 Jun., 1993); *A. agrarius* (Pallas) ($N=1$) and *A. peninsulae* ($N=4$) of Vladivostok, Primorskiy Region (8 Jul., 1993); *A. agrarius* ($N=7$) and *A. peninsulae* ($N=8$) (14 Aug., 1993) of Rudnaya Pristan, Primorskiy Region.

Parasitic nematodes. Nematodes were fixed and preserved in 10% formalin solution, and examined microscopically with lactophenol solution. Some heligmosomid and heligmonellid nematodes were sectioned with a razor for observation of the synlophe (Durette-Desset, 1983). Measuring and drawing of these nematodes were done with the aid

of a camera lucida, OLYMPUS Model BH2-DA.

These specimens are deposited in the Department of Veterinary Medicine, Rakuno Gakuen University, Hokkaido, Japan, and Institute of Biology and Pedology, Far East Branch, Russian Academy of Sciences, Vladivostok, Russia.

Results and Discussion

1) Kunashir Island. Three species, namely *Syphacia agraria* Sharpilo, 1973 (Fam.: Oxyuridae; Site: caecum and colon), *Heligmosomoides kurilensis* (Nadtochi, 1966) (Heligmosomidae; small intestine) and *Heligmonoides speciosus* (Konno, 1958) (Heligmonellidae; small intestine) were obtained from *Apodemus speciosus* on Kunashir Island.

This is the first report of *S. agraria* and *H. speciosus* on Kunashir Island. On the other hand, because the original description of *H. kurilensis* was given on the basis of the materials collected on this island (Nadtochi, 1966), the present data is not the first record of *H. kurilensis* on the island. However, it is remarkable that *H. kurilensis* and *H. speciosus* occur on Kunashir Island, although both do not

occur on Rishiri and Okushiri Islands which are located near to Kunashir Island (Asakawa and Yoshiyuki, 1992; Asakawa *et al.*, 1992).

2) Sakhalin Island. On Sakhalin Island, *Syphacia montana* Yamaguti, 1943 (Oxyuridae; caecum and colon), *Syphacia* sp. and *Heligmosomum* (*Paraheligosomum*) *yamagutii* Chabaud *et al.*, 1963 (Heligmosomidae; small intestine) were obtained from *C. rufocanus*, *Heligmosomum* (*Paraheligosomum*) sp. and *Rhabditis* (*Pelodera*) *orbitalis* Sudhaus *et* Schulte, 1986 (3rd-stage larva) (Rhabditidae; orbit) were obtained from *C. rutilus*, and *S. agraria*, *Heligmosomoides neopolygyrus* Asakawa *et* Ohbayashi, 1986 (Fig. 1a) and *Heligmosomoides* sp. were obtained from *A. peninsulae*, respectively.

This is the first record of *R. (P.) orbitalis*, *S. agraria* and *H. neopolygyrus* from this island, although these nematode species have been reported from Hokkaido (Asakawa, 1993; Asakawa and Ohbayashi, 1986; Asakawa *et al.*, 1992). Although the number of the ridges of the cross-section of the male body is 20–23, the males of the present specimens obtained from *C. rutilus*, *Heligmosomum*

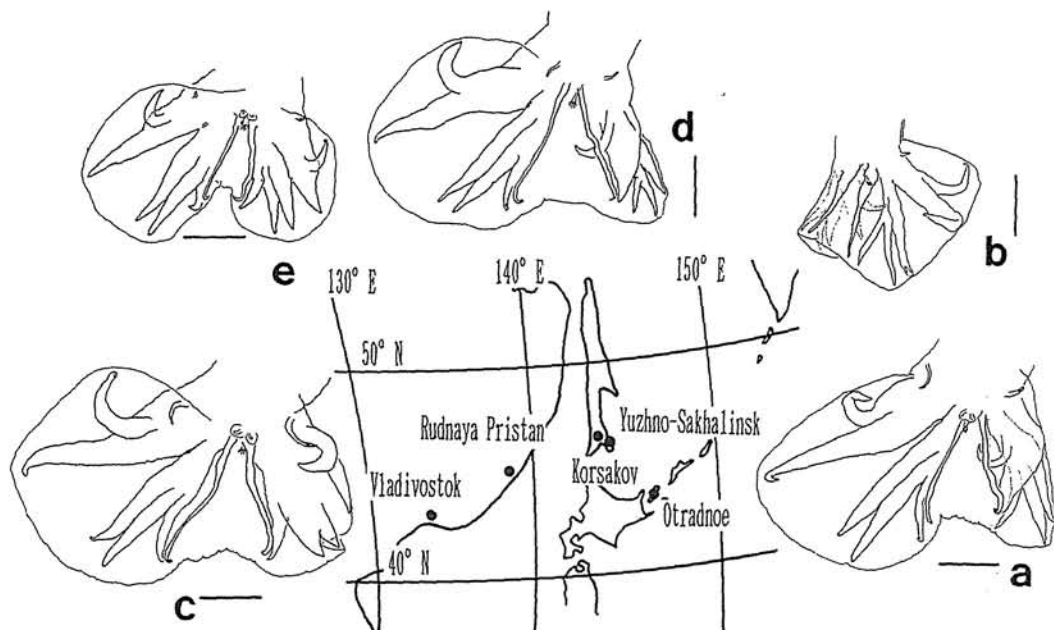


Fig. 1. Map showing collection points (●), and bursae of *Heligmosomoides neopolygyrus* (a and c–e) and *H. polygyrus* (b) from *Apodemus peninsulae* (a, c and d), *A. agrarius* (e) and *Mus musculus* (b). —a and b: Yuzhno-Sakhalinsk. c: Vladivostok. d: Rudnaya Pristan. Ventral (a and c–e) or dorsal (b) view and scale bar = 0.1 mm.

Parasitic Nematodes of Rodents on Kunashir and Sakhalin Islands

Table 1. Occurrence of parasitic nematodes obtained from the rodents of the genera *Apodemus* and *Clethrionomys* on Kunashir and Sakhalin Islands, and Primorskiy Region.

Parasitic nematodes	Localities	Kuna. I	Sakhalin I.			Primorskiy Region				
		Otradn.	Yuzh.-Sakh.		Kor.	Vladiv.		Rud. Pr.		
	Hosts	As	Ap	Crf	Crt	Crt	Ap	Aa	Ap	Aa
Total no. of rodents examined		15	7	9	8	2	4	1	8	7
<i>Syphacia agraria</i>		13	2	0	0	0	0	0	2	2
<i>S. montana</i>		0	0	5	0	0	0	0	0	0
<i>S. spp.</i>		0	0	1	0	0	2	1	0	0
<i>Heligmosomoides kurilensis</i>		10	0	0	0	0	0	0	0	0
<i>H. neopolygyrus</i>		0	4	0	0	0	2	0	3	3
<i>H. sp.</i>		0	1	0	0	0	0	0	1	2
<i>Heligmosomum (Paraheligmosomum) yamagutii</i>		0	0	6	0	0	0	0	0	0
<i>H. (P.) sp.</i>		0	0	0	3	1	0	0	0	0
<i>Heligmonoides speciosus</i>		15	0	0	0	0	0	0	0	0
<i>H. sp.</i>		0	0	0	0	0	2	0	0	0
<i>Rhabditis (Pelodera) orbitalis</i>		0	0	0	1	0	0	0	0	0
<i>Rictularia cristata</i>		0	0	0	0	0	3	1	1	0
<i>Heterakis spumosa</i>		0	0	0	0	0	0	1	0	2
<i>Toxocara apodemi</i>		0	0	0	0	0	0	0	0	1
<i>Eucoleus sp.</i>		0	0	0	0	0	0	0	0	1
Nematode fam. gen. sp. (encysted larva)		0	0	0	0	0	0	0	0	1
nematode free		0	2	1	5	1	0	0	2	2

Abbreviations of host and locality names. As: *Apodemus speciosus*, Ap: *A. peninsulae*, Aa: *A. agrarius*, Crf: *Clethrionomys rufocanus*, Crt: *C. rutilus*, Kuna. I: Kunashir Island, Otradn.: Otradnoe, Yuzh.-Sakh.: Yuzhno-Sakhalinsk, Kor.: Korsakov, Vladiv.: Vladivostok, Rud. Pr.: Rudnaya Pristan.

(*Paraheligmosomum*) sp., were similar to *H. (P.) mixtum* because of the morphology of the ventral rays of the bursa (Asakawa and Satoh, 1987). However, the precise classification was not possible because the specimens were few in number and damaged. *Syphacia* sp. from *C. rufocanus* is probably *S. montana*, but positive identification was not possible because of the absence of mature nematodes.

Furthermore, although positive identification was not possible because of the absence of male, *Heligmosomoides* sp. from *A. peninsulae* seems to be *H. neopolygyrus*. Although Nadtochi (1970) reported *H. polygyrus* (syn. *H. skrjabini*) from *A. peninsulae* on Sakhalin Island, this species was not obtained from this field mice, but from *Mus musculus* collected in Yuzhno-Sakhalinsk, 25 Aug., 1992 (Asakawa *et al.*, unpubl.) (Fig. 1b).

3) Primorskiy Region. In Primorskiy Region, *S. agraria*, *Syphacia* sp., *H. neopolygyrus* (Figs. 1c and 1d), *Heligmosomoides* sp., *Heligmonoides* sp. (Heligmonellidae; small intestine) and *Rictularia cristata* Froelich, 1802 (Rictulariidae; stomach and small intestine) were obtained from *A. peninsulae*, and *S. agraria*, *Syphacia* sp., *H. neopolygyrus* (Fig. 1e), *Heligmosomoides* sp., *R. cristata*, *Heterakis spumosa* Schneider, 1866 (Heterakidae; caecum and colon), *Toxocara apodemi* (Olsen, 1957) (Ascarididae; small intestine), *Eucoleus* sp. (Capillariidae; stomach) and encysted larva of nematode (submucous tissue of gut) were obtained from *A. agrarius*, respectively.

Although *S. agraria*, *H. neopolygyrus*, *R. cristata* and *T. apodemi* have been reported from the Eastern Part of Chinese Continent (Asakawa *et al.*, 1990, 1993, 1994), this is the first record of these nematode species from Primorskiy Region. Furthermore, the present specimens of its males of *Heligmonoides* sp.

obtained from *A. peninsulae* showed a close similarity with *Heligmosomoides* sp. which was reported by Asakawa *et al.* (1990) from *A. agrarius* in Shenyang based on the morphology of the dorsal rays of the bursa. Hence, the main parasitic nematode fauna of *Apodemus* spp. of Primorsky Region accorded almost with the fauna of the Eastern Part of Chinese Continent.

Acknowledgements

The authors wish to thank to Far East Branch, Russian Academy of Sciences, for support of the first author's stay at Institute of Biology and Pedology, Far East Branch, Russian Academy of Sciences in Vladivostok, in July, 1993. The present survey of Sakhalin Island was partly supported by the Akiyaka Foundation, Sapporo (92-12-013).

Literature cited

- Asakawa, M., 1993. Parasitic helminths obtained from rodents on Nemuro Peninsula and Notsuke-saki, Hokkaido, Japan. *Mem. Natl. Sci. Mus.*, Tokyo, (26): 75-82.
- Asakawa, M., A.-H. Guo, X.-Y. Yang, Z.-L. Liu, J.-F. Li, K. Koyasu, K. Tsuchiya, N. Miyashita, F.-S. Wang & K. Moriwaki, 1993. A further survey on the distribution of *Heligmosomoides neopolygyrus* Asakawa *et* Ohbayashi, 1986 (Nematoda: Trichostrongyloidea: Heligmosomidae) in eastern part of China. *Bull. Biogeogr. Soc. Japan*, 48: 49-52.
- Asakawa, M., H. Hasegawa, M. Ohnuma, T. Tatsushima & M. Ohbayashi, 1992. Parasitic nematodes of rodents on the offshore islands of Hokkaido. *Jpn. J. Parasitol.*, 41: 40-41.
- Asakawa, M., J.-F. Li, A.-I. Guo, X.-Y. Yang, Huhebater, Z.-L. Liu, Y. Liu, X.-M. Cao & K.-Y. Chen, 1994. A new and locality record for *Toxocara apodemi* (Olsen, 1957) (Nematoda: Ascarididae) from striped field mice. *Apodemus agrarius* (Pallas) (Rodentia: Murinae) in Changsha, China. *J. Rakuno Gakuen Univ.*, Nat. Sci., 19: 193-196.
- Asakawa, M. & M. Ohbayashi, 1986. Genus *Heligmosomoides* Hall, 1916 (Heligmosomidae: Nematoda) from the Japanese wood mice, *Apodemus* spp. I. A taxonomical study on four taxa of the genus *Heligmosomoides* from three species of the Japanese *Apodemus* spp. *J. Coll. Dairying, Nat. Sci.*, 11: 317-331.
- Asakawa, M. & R. Satoh, 1987. Discovery of the genus *Heligmosomum* Railliet *et* Henry, 1909 (Heligmosomidae: Nematoda) from the Japanese *Clethrionomys* and establishment of *Paraheligmosomum* n. subgen. *J. Coll. Dairying, Nat. Sci.*, 12: 111-129.
- Asakawa, M., W.-Z. Ying, J.-H. Zhu, G.-Q. Chen, K. Takahashi, H. Hasegawa, I. Sawada, K. Matsukawa, & M. Ohbayashi, 1991. A preliminary report on the helminth fauna of small mammals in Shenyang, China. *J. Rakuno Gakuen Univ.*, Nat. Sci., 14: 135-146. (In Japanese with English summary).
- Asakawa, M., Y. Yokoyama, S.-I. Fukumoto & A. Ueda, 1983. A study of the internal parasites of *Clethrionomys rufocanus bedfordiae* (Thomas). *Jpn. J. Parasitol.*, 32: 399-411.
- Asakawa, M. & M. Yoshiyuki, 1992. Parasitic nematodes obtained from rodents on Rishiri Island, Hokkaido, Japan. *Mem Natl. Sci. Mus.*, Tokyo, (25): 105-110. (In Japanese with English summary).
- Durette-Desset, M.-C., 1983. Key to genera of the superfamily Trichostrongyloidea. In: CIH keys to the nematode parasites of vertebrates, No. 10 Eds. Anderson, R. C., A. G. Chabaud & S. Willmott, 1-83, Farnham Royal, Bucks, England: Commonwealth Agricultural Bureaux.
- Krotov, A. I., 1959. Two new species of helminth parasites in vertebrates in the Island of Sakhalin. *Acta Vet. Budapest*, 9: 7-12. (In Russian).
- Nadtochi, E. V., 1966. New species of nematodes from rodents on the Kuril Islands. *Mater. Nauch. Konf. Vses. Obshch. Gel'mint.*, Year 1966, Part 3, Moscow: 191-195. (In Russian).
- Nadtochi, E. V., 1970. Helminth fauna of rodents in the Far East. *Uchenye Zapiski Dal'nevostochnyi Gosudarstvennyi Universitet—Parasitologicheskie i Zoologicheskie issledovaniya na Dal'nem Vostoke, Vladivostok, U.S.S.R.*, 16: 62-80. (In Russian).
- Sadovskaya, N. P., 1952. Parasitic worms of rodents and insectivores of the Maritime Territory. *Trud. Gel'mintol. Lab.*, 7: 388-390. (In Russian).
- Surkov, V. S., 1972. Biotope distribution of helminths of forest voles in Sakhalin Island. *Zool. Zh.*, 51: 748-750. (In Russian with English summary).
- Surkov, V. S. & E. V. Nadtochi, 1971. On the helminth fauna of Muridae of Sakhalin Island. *Zool. Zh.*, 50: 278-279. (In Russian with English summary).
- Yamaguti, S., 1954. Studies on the helminth fauna of Japan. Part 51. Mammalian nematodes, V. *Acta Med. Okayama*, 9: 105-121.
- (Asakawa, M.: Department of Veterinary Medicine, Rakuno Gakuen University, Ebetsu, Hokkaido, 069 Japan. Pavlenko M. V. and Kartavtseva I. V.: Institute of Biology and Pedology, Far East Branch, Russian Academy

of Sciences, 690022, Vladivostok, Russia. Tsuchiya K.: Experimental Animal Center, Miyazaki Medical College, Miyazaki, 889-16 Japan. Moriwaki K.: National Institute of Genetics, Shizuoka, 411 Japan. Harada M.: Laboratory of Experimental Animals, Osaka City University Medical School, Osaka, 545 Japan)

国後島およびサハリン産野ネズミ類の寄生線虫類

浅川満彦・M. V. パブレンコ
I. V. カルタフトセーバ・土屋公幸
森脇和郎・原田正史

北海道産野ネズミ類の寄生線虫相に強い影響を与えたと考えられる国後島、サハリンおよび極東ロシア大陸部におけるこの領域に関わる情報は、一般に乏しいかあるいは分類学的にあまり信頼の置けるものが少ない。そこで、今回、これら諸地域について、野ネズミ類の寄生線虫類の調査をおこなった。宿主材料は、次に示すネズミ科5種の合計61個体であった。なお[]内にそれぞれの宿主略号を記した；アカネズミ *Apodemus speciosus* [As], ハントウアカネズミ *A. peninsulae* [Ap], セスジネズミ *A. agrarius* [Aa], タイリクヤチネズミ *Clethrionomys rufocanus* [Crf], ヒメヤチネズミ *C. rutilus* [Crt]。これら野ネズミ類から、次の線虫類が検出された； *Syphacia agraria* [As, Ap, Aa], *S. montana* [Crf], *S. spp.* [Crf, Ap, Aa], *Heligmosomoides kurilensis* [As], *H.*

neopolygyrus [Ap, Aa], *H. sp.* [Ap, Aa], *Heligmosomum (Parahelgmosomum) yamagutii* [Crf], *H. (P.) sp.* [Crt], *Heligmonoides speciosus* [As], *H. sp.* [Ap], *Rhabditis (Pelodera) orbitalis* [Crt], *Rictularia cristata* [Ap, Aa], *Heterakis spumosa* [Aa], *Toxocara apodemi* [Aa], *Eucoleus sp.* [Aa], 所属不明の線虫類被囊幼虫 [Aa]。国後島からの *S. agraria* および *H. speciosus*, またサハリンからの *R. (P.) orbitalis*, *S. agraria* および *H. neopolygyrus* は、いずれも隣接する北海道では普通に分布する種であるが、これら両島で確認されたのは今回初めてである。さらに、*S. agraria*, *H. neopolygyrus*, *R. cristata* および *T. apodemi* は、いずれも最近、中国大陸東部でその分布を認められたが、極東ロシア大陸部における信頼すべき報告は今回が初めてである。なお、ハントウアカネズミから見つかった *Heligmonoides sp.* は、中国瀋陽産セスジネズミから報告された線虫と同一種と考えられるので、極東ロシア大陸部と中国産アカネズミ属の主要な寄生線虫相はほぼ一致すると考えられる。

(浅川満彦：069 北海道江別市 酪農学園大学獣医学科 寄生虫学教室。M. V. パブレンコ・I. V. カルタフトセーバ：ロシア共和国ウラジオストク市 ロシア科学アカデミー極東支部生物・土壌学研究所。土屋公幸：889-16 宮崎県宮崎郡 宮崎医科大学医学部動物実験施設。森脇和郎：411 静岡県三島市 国立遺伝学研究所。原田正史：545 大阪市阿倍野区 大阪市立大学医学部実験動物研究室)