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GASTROINTESTINAL HELMINTH FAUNA OF JAPANESE MOLES, *MOGERA* SPP.

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One trematode, *Echinostoma macrorchis*, 2 cestodes, *Hymenolepis diminuta* and *Choanotaenia spasskii* and 5 nematodes, *Parastrongyloides winchesi*, *Tricholinstowia talpae*, *Heterakis spumosa*, *Trichuris* sp. and *Capillaria soricis* were obtained from 129 *Mogera wogura*, 233 *M. kobeae* and 28 *M. tokudae*, which were collected from almost all over Japan. All present cases were new host and locality records. The discovery of *T. talpae* in Japan shows the wide distribution of this species from Japan to Europe.

Key words: gastrointestinal helminths, *Mogera* spp., Japan

INTRODUCTION

There are at least 4 species of moles *Talpa mizura*, *Mogera wogura*, *M. kobeae*, and *M. tokudae* in Japan (ABE, 1967, 1968, 1985, 1988; TSUCHIYA, 1988), but little have been so far reported on their helminth fauna (YAMAGUTI, 1941), except for our recent contributions on pseudoparasitism of thelastomatid nematodes (YOKOHATA et al., 1988a) and redescription and multivariate morphometrics of *Moguranema nipponicum* (YAMAGUTI, 1941 (YOKOHATA et al., 1988b).

In this paper, we report additional gastrointestinal helminths of the Japanese moles with new host and locality records.

MATERIALS AND METHODS

Four species of Japanese moles, 2 *Talpa mizura*, 129 *Mogera wogura*, 233 *M. kobeae* and 28 *M. tokudae* were collected from almost all over the Islands of Japan from 1958 to 1988 and stored in 10% formalin, and their stomachs and three parts of intestines i. e., upper, middle and lower portions, were examined. Trematode and cestode specimens were softened and flattened in 40% acetic acid, refixed in 70%

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ethanol and stained with aceto-carmin. Nematodes were refixed in 10% formalin and cleared in lacto-phenol solution.

The present specimens are deposited in the collection of Department of Parasitology, Faculty of Veterinary Medicine, Hokkaido University (No. 1354-1362).

DESCRIPTIONS AND REMARKS

One trematode, 2 cestode and 5 nematode species were obtained from 3 *Mogera* species. All cases found herein are new host and locality records. No helminth was recovered from *Talpa mizura*. In the following descriptions, all measurements are in μ unless otherwise noted. Positive numbers of hosts are in parenthesis.

1) *Echinostoma macrorchis* ANDO and OZAKI, 1923

Host: *Mogera wogura* (6) and *Mogera tokudae* (3)

Habitat: Upper to middle intestine

Locality: Semine, Miyagi Pref.; Bange, Fukushima Pref.; Shibata and Niitu, Niigata Pref.

Date collected: Nov., 4, 1959; Jul., 10, 19, Oct., 11, 12, 1960

The present flukes were identified as *Echinostoma macrorchis* based on the body size, 3.47-5.83mm long, 0.91-1.62mm wide, the number of collar spines, 40 (1 specimen), the weakly lobuled testes and the distribution of vitelline follicles, extending from lateral field near posterior end of acetabulum to posterior extremity. The fluke has been found from Japanese rats and common snipe *Gallinago gallinago* (SKRJABIN, 1956 YAMAGUTI, 1958, 1971).

2) *Hymenolepis diminuta* RUDOLPHI, 1819

Host: *Mogera wogura* (13) and *M. kobae* (13)

Habitat: Lower intestine

Locality: Hanaizumi and Morioka, Iwate Pref.; Semine, Miyagi Pref.; Okuwa, Shiojiri, Souga and Tatsuno, Nagano Pref.; Kiyomi, Gifu Pref.; Saigo, Oki Iss., Shimane Pref.; Zendoji, Fukuoka Pref.; Izuhara, Tsushima Iss., Nagasaki Pref.; Kagoshima and Nishinoomote, Tane Is., Kagoshima Pref.

Date collected: Nov., 17, 19, 22, 1958; Apr., 21, 25-26, Jun., 2, Aug., 6, 12, 19, 21-22, 24, 28, Oct., 25, 28, Nov., 25, Dec., 12, 14, 1959; Jul., 19, 23, 1960

The present almost all cestodes were identified as *Hymenolepis diminuta* with body width, 0.74-1.92mm, rostellum 42.7-60.1 with no hook, spherical suckers, 58.2-104.8 long, 56.3-91.2 wide and eggs spherical with thin shell, 42.7-56.3 by 50.4-62.1. This species is common in intestines of rats and mice (KAMIYA et al., 1968, 1971; TANIGUCHI et al., 1977) and has been reported from large mole, *Mogera robusta* in USSR (MAMAEV and OKHOTINA, 1968b).

3) *Choanotaenia spasskii* MAMAEV and OKHOTINA, 1968

Host: *Mogera wogura* (2) and *M. kobae* (3)

Habitat: Upper to lower intestine

Locality: Souga, Nagano Pref.; Saigo, Oki Iss., Shimane Pref.

Date collected: Aug., 18, Dec., 1, 1959

Some cestodes obtained were identified as *Choanotaenia spasskii* with body width, 1.54–2.67mm, rostellum 67.9–71.8 with long and short hooks, 35.0 and 27.2 long, respectively, spherical suckers, 75.7–104.8 long, 77.6–114.5 wide and eggs global with thick shell, 62.1–67.9 in diameter. This worm has originally been found from *Mogera robusta* in USSR (MAMAEV and OKHOTINA, 1968a).

4) *Parastrongyloides winchesi* MORGAN, 1928

Host: *Mogera wogura* (17), *M. kobae* (7) and *M. tokudae* (1)

Habitat: Upper to lower intestine

Locality: Noheji, Aomori Pref.; Hanaizumi, Maesawa and Morioka, Iwate Pref.;

Semine, Miyagi Pref.; Agematsu, Chiyo, Okuwa and Shiojiri, Nagano Pref.;

Hiroshima, Hiroshima Pref.; Saigo, Oki Iss., Shimane Pref.

Date collected: Jul., 1, 26–27, Aug., 9, 12, 21–22, Oct., 18, 28–29, Nov., 8, Dec., 6, 1959; Jul., 13, 19–23, 1960

Description: Slender worms with smooth cuticle. Buccal cavity cup-shaped. Anterior part of oesophagus narrow, posterior one wide. A few large type females were obtained from only 2 *M. wogura* collected in Semine and Hanaizumi.

Male: Total length 0.83–1.38mm, maximum width 27.2–38.8. Oesophagus 0.31–0.45mm long, 14.6–21.3 wide. Tail bent inwards, to ventral surface with sharp tip. One pair of postanal and one preanal papillae exist. Spicule single, 32.0–45.6 long with cradle-shaped gubernaculum.

Female (normal type): Total length 1.42–2.05mm, maximum width 33.0–42.7. Oesophagus 0.32–0.50mm long, 17.5–19.4 wide. Vulva 0.42–0.77mm from tail end. Eggs 38.8–46.6 long, 19.4–25.2 wide. Number of eggs more than 10.

Female (large type): Total length 3.05–3.28mm, maximum width 58.2–67.9. Oesophagus 0.66–0.72mm long, 38.8–46.6 wide. Vulva 1.14–1.28mm from tail end. Eggs 38.8–48.5 long, 21.3–27.2 wide. Number of eggs more than 10.

Remarks: There are 6 species in genus *Parastrongyloides* (MORGAN, 1928a; MACKERRAS, 1959; PETROW and SAVINOW, 1959; MAWSON, 1960; QUENTIN, 1969). The present specimens were identified as *P. winchesi*, which has been found from the common mole, *Talpa europaea* and shrews, *Sorex* spp. in Europe (MORGAN, 1928a; MAS-COMA and GALLEGRO, 1975) and the short tailed shrew, *Blarina brevicauda* in North America (VAUCHER and DURETTE-DESSET, 1978). PETROW and SAVINOW (1959) have discovered *P. skrjabini* from the large mole, *Mogera robusta* in eastern Asia, but a male of this species has a round tail and no papillae.

MORGAN (1928a) has divided females of this species into 2 types based on their body size and the number of eggs. Worms of the small type have less than some 4–5 eggs and those of the large type have more than 10. All the present mature females belonged to the large type of MORGAN (1928a) according to the large measurements and the large number of eggs. MAS-COMA and GALLEGO (1975) have found only large type females from *Sorex* sp.

5) *Tricholinstowia talpae* (MORGAN, 1928) TRAVASSOS, 1937

Host: *Mogera wogura* (6) and *M. kobae* (4)

Habitat: Upper to lower intestine

Locality: Hanaizumi, Maesawa and Morioka, Iwate Pref.; Okuwa, Shiojiri and Yomikaki, Nagano Pref.; Saigo, Oki Iss., Shimane Pref.; Yatsushiro, Kumamoto Pref.

Date collected: Aug., 4, 6, 21, Oct., 28, Dec., 6, 21, 1959; Jul., 21–23, 1960

Description: Weakly-developed transverse striations exist from spherical cuticular vesicle of anterior end to tail end except bursa. Three and 6 cuticular ridges on right lateral and left ventral side, respectively. Oesophagus muscular, with thin anterior, relatively thick posterior portion.

Male: Total length 0.88–1.50mm, maximum width 40.7–69.8. Nerve ring 0.13–0.15mm from anterior end. Cephalic vesicle 21.3–44.9 long, 13.6–27.2 wide. Oesophagus 0.22–0.28mm long, 17.5–27.2 wide. Bursa supported six pairs of symmetrical rays and long dorsal ray divided into two branches on its tip. Exterodorsal ray long, independent on other rays with no contact to edge of bursa. Medio- and posterolateral rays and ventroventral ones small, divergent from large anteriolateral and lateroventral rays, respectively. Spicules complex, equal, 58.2–75.7 long with splits into each two prongs at 15.5–23.3 from posterior tips.

Female: Total length 1.63–2.10mm, maximum width 46.6–58.2. Nerve ring 0.12–0.17mm from anterior end. Cephalic vesicle 29.1–46.6 long, 19.4–24.3 wide. Oesophagus 0.28–0.31mm long, 21.3–25.2 wide. Tail end tapering with blunt point. Anus and vulva 50.4–64.0 and 83.4–106.7 from tail end, respectively. Eggs elliptical with thin shell, 58.2–69.8 long, 25.2–33.0 wide, 3–5 per one worm.

Remarks: There have been 7 species in the genus *Tricholinstowia* (= *Morganiella* or *Morganostrongylus*; MORGAN, 1928b; SKRJABIN, 1954; FAHMY, 1956; PETROW and SAVINOW, 1959; DURETTE-DESSET and VAUCHER, 1974). All of present worms were clearly identified as *T. talpae*, which had so far been reported only from west Europe (MORGAN, 1928b; FAHMY, 1956; DURETTE-DESSET and VAUCHER, 1974), based on the short and complex spicule, long dorsal ray and relatively simple synlophes. Therefore, the present finding shows the seriated distribution of *T. talpae* from Japan to Europe, at least in any past time. *T. mogera*, found from *M. robusta* in eastern Asia (SKRJABIN, 1954), has not been found in present study, although the host specimens were collected from almost all over Japan. *T. mogera* would have developed after the

separation of Japan and the Eurasian Continent.

6) *Heterakis spumosa* SCHNEIDER, 1866

Host: *Mogera kobae* (1)

Habitat: Stomach

Locality: Izuhara, Tushima Iss., Nagasaki Pref.

Date: collected: Sept., 14, 1983

Only 1 male was obtained and identified as *H. spumosa*, based on body size, 6.55mm long, 0.25mm wide, eight pairs of papillae on posterior extremity and preanal sucker, 0.55mm from tail end. This species usually parasitize in cecums of rodents (BAYLIS, 1928; YAMAGUTI, 1961; MEYERS and KUNTZ, 1964; KAMIYA, et al., 1968, 1971; SHOGAKI et al., 1972; ISHIMOTO, 1974; TANIGUCHI et al., 1977). The present case would be attributable to the feeding on rodent carcasses by the mole i. e., a pseudoparasitism, as shown by YOKOHATA et al. (1988a) for thelastomatids.

7) *Trichuris* sp.

Host: *Mogera kobae* (1)

Habitat: Stomach

Locality: Kawashima, Tokushima Pref.

Date collected: Mar., 23, 1962

Only 2 fragmented gravid females of genus *Trichuris* were obtained but it was not possible to identify the species of them. Body width 56.3, 56.3. Eggs 58.2, 56.3 long, 25.2, 25.2 wide. Three species of this genus have been reported from Insectivora: *T. busuluk* from *Sorex araneus* in Middle Volga, *T. mettami* from *Atelelix* or *Aethechinus* sp. in Uganda (POLOGENTSEV, 1935; YAMAGUTI, 1961; SKRJABIN et al., 1970) and *T. neomi* from *Neomys fodiens* (LYUBARSKAYA, 1962).

8) *Capillaria (Aonchotheca) soricis* ASAKAWA et al., 1988

Host: *Mogera kobae* (2) and *M. tokudae* (4)

Habitat: Stomach and upper to middle intestine

Locality: Ryozu, Sado Is. and Shibata, Niigata Pref.; Shiojiri, Nagano Pref., Hiroshima, Hiroshima Pref.; Kawashima, Tokushima Pref.

Date collected: Jul., 1, Nov., 24., Dec., 14, 1959; Jul., 11-12, Oct., 11, 1960

Description: Body filiform with a bacillary band on right lateral side. Stichocyte rosary-shaped. One stichocyte lighter in color alternating with 1 darker stichocyte. *Male*: Total length 4.65-6.28mm, maximum width 50.4-71.8. Nerve ring 0.08-0.13mm from anterior end. Total length of oesophagus 2.06-2.70mm. Anterior part of oesophagus 0.19-0.29mm long. Part of oesophagus with stichosome 1.77-2.51mm long. Number of stichocytes 26-30. Ratio of total length of body to total one of oesophagus, 2.26-2.28. Spicule 0.19-0.43 long.

Female: Total length 11.4mm (1 specimen), maximum width 67.9–100.9. Nerve ring and vulva, 97.0–128.0 and 2.42 (1 specimen) mm from anterior end, respectively. Total length of oesophagus 2.46–3.02mm. Anterior part of oesophagus 0.24–0.34mm long. Part of oesophagus with stichosome 0.21–0.34mm long. Ratio of total length of body to total one of oesophagus 4.63. Eggs 54.3–66.0 long, 31.0–34.9 wide. Remarks: There had been 42 species in genus or subgenus *Aonchotheca* (MORAVEC, 1982). Recently, however, ASAKAWA et al. (1988) have found two new species, *Capillaria* (A.) *soricis* and *C. (A.) crociduri* from Japanese shrews, *Sorex shinto saevus*, *S. unguiculatus* and *S. minutus* and *Crocidura dsinezumi dsinezumi*, respectively. The present worms were identified as *C. (A.) soricis* based on the number of the bacillary band and the shape of the male tail end.

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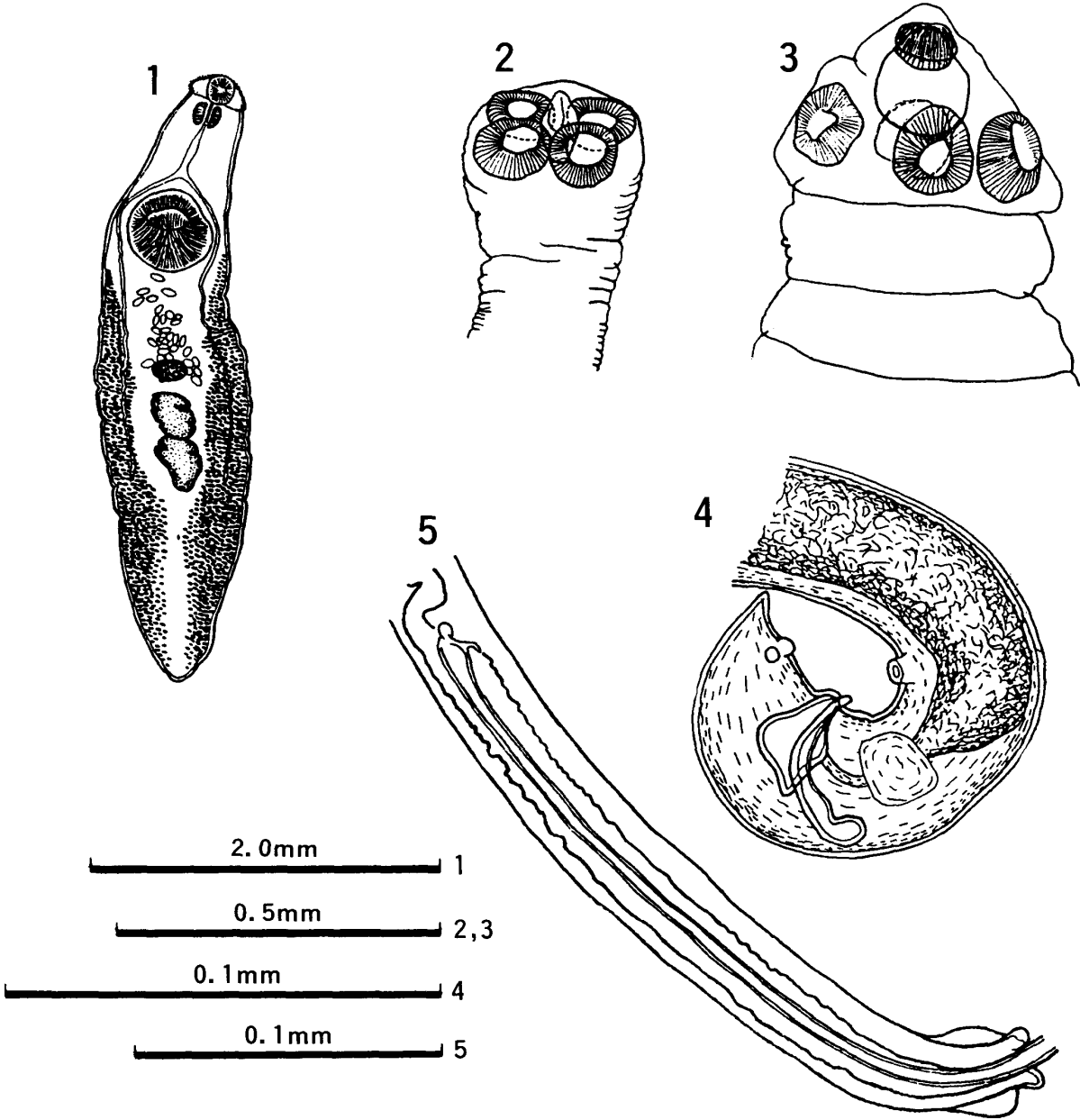
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Explanations of Plate I

1. *Echinostoma macrorchis*, General view
2. *Hymenolepis diminuta*, Anterior end
3. *Choanotaenia spasskii*, Anterior end
4. *Parastrongyloides winchesi*, Male tail end
5. *Capillaria soricis*, Male tail end



Explanations of Plate II

1-3. *Tricholinstowia talpae*

1. Male, Tail end
2. Female, General view
3. Cross section of mid-body of female

