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SOME RARE HELMINTHS FROM STRAY DOGS OF SAPPORO

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Three hundred and thirty-nine stray dogs, 178 males and 161 females, were investigated in Sapporo, Hokkaido, Japan, and 14 helminth species were recognized. From these helminths, 6 rare species, *Phocitrema fusiforme* GOTO et OZAKI, 1930, *Cryptocotyle lingua* (CREPLIN, 1825), *Metagonimus yokogawai takahashii* SUZUKI, 1930, *Corynosoma strumosum* (RUDOLPHI, 1802), *C. villosum* VAN CLEAVE, 1953, and *Corynosoma* sp. are discussed from the taxonomical and distributional points of view.

INTRODUCTION

A large number of stray dogs captured in Sapporo, Hokkaido, Japan, were investigated and 14 helminth species were recognized. Among those species, 6 rare species are dealt with in this paper; although general results will be considered elsewhere.

MATERIALS AND METHODS

One hundred and seventy-eight male and 161 female stray dogs captured in Sapporo were autopsied during the year, 1973. All the visceral organs and tissues were carefully examined macro- and microscopically. The preparation of helminths were made by routine methods. The specimens — with the exception of the nematode species — were stained with Delafield's hematoxylin. The helminths obtained were composed of 14 species: 5 nematodes, 4 trematodes, 2 cestodes, and 3 acanthocephalans, as shown in table 1. Six of them are described and discussed below.

RESULTS AND DISCUSSIONS

A Trematoda

1 *Phocitrema fusiforme* GOTO et OZAKI, 1930

Two mature specimens were obtained from the small intestines of 2 cases.

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TABLE 1 Incidence of helminth parasites recovered in stray dogs from Sapporo

SPECIES OF HELMINTHS	INCIDENCE
<i>Toxocara canis</i> (WERNER, 1782)	19.5%
<i>Toxascaris leonina</i> (LINSTOW, 1902)	2.7
<i>Ancylostoma caninum</i> (ERCOLANI, 1859)	15.6
<i>Trichuris vulpis</i> (FROELICH, 1789)	43.7
<i>Dirofilaria immitis</i> (LEIDY, 1856)	26.8
<i>Plagiorchis muris</i> TANABE, 1922	6.8
<i>Metagonimus yokogawai takahashii</i> SUZUKI, 1930	1.2
<i>Phocitrema fusiforme</i> GOTO et OZAKI, 1930	0.6
<i>Cryptocotyle lingua</i> (CREPLIN, 1825)	0.3
<i>Dipylidium caninum</i> (LINNAEUS, 1758)	1.8
<i>Diphyllobothrium</i> sp.	0.3
<i>Corynosoma strumosum</i> (RUDOLPHI, 1802)	0.9
<i>Corynosoma villosum</i> VAN CLEAVE, 1953	0.9
<i>Corynosoma</i> sp.	0.3

One of them was broken and unsuitable for study.

Body fusiform, 1.56 mm long, the maximum width 0.403 mm. Oral sucker subterminal, elongate, funnel-shaped, 0.088 mm long, and 0.036 mm wide. Anterior margin of acetabulum at 0.689 mm from anterior end, size 0.095×0.095 mm. Prepharynx 0.130 mm long. Pharynx short, cylindrical, 0.072 mm long, and 0.029 mm wide. Esophagus, 0.173 mm long, ending just midway between pharynx and acetabulum. Ceca terminate in front of testes. Testes somewhat reniform, at posterior region, 0.157~0.166×0.082~0.091 mm in size. Genital pore in median line, immediately in front of acetabulum. Vas deferens, a narrow tube, surrounded by glandular cells, proceeding forwards from elongated seminal vesicle on left side of acetabulum, and forming a bulbous pars prostatica directly in front of acetabulum. Pars prostatica surrounded by very conspicuous gland cells. Ovary, 0.157×0.121 mm in size, on right side of median line, in front of right testis. Receptaculum seminis globular, 0.134×0.144 mm in size, obliquely anterior to ovary. Uterine coils between testes and acetabulum. Vitellaria consisting of 5 groups of small follicles. Uterine eggs, light yellow, with a distinct operculum, 0.025~0.030×0.013~0.015 mm in size.

This species is an intestinal parasite mainly found in marine mammals; *Enhydra lutris* LINNAEUS, *Phoca vitulina richardi* (GRAY), *Callorhinus ursinus* LINNAEUS, etc. GOTO & OZAKI (1930) described this species from *Phoca hispida* SCHREBER for the first time. In Hokkaido YOSHIMURA (1965) reported this species from *Eumetopias jubata* SCHREBER and stray dogs, although incidence of this

trematode in dogs is very low. He supposed two possibilities of infestation of dogs by this trematode: 1) Stray dogs ingest some intermediate host (presumably fish), and 2) accidental infection from ingesting the guts of the marine mammals which are the natural final host of *P. fusiforme*. In Sapporo dogs have few opportunities to eat the guts of marine mammals; therefore, we consider YOSHIMURA's former supposition (ingestion of some second intermediate host) as the probable one.

2 *Cryptocotyle lingua* (CREPLIN, 1825)

A mature specimen was obtained from the small intestine of a dog.

Body tongue-shaped, 2.028 mm long, maximal width 0.455 mm. Dermal gland cells well developed at anterior portion. Oral sucker subterminal, 0.088×0.085 mm in size. Prepharynx short, 0.020 mm long. Pharynx subglobular, 0.082×0.078 mm in size. Esophagus 0.082 mm long. Acetabulum small, in front of genital sucker, embedded in body parenchyma, 0.065 mm in diameter. Testes triangular, deeply incised, $0.196 \sim 0.199 \times 0.368 \sim 0.398$ mm in size. Details of ovary obscure. Seminal vesicle extremely elongated with 2 coils, in median field between acetabulum and testes. Genital sucker near equatorial, in median line, contacted with posterior margin of acetabulum, 0.137 mm in diameter. Uterus with 3 coils, between genital sucker and anterior testis. Uterine eggs elliptical, thick-shelled, light yellow, $0.038 \sim 0.043 \times 0.018 \sim 0.023$ mm in size. Vitellaria consist of small follicles, extending along lateral edges of posterior three fifths of body.

This trematode was reported in Japan by YAMAGUTI (1939), YOSHIMURA (1965) and KITAMURA & MACHIDA (1973) from the herring gull, *Larus argentatus vegae* PALMÉN, at Fukui Prefecture, from stray dogs on Rebun Island, northern Hokkaido, and from the red fox, *Vulpes vulpes schrencki* KISHIDA, at Tokoro and Yambetsu, near Abashiri City, eastern Hokkaido, respectively.

The stray dog may be infected by ingestion of the second intermediate host, fishes of the genera *Gobius*, *Osmerus*, etc., in which the larval trematode encysts in the skin.

The incision of testes of this specimen is similar to those of LINTON (1915) and KITAMURA & MACHIDA (1973).

3 *Metagonimus yokogawai takahashii* SUZUKI, 1930

Four dogs positive for this trematode are 1, 1.5, 2 and 5 years old, respectively. This is the first recorded species in Hokkaido. Number of worms in each dog were 171, 896, 7 and 113, respectively. Some pre-adult worms were found.

Generally speaking, globular testes lying obliquely near posterior end of body. Testes in some specimens arranged in a row at posterior part of body.

TABLE 2 *Measurements of Metagonimus yokogawai, M. takahashii and M. yokogawai takahashii (in mm)*

PARTS MEASURED	AUTHORS (HOSTS)		
	YOKOGAWA, 1913* ¹ (<i>Mus musculus</i>)	TAKAHASHI ¹⁴), 1929* ² (<i>Canis familiaris</i>)	PRESENT AUTHORS* ³ (<i>Canis familiaris</i>)
Length of body	1.125 ~1.650	0.840~1.480	1.30 ~1.53
Width of body	0.425 ~0.730	0.420~0.720	0.43 ~0.65
Diameter of oral sucker	0.077 ~0.086	0.070~0.091	0.069 ~0.091
Size of pharynx	0.0504~0.0528	0.042~0.063	0.046 ~0.065
	× 0.045 ~0.052	× 0.035~0.056	× 0.042 ~0.052
Size of testes	0.210 ~0.280	0.175~0.259	0.235 ~0.293
		× 0.154~0.245	× 0.202 ~0.290
Size of acetabulum	0.120 ~0.1368	0.091~0.175	0.140 ~0.196
	× 0.0848~0.108	× 0.070~0.105	× 0.069 ~0.104
Size of ovary	0.1200~0.132	0.091~0.175	0.137 ~0.163
		× 0.084~0.140	× 0.098 ~0.121
Size of eggs	0.0275~0.03	0.030~0.036	0.030 ~0.035
	× 0.0155~0.0168	× 0.018~0.023	× 0.0175~0.0225

*¹: *Metagonimus yokogawai*

*²: *M. takahashii*

*³: *M. yokogawai takahashii*

Uterus occupying nearly all available space of hind body from acetabulum to testes, extending to posterior extremity between both testis. Vitellaria distinct at lateral side of body, between level of ovary and posterior extremity, not extending to anterior part from ovary. Eggs light yellowish, generally stocky in shape with a distinct operculum. The comparison of dimensions among the present specimens, *M. yokogawai* (after YOKOGAWA; 1913) and *M. takahashii* (after TAKAHASHI¹⁴); 1929) are summarized in table 2. The measurements of the present specimens correspond well with those of *M. yokogawai* and *M. takahashii*, though the size of the eggs of the present specimens is similar to that of *M. takahashii*.

The differentiations between *M. yokogawai* and *M. takahashii* have been discussed for many years, and now the latter is commonly considered as the subspecies of the former; *M. yokogawai takahashii* SUZUKI, 1930. But some feel that these two species are identical and that the latter is the large-egged form of the former. As yet, there is no definite answer to this question. Recently, SAITO (1972, 1973) suggested that *M. takahashii* is a different species

from *M. yokogawai* by making morphological comparisons of parapleurolophocercous cercariae and metacercariae and by examining experimental infections of cercariae to the second intermediate hosts. Furthermore, SAITO & TSUJI (1973) obtained the same result by immunoelectrophoretic comparisons of the rediae-cercariae of the above-mentioned two *Metagonimus* species. The present species found in dogs of Sapporo, however, should be *Metagonimus yokogawai takahashii* SUZUKI, 1930, because of their having large size eggs, although the description of the present specimens is based only on adult worms.

There are many reports recording *Metagonimus* spp. in dogs, such as investigations by TAKAHASHI¹³⁾ (1929) in Okayama Prefecture, OKABE & KOGA (1952) in Saga Prefecture, ITO et al. (1958) in Shizuoka Prefecture, etc. Comparing the present results with those of the above-mentioned authors, the infection rate of *Metagonimus* in dogs of Sapporo is lower than those of other districts of Japan.

B Acanthocephala

4 *Corynosoma strumosum* (RUDOLPHI, 1802)

An immature male and 2 immature female specimens were obtained from the small intestines of three dogs. The proboscis of one female worm could not be projected. Two specimens were examined, one each from a male and female; measurements were similar in both.

Body bent ventrally, with broadened anterior part at approximately one-third of body length. Posterior part cylindrical, more attenuated than anterior, relatively long. Body, 4.0 mm and 3.4 mm long by 0.94 mm and 0.72 mm in maximum width at anterior part, respectively. Trunk spines 0.020~0.046 mm long at anterior part, extending along ventral surface nearly to middle of posterior attenuated part, appearing again as genital spines around posterior extremity of the male. Genital spines about 0.020 mm long. Proboscis ventrally subterminal, 0.559 mm and 0.572 mm in length, 0.248 mm and 0.250 mm in maximum width, respectively. Proboscis cylindrical, with slight broadening between median and posterior thirds of its length. Proboscis hooks in 18 longitudinal rows, 10 hooks in each row. Anterior 5 or 6 hooks 0.052~0.062 mm long, having larger and longer roots; Posterior 4 rootless. Most posterior hooks about 0.033~0.036 mm long.

The first description of *Corynosoma* sp. from dogs in Japan appeared in KAMIYA et al. (1973). In the review of VAN CLEAVE (1953), *Corynosoma semerme* (FORSELL, 1904) and *C. strumosum* (RUDOLPHI, 1802) from the dog were discovered as an accidental infection in North America. *C. strumosum* is widely distributed in the northern hemisphere. ZHUKOV (1960) recorded 24 fish intermediate hosts of larval *C. strumosum* from Putjatin and Shikotan Island, and STRELKOW (1960) reported 15 species from the region of Ust-Kamchatsk. On the other hand,

in Hokkaido, ORIHARA obtained this species from *Eumetopias jubata* SCHREBER captured near Rebun Island and Otaru City (unpublished data). Furthermore, MACHIDA et al. discovered the larvae of *C. strumosum* in sea fishes, *Verasper moseri* JORDAN et GILBERT and *Hypomesus japonicus* (BREVOORT), captured at Hidaka district, Hokkaido (unpublished data). Thus, it is supposed that the dog is infected with this acanthocephalan by ingesting the intermediate hosts, such as the above-mentioned sea fishes. At any rate, this is the first description of *Corynosoma strumosum* (RUDOLPHI, 1802) found in dogs of Japan.

5 *Corynosoma villosum* VAN CLEAVE, 1953

Four specimens, 3 males and a sub-matured female, were collected from the small intestines of 3 dogs. This is the first record of *Corynosoma villosum* VAN CLEAVE, 1953, found in dogs of Japan.

Male: Body 4.08~4.72 mm long, 1.56~1.66 mm in maximum width at anterior part. Anterior body broadened and armed with trunk spines; posterior attenuated body 0.741~0.780 mm wide. Proboscis cylindrical, 0.561~0.668 mm long, 0.271~0.329 mm wide, armed with 22~24 longitudinal rows, 12 hooks in each row. Largest proboscis hook, 0.062~0.069 mm long by 0.020~0.026 mm wide. Trunk spines extending to end of broadened part, more conspicuous on ventral surface than dorsal. Genital spines stouter than trunk spines, 0.049~0.052 mm long by 0.013~0.016 mm wide.

Female: Body 3.97 mm long, 1.64 mm in maximum width. Proboscis 0.629 mm long, 0.293 mm wide. Trunk spines in anterior part as those in males. Largest hook of proboscis, 0.065 mm long by 0.020 mm wide. Genital spines 0.029 mm long by 0.007 mm wide, more slender and shorter than those of the males. Immature eggs without egg shell 0.042~0.046×0.013 mm in size.

This species was described by VAN CLEAVE (1953) from *Eumetopias jubata* SCHREBER captured near St. Lawrence Island for the first time. The present specimens are generally smaller than VAN CLEAVE's specimens, and most of the worms collected are at the pre-adult stage, except one female with small eggs having no egg shell formation. ORIHARA obtained this species from the same host as VAN CLEAVE (1953), which was captured near Rebun Island and Otaru City (unpublished data). One immature *Corynosoma* sp. in KAMIYA et al. (1973) is considered to be this species because of the arrangement of proboscis hooks, etc. The route of infection in dogs is unclear but it is supposed that these stray dogs ingest some intermediate hosts, probably marine fishes. Further experimental and epidemiological studies about *C. villosum* are necessary.

6 *Corynosoma* sp.

An immature female was collected from a dog, and the body was somewhat damaged.

Anterior body broadened. Posterior body cylindrical and short, not so markedly attenuated, comparing with anterior body. Body 3.82 mm long, 1.40 mm in maximum width at anterior part. Proboscis 0.585 mm long, 0.284 mm wide, armed with 16 longitudinal rows, 9 hooks in each row. Anterior 6 hooks larger than posterior 3 hooks. Largest 6th hook strongly curved, 0.065 mm long by 0.029 mm wide. Most posterior hooks 0.036 mm long by 0.013 mm wide. Neck 0.455 mm long. Trunk spines only on broadened anterior part, more conspicuous on ventral surface than dorsal. Biggest trunk spines about 0.029 mm long. Arrangement of trunk spines with papillae-like cuticular elevation shows squamous appearance. A small number of small genital spines recognizable.

The arrangement of proboscis hooks of the present specimen resembles that of *C. cameroni* VAN CLEAVE, 1953, from the white whale, *Delphinapterus leucas* (PALLAS), at St. Lawrence Island. The present description is based on only one immature worm. Thus, it is necessary to collect more specimens in good condition to decide the name of the species. The present *Corynosoma* sp., however, is apparently different from the two *Corynosoma* species mentioned above.

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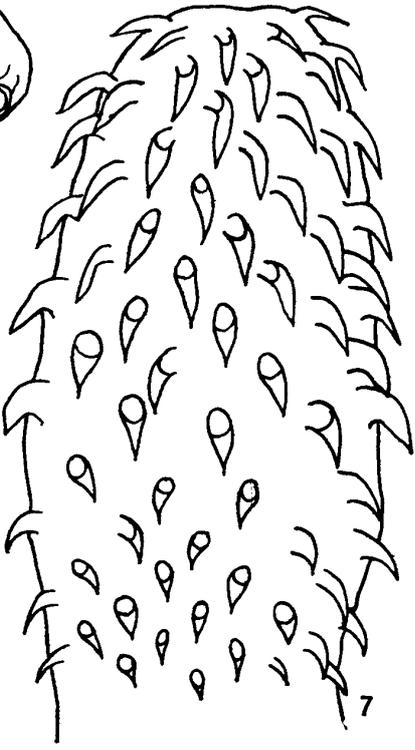
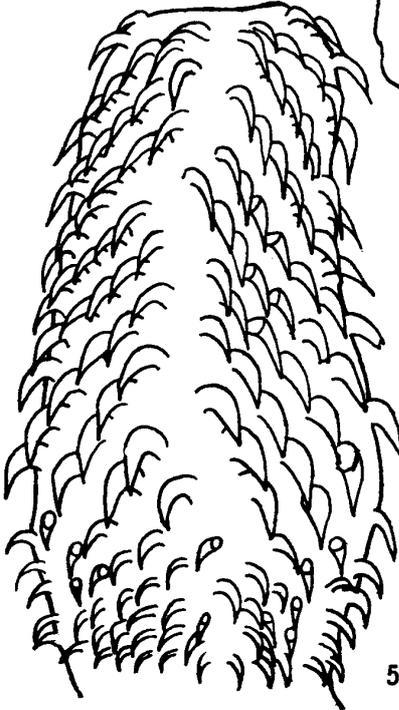
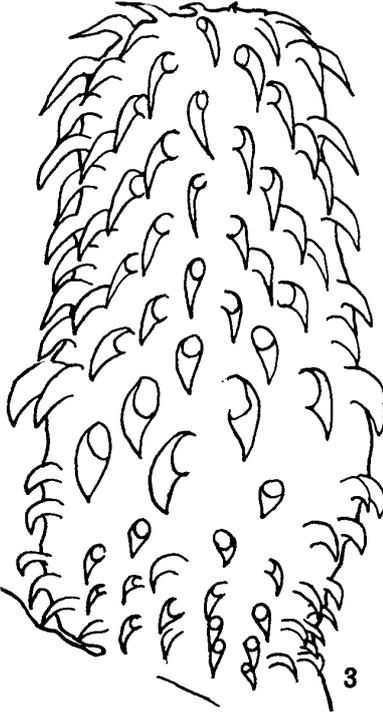
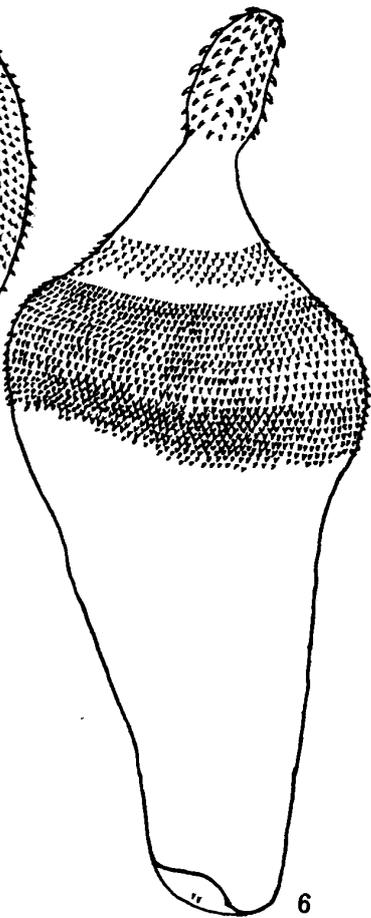
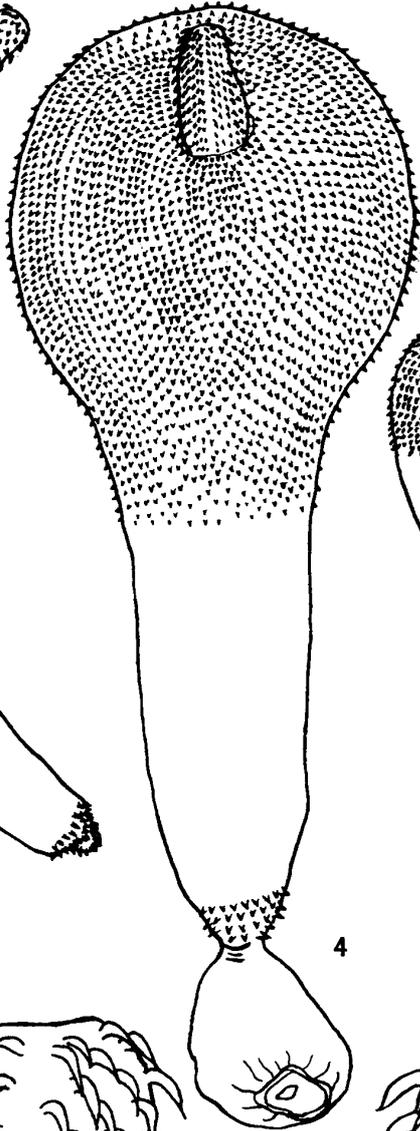
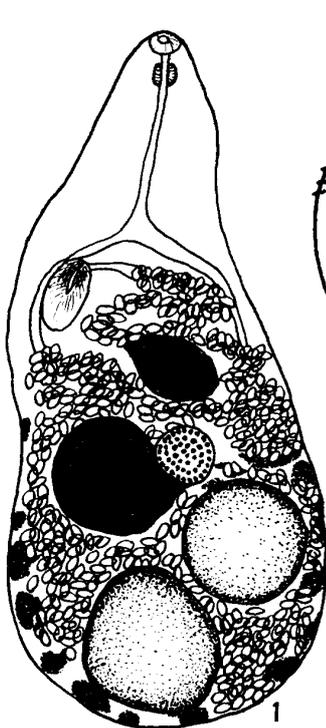
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EXPLANATION OF PLATES

PLATE I

- Fig. 1 *Metagonimus yokogawai takahashii* SUZUKI, 1930
Almost all the body spines were lost, since the specimens were collected from refrigerated materials.
- Figs. 2 & 3 *Corynosoma strumosum* (RUDOLPHI, 1802)
Fig. 2 Male, lateral view
Fig. 3 Proboscis
- Figs. 4 & 5 *Corynosoma villosum* VAN CLEAVE, 1953
Fig. 4 Male, ventral view
Fig. 5 Proboscis
- Figs. 6 & 7 *Corynosoma* sp.
Fig. 6 Female, ventral view
Fig. 7 Proboscis



0.5mm : 1
1 mm : 2, 4, 6
0.2mm : 3, 5, 7

PLATE II

Fig. 8 *Phocitrema fusiforme* GOTO et OZAKI, 1930

Fig. 9 *Cryptocotyle lingua* (CREPLIN, 1825)

Figs. 10 & 11 *C. strumosum*

Fig. 10 Trunk spines

Fig. 11 Genital spines of the male

Figs. 12~15 *C. villosum*

Fig. 12 Trunk spines

Fig. 13 Genital spines of the male

Fig. 14 Genital spines of the female

Fig. 15 Immature eggs

Fig. 16 Trunk spines of *Corynosoma* sp.

Fig. 17 Eggs of *M. yokogawai takahashii*

