

## Parasitic nematodes of anseriform birds in Hokkaido, Japan

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### Summary

Parasitic nematodes of 176 individuals of 15 bird species belonging to the order Anseriformes from Hokkaido, Japan were investigated. A total of 12 nematode species were obtained, namely *Amidostomum anseris*, *A. acutum*, *Epo-midiostomum crami*, *E. uncinatum*, *Tetrameres fissispina*, *Eucoleus contortus*, *Capillaria anatis*, *Baruscapillaria mergi*, *Contracaecum rudolphii*, *Echinuria uncinata*, *Streptocara crassicauda* and *Sarconema eurycerca*. Among these, *E. uncinatum* (hosts: *Anas platyrhynchos*, *A. poecilorhyncha*, *A. acuta*, *Mel. nigra*) and *E. crami* (hosts: *Anser albifrons*, *Ans. fabalis*, *C. cygnus*, *C. columbianus*) were the first geographical records in Japan. There appeared to be strict host-parasite relationships between the wild swans/geese and *A. anseris*/*E. crami*, and between wild duck species and *A. acutum*/*E. uncinatum*, respectively.

Key words: Anseriformes; parasitic nematodes; first geographical records; Japan

### Introduction

The most northern part of Japan, Hokkaido, is situated on the East Asian Flyway and is an important transit area for migratory waterfowls belonging to the order Anseriformes during stopovers on migration and during the main winter period (Miyabayashi, 1994). Because of the annually shrinking habitats for waterfowls in Hokkaido, there is a greatly increased risk of infectious disease outbreak, such as fatal nematodiasis, and death en mass (Ryšavý *et al.* 1982; Friend & Franson, 1999; Asakawa *et al.*, 2002; Kavetska, 2006). A preliminary survey of parasitic nematodes in waterfowls was carried out by Nakamura and Asakawa (2001) using materials derived from 30 individuals and the central part of the island. Between 2003 and 2006, we carried out a detailed survey over all of Hokkaido and obtained much new data. Among the nematode spe-

cies obtained, redescrptions of 4 species belonging to the genera *Amidostomum* Railliet and Henry, 1909 and *Epo-midiostomum* Skrjabin, 1915, regarded as highly pathogenic agents in waterfowls, (Friend & Franson, 1999) were achieved as a base for future studies.

### Materials and methods

A total of 176 carcasses of 15 anseriform species, *Anser albifrons* (Scopoli, 1769) (n = 9), *A. fabalis* (Latham, 1787) (n = 2), *Cygnus cygnus* (Linnaeus, 1758) (n = 45), *C. columbianus* (Ord, 1815) (n = 24), *Aix galericulata* (Linnaeus, 1758) (n = 2), *Anas platyrhynchos* (Linnaeus, 1758) (n = 24), *A. poecilorhyncha* (Forster, 1781) (n = 18), *A. crecca* (Linnaeus, 1758) (n = 21), *A. penelope* (Linnaeus, 1758) (n = 4), *A. acuta* (Linnaeus, 1758) (n = 6), *Aythya fuligula* (Linnaeus, 1758) (n = 4), *A. marila* (Linnaeus, 1761) (n = 8), *Melanitta nigra* (Linnaeus, 1758) (n = 5), *Bucephala clangula* (Linnaeus, 1758) (n = 3) and *Mergus merganser* (Linnaeus, 1758) (n = 1) were collected between July 2003 and November 2006 in Hokkaido, Japan. The carcasses came from local governmental or private rescue centers, zoological gardens and animal hospitals. Helminthological examinations were performed in the Wild Animal Medical Center (WAMC) of Rakuno Gakuen University, Japan. All visceral organs of the carcasses were examined under a binocular microscope, and about 5 g of pectoral muscle tissue of each individual was examined for *Trichinella* larvae with thick glass plates. Parasitic nematodes were preserved and sorted in fixed 70 % ethanol solution and cleared in lactophenol solution for morphological examination. Morphological and metrical data based on 10 individuals of each trichostrongylid species were obtained with a camera lucida (OLYMPUS Model BH-2DA). All nematode specimens are preserved in the WAMC or the Meguro Parasitological Museum, Tokyo, Japan.

Table 1: Parasitic nematodes obtained from Anseriformes

Parasitic nematodes	Site	Host	Prevalence		Intensity		
			Infected	%	mean	SD	range
Order Enoplida							
Superfamily Trichrioidea							
Family Capillariidae							
<i>Eucoleus contortus</i>	oe	<i>Cygnus cygnus</i>	2	4.45	3	2.83	1 – 5
	oe	<i>C. columbianus</i>	6	25	3.67	3.72	1 – 11
	oe	<i>Anas platyrhynchos</i>	4	16.67	16.75	25.75	1 – 55
	oe	<i>A. poecilorhyncha</i>	3	16.67	2.33	1.53	1 – 4
	oe	<i>A. crecca</i>	1	4.76	5	-	5
	oe	<i>Aythya marila</i>	2	25	1.5	0.71	1 – 2
<i>Capillaria anatis</i>	si	<i>C. columbianus</i>	2	8.33	3	-	3
	si	<i>A. platyrhynchos</i>	2	8.33	2.5	0.71	2 – 3
	si	<i>A. poecilorhyncha</i>	7	38.89	1.57	0.79	1 – 3
<i>Baruscapillaria mergi</i>	si	<i>C. cygnus</i>	4	8.89	8	7.07	3 – 18
	si	<i>Ay. fuligula</i>	1	25	1	-	1
	si	<i>Ay. marila</i>	3	37.5	2.67	2.08	1 – 5
	si	<i>Mergus merganser</i>	1	100	1	-	1
Order Strongylida							
Superfamily Strongyloidea							
Family Amidostomatidae							
<i>Amidostomum anseris</i>	gi	<i>Anser albifrons</i>	7	77.78	16	21.5	1 – 60
	gi	<i>Ans. fabalis</i>	2	100	13	14.14	3 – 23
	gi	<i>C. cygnus</i>	26	57.78	9.23	16.1	1 – 83
	gi	<i>C. columbianus</i>	19	79.17	17.25	27.93	1 – 125
<i>A. acutum</i>	gi	<i>Aix gareliculata</i>	1	50	1	-	2
	gi	<i>A. platyrhynchos</i>	14	58.33	11.57	11.06	2 – 40
	gi	<i>A. poecilorhyncha</i>	10	55.56	4.7	5.31	1 – 17
	gi	<i>A. crecca</i>	7	33.33	3.29	3.25	1 – 10
	gi	<i>A. penelope</i>	3	75	1.33	0.58	1 – 2
	gi	<i>Ay. fuligula</i>	1	25	5	-	5
	gi	<i>Ay. marila</i>	4	50	18.25	24.68	3 – 55
	gi	<i>Melanitta nigra</i>	4	80	7.35	3.5	3 – 11
	gi	<i>Bucephala clangula</i>	1	33.3	1	-	1
Family Trichostrongylidae							
<i>Epomidiostomum crami</i>	gi	<i>Ans. albifrons</i>	6	66.67	4.83	7.5	1 – 20
	gi	<i>Ans. fabalis</i>	2	100	3	-	3
	gi	<i>C. cygnus</i>	6	13.33	2.83	2.79	1 – 8
	gi	<i>C. columbianus</i>	4	16.67	3.5	3	1 – 7
<i>E. uncinatum</i>	gi	<i>A. platyrhynchos</i>	4	16.67	7.75	9.54	2 – 22
	gi	<i>A. poecilorhyncha</i>	2	11.11	2	1.41	1 – 3
	gi	<i>A. acuta</i>	1	20	1	-	1
	gi	<i>Mel. nigra</i>	1	20	2	-	2
Order Ascaridida							
Superfamily Ascaridoidea							
Family Anisakidae							
<i>Contraecum rudolphii</i>	gi	<i>M. merganser</i>	1	100	3	-	3

Superfamily Acuarioidea								
Family Acuariidae								
	<i>Echinuria uncinata</i>	pr	<i>C. columbianus</i>	1	4.17	1	-	1
	<i>Streptocara crassicauda</i>	gi	<i>C. cygnus</i>	1	2.22	1	-	1
		gi	<i>C. columbianus</i>	1	4.17	2	-	2
		gi	<i>A. platyrhynchos</i>	1	4.17	3	-	3
Order Spirurida								
Superfamily Habronematoidea								
Family Tetrameridae								
	<i>Tetrameres fissispina</i>	pr	<i>C. cygnus</i>	10	26.67	13.4	23.96	1-79
		pr	<i>C. columbianus</i>	17	70.83	97.24	158.93	1-600
		pr	<i>Aix gareliculata</i>	1	50	-	-	1
		pr	<i>A. platyrhynchos</i>	9	37.5	9.56	11.26	1-36
		pr	<i>A. poecilorhyncha</i>	4	22.22	2.75	2.87	1-7
		pr	<i>A. crecca</i>	2	9.52	1.5	0.71	1-2
		pr	<i>A. acuta</i>	1	20	1	-	1
		pr	<i>Ay. fuligula</i>	2	50	7.5	3.54	5-10
		pr	<i>Ay. marila</i>	5	62.5	23.6	21.66	5-60
		pr	<i>B. clangula</i>	2	66.67	5.5	3.54	3-8
Superfamily Filarioidea								
Family Onchocercidae								
	<i>Sarconema eurycerca</i>	hm	<i>C. columbianus</i>	2	8.33	5.5	9.45	2-9

\*Abbreviation of site: oe; oesophages, pr; proventriculus, gi; gizzard, si; small intestine, hm; heart muscle

## Results and Discussion

A total of 12 nematode species, namely *Amidostomum anseris* (Zeder, 1800), *A. acutum* (Lundahl, 1848), *Epomidiostomum crami* (Wetzel, 1931), *E. uncinatum* (Lundahl, 1848), *Tetrameres fissispina* (Diesing, 1861), *Eucoleus contortus* (Creplin, 1839), *Capillaria anatis* (Schränk, 1790), *Baruscapillaria mergi* (Madsen, 1945), *Contraecaeum rudolphii* (Hartwich, 1964), *Echinuria uncinata* (Rudolphi, 1819), *Streptocara crassicauda* (Creplin, 1829) and *Sarconema eurycerca* (Wehr, 1939) were obtained from the esophagus, intestines and heart muscles of 134 individual avians (Table 1), but no *Trichinella* larvae were observed in the present survey. Among them, the nematodes of the Amidostomatidae Travassos, 1919, subfamilies Amidostomatinae and Epomidiostomatinae, were the most commonly encountered. All avian species examined excluding *M. merganser* were hosts for *Amidostomum* and/or *Epomidiostomum*. Two trichostrongylid species belonging to each genus, namely *A. anseris*, *A. acutum*, *E. crami* and *E. uncinatum*, were obtained. These species seem to be highly pathogenic agents. Although there have been excellent taxonomic studies of the species in Europe and Russia (Skrjabin *et al.*, 1951; McDonald, 1974; Ryšavý *et al.*, 1982; Barus *et al.*, 1978; Petrova, 1987, 1989; Lomakin, 1991, 1993; Kavetska, 2006), there have not been sufficiently full morphological descriptions of these species in Asia including Japan. Hence, figures of the species (Figs 1 – 3) are given. Furthermore, there appeared to be strict host-parasite relationships between

the wild swans/geese and *A. anseris*/*E. crami*, and between wild duck species and *A. acutum*/*E. uncinatum*, respectively. Since both *Amidostomum* and *Epomidiostomum* are regarded as highly pathogenic agents for Anseriformes (Ryšavý *et al.*, 1982; Friend & Franson 1999; Kavetska, 2006), more detailed and systematic epidemiological sur-

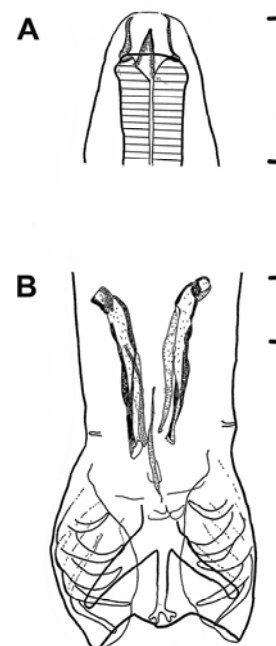


Fig. 1. *Amidostomum acutum*: 1A-Anterior extremity of male, lateral view; 1B-Bursa and spicules, ventral view (scale=0.05 mm)

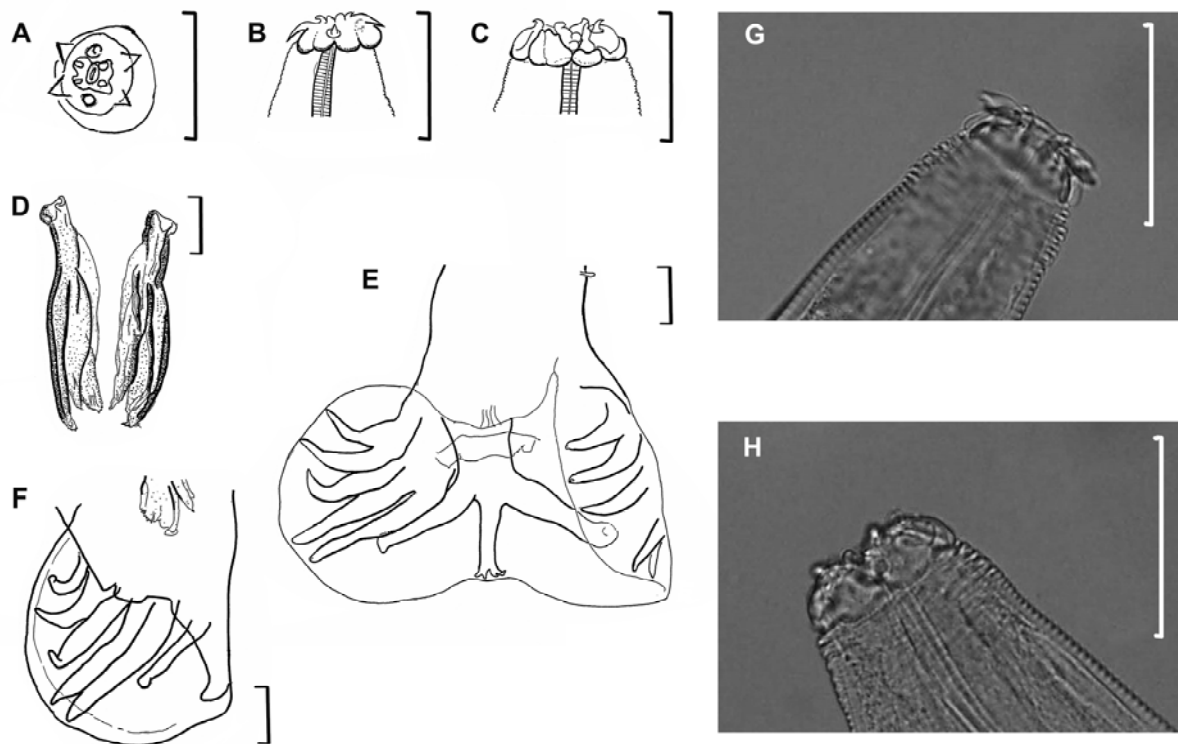


Fig. 2. A – E *Epomidiostomum crami*: A - anterior extremity of male, apical view, B - ibid, lateral view of normal type; C - ibid, abnormal type; D - spicules, ventral view; E - bursa, ventral view; F - bursa, lateral view, G - anterior extremity; lateral view of normal type, H - ibid; lateral view of abnormal type (scale=0.05mm)

veys are needed in the future. Therefore, the newly presented data, including morphology and host-parasite relationships, will be useful for surveys at sites on the East Asian Flyway and in the transit areas for the Anseriformes. Several nematode species in 5 genera have been reported in Anseriformes, including captive geese and ducks, from other islands in Japan, namely, Honshu and Kyushu (Yamaguti, 1941; Uchida *et al.*, 1991; Sakamoto *et al.*, 1995;

Nakano *et al.*, 1996; Shimizu *et al.*, 2000; Nakamura *et al.*, 2003). These are *Baruscapillaria* Moravec, 1982 (although Nakamura and Asakawa (2001) recorded *Pseudocapillaria mergi*, Baruš and Sergeeva (1990) transferred this species in the genus *Baruscapillaria*), *Contracaecum*, *Tetrameres* (Creplin, 1846), *Physaloptera* (Rudolphi, 1819) and *Amidostomum*, all reported from Hokkaido (Nakamura and Asakawa, 2001). Hence for the order Anseriformes, the

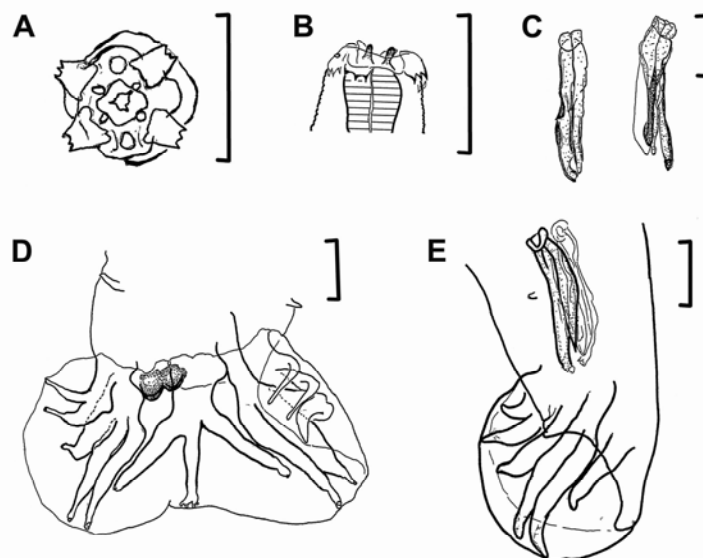


Fig. 3. *Epomidiostomum uncinatum*: A - anterior extremity of male, apical view; B - ibid, lateral view; C - spicules, ventral view, D - bursa, ventral view, E - bursa, lateral view (scale=0.05 mm)

genus *Streptocara* (Railliet, Henry and Sisoff, 1912) was the first host record in Japan. Other genera, *Eucoleus* (Dujardin, 1845), *Capillaria* Zeder, 1800, *Echinuria* Soloviev, 1912, and *Sarconema* Wehr, 1939 in the present survey are the first local records from Hokkaido. Both *Echinuria* and *Streptocara* are spirurid nematodes, with a cosmopolitan distribution, are well known to cause severe esophagitis and ventriculitis, and have resulted in fatalities in wild and domestic waterfowl (Boughton, 1969; Fox *et al.*, 1974; Griffiths *et al.*, 1985; Sterner and Stackhouse, 1987; Mason, 1988; Work *et al.*, 2004; Bano *et al.*, 2005). *Streptocara* is known as a facultative agent in other waterfowls and gallinaceous birds. For example, even in Japan, Yamaguti (1935) reported *S. recta* (Linstow, 1879) from *Tachybaptus ruficollis* (Pallas, 1764) (Podicipediformes) and Yokohata (2002) reported *S. crassicauda* from *Cerorhinca monocerata* (Pallas, 1811) (Charadriiformes) and *Gavia pacifica* (Lawrence, 1858) (Gaviiformes). In the Slovak Republic, Berza (1958) reported *S. pectinifera* (Newmann, 1900) from *Gallus gallus* (Linnaeus, 1758). However, the present finding of *S. crassicauda* is the first host record of the order Anseriformes in Japan. Indeed, *C. cygnus* and *C. columbianus* are new host species for this nematode species, on a worldwide basis. The filariid nematode *Sarconema eurycerca* is well known as heartworm, sometime causing death in wild swans and geese (Holden & Sladen, 1968; Sonin *et al.*, 1974; Macneill, 1975; Friend & Franson, 1999). Sakamoto *et al.* (1995) reported *S. eurycerca* from *C. cygnus* in Honshu, but in Hokkaido, this nematode species was obtained from *C. columbianus*.

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