

Infection status with helminthes in feral cats purchased from a market in Busan, Republic of Korea

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Abstract: The present study was performed to investigate the infection status with helminth in a group of feral cats in Korea. More than 29 helminth species including adults or eggs were detected in visceral and fecal samples of the examined cats. Among these were a host of nematodes, including toxocarids, *Ancylostoma* sp. and the larva of *Anisakis simplex*; trematodes, including *Clonorchis sinensis*, *Paragonimus westermani*, *Eurytrema pancreaticum*, *Pharyngostomum cordatum*, *Metagonimus* spp., *Heterophyes nocens*, *Pygidiopsis summa*, *Heterophyopsis continua*, *Stictodora fuscata*, *Stictodora lari*, *Acanthotrema felis*, *Stellantchasmus falcatus*, *Centrocestus armatus*, *Procerovum varium*, *Cryptocotyle* sp., *Echinostoma revolutum*, *Echinostoma hortense*, *Echinochasmus japonicus*, *Stephanoprora* sp., *Plagiorchis muris*, *Neodiplostomum* sp. and diplostomulum. We also detected a variety of cestodes, including *Spirometra erinacei*, *Taenia taeniaeformis* and unidentified species of tapeworm. We also found examples of the acanthocephalan, *Bolbosoma* sp. In our assessment of the stools, we detected at least 12 species of helminth eggs. These findings confirmed that feral cats in Korea are infected with a variety of helminth parasite species. Furthermore, among the helminths detected, *E. pancreaticum*, *S. fuscata*, *S. lari*, *A. felis*, *S. falcatus*, *C. armatus*, *P. varium*, *Cryptocotyle* sp., *E. revolutum*, *E. japonicus*, *Stephanoprora* sp., *P. muris*, *Neodiplostomum* sp. and *Bolbosoma* sp. represent helminth fauna which have not been reported previously in feral cats in the Republic of Korea.

Key words: helminths, nematoda, trematoda, cestoda, acanthocephala, infection, cats

INTRODUCTION

Feral cats are known to be frequently infected with a host of parasite species. Some cat parasites can infect humans, and can function as the causative agent of zoonosis. In Korea, cats are often reared at home as a pet and/or exploited as a predator of rats. However many of them become feral or stray cats as the result of changes in housing patterns. These cats live freely

in urban and rural areas, and tend to discharge helminth eggs, larvae, and protozoan cysts into the general environment (Jang, 1975; Min, 1981; Uga et al., 1989; Oikawa et al., 1991; Saito et al., 1995). Accordingly, feral cats are important as the potent reservoir hosts of a variety of parasites in medical and veterinary point of view.

Many surveys regarding cat helminth have been conducted in Korea (Kang, 1967; Lee 1979; Huh et al., 1993; Yang et al. 1995), Japan (Uchida et al., 1982; Uga et al., 1983; Tanaka et al., 1985; Asato et al., 1986) and other countries (Ash, 1962; Rao and Anantaraman,

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1967; Nichols et al., 1981a & b). In Korea, Kang (1967) examined 51 cats obtained in the western part of Kyongsangnam-do. Subsequently, Lee (1979) evaluated the status of 65 cats obtained from Kyongsangbuk-do, Huh et al. (1993) examined 41 cats which had been purchased in a market of Seoul, and Yang et al. (1995) conducted a study with 133 cats from Iri-shi, Chollabuk-do. The numbers of cats examined in these studies were generally small, though, and the cats were collected from fairly restricted localities. The objective of the present study, therefore, was to determine the helminthic infection status of a group of feral cats collected from certain localities within the Republic of Korea.

MATERIALS AND METHODS

We purchased the entire viscera of 438 feral cats from a wholesale house of animals located in Kupo, Puk-gu, Busan, Korea, between February 1996 and January 1997. These cats had been caught primarily in the southern regions of Korea, but were also collected from several other localities. The internal organs of the cats (stomach, intestine, lungs, heart, and liver) were examined thoroughly with the naked eye. The small intestine, in particular, was opened longitudinally with a pair of scissors in 0.85% saline, and washed with the same solution until the supernatant had cleared. The intestinal sedimentary contents were then carefully assessed with the naked eyes, as well as under a stereomicroscope. In order to determine the status of *Trichinella* larval infections, we minced diaphragm tissue with a mortar and pestle, followed by artificial digestion with pepsin-HCl solution in an incubator at 36°C for 3 hours. The digested material was then washed with saline until the supernatant had cleared, and examined via stereomicroscopy. The stool samples from the recta of the cats were examined by formalin-ether sedimentation technique.

In order to visualize the morphology of the trematodes in detail, we fixed the recovered worms with 10% neutral buffered formalin under slight pressure of a cover glass. The fixed worms were then stained with Semichon's acetocarmine, and measured using a

micrometer (OSM-4, Olympus Co.).

RESULTS

Worm collection

We ultimately detected more than 29 helminth species from the 438 feral cats. The majority of the detected species were identified as trematodes, including *Clonorchis sinensis*, *Paragonimus westermani*, *Eurytrema pancreatitis*, *Pharyngostomum cordatum*, *Metagonimus* spp., *Heterophyes nocens*, *Pygidiopsis summa*, *Heterophyopsis continua*, *Stictodora fuscata*, *Stictodora lari*, *Acanthotrema felis*, *Stellantchasmus falcatus*, *Centrocestus armatus*, *Procerovum varium*, *Cryptocotyle* sp., *Echinostoma revolutum*, *Echinostoma hortense*, *Echinochasmus japonicus*, *Stephanoprora* sp., *Plagiorchis muris*, *Neodiplostomum* sp. and diplostomulum (mesocercaria of *Diplostomum* sp.). We also detected many worms belonging to the Nematoda and Cestoda, including toxocarids, hookworms, *Anisakis simplex* larvae, *Spirometra erinacei*, *Taenia taeniaeformis*, and one tapeworm remains to be identified. One species of Acanthocephala, *Bolbosoma* sp., was also detected in the small intestines of 2 cats (Table 1).

Toxocarids were the most frequently detected organism. These were detected in the small intestines of 157 cats (35.8%). *T. taeniaeformis* (33.8%), *S. erinacei* (28.5%), *H. nocens* (24.2%) and *P. summa* (21.0%) were relatively prevalent in the samples, and the rate of infection with other worms is shown in Table 1.

Among the 438 cats examined in this study, 375 (85.6%) were found to have been infected with 1-8 helminth species. The highest frequency of infection was determined to exist in the group infected with 2 species (24.7%), followed by the group of cats infected with only one species- (23.1%), and then 3 species- (18.0%), 4 species- (9.4%), 5 species- (7.8%), 6 species- (1.6%), 7 species- (0.9%), and the 8 species-infected groups (0.2%) (Table 2).

Stool examination

Eggs from at least 12 helminth species were detected in 438 fecal samples. The eggs of *S. erinacei* (41.3%) were most frequently detected, and those of the toxo-

Table 1. Results of the worm collection and the stool examination in 438 feral cats

Parasites	No. (%) of cats positive	
	in worm collection	in stool examination
Nematoda		
Toxocarid	157 (35.8)	107 (24.4)
<i>Ancylostoma</i> sp.	33 (7.5)	9 (2.1)
<i>Capillaria hepatica</i>	-	11 (2.5)
Larva of <i>Anisakis simplex</i>	1 (0.2)	-
Trematoda		
<i>Clonorchis sinensis</i>	24 (5.5)	51 (11.6)
<i>Paragonimus westermani</i>	2 (0.5)	1 (0.2)
<i>Eurytrema pancreaticum</i>	2 (0.5)	-
<i>Pharyngostomum cordatum</i>	53 (12.1)	63 (14.4)
<i>Metagonimus</i> spp.	78 (17.8)	60 (13.7) ^{a)}
<i>Heterophyes nocens</i>	106 (24.2)	-
<i>Pygidiopsis summa</i>	92 (21.0)	-
<i>Heterophyopsis continua</i>	58 (13.2)	-
<i>Stictodora fuscata</i>	15 (3.4)	-
<i>Cryptocotyle</i> sp.	13 (3.0)	-
<i>Stellantchasmus falcatus</i>	9 (2.1)	-
<i>Acanthotrema felis</i>	5 (1.1)	-
<i>Centrocestus armatus</i>	5 (1.1)	-
<i>Stictodora lari</i>	2 (0.5)	-
<i>Procerovum varium</i>	1 (0.2)	-
<i>Echinostoma revolutum</i>	2 (0.5)	9 (2.1) ^{b)}
<i>Echinostoma hortense</i>	5 (1.1)	-
<i>Echinochasmus japonicus</i>	18 (4.1)	-
<i>Stephanoprora</i> sp.	1 (0.2)	-
Unidentified echinostome larva	16 (3.7)	-
<i>Plagiorchis muris</i>	3 (0.7)	-
<i>Neodiplostomum</i> sp.	2 (0.5)	-
Diplostomulum	2 (0.5)	-
Cestoda		
<i>Spirometra erinacei</i>	125 (28.5)	181 (41.3)
<i>Taenia taeniaeformis</i>	148 (33.8)	64 (14.6)
Diphyllobothriid tapeworm	-	1 (0.2)
<i>Hymenolepis diminuta</i>	-	1 (0.2)
Unidentified tapeworm larva	8 (1.8)	-
Acanthocephala		
	2 (0.5)	-

^{a)}heterophyid flukes, ^{b)}echinostomes.

carids (24.4%), *T. taeniaeformis* (14.6%), *P. cordatum* (14.4%), heterophyid flukes (13.7%), *C. sinensis* (11.6%), *Capillaria hepatica* (2.5%), hookworm (2.1%), echinostomatid flukes (2.1%), *P. westermani* (0.2%), *Hymenolepis. diminuta* (0.2%) and diphyllobothriid

Table 2. Results of worm collection and stool examination by the number of helminth species detected

No. of species detected	No. (%) of cats positive	
	in worm collection	in stool examination
Negative	63 (14.4)	127 (29.0)
1 sp.	101 (23.1)	142 (32.4)
2 spp.	108 (24.7)	111 (25.3)
3 spp.	79 (18.0)	42 (9.6)
4 spp.	41 (9.4)	13 (3.0)
5 spp.	34 (7.8)	3 (0.7)
6 spp.	7 (1.6)	-
7 spp.	4 (0.9)	-
8 spp.	1 (0.2)	-
Total	438 (100.0)	438 (100.0)

tapeworm (0.2%) were also detected at varying frequencies (Table 1).

Among the 438 examined fecal specimens, 311 (71.0%) were determined to be positive for 1-5 types of helminth egg. The majority of the cats fell into the group that was positive for one type of eggs (32.4%), followed by the totally egg-negative group (29.0%), the group harboring 2 egg types- (25.30%), the 3 type group (9.6%), the 4 type group,- (3.0%) and the group of cats positive for 5 types of eggs (0.7%) (Table 2).

Worm burdens in the infected cats

Out of 157 cats infected with toxocarids, 129 (82.2%) were infected with 1-5 worms (Table 3). A total of 33 cats (7.5%) was confirmed to be infected with hookworms. Most of them (90.9%) were also determined to harbor worm burdens of 1-5 (Table 4).

A total of 24,104 heterophyid flukes (representing at least 11 species) was collected from 384 cats (87.7%). *H. nocens* was detected in 106 cats (24.2%), and the worm burden in these cats ranged from one to 389 (38.2 in average). The second frequently encountered species was *P. summa* (21.9%), and the number of worms per infected cat was 70.4 in average. *Metagonimus* spp. were associated with the most severe infections in the infected cats. Examples of this species were recovered in burdens from one to 3,984 (148.7 in average) from 78 cats (17.8%). Examples of *H.*

Table 3. Worm burdens of toxocarids in infected cats

No. of worms detected	No. (%) of cats infected
1 - 5	129 (82.2)
6 - 10	13 (8.3)
11 - 20	11 (7.0)
Over 21	4 (2.5)
Total	157 (100.0)

Table 4. Worm burdens of hookworms in infected cats

No. of worms detected	No. (%) of cats infected
1	13 (39.4)
2	10 (30.3)
3	3 (9.1)
4	1 (3.0)
5	3 (9.1)
6	2 (6.1)
Over 10	1 (3.0)
Total	33 (100.0)

continua were collected from 58 cats (13.2%), and the number of worms in each cat ranged from one to 135 (12 in average). Data regarding infections with other heterophyid flukes is shown in Table 5. The worm burdens of 4 heterophyid flukes, namely, *H. nocens*, *P. summa*, *Metagonimus* spp., and *H. continua* are shown in Table 6. The majority of the cats were infected with between 1 and 50 worms.

Table 5. Infection status of heterophyid flukes in 438 feral cats

Flukes of cats	No. (%) infected	No. of worms detected		
		Total	Range	Average
<i>Heterophyes nocens</i>	106 (24.2)	4,052	1 - 389	38.2
<i>Pygidiopsis summa</i>	92 (21.0)	6,478	1 - 1,486	70.4
<i>Metagonimus</i> spp.	78 (17.8)	11,598	1 - 3,984	148.7
<i>Heterophyopsis continua</i>	58 (13.2)	696	1 - 135	12.0
<i>Stictodora fuscata</i>	15 (3.4)	91	1 - 21	6.1
<i>Cryptocotyle</i> sp.	13 (3.0)	286	1 - 267	22.0
<i>Stellantchasmus falcatus</i>	9 (2.1)	377	1 - 270	41.9
<i>Centrocestus armatus</i>	5 (1.1)	135	2 - 105	27.0
<i>Acanthotrema felis</i>	5 (1.1)	370	1 - 238	74.0
<i>Stictodora lari</i>	2 (0.46)	18	1 - 17	9.0
<i>Procerovum varium</i>	1	3	-	3.0
Total	384 (87.7)	24,104	1 - 3,984	62.8

Information regarding infections with echinostomatid flukes is provided in Table 7. *E. japonicus* was collected from 18 cats (4.1%), and the numbers of worms found ranged from one to 146 (22.8 in average). Information regarding infections with other intestinal flukes, with the exception of the Heterophyidae and Echinostomatidae, is provided in Table 8. *P. cordatum* was detected in 53 cats (12.1%). As a great number of worms was found to have been embedded deeply in the intestinal wall, it proved quite difficult to precisely enumerate the exact number of *P. cordatum* worms.

Morphologies of the detected eggs

The eggs of *C. hepatica* were measured to be 57 (51-58) by 31 (19-33) μm in size, and exhibited a thick shell and two mucoid plugs on both poles (Fig. 1). Some of the heterophyid fluke eggs were measured to be 35 (33-37) by 21 (20-22) μm in size, and exhibited miracidia, smooth shells, and faint opercula (Fig. 2). The diphylobothriid tapeworm eggs were 63 (58-69) by 44 (43-47) μm in size, bilaterally symmetrical, and exhibited weakly developed opercula (Fig. 3). The eggs of *H. diminuta* were 69 (67-72) by 64 (62-67) μm in size, and possessed oncospheres and thick shells (Fig. 4).

Detection of *Trichinella* larvae

No larvae were detected in the diaphragm tissue of the 438 examined cats.

Table 6. Worm burdens of heterophyid flukes in feral cats

No. of worms detected	No. (%) of cats infected with			
	<i>H. nocens</i>	<i>P. summa</i>	<i>Metagonimus spp.</i>	<i>H. continua</i>
1 - 50	88 (83.0)	71 (77.2)	55 (70.5)	55 (94.8)
51 - 100	9 (8.5)	7 (7.6)	9 (11.5)	2 (3.4)
101 - 200	4 (3.8)	7 (7.6)	3 (3.8)	1 (1.7)
201 - 300	1 (0.9)	2 (2.2)	5 (6.4)	0
301 - 400	4 (3.8)	0	1 (1.3)	0
401 - 500	0	2 (2.2)	1 (1.3)	0
Over 501	0	3 (3.3)	4 (5.1)	0
Total	106 (100.0)	92 (100.0)	78 (100.0)	58 (100.0)

Table 7. Infection status of echinostome flukes in 438 cats

Flukes of cats	No. (%) infected	No. of worms detected		
		Total	Range	Average
<i>Echinochasmus japonicus</i>	18 (4.1)	411	1 - 146	22.8
<i>Echinostoma hortense</i>	5 (1.1)	511	1 - 485	102.2
<i>Echinostoma revolutum</i>	2 (0.5)	7	3 - 4	3.5
<i>Stephanoprora</i> sp.	1 (0.2)	3	-	3.0
<i>Echinostome</i> larvae	16 (3.7)	125	1 - 47	7.8
Total	42 (9.6)	1,057	1 - 485	25.2

Table 8. Infection status of other intestinal flukes in 438 feral cats

Flukes of cats	No. (%) infected	No. of worms detected		
		Total	Range	Average
<i>Pharyngostomum cordatum</i>	53 (12.1)		uncountable ^{a)}	
<i>Plagiorchis muris</i>	3 (0.7)	4	1 - 2	1.3
<i>Neodiplostomum</i> sp.	2 (0.5)	7	3 - 4	3.5

^{a)}Numerous worms were deeply embedded in the intestinal wall.

DISCUSSION

Several workers have previously reported on helminth infections in cats in Korea (Kang, 1967; Lee 1979; Eom et al., 1985; Huh et al., 1993; Yang et al. 1995). Kang (1967) detected 5 helminth species, namely, *T. cati*, *C. sinensis*, *Paragonimus* sp., *Spirometra* sp. and *T. taeniaeformis*, in 51 cats from the western region of Kyongsangnam-do. Lee (1979) reported detecting 6 trematode species, namely, *C. sinensis*, *H. nocens*, *M. yokogawai*, *Centrocestus* sp. *Echinochasmus perfoliatus*, and *Echinoparyphium* sp., in 65 cats acquired from

Kyongsangbuk-do. Eom et al. (1985) described 3 heterophyid flukes, *H. continua*, *H. nocens*, and *P. summa*, which had been collected from 181 domestic cats purchased at the Chungang Market in Seoul. Huh et al. (1993) detected 7 helminth species, namely, *T. cati*, *A. simplex* larvae, *C. sinensis*, *P. cordatum*, *S. erinacei*, and *T. taeniaeformis*, from 41 cats which had been purchased at a market in Seoul. Yang et al. (1995) detected 4 helminth species *T. cati*, *Diphyllbothrium latum*, *S. erinacei* and *T. taeniaeformis* in 133 cats obtained from Iri-shi, in Chollabuk-do.

A total of 15 helminth species (2 nematodes: *T. cati*, *A. simplex* larva; 10 trematodes: *C. sinensis*,

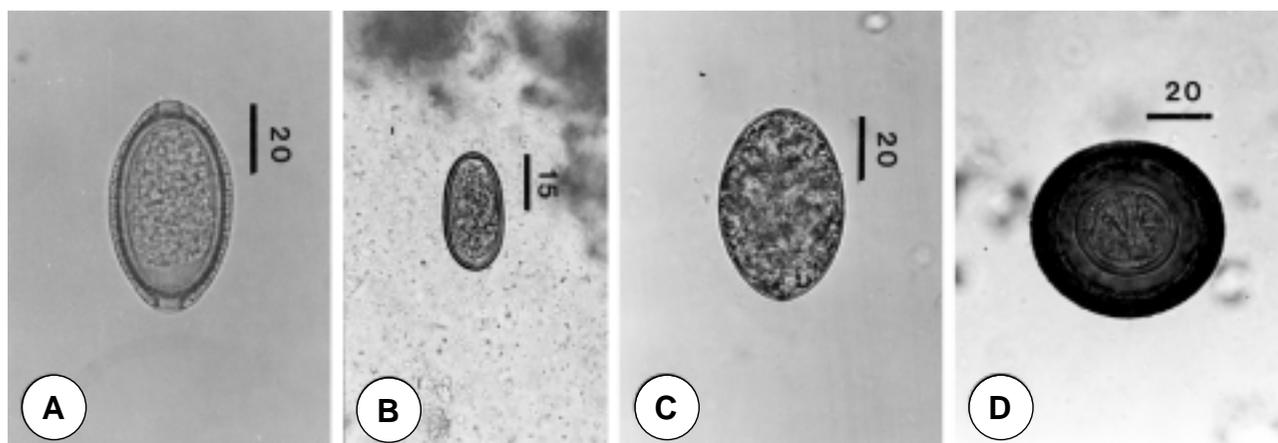


Fig. 1. Eggs detected in feces of cats. **A.** *Capillaria hepatica*, exhibiting a thick shell and two mucoid plugs at both poles. **B.** A heterophyid fluke, exhibiting a miracidium, smooth shell, and a faint operculum. **C.** A diphyllbothriid tapeworm, bilaterally symmetrical, with a weakly developed operculum. **D.** A *Hymenolepis diminuta*, showing an oncosphere and thick shell. Bar represents μm in length.

Paragonimus sp., *M. yokogawai*, *H. nocens*, *H. continua*, *P. summa*, *Centrocestus* sp., *E. perfoliatus*, *Echinoparyphium* sp., *P. cordatum*; 3 cestodes: *S. erinacei*, *D. latum*, *T. taeniaeformis*) has been designated, thus far, as cat parasites commonly found in Korea. However, according to our results, more than 17 species (1 nematode: *Ancylostoma* sp.; 15 trematodes: *E. pancreatitis*, *Metagonimus* spp., *S. fuscata*, *S. lari*, *A. felis*, *S. falcatus*, *C. armatus*, *P. varium*, *Cryptocotyle* sp., *E. revolutum*, *E. hortense*, *E. japonicus*, *Stephanoprora* sp., *P. muris* and *Neodiplostomum* sp.; 1 acanthocephala: *Bolbosoma* sp.) should be added to this list. By way of comparison, in Japan, a total of 17 species (6 nematodes: *T. cati*, *Ancylostoma tubaeforme*, *Strongyloides* sp., *Dirofilaria immitis*, *Mammonogamus auris*, *Oslerus* sp.; 6 trematodes: *M. yokogawai*, *P. cordatum*, *Paragonimus miyazakii*, *P. westermani*, *Echinostoma* sp., *Concinnum okinawanum*; 4 cestodes: *S. erinacei*, *T. taeniaeformis*, *D. caninum*, sparganum; 1 acanthocephala: *Centrorhynchus* sp.) has been isolated from cats (Uga et al., 1983 & 1986; Tanaka et al., 1985; Asato et al., 1986).

Most of the helminth species detected in this study are of great epidemiological importance, as they are zoonotic parasites. In particular, toxocarids, the most frequently encountered species in Korea, are known agents of visceral larva migrans in humans, and *S. erinacei* is the adult stage of sparganum, which causes

human sparganosis. Both of these helminthes can result in very important and possibly serious human diseases. Many trematode species, including 3 major human-infecting trematodes in Korea, i.e., *C. sienensis*, *P. westermani*, and *M. yokogawai*, were detected during this study. Among these, many intestinal trematodes have been reported as the human infecting species in Korea (Chai and Lee, 2002). Our findings suggest that feral cats had a chance to eat the flesh of freshwater fishes, brackish water fishes, and freshwater crabs or crayfish, and they play an important role as reservoir hosts of trematodes.

Helminth infection status in feral cats appears to differ according to the habitats of the cats, i.e., urban or rural, coastal or inland, plains or mountains. Currently, little information is available regarding the precise habitats of the examined cats. However, from the high prevalence of heterophyid flukes, we surmise that many of the cats examined in this study had come from coastal and/or island areas.

There have previously been several helminthological surveys conducted via stool examination (coproscopy) in order to characterize the parasitic infection status of cats in Korea and Japan (Min, 1981; Oikawa et al., 1991; Huh et al., 1993; Saito et al., 1995). Min (1981) detected eggs from 6 helminth species, namely *T. cati* (7.7%), *A. tubaeforme* (3.1%), *C. sienensis*

(1.9%), *P. westermani* (1.4%), *M. yokogawai* (1.2%) and *Spirometra* sp. (0.7%) in 416 fecal samples collected from all around the Republic of Korea, and Huh et al. (1993) also detected 6 species, *T. cati* (41.4%), *C. sinensis* (12.2%), *Metagonimus* spp. (9.8%), *P. cordatum* (7.3%), *S. erinacei* (41.5%) and *T. taeniaeformis* (24.4%), from 41 fecal samples obtained from cats that were purchased at a market in Seoul. In this study, we detected more than 12 types of helminth eggs from 438 fecal samples. To our knowledge, eggs of *C. hepatica*, echinostomes, and *H. diminuta* had never before been reported in Korean cats. However discharge of *C. hepatica* eggs via cat feces is originated in the predation of infected rats, and it is epidemiologically important as the one of transmission factors in this nematode infection. Oikawa et al. (1991) reported on the prevalence of intestinal parasites in 1,064 fecal samples from stray cats which had been collected in the western regions of Japan, from 1983 to 1990. Saito et al. (1995) examined 500 fecal samples from cats kept as pets in Fukuyama City, Hiroshima Prefecture, Japan, in 1972 and 1992.

A comparison of helminthic infections examined via two methods (worm collection during autopsy and coproscopic egg detection) was conducted for each parasite species by Nichols et al. (1981); *T. cati* was detected in 52.2% of autopsies and 36.2% of coproscopies, *D. caninum* 30.4% and 7.3%, *T. taeniaeformis* 15.9% and 2.9% and *Toxascaris leonina* 1.5% and 0%, respectively. Generally, as was reported by Nichols et al. (1981), the detection rate by coproscopy was far lower than that by autopsy. However, the rates of coproscopic detection of *S. erinacei*, *C. sinensis* and *P. cordatum* were far higher than associated with autopsy in this study; *S. erinacei* was detected in 28.5% of autopsies and 41.3% of coproscopies, *C. sinensis* was detected at frequencies of 5.5% and 11.6%, and *P. cordatum* was detected in 12.1% of autopsies, and 14.3% of coproscopies. This trend was also seen with the detection rates of toxocarids, *Ancylostoma* sp., and *T. taeniaeformis* via coproscopy and autopsy in this study; toxocarids were detected by autopsy at a rate of 35.8% and by coproscopy at a rate of 24.4%, *Ancylostoma* sp. were detected at rates of 7.5% and

2.1%, and *T. taeniaeformis* was detected at rates of 33.8% by autopsy, and 14.6% by coproscopy.

Recent trends of parasitic infections in Korea are typified by remarkable reductions in the frequency of soil-transmitted nematodiasis, the moderate endemicity of foodborne trematodiasis, a gradual increase in zoonosis, an increase in the detection of ostensibly imported parasitosis and opportunistic infections, and the reemergence of malaria (Lee et al., 1996; MHSA and KAH, 1997). It is worthy of mention that feral cats function as reservoir hosts for zoonosis and foodborne trematodiasis. Nowadays, the importance placed on the incidence of these parasitic infections is steadily increasing. In this study, we confirmed that feral cats in Korea tend to be infected with many different helminth species, which tend to induce zoonosis. Among these species, *E. pancreatitum*, *S. fuscata*, *S. lari*, *A. felis*, *S. falcatus*, *C. armatus*, *P. varium*, *P. muris*, *E. revolutum*, *E. japonicus*, *Cryptocotyle* sp., *Stephanoprora* sp., *Neodiplostomum* sp. and *Bolbosoma* sp. are all helminth fauna newly reported in feral cats from the Republic of Korea.

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