

## *Echinostoma revolutum* and *Echinoparyphium recurvatum* recovered from house rats in Yangyang-gun, Kangwon-do

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**Abstract:** During an investigation on intestinal flukes of house rats in Yangyang-gun, Kangwon-do, a total of 6 species of trematodes belonging to 3 families; Echinostomidae (*Echinostoma hortense*, *E. cinetorchis*, *E. revolutum* and *Echinoparyphium recurvatum*), Diplostomidae (*Fibricola seoulensis*) and Plagiorchiidae (*Plagiorchis muris*), were recovered from two adult rats. *E. revolutum* and *E. recurvatum* were new trematode faunae of rats in Korea. *E. revolutum* had an elongated body, 5.3~6.0 mm long and 1.0~1.3 mm wide. The total number of collar spines was 35~37 including 5 end group ones on each ventral corner. Its coiled uterus contained numerous eggs. *E. recurvatum* also had an elongated body, 3.5~4.7 mm long and 0.50~0.65 mm wide. It had total 45 collar spines including 4 end group ones. The uterus was short with only a few eggs. It has been first confirmed by this study that *E. revolutum* and *E. recurvatum* are indigenously distributed among house rats in Korea.

**Key words:** *Echinostoma revolutum*, *Echinoparyphium recurvatum*, new fauna, house rats, Yangyang-gun (Kangwon-do)

### INTRODUCTION

There were at least 4 papers on the faunae of intestinal flukes of rats in Korea (Park, 1938; Seo *et al.*, 1964a, 1964b & 1981). In those papers several species of trematodes, *i.e.*, *Echinostoma hortense*, *E. cinetorchis*, *Euparyphium murium*, *Plagiorchis muris* and *Fibricola seoulensis*, were reported. However, *Echinostoma revolutum* and *Echinoparyphium recurvatum* had never been described from the rat host.

As for the natural final hosts of *E. revolutum* or *E. recurvatum*, various species of aquatic birds, partridges, fowls and mammals were reported in the world literature (Tsuchimochi, 1924; Tamura and Iwata, 1930; Ishii, 1932 & 1935; Yamashita, 1939 & 1964; Skrjabin, 1947; Beaver *et al.*, 1984). Human infections with

*E. revolutum* or *E. recurvatum* were reported from Taiwan, Indonesia and Egypt (Anazawa, 1929; Bonne *et al.*, 1948; Fain and Galal, 1977).

In Korea, *E. revolutum* was found from wild birds such as *Anas platyrhynchos platyrhynchos*, *A. poecilorhynchos zonorhynchos*, *A. fulcata* and *Aythya fuligula* (Ishii, 1932; Chu *et al.*, 1973). *E. recurvatum* was also described from *A. platyrhynchos platyrhynchos*, *A. poecilorhynchos zonorhynchos* and *Podiceps cristatus*, under a name of *E. koidzumii* (Chu *et al.*, 1973). Recently we had a chance to collect these two kinds of echinostomes from the rats.

### MATERIALS AND METHODS

In August and September 1989, two house rats were captured in Hyunbuk-myon, Yangyang-

gun, Kangwon-do. They were killed and their intestines removed. The intestines were opened by blunt-tip scissors in 0.85% saline and washed several times. The sediments were examined for worms under stereomicroscopy. The collected worms were fixed under cover glass pressure, and stained with Semichon's acetocarmine.

## RESULTS

### 1. Results of worm collection

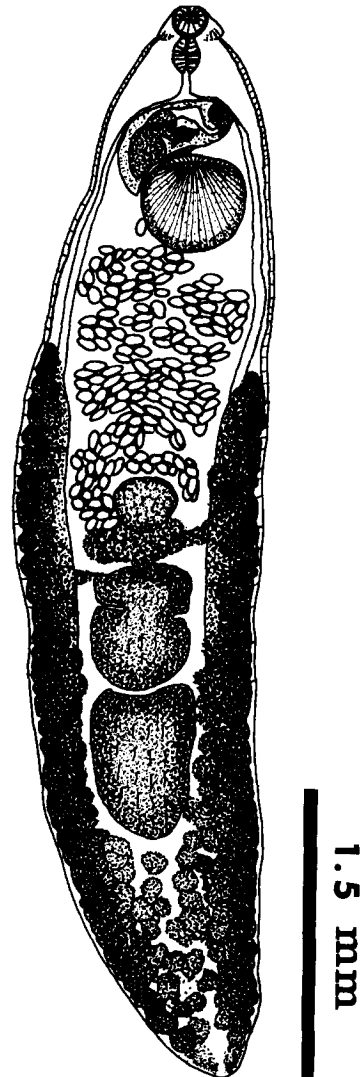
A total of 314 specimens of 6 species of flukes, i.e., *Echinostoma hortense*, *E. cinetorchis*, *E. revolutum*, *Echinoparyphium recurvatum*, *Fibricola seoulensis* and *Plagiorchis muris*, were collected from two rats (Table 1).

**Table 1.** Infection status of the intestinal flukes in house rat from Hyunbuk-myon, Yangyang-gun, Kangwon-do

Parasites	No. worms from		
	Rat A	Rat B	Total
<i>Echinostoma hortense</i>	44	24	68
<i>E. cinetorchis</i>	19	12	31
<i>E. revolutum</i>	0	28	28
<i>Echinoparyphium recurvatum</i>	125	0	125
<i>Fibricola seoulensis</i>	60	0	60
<i>Plagiorchis muris</i>	0	2	2
Total	248	66	314

### 2. *Echinostoma revolutum*

All worms were found from the small intestine of a rat. Measurements are shown in Table 2 in comparison with those by previous authors. Body elongated, dorsoventrally flattened, and somewhat attenuated at both ends (Fig. 1). Tegument of anterior body armed with numerous spines, which extended to the anterior level of posterior testis. Head crown distinct, bearing 35~37 collar spines with 5 end group spines on each side, and the median group somewhat smaller in size than the others. Oral sucker subterminal and pre-pharynx very short. Pharynx well developed, muscular and longer than wide. Esophagus not so elongated and intestine bifurcated at the end



**Fig. 1.** Ventral view of *Echinostoma revolutum*.

of anterior 1/3 portion of cirrus sac. Cirrus sac well developed, elongated and contained saccular seminal vesicle. Ventral sucker very large and protruded ventrally. Uterus coiled and filled with numerous eggs. Ovary globular and on the median line of the body. Mehlis' gland located between the ovary and anterior testis. Testes tandem and slightly lobed. Vitelline glands follicular and extending laterally from the middle level of uterus to the posterior end of the body. Eggs operculated, elliptical, golden yellow, and thin-shelled.

### 3. *Echinoparyphium recurvatum*

Worms were found from the small intestine of another rat. Measurements are presented in

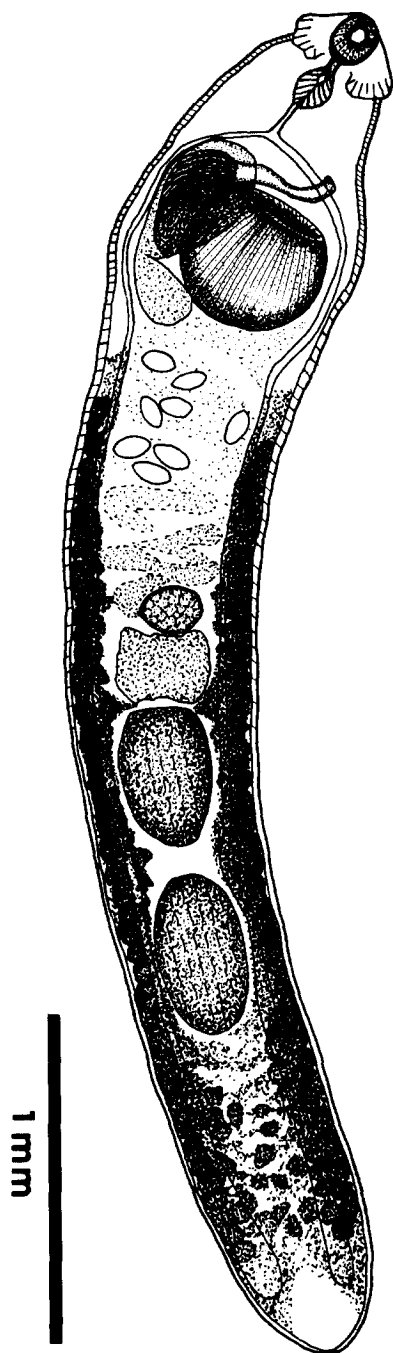


Fig. 2. Ventral view of *Echinoparyphium recurvatum*.

Table 3 in comparison with previous authors. Body elongated and dorsoventrally flattened (Fig. 2). Tegumental spines distinct and extended from head crown to the anterior level of anterior testis. Head crown distinct, kidney-shaped, armed with 45 collar spines including 4 end group ones on each ventral corner. Oral sucker subterminal and pre-pharynx present. Pharynx well developed, muscular and a little longer than wide. Esophagus slender and intestine bifurcated at some distance from the anterior end of cirrus sac. Cirrus sac well developed, contained saccular seminal vesicle and overlapped with the right anterior margin of ventral sucker. Cirrus protruded out of its sac in some specimens. Ventral sucker very large, and more or less protruded ventrally. Uterus short with only a few eggs. Ovary spherical or transversely oval. Mehlis' gland situated between the ovary and anterior testis. Testes tandem and longitudinally oval. Vitelline gland follicular and laterally extending from the anterior 1/3 level of uterus to the posterior extremity of the body.

### DISCUSSION

By the present study, it has been verified that *E. revolutum* and *E. recurvatum* are distributed indigenously among the Korean house rats. Although these two kinds of echinostomes were reported previously from wild birds in Korea (Chu *et al.*, 1973), it is not certain whether the infections were indigenously obtained, since the hosts were migratory birds who came to Korea in the winter season. The presence of other flukes, *i.e.*, *E. hortense*, *E. cinetorchis*, *F. seoulensis* and *P. muris*, were reported already from the rat host (Park, 1938; Seo *et al.*, 1964a, 1964b & 1981). However, it was highly suggested by this study that these kinds of intestinal trematodes are widely distributed in this country.

The present specimens of *E. revolutum* were somewhat smaller in their body size than those described by previous authors (Rim, 1982).

**Table 2.** Comparison of the measurements of *E. revolutum* adults by authors(mm)

Items	Present study (1990)	Anazawa* (1929)	Yamaguti (1934)	Bashikirova (1941)
Body length (L)	5.35~6.00	4.68	5.50~7.68	6.80~12.00
width (W)	1.00~1.30	0.98	0.88~1.00	0.88~2.00
Diameter of head crown	0.34~0.40	—	0.38~0.43	0.44~0.823
Oral sucker (L)	0.11~0.17	0.15	0.18	0.138~0.341
(W)	0.16~0.18	0.17		0.198~0.358
Pharynx (L)	0.14~0.18	0.17	0.14~0.15	0.14~0.32
(W)	0.09~0.13	0.13		0.099~0.253
Esophagus	0.12~0.20	—	0.3~0.44	0.33~0.83
Cirrus sac (L)	0.33~0.55	0.33	—	0.473~0.605
(W)	0.20~0.30	0.23		0.341~0.407
Ventral sucker (L)	0.45~0.52	0.52	0.63	0.68~1.32
(W)	0.43~0.49	0.56		0.64~0.84
Ovary (L)	0.25~0.35	0.20	0.23~0.26	0.605~0.760
(W)	0.31~0.40	0.22		0.620~0.638
Anterior testis (L)	0.55~0.78	0.29	0.56~0.58	0.52~1.40
(W)	0.46~0.62	0.27	0.31~0.37	0.40~0.84
Posterior testis (L)	0.70~0.96	0.39	0.64~0.68	0.52~1.62
(W)	0.46~0.58	0.28	0.32~0.35	0.36~0.76
Eggs (L)	0.085~0.102	—	0.105~0.111	0.099~0.132
(W)	0.056~0.069		0.069~0.072	0.050~0.073
No. of collar spines	35~37	—	35	35~37

\* 19-day old worms.

**Table 3.** Comparison of the measurements of *E. recurvatum* adults by authors(mm)

Items	Present study (1990)	Lühe (1909)	Ishii (1932)	Bashikirova (1941)
Body length (L)	3.5~4.7	2.8~5.0	3.17~5.04	2.0~5.0
width (W)	0.50~0.65	0.50~0.85	0.56~0.78	0.40~0.85
Diameter of head crown	0.29~0.34	0.36	0.28~0.49	0.220~0.385
Oral sucker (L)	0.12~0.15	0.12~0.13	0.072~0.117	0.099~0.130
(W)	0.12~0.15		0.092~0.098	
Pharynx (L)	0.11~0.13	—	0.089~0.114	0.077~0.170
(W)	0.09~0.11		0.061~0.092	
Esophagus	0.16~0.19	—	0.425~0.714	0.282~0.605
Cirrus sac (L)	0.30~0.40	0.24	0.255~0.425	0.176~0.385
(W)	0.13~0.18	0.14	0.119~0.187	0.099~0.264
Ventral sucker (L)	0.32~0.40	0.32~0.35	0.359~0.493	0.253~0.407
(W)	0.32~0.39		0.34~0.51	0.253~0.363
Ovary (L)	0.13~0.22	—	0.119~0.221	0.077~0.187
(W)	0.13~0.20		0.136~0.238	0.123~0.187
Anterior testis (L)	0.28~0.42	—	0.289~0.544	0.242~0.506
(W)	0.21~0.28		0.187~0.323	0.154~0.275
Posterior testis (L)	0.39~0.48	—	0.347~0.598	0.121~0.484
(W)	0.18~0.29		0.170~0.289	0.176~0.275
Eggs (L)	0.082~0.097	0.088~0.1	0.085~0.100	0.090~0.110
(W)	0.054~0.059	0.056~0.06	0.056~0.061	0.051~0.084
No. of collar spines	45	45	45	45

Otherwise, they were well corresponded with the previous descriptions, *i.e.*, 35-37 collar spines, 5 end group spines, smaller size of median group spines, and general shape and arrangement of internal organs (Anazawa, 1929; Yamaguti, 1934; Skrjabin, 1947).

*E. recurvatum* found from wild birds in Korea was at first named as *E. koidzumii* (Chu *et al.*, 1973). *E. koidzumii* was described as a new species in Taiwan (Tsuchimochi, 1924), but it was later regarded as a synonym of *E. recurvatum* by Yamaguti (1933). Most of the reviewers agreed to the Yamaguti's opinion (Skrjabin, 1947; Yamashita, 1964; Rim, 1982). In this context, *E. koidzumii* reported by Chu *et al.* (1973) in Korea should have been *E. recurvatum*.

Several kinds of fresh water snails, and several species of frogs and their tadpoles were reported as the first and second intermediate hosts respectively, of *E. revolutum* or *E. recurvatum* in the world literature (Yamashita, 1964; Rim, 1982; Beaver *et al.*, 1984). However, no reports have been available on the intermediate hosts of *E. revolutum* or *E. recurvatum* in Korea. Therefore, studies on intermediate hosts in this area should be an interesting subject of investigation in the future.

Although we were not able to estimate the exact prevalence of these flukes among the rats, it seems to be considerably high. The worm burdens in the two infected rats were high. It is suggested that the surveyed area should be favorable for the thriving of these kinds of intestinal trematodes. Since human infections with *E. revolutum* or *E. recurvatum* were reported in other countries (Anazawa, 1929; Bonne *et al.*, 1948; Fain and Galal, 1977), it is necessary to pay attentions for possible occurrence of human infections in Korea.

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＝국문초록＝

강원도 양양군 집쥐에서 검출된 *Echinostoma revolutum*과  
*Echinoparyphium recurvatum*

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1989년 8~9월에 강원도 양양군 현북면에서 잡은 집쥐 2마리에서 *Echinostoma hortense*, *E. cinetorchis*, *E. revolutum*, *Echinoparyphium recurvatum*, *Fibricola seoulensis* 및 *Plagiorchis muris* 등 모두 6종류의 장흡충을 검출하였다. 이들 중 *E. revolutum*과 *E. recurvatum*은 국내산 집쥐에서는 처음 발견되었기에 형태학적 특징의 기술과 더불어 보고하고자 한다.

*E. revolutum*은 총체가 길쭉하며 체장 5.3~6.0 mm, 체폭 1.0~1.3 mm이었다. 두극의 수는 모두 35~37개이었으며 end group spine이 좌우에 각각 5개씩 있었다. 길다란 자궁은 굽어져 있었고 충란이 가득 들어 있었다. *E. recurvatum*도 총체가 길쭉하였으며 체장 3.5~4.7 mm이었고 체폭 0.50~0.65 mm이었다. 두극의 수는 모두 45개이었으며, 복측 양단에 위치한 end group spine이 각각 4개씩 있었다. 짧은 자궁 내에는 소수(10개 미만)의 충란이 들어 있었다.

이상의 결과로 국내의 집쥐가 자연계에서 *E. revolutum*과 *E. recurvatum*의 중숙주 역할을 하고 있음을 확인하였다.

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