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STUDIES ON THE PARASITIC HELMINTHS OF KOREA I. TREMATODES OF RODENTS

Byong Seol Seo, Han Jong Rim and Chan Wuk Lee

Department of Parasitology and Institute of Endemic Diseases, College of Medicine, Seoul National University

An investigation of the helminth parasites of house and wild rats of Korea has been carried on 1956 to March of 1964. A total of 624 rodents of six species was examined, House rats trapped mostly from Seoul, and wild rats from areas of Chulwon, Kumwha, Chyongpyong, Pochon, and Paju districts of South Korea. These rats comprised 357 *Rattus norvegicus*, 221 *Apodemus agrarius*, 8 *Rattus r. alexandrinus*, 13 *Mus musculus yamashinai*, 4 *Microtus fortis pelleeus*, and 21 *Crocidura russula*.

In the results of this work we found five species of trematodes included a new species, of which three trematodes are recorded for the first time from Korea. Each species is described separately below.

FAMILY *PLAGIORCHIIDAE* WARD, 1917

Plagiorchis muris Tanabe, 1922

Thirty-three specimens of *Plagiorchis muris* were taken from the small intestine of 5 *Apodemus agrarius* and 1 *Rattus r. alexandrinus*. *P. muris* and its life cycle were first described by Tanabe (1922) who found this trematode in both *Rattus r. rattus* and *R. norvegicus* of Kyoto, Japan.

Ogata (1938) reported *Plagiorchis koreanum* from *Nyctalus aviator* in Korea, and also Park (1939) reported *P. rhinolophi* and *P. magnacotylus*, from *Eptesicus velox* and *Rhinolophus ferrum-equinum* in Korea. These species were found from korean bats and distinctly differ from *P. muris* in body length and distribution of vitellaria.

Description: Body elongate with tapering extremities, four times as long as wide, widest at the level of ventral sucker, 1.46 to 1.77 mm long by 0.364 to 0.448 mm wide. Cuticle minutely spined in anterior half of body.

Oral sucker spherical, equal in size to ventral sucker, measuring 0.154 to 0.168 mm in diameter; ventral sucker at a distance of 0.420 to 0.644 mm from anterior end of body. Pharynx 0.066 to 0.084 mm long by 0.076 to 0.084 mm wide with very short prepharynx; esophagus short; bifurcation of intestine approximately midway between the suckers or near the oral sucker; ceca extending to near the posterior end of the body.

Excretory bladder tubular, bifurcating in the level of anterior border of anterior testis; excretory pore at extreme posterior end of body.

Genital aperture immediately anterior to anterior border of ventral sucker, in median line. Cirrus sac elongate, narrow in anterior part, 0.350 to 0.396 mm long by 0.059 to 0.070 mm wide, extends from genital aperture posteriad beyond anterior margin of ovary; seminal vesicle located in the posterior portion of the cirrus sac; pars prostatica and ejaculatory duct present within the anterior portions of the cirrus sac.

Testes oval, almost contiguous, slightly oblique in intraccecal space; anterior testis, 0.182 to 0.266 mm long by 0.168 to 0.238 mm wide slightly left side of median lines; posterior testis, 0.224 to 0.280 mm long by 0.154 to 0.210 mm wide, slightly right side of median line.

Ovary oval, 0.154 to 0.210 mm long by 0.154 to 0.196 mm wide, almost contiguous with ventral sucker on its right posterior border and touching right cecum; Mehlis' gland to left of ovary. Vitelline glands well developed, follicular, extending from posterior margin of oral sucker to posterior tip of body, and extending laterally beyond ceca and filling whole width of body. Uterus forms large "S" shape with descending and ascending loops, intertesticular, extending posterior tip of body.

Eggs clear, yellowish-brown, measures 0.030 to 0.033 mm by 0.020 to 0.023 mm.

HOST: *Apodemus agrarius, Rattus r. alexandrinus.*
LOCATION: Small intestine
LOCALITY: Kumwha and Pochon districts, Korea

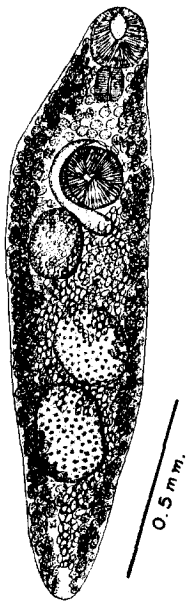

Fig.1 *Plagiorchis muris:* ventral view.

FAMILY *ECHINOSTOMATIDAE* POCHE, 1923

Echinostoma hortense Asada, 1926

This species was collected from 6 *R. norvegicus*, 3 *R.r. alexandrinus*, 2 *A. agrarius*, 2 *Mus musculus yamashinai*, and 2 *Microtus fortis pellcius* from several localities. One of *R.r.alexandrinus* contained 134 specimens, the maximum seen in a single animal.

Asada (1926) found this parasite experimentally in white rats fed with cysts from tadpoles which had been infected with cercariae from *Lymnaea japonica* and *L.pervia*. Yamaguti (1933) found in the small intestine of a naturally infested *R. norvegicus* in Japan. The first report of this parasite from Korean rat reported by Park (1938) in the area of Seoul.

Description: Body elongated, dorsoventrally flattened, weak attenuated anteriorly, 2.80 to 8.67 mm long by 0.60 to 1.70 mm in greatest breadth. Head collar reniform, measures 0.266 to 0.406 mm across, bearing twenty-eight spines arranged in two rows; the end group spines constantly four in number on each side; measuring 0.023 to 0.058 mm by 0.010 mm; collar not met ventrally. Cuticle, 0.036 mm in average thickness; cuticular spines covered the surface of the body from the posterior level of the collar to the level of one third of posterior part of the body.

Oral sucker subterminal, 0.154 to 0.210 mm long by 0.140 to 0.238 mm wide; ventral sucker well developed, 0.392 to 0.728 mm long by 0.336 to 0.658 mm wide, at a distance of 0.588 to 0.882 mm from anterior end of body; mouth ventrally subterminal, prepharynx 0.030 mm in average length. Pharynx well developed, usually longer than wide, always similar length or a little longer than the oral sucker, 0.182 to 0.224 mm long by 0.168 to 0.210 mm wide; esophagus slender and mascular, 0.140 to 0.350 mm long; bifurcation of intestine approximately midway between the suckers or near the ventral sucker; intestinal ceca narrow and smooth extending to near the posterior end of the body.

Excretory pore dorsally subterminal; excretory bladder large with numerous irregular lateral branches, extending to the posterior testis.

Genital aperture closely behind intestinal bifurcation; median or submedian; genital atrium present. Cirrus sac elongated with its anterior part, 0.420 to 0.798 mm long by 0.168 to 0.322 mm wide. Seminal vesicle located in the posterior portion of the cirrus sac; pars prostatica and ejaculatory duct present in the anterior portion of the cirrus sac.

Testes usually spirally lobed with three or four folds or rarely entire, tandem, and their center preequatorial or rarely equatoreal; anterior testis usually wider than long, 0.280 to 0.658 mm long by 0.322 to 0.798 mm wide; the posterior testis usually longer than wide; 0.364 to 0.756 mm long by 0.294 to 0.700 mm wide.

Ovary spheroidal or rarely oval, immediately anterior to the anterior testis, 0.168 to 0.336 mm by 0.168 to 0.378 mm. located toward the right from the median line of the body. Mehlis' gland large, 0.140 to 0.280 mm by 0.322 to 0.462 mm, located to the left of the ovary at its posterior region. Vitelline glands well developed, follicular, laterally extending from the anterior level of the ovary to near the posterior end of the body meeting posterior to the posterior testis. Uterine coils transverse intercecal, extending from the level of the ovary to the anterior level of the acetabulum.

Eggs large yellowish-brown, measure 0.109 to 0.125 mm by 0.043 to 0.069 mm.

HOST: *Rattus norvegicus*, *Rattus r. alexandrinus*, *Apodemus agrarius*, *Mus musculus yamashinai*, and *Microtus fortis pelleeus*.

LOCATION: Small intestine

LOCALITY: Chulwon, Kumwha, Chongpyong, Paju, Pochon districts, and Seoul, Korea

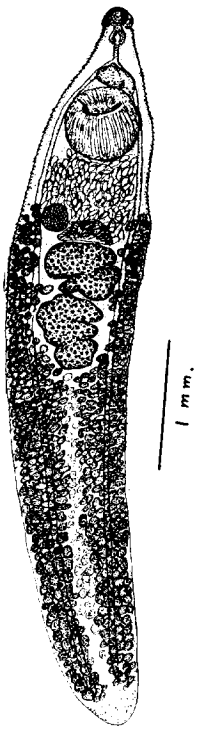

Fig. 2. *Echinostoma hortense*; ventral view.

Echinostoma cinetorchis Ando et Ozaki, 1923

A single specimen of this species was taken from the small intestine of one *Rattus norvegicus* in Chongpyong district. *E. cinetorchis* was first reported by Ando and Ozaki (1923) who found this trematode in *R. norvegicus* in Japan.

Description: Body large, elongated spindle-shaped with attenuated anteriorly, 12.21 mm long by 2.80 mm in greatest breadth which is found at the level of the Mehlis' gland. The lateral edges of the body is slightly corrugated. Head collar reniform, 0.504 mm across, bearing thirty-seven spines arranged in two rows; the end group spines six in number on each side. Cuticular spines covered the surface of the body from the anterior to the level of one third of posterior part of the body.

Oral sucker subterminal, 0.266 mm by 0.280 mm; ventral sucker well developed, 0.854 by 0.756 mm at anterior fifth of body length. Mouth ventrally subterminal; prepharynx 0.112 mm in length; pharynx 0.210 mm in diameter. Esophagus slender, 0.910 mm long; bifurcating immediately in front of genital pore; intestinal ceca narrow and smooth extending to near the posterior end of the body.

Excretory bladder tubule, bifurcating in the level of posterior fourth of the length; excretory pore at extreme posterior end of body.

Genital aperture immediately behind intestinal bifurcation, in median line. Cirrus sac oval, 0.294 mm long by 0.252 mm wide, usually in median between preacetabular and cecal bifurcation. Seminal vesicle, pars prostatica and ejaculatory duct prominent.

Testes small and elongate; situated bilaterally to the ovary; probably a variation of testes from their original position of postovarian. One testis measures 0.336 mm long by 0.252 mm wide at the right side of anterior border of ovary; the other testis, 0.364 mm long by 0.266 mm wide at the left side of posterior border of ovary.

Ovary transversely oval, 0.420 mm by 0.518 mm, equa-

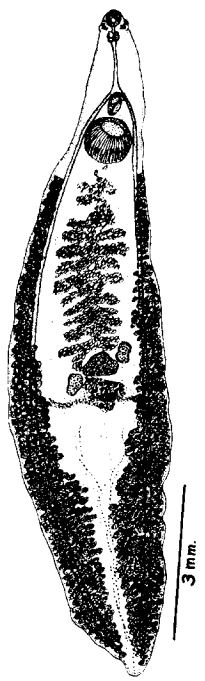

Fig. 3. *Echinostoma cinetorchis;* ventral view.

torial in the median line. Mehlis' gland conspicuous, immediately postovarian, larger than ovary, 0.532 mm by 0.672 mm. Uterine coils filled with eggs, between ventral sucker and ovary. Vitelline gland in the form of distinctly small follicles are confined to the narrow lateral fields from behind the posterior margin of the ventral sucker to posterior extremity of the body, closely approaching each other posterior third of the body.

Eggs many, oval operculated, yellowish, 0.089 to 0.096 mm by 0.053 to 0.059 mm.

HOST: *Rattus norvegicus*

LOCATION: Small intestine

LOCALITY: Chungpyong district, Korea

Euparyphium murinum Tubangui, 1931

Eight specimens of *Euparyphium murinum* were taken from the small intestine of two *Apodemus agrarius* in the area of Kumwha district. This species was first described by Tubangui (1931) in *Rattus norvegicus*, Manila. *E:murinum* was included in genus *Isthmiophora* Lühe, 1909 by Yamaguti. (1958). However Velasquez (1964) does not conform the diagnostic characters of *Isthmiophora* as given by Yamaguti with the absence of the receptaculum seminis in his adult specimen of *E. paramurinum* and in the specimens described by Tubangui (1931).

Our specimens are quite similar to *E. murinum* descri bed by Tubangui (1931) except difference in their size.

Description: Body small elongatde, dorsoventrally flattened, measures 1.58 to 2.36 mm long, with fairly pointed extremities; the greatest breadth being found at the testicular zone, 0.27 to 0.48 mm in breadth. Head collar reniform, 0.142 to 0.224 mm across, bearing forty-five spines arranged in two alternating rows. Cuticle armed with flat scales, dorsally from anterior end to ventral sucker and ventrally from anterior end to posterior level of first testis.

Oral sucker small and subterminal, 0.073 to 0.100 mm by 0.083 to 0.100 mm; ventral sucker well developed, 0.182 to 0.280 mm by 0.154 to 0.252 mm in size, at anterior third of body length. Mouth ventrally subterminal, prepharynx 0.017 to 0.050 mm; pharynx oval, 0.073 to 0.083 mm by 0.073 to 0.076 mm in size; esophagus 0.154 to 0.350 mm long, narrow anteriorly, broadening near bifurcation; bifurcating immediately in front of level of genital pore. Intestinal ceca long, reaching to near posterior end of body.

Excretory bladder tubular, bifurcating behind posterior testis; excretory pore at extreme posterior end of body.

Genital aperture immediately behind intestinal bifurcation, submedian; cirrus sac oval, 0.210 to 0.364 mm by 0.098 to 0.154 mm in size, usually to one side of median line, dorsal to ventral sucker and extending posteriorly beyond the equator. Seminal vesicle and pars prostatica distinct, cirrus protrusible.

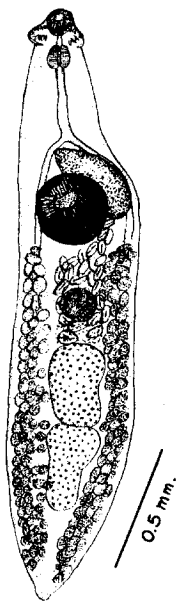

Fig. 4. *Euparyphium murinum*; ventral view

Testes tandem, postequatorial, oval to sausage-shaped, with smooth borders or slightly constricted at middle; anterior testis usually smaller 0.182 to 0.350 mm by 0.112 to 0.210 mm; posterior testis 0.196 to 0.448 mm by 0.112 to 0.238 mm.

Ovary globular or subspherical, 0.056 to 0.126 mm by 0.056 to 0.154 mm, equatorial, pretesticular. Mehlis' gland conspicuous, immediatly postovarian, larger than ovary, 0.099 to 0.112 mm by 0.116 to 0.168 mm. Uterus short, with few coils. Vitelline glands in the form of distinct follicles extending from the level of posterior margin of ventral sucker to near posterior end of body.

Eggs few, oval, operculated, thin shelled, yellowish, 0.083 to 0.102 mm by 0.046 to 0.056 mm.

HOST: *Apodemus agrarius*

LOCATION: Small intestine
LOCALITY: Kumwha district, Korea

FAMILY *DIPLOSTOMATIDAE* POIRIER, 1886

Fibricola seoulensis sp. nov.

Description: Body distinctly bisegmented, measures from 1.42 to 1.66 mm in total length. The elliptical anterior segment has borders curved only backward, 0.749 to 0.788 mm long by 0.630 to 0.798 mm wide; anterior part foliate but the lateral margins unite posteriorly to form a conspicuous spoon shape. The posterior segment, in form of an elongate ellipsoid, is almost equal length or slightly shorter than the anterior segment; the main axis measures 0.670 to 0.867 mm, its transverse diameter reaches the maximum at the level of the testes, 0.532 to 0.658 mm. Ratio of the length of the posterior segment, to that of the anterior segment is between 0.90 to 1.10.

Oral sucker measures 0.073 to 0.110 mm long by 0.069 to 0.079 mm wide; ventral sucker, transversely elongated, has a diameter of 0.069 to 0.070 mm by 0.089 to 0.099 mm; situated on an average at the 35 hundreadths of the length of the anterior segment. Its posterior border is at a distance of 0.070 mm from the anterior edge of the tribocytic organ which is approximately circular, measures 0.280 to 0.294 mm long and 0.238 mm in width. Pharynx measures 0.073 to 0.099 long by 0.046 to 0.053 mm wide. Prepharynx and esophagus are not recognized; ceca are narrow (0.023 to 0.030 mm) in their visible section.

Genital aperture is dorsal and subterminal; the anterior border of the bursa copulatrix is found between the 86 and 94 hundredths of the length of the posterior segment.

Testes large tandem, symmetrically; the first testis clearly bilobed, measures 0.210 to 0.252 mm longitudinal dimension and 0.420 to 0.658 mm transversely; the second testis deeply bilobed, 0.210 to 0.546 mm by 0.378 to 0.532 mm. The anterior border of the first testis is situated between the 9 and 17 hundredths of the length of the segment; the posterior border of the second between the 71 and 97 hundredths. Vesicula seminalis lies postero-dorsal to the interspace of the between two testes in median line.

Ovary transversely oval, 0.112 to 0.140 mm by 0.210 to 0.280 mm, situated laterally at junction of two body regions directly in front of anterior testis. In the anterior segment, the vitelline glands composed of very numerous follicles densely packed in posterior half of forebody, and limited at the level of the front of the ventral sucker, or slightly ahead of it, but not reach to intestinal bifurcation. In the posterior segment, they are prolonged in the form of two lateral clusters, interrupted in the zone of the

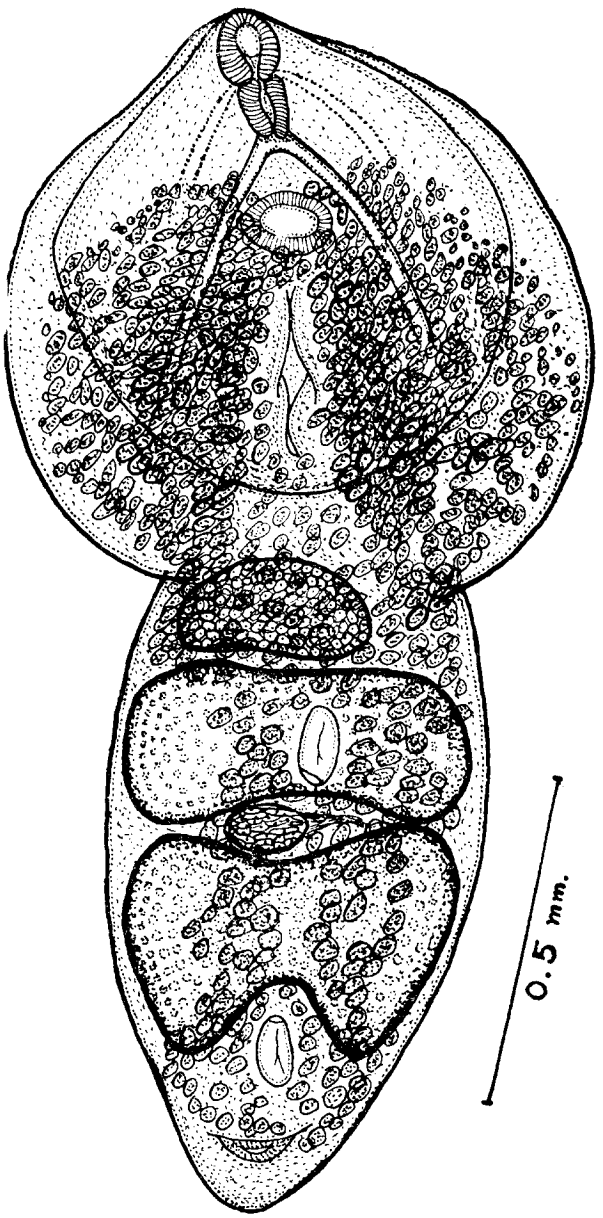

Fig. 5. *Fibricola seoulensis* sp. nov; ventral view.

testis, and reappearing wider, but a little less dense, beyond these organs, to terminate in the round extremity of the segment.

Eggs, few in number, measure 0.086 to 0.092 mm long by 0.050 to 0.056 mm.

HOST: *Rattus norvegicus*

LOCATION: Small intestine

LOCALITY: Seoul, Korea

Discussion: Thirteen specimens of this species were collected from 2 *Rattus norvegicus* in Seoul. Dubois (1953) summarized genus *Fibricola* and recognized five species.

Of these, *F. caballeroi* and *F. texensis* appear to be most similar to *F. seoulensis*. *F. caballeroi* was reported by Zerecero who found it from *R. norvegicus* in Mexico and *F. texensis* was reported by Chandler (1942), who found it from raccoon in Texas, United States.

F. caballeroi differs from *F. seoulensis* in total body length (1.50-2.28 mm as compared with 1.42-1.66 mm); transverse diameter of anterior segment (1.06-1.38 mm as compared with 0.630-0.798 mm); diameter of oral sucker longer than 0.100 mm; vitelline glands limit anteriorly at the level of intestinal bifurcation or at the immediately posterior to the pharynx, and confined in only anterior segment.

F. texensis differs from *F. seoulensis* in the total length (0.53-1.15 mm as compared with 1.42-1.66 mm); esophagus recognized, tribocytic organ (0.150-0.214 mm by 0.145-0.198 mm as compared with 0.280-0.294 mm by 0.238 mm); anterior segment longer than breadth; asymmetrical testes; and eggs (0.098-0.117 mm by 0.068-0.075 mm as compared with 0.086-0.092 mm by 0.050-0.056 mm).

Other species, *F. minor*, *F. lucida*, and *F. cratera* differ from *F. seoulensis* in ventral sucker (situated 42-55 hundredths as compared with 35 hundredth of the length of anterior segment); anterior segment longer than breadth (3/4 of length); tribocytic organ not exceed to 0.280 mm in its diameter; prepharynx and esophagus long; and asymmetrical testes.

SUMMARY

A total of 624 rodents of six species was examined for trematodes. Five species of trematodes were considered, of which *Fibricola seoulensis* sp. nov. was reported as a new species. *Plagiorchis muris*, *Echinostoma cinetorchis* and *Euparyphium murinum* was recorded for the first time from Korea. Descriptions are included for each species considered.

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=抄　錄=

韓國의 寄生蠕蟲類에 關한 研究 Ⅰ.

齧齒類의 吸蟲類

서울大學校 醫科大學 寄生蟲學敎室 및 風土病研究所

徐丙卨・林漢鍾・李燦旭

1956年부터 1964年 3月 까지 韓國內의 家鼠 및 野生鼠에 寄生하고 있는 吸蟲類에 對하여 調査하였다. 家鼠는 大部分 서울市內에서 野生鼠는 鐵原, 金化, 淸平, 抱川, 坡州 等地에서 捕獲하였다.

檢査한 鼠類는 *Rattas norvegicus* 357匹, *Apodemus agrarius* 221匹, *Rattus r. alexandrinus* 8匹, *Crossidura russula* 21匹, 總數 624匹이었다.

調査結果 *plagiorchis muris, Echinostoma hortense, Echinostoma cinetorchis, Euparyphium murinum* 및 *Fibricola sp nov*의 5種類의 吸蟲類를 發見하였고 그中 *Fibricola sp.*는 新種으로 記載報告하였으며 *P. muris. E. cinetorchis* 및 *E. murinum*은 韓國에서 처음으로 發見 記錄된 것이다.

*plagiorchis muris*는 金化 및 抱川에서 捕獲한 5匹의 *Apodemus agrarius*, 1匹의 *Rattus r. alexandrinus*에서 發見하였고 *Echinostoma hortense*는 서울市를 爲始하여 鐵原, 金化, 淸平, 坡州 및 抱川等地에서 捕獲한 *R. norvegicus*(6匹) *R.r. alexandrinus*(3匹), *Apodemus agrarius*(2匹), *M. musculus yamashinai*(2匹) 및 *Microtus fortis pelleeus*(2匹) 등 여러 種類의 鼠類에서 採集되었으며 比較的 廣範한 地域에 分布되어 있었다. *Echinostoma cinetorchis*는 淸平에서 捕獲된 *R. norvegicus*에서 1마리의 蟲體를 얻었으며 睾丸이 本來의 位置에 있지 않고 卵巢兩側에 位置하고 있는 一變種이었다. *Euparyphium murinum*은 金化地域에서 잡은 2匹의 *Apodemus agrarius*에서 發見하였다.

新種으로 記載報告한 *Fibricola sp*는 서울市內에서 捕獲한 2匹의 *R. norvegicus*의 小腸에서 發見된 Diplostomatidae에 屬하는 것으로 鼠類에서는 極히 드물게 볼 수 있는 吸蟲類이다.

本種은 Mexico의 *R. norvegicus*에서 發見된 *F. caballeroi*와 蟲體의 크기, 前體節의 幅長, 口吸盤의 直徑 및 卵黃巢의 分布狀態로서 區別되며 美國 Texas의 raccoon에서 發見報告된 *F. texensis* 및 그 外에 *F. minor F. lucida, F. cratera*와는 蟲體의 크기, 食道의 缺如, 附着器官의 크기, 前體節의 幅長比, 睾丸의 對稱性 및 蟲卵의 크기로서 區別됨으로 明白히 新種으로 認定되여 *Fibricola seoulensis*라 命名하여 記載報告하는 바이다.