

Two Species of Genus *Gordius* (Gordioidea, Nematomorpha) from Korea

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한국산 연가시 속(철선충 목, 유선형동물 문)의 2종

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적 요

한국산 철선충류의 분류학적 연구를 위해 1986년 8월부터 1992년 5월까지 남한의 16개 지역에서 철선충을 채집하여 조사한 결과 1속에 속하는 1신종 1한국 미기록종이 확인되었다. 이들은 *Gordius lineatus* n.sp.와 *Gordius robustus*이며, 기재와 함께 그림을 작성하였다. 지금까지 한국산 철선충류는 1906년 Linstow에 의해 2속(*Gordius*, *Parachordodes*) 3종, 1959년 조에 의해 *Gordius aquaticus* 1종이 기록되어있다. 따라서 한국산 철선충류는 모두 2속 6종이 된다.

Key words: *Gordius*, Gordioidea, Nematomorpha, new species, Korea.

INTRODUCTION

The present paper deals with horse-hair worms (or gordian worms) of genus *Gordius* from Korea. Horse-hair worms are very interesting wormlike animals. Adult horse-hair worms are free living in fresh-water habitats, while the larvae are parasitic in arthropod hosts living in water or along the water's edge (May, 1919). Also, the larvae can accidentally parasitize in human. Kagei (1977) noted that around 35 cases in human have been reported world-wide.

About 230 species of the horse-hair worms are known all over the world, but only four species have been recorded in this group from Korea. Among them *Gordius semilunaris*, *G. pallidus*, *Parachordodes coreanus* have been named by Linstow (1906a, b) without sufficient description to distinguish them and *G. aquaticus* was recorded in textbook by Cho (1959) without any description. Identification must be based on the details of the extremities and especially on the minute structures of the cuticle: its areolae, bristles, tubercles.

Since horse-hair worms are variable according to ages and localities, this paper gives the data on the details of the extremities that are distinguished from the other species of *Gordius*.

MATERIALS AND METHODS

This study was based on the materials collected from 15 areas in Korea during the period from October 1986 to June 1992 (Fig. 1). The materials were preserved in 10% neutral formalin. For the study of the extremities, a worm should be cut somewhat anterior to the cloacal aperture and posterior to the neck ring. For the study of the cuticle, small pieces should be cut off from the middle part of the body. It is also desirable to secure an entire circumferential piece which, after some time in lacto-phenol solution, can be released from the underlying musculature. The technique of Muller (1927) and Heinze (1937, 1941) was used in making preparations of the cuticle. To study the structures of the cuticle accurately, it should be observed in various conditions as followings: 1. in lacto-phenol solution, 2. in water, 3. in Canada balsam, 4. in superficially dried condition. Histological section of the cuticle should be made as possible as it can, since the surface examination alone is not enough. The system of classification is based on Carvalho (1942) for higher categories, and Montgomery (1898a, 1898b), Inoue (1952, 1979) for genus and species. The type specimens are retained in the Department of Biology, Kon-Kuk University, Seoul, Korea.

RESULTS

Order Gordioidea Rauther, 1930

Family Gordiidae May, 1919

Gordius lineatus n.sp. 가는줄연가시 (신칭)

(Fig.2)

Type-series. Holotype: ♂, Mt. Ch'onma, Kyunggi-do, Apr.14,1991 (GSM 3). Allotype: ♀, Mt. Ch'onma, Kyunggi-do, Apr.14, 1991 (GSF 4). Paratype: 9♂♂, 3♀♀ same data as the holotype; 4♂♂, 1♀ Mt. Ch'onma, Kyunggi-do, Apr.17, 1991; 1♂, Taesong-ri, Kyunggi-do, Apr.24, 1991; 2♂♂, Mt. Chogye, Chollanam-do, May 2, 1991; 3♂♂, Mt. Myongji, Kyonggi-do, May 10, 1991; 3♂♂, Taesung-ri, Kyunggi-do, May 1,1990.

Male (Holotype): Body slender and cylindrical, measuring 167mm long by 0.52mm broad at thickest portion and decreasing very slightly in diameter toward both ends. Body color light yellow and two light brown lines (0.11mm broad at anterior portion) passing backward from neck ring through body length, one on ventral and the other on dorsal. These lines distinctly darker than rest of body, especially anterior part, but the more backward the more weak. Dorsal line traced to base of tail lobes while ventral line disappeared a short distance before cloacal aperture.

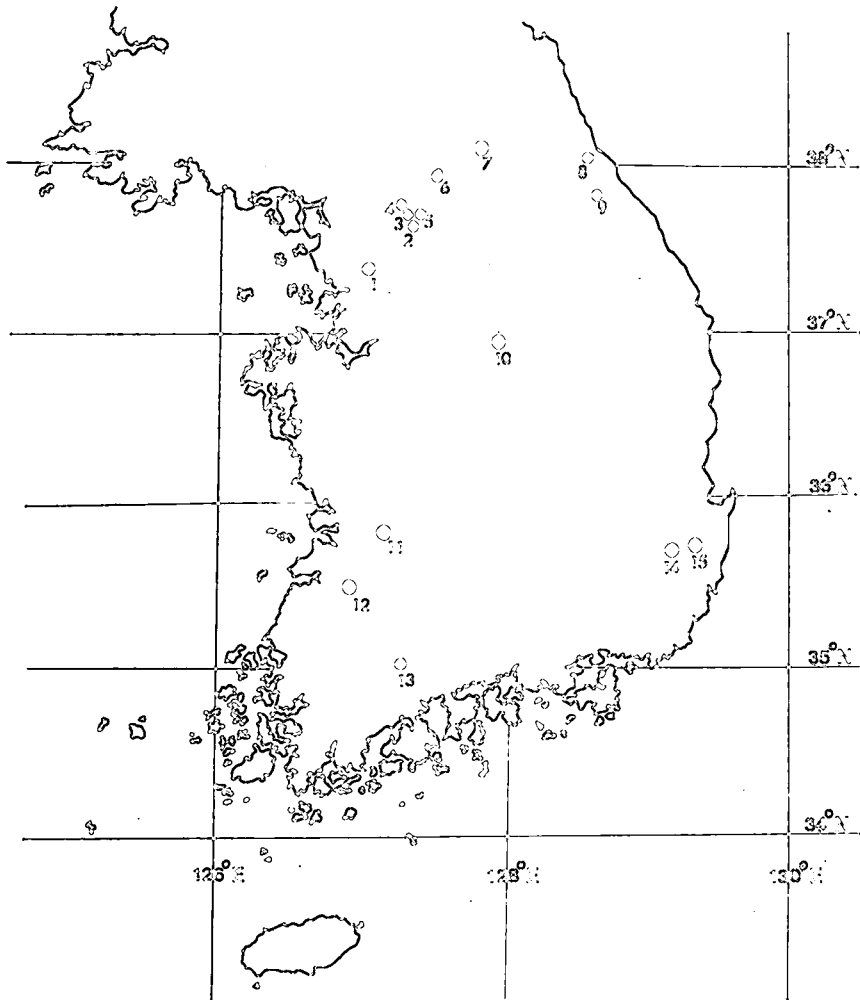


Fig. 1. A map showing the localities where the materials were collected.

1, Anyang(안양); 2, Masok(마석); 3, Mt. Ch'onma(천마산); 4, Naebang-ri(내방리); 5, Taesong-ri(대성리); 6, Mt. Myongji(명지산); 7, Hwach'on(화천); 8, Yangyang(양양); 9, Mt. Odae(오대산); 10, Mt. Worak(월악산); 11, Mt. Moak(모악산); 12, Mt. Naejang(내장산); 13, Mt. Chogye(조계산); 14, Parkdal(박달); 15, Mohwa(모화).

Calotte (Fig. 2A) clear white, round edge, bigger than neck ring, measuring 0.25mm long by 0.32mm broad and bounded by light brown neck ring (0.11mm in length) with short bristles.

Posterior end (Fig. 2D) furcated into two caudal lobes. Each caudal lobe cylindrical and nearly conical at edge, measuring 0.37mm in length and 0.19mm in width but somewhat concave on their medio-ventral surface with slight flatten on inner side. Transversed cuticular ridge located at bifurcated point of caudal lobes. Postcloacal cuticular ridge crescentic-shaped with posteriorly sharp edge, slightly passing onto base of lobes, about 1/5 lobe length; color brown, its posterior edge dark brown.

Cloacal aperture round and situated anterior to middle of postcloacal cuticular ridge. Internal sides of tail lobes light brown. No small dark ring surrounding cloacal aperture.

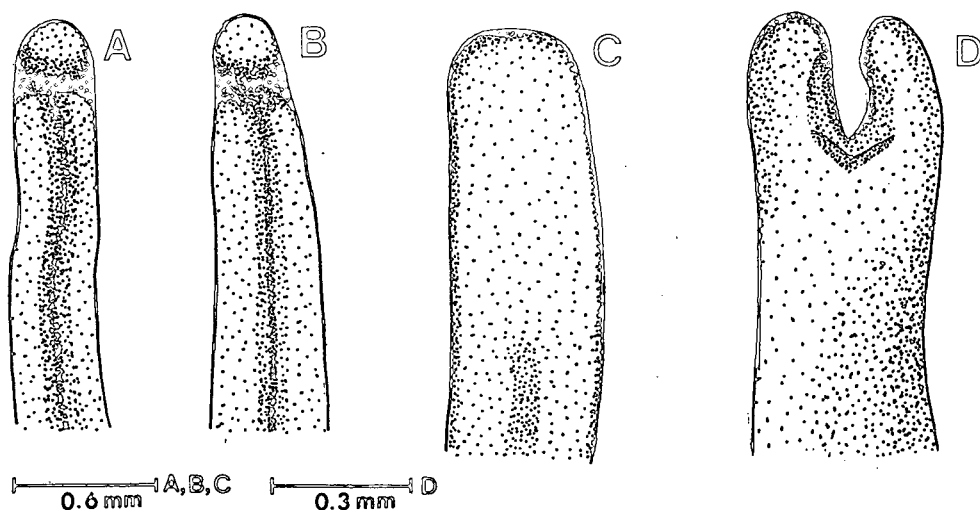


Fig. 2. *Gordius lineatus* n. sp. A, anterior end of the male; B, anterior end of the female; C, posterior end of the female; D, tail lobes of the male.

Cuticle not areolated and many bristles present on anterior and posterior part. Lighter spots scattered over whole body. Data of other specimens given in Table 1.

Female (Allotype): Body cylindrical, measuring 260mm long 0.87mm broad at thickest portion and distinctly attenuated just before both ends. Female thicker than male. Anterior end (calotte) of female somewhat conical in shape, clear white in color (Fig. 2B).

Posterior end of female slightly enlarged and abruptly truncated at end (Fig. 2C). Cloacal aperture located at center of truncated area. Round cloacal aperture surrounded by a brown ring encircled by another light brown ring. Other characters similar to male's and data of other specimens given in Table 1.

Etymology: *Gordius lineatus* n.sp. (*lin*, in Latin means line) is named for its dorsoventral line which is running through the body length.

Discussion: In the genus *Gordius*, three species have been reported from Korea by Linstow (1906a,b) and Cho (1959). The diagnostic characters of this new species are as followings: 1) Distinct dorsoventral line, the color from yellow to lightbrown (Table 1) passing backward through the body length in both sexes (Fig. 2A, B). 2) The body is very slender and cylindrical (all measurements in Table 1). 3) The calotte is bigger than the neck ring, the edge round.

This new species is similar to following species: *Gordius aquaticus* Linne, *G. robustus* Leidy, *G. japonicus* Inoue, *G. ogatai* Inoue, *G. pavlovskii* Kirjanova, but it is distinguished from *G. aquaticus* by presence of the following characters: 1) white spot absent on the cuticle 2) clear white calotte surrounded by dark ring 3) distinct dorsoventral line running through the body length 4) absence of a row of bristles on the male cloacal aperture 5) very slender body (0.45-0.95mm), etc.; from *G. robustus* by presence of 1) color of the body only white to light yellow, no brown or dark brown 2) distinct dorsoventral line running through the body length 3) clear white and bulb like rounded calotte 4) calotte is bigger than the neck ring 5) postcloacal cuticular ridge with sharp edge 6) small and slender tail lobes, etc.; from *G. japonicus* by presence of 1) absence of areoles and transparent spots on the cuticle 2) ends of the postcloacal cuticular ridge passing onto the tail lobes, about 1/5 (not over 1/3) the lobe length 3) dorsoventral line, etc.; from *G. ogatai* by

of ridge passing deeply onto lobes, about 1/4 of lobe length. This ridge broad, open crescent-shaped, and brown color with its posterior edge dark brown (Fig. 3D).

Cloacal aperture round and located anterior to middle of crescent-shaped ridge. A dark ring encircle at a little distance from cloacal aperture.

Short bristles present on posterior part(not whole body), especially on caudal lobes and cloacal aperture region, but rarely present on anterior portion.

Anterior end(calotte) yellow or yellowish white in color, round but somewhat conical in shape, smaller than dark brown neck ring (Fig. 3A).

Female: Posterior end of female swollen, abruptly truncated and not bifurcated(Fig. 3C). Cloacal aperture located at center of truncated area and surrounded with dark ring. Calotte yellow in color with dark brown neck ring(Fig. 3B). Bristles present more on anterior part than posterior part. Other characters same as males.

Discussion: This species was named by Leidy in 1851. Leidy's original description was not sufficient for identification, but his description in 1879 was fairly complete and the materials were available for study (May, 1919). Also this species was placed by Montgomery (1898 a,b) as a subspecies of *G. aquaticus*, since the differences was not warrant for ranking it as a seperate species. But May (1919) regarded the two species could not be combined. For there were several characters described by several authors to the European species that were not present in *Gordius robustus*. The characters not present in *Gordius robustus* are pseudoareolae, pores, white spots on the cuticle, a dorsoventral furrow at the posterior end of the female.

This species from Korea has bristles chiefly on the anterior end of females and the posterior end of males, not on entire body. Some specimens have little bristles on the whole body. The bristles are very minute, measuring 1-10um long. Neither areoles nor granules can be found. Lighter spot not white can be recognized on the cuticle. Color pattern is not a taxonomic character, since according to the difference on duration of survival, habitat and fixatives there are a lot of variation. The shape of postcloacal cuticular ridge is variable, wide u,v and crescentic etc. . The calotte of this species is remarkably smaller than that of *G. lineatus*.

ABSTRACT

The present study of horse-hair worms was based on the materials collected from 17 areas in Korea during the period from October 1986 to June 1992. As a result the identified Korean horse-hair worms consist of 2 species in 1 genus. One is new species, *Gordius lineatus* n. sp. and the other, *Gordius robustus* Leidy, 1851 is newly recorded in South Korea. Total 6 species in 2 genera are now listed for the gordioidean fauna of Korea.

REFERENCES

- Camerano, L., 1915. Revisione dei Gordii. Mem. R. Accd. Sc. Torino, 35: 1-66.
Carvalho, J., 1942. Studies on some Gordiacea of North and South America. J. Parasitol., 28: 213-222.
Cho, B. S., 1959. Taxonomy of zoology. Hong Ji Sa, Seoul, pp.189 (in Koean).

- Heinze, K., 1937. Die Saitenwürmer (Gordioidea) Deutschlands. Eine systematisch-faunistische Studie über Insectenparasiten aus der Gruppe der Nematomorpha. Z. Parasitenk., **9**: 263-344.
- Heinze, K., 1941. Saitenwürmer oder Gordioidea. Die Tierwelt Deutschlands, Teil, **39**: 1-77.
- Inoue, I., 1952. On a new species of *Chordodes* (Gordioidea) from Japan. Zool. Soc. Jap. (Zool. Insti., Tokyo Univ.), **25**(3):400-402.
- Inoue, I., 1979. Two new species of *Gordius* (Gordioidea) from Japan. Annotationes Zoologicae Japonenses, **52**: 235-239.
- Kagei, N., T. Oshima, I. Inoue and T. Kuwasaki, 1966. First human case on Gordid worm in Japan (Nematomorpha: Gordiidae). Jap. J. Parasitol., **15**(1):79-81.
- Kagei, N., 1977. Discussion on the human parasitism with hairworms (Gordioidea, Nematomorpha). Bull. Inst. Publ. Health, **26**: 14-18
- Leidy, J., 1851. Gordiaceae. Proc. Acad. Nat. Sci. Phila., **5**: 262-263, 275.
- Leidy, J., 1879. On *Gordius*, and on parasites of the rat. Proc. Acad. Nat. Sci. Phila., **1**: 10-11.
- Linstow, O. von., 1906a. Gordiiden und Mermithiden des Königlichen Museums in Berlin. Mitt. Zool. Mus. Berlin, **3**: 241-248.
- Linstow, O. von., 1906b. On worms of the family Gordiidae from corea. Proc. Zool. Soc. London, **1906**: 556-557.
- May, H. G., 1919. Contribution to the life histories of *Gordius robustus* Leidy and *Paragordius varius* (Leidy). Ill. Biol. Monogr., **5**(2): 1-118.
- Montgomery, T. H. Jr., 1898a. The Gordiaceae of certain American collections with particular reference to the North American fauna. Bull. Mus. Comp. Zool. Havard Coll., **32**: 23-59.
- Montgomery, T. H. Jr., 1898b. The Gordiaceae of certain American collections with particular reference to the North American fauna. II. Proc. Calif. Acad. Sc., **1**(3):333-344.
- Müller, G., 1927. Über Gordiaceen, Ztschr. Morphol. Ökol. Tiere, **7**:134-219.
- Rauther, M., 1930. Nematomorpha, Kükenthal-Krumbach, Hdb. der Zoologie 2; 1. Hälfte, Lief., **8**:403-448.
- Villot, A., 1886. Révision des Gordiens. Ann. Sci. Nat. Zool., **1** (7):271-318.

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