

Collembola from North Korea, III. Isotomidae

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北韓産 톡토기류. III. 마디톡토기 과

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적 요

북한산 마디톡토기과의 5종을 기재, 논의한다. 이 중에서 4종 즉 *Isotomurus griseus*, *I. myohyangsanus*, *Isotoma grana*, *I. agrana*는 신종이고 *Folsomia octoculata* Handschin, 1925은 북한미기록종이다. 이로서 한국산 마디톡토기과는 남한산 6속 15종을 포함하여 총 6속 19종에 이른다.

Key words: Collembola, Systematics, North Korea, Isotomidae

INTRODUCTION

This work presents the result of the study on North Korean Collembola by the senior author (Lee, B.H.), comprising the third paper after his early one for Hypogastruridae (Lee et Thibaud, 1975) and his recent one on Entomobryidae and Tomoceridae (Lee and Park, 1992). The materials were graciously offered by Dr. Mahunka Sandor of the Hungarian Natural History Museum who organized

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expeditions to North Korea more than 15 times during last twenty years.

Studies on Isotomidae from North Korea, however, have not been made so far, this one, therefore, being the first report even though those for South Korea have revealed 15 species in six genera by a few workers (Sohn, 1963; Yosii and Lee, 1963; Lee, 1977). Our examinations of the present specimens enabled us to describe four species in three genera as new to science and one species of new record to North Korea, having been earlier reported from South. The materials were collected from five localities in North Korea (Fig. 1).

The holotype as well as paratypes will be deposited in the Hungarian Natural History Museum, Budapest, whereas Department of Biology Education of Jeonbuk National University preserves some paratypes for later study.

Here descriptions were made by the first (Lee, B.H.) and the last (Kim, J.T.) authors among the three collaborators. Collection numbers were provided by the Hungarian Natural History Museum.

***Folsomia octoculata* Handschin, 1925**

The characters of this materials are the same as those described by Lee from South Korea (Lee, 1977), except for some variation in the number of setae 2 + 2 or 3 + 3 in anterior face of manubrium in the present specimens.

This species is a new record for North Korea.

Additional material examined. Eight individuals, Mt. Kumkang-san, Kangwon Prov., Collection no. 699, 18 Sept. 1980, from moss sample collected along the foot-path to Kuryong Falls, 7-800 m a.s.l., extracted with Berlese-funnel. Four individuals, Mt. Lyongak-san, South Pyongan Prov., Collection no. 622, 9 Sept. 1980. Litter sample extracted with Berlese-funnel. Twelve individuals, Mt. Myohyang-san, Changang Prov., Collection no. 651, 12 Sept. 1980. Moss sample from stone extracted with Berlese-funnel. Thirteen individuals, Bagyon Falls, Kaesong City, Collection no. 878, 30 July 1982, from moss sample taken from rocks above the falls, specimens extracted in Budapest.

***Isotomurus griseus* Lee et Kim, n. sp. (Fig. 2)**

Length up to 1.4 mm. Body elongate, dark gray in alcohol. Dorsal side of body densely spotted and on Ant. and leg with moderately dispersed spots. Furcula and ventral side of abdomen pale in color (Fig. 2A). Antenna 1.6 times as long as head, with its segments, in lengths, related as about 13:21:21:35. Fourth antennal segment without any apical bulb. Third antennal organ with 2 curved sense rods and 2 guard setae (Fig. 2B). Postantennal organ oval and larger than ocelli (6:5)(Fig. 2C). Labral edge with 4 processes and 16 setae in 4 rows (Fig. 2D).

Eyes 8 + 8 with dark blue patch, ocelli G, H smaller than others (Fig. 2C). Unguis simple, curving at apex, but with 1 minute lateral tooth (Fig. 2E). Unguiculus broadly lanceolate, approximately 1/3 external margin of unguis in length, but shorter on fore and middle feet, and, on hind feet, inner basal lamella strongly curved and untoothed, with 1 tenent hair (Fig. 2E). Ventral tube with 7 + 7 setae. Rami of tenaculum quadridentate, corpus with 8 setae arranged longitudinally (Fig. 2F). Furcula relatively long, appended to 5th abdominal segment, reaching ventral tube. Manubrium:dentes:mucron ratio related as 10:24:1. Manubrium with 28 setae in 7 rows and without spinous process (Fig. 2G). Dentes 2.4 times as long as manubrium, slender, minutely crenulated, with 8 pairs of setae on posterior of dentes dorsally, and with 1 lateral seta longer than mucro (Fig. 2H). Mucro tridentate,

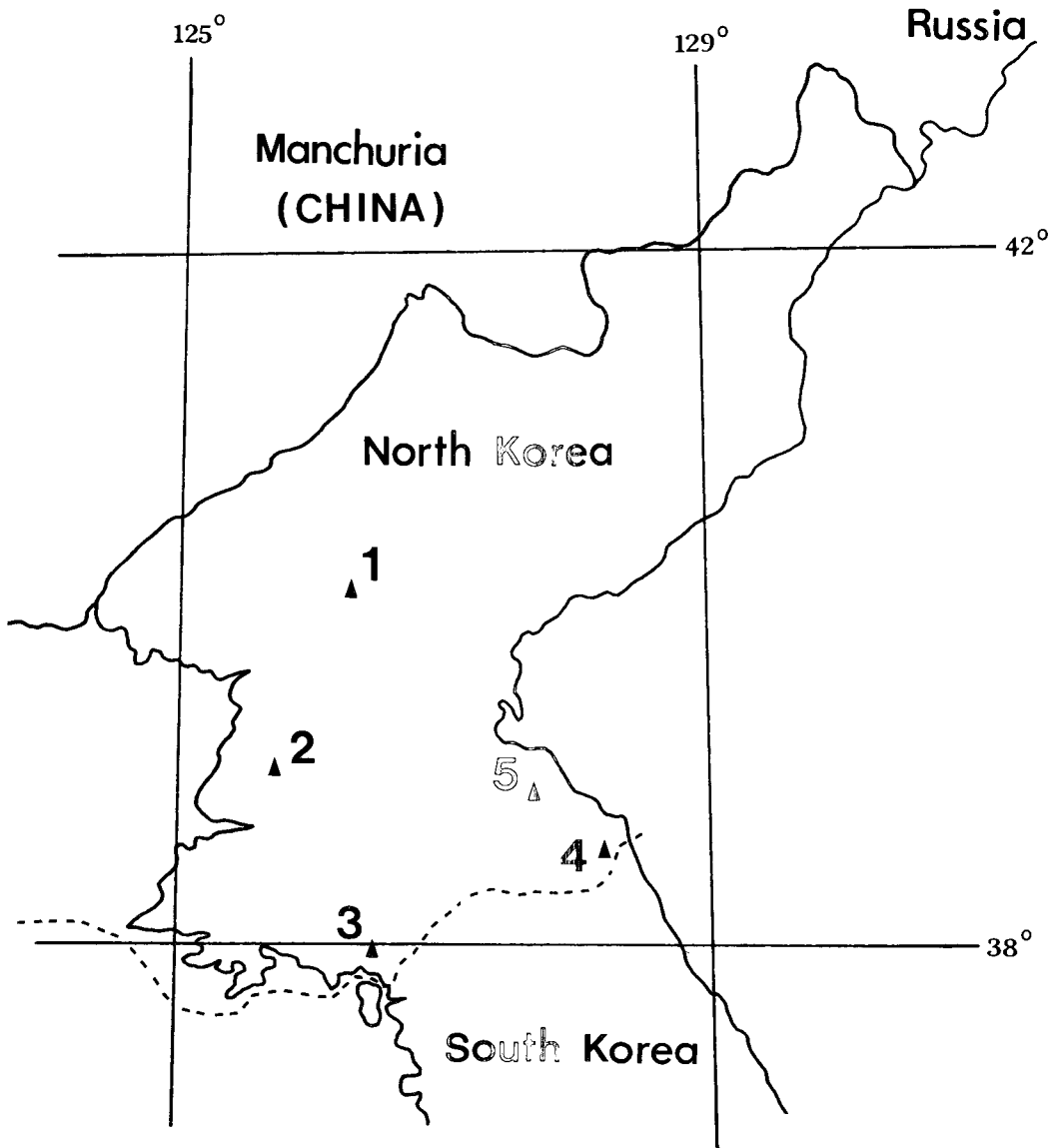


Fig. 1. Collection sites of Isotomidae from North Korea. 1. Mt. Myohyang-san (North Pyongan Prov.) 2. Mt. Ryongak-san (Pyongyang City) 3. Bagyon Falls (Kaesong City) 4. Mt. Kumgang-san (Kangwon Prov.) 5. Lake Sijung-ho (halfway between Wonsan and Mt. Kumgang-san)

with smoothly curved ventral margin, and shorter than unguiculus of hind feet (Fig. 2H).

Clothing of dense simple setae, unequal in length, erect setae dispersed among shorter ones, longer stiff setae characterizing general appearance, especially on posterior abdomen (Fig. 2I). Long setae of posterior abdominal segments often feathered in distal half.

Type data. Holotype ♀, Mt. Myohyang-san, North Pyongan Prov., Collection no. 830, 19 July 1982. Moss sample taken from rocks at the lower part of the pathway to Sangwonam and extracted

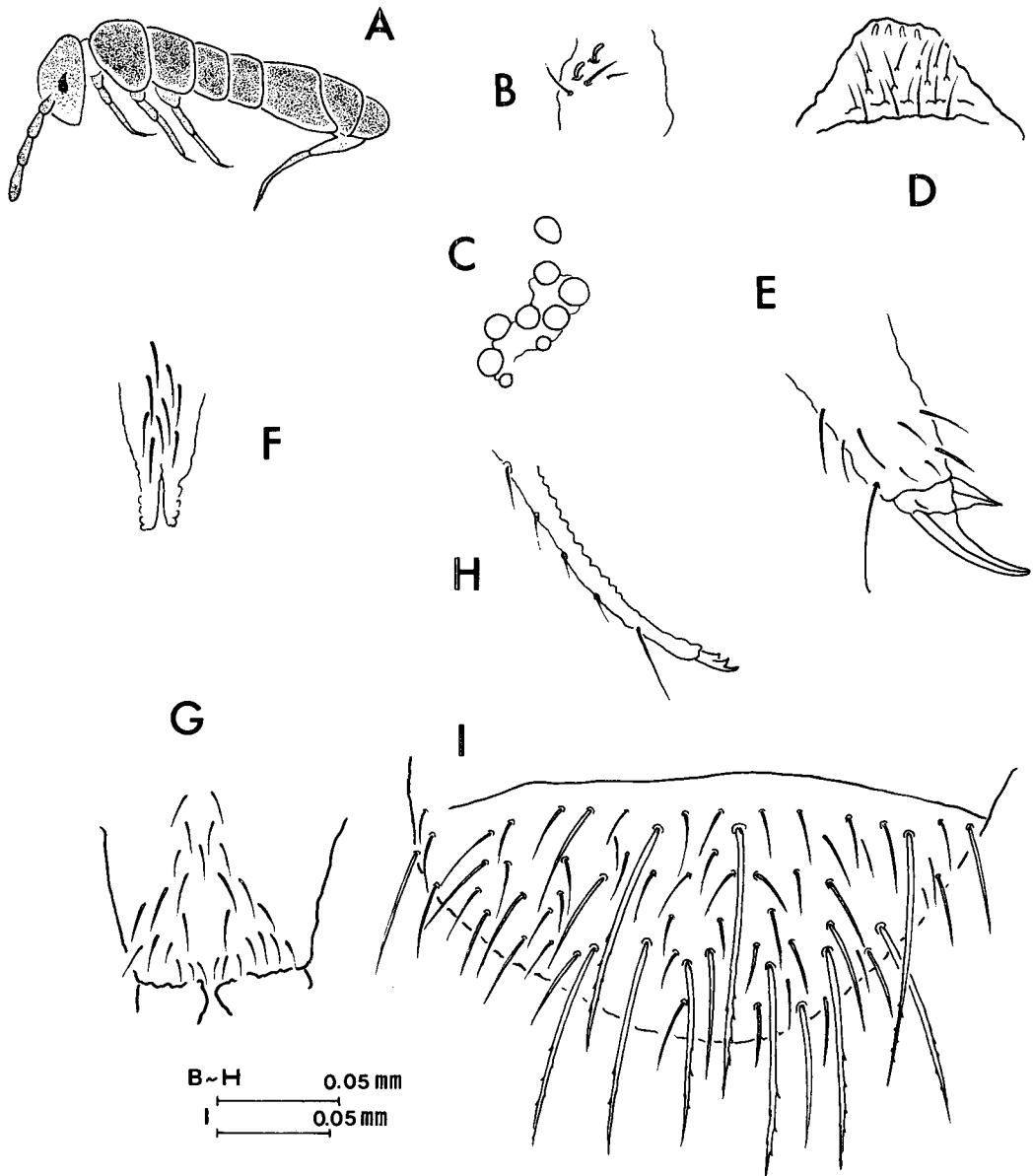


Fig. 2. *Isotomurus griseus* Lee et Kim, n. sp. A: whole insect, B: third antennal organ, C: postantennal organ and ocelli, D: labral edge, E: midclaw, F: rami, G: anterior face of manubrium, H: posterior of dentes, and mucro, I: abd. V + VI segment

with Berlese-funnel.

Paratypes. 6, same data as holotype.

Additional material examined. Fifteen individuals, Lake Sijung-ho (halfway between Wonsan and Mt. Kumgang-san), Collection no. 868, 26 July 1982. Soil sample scraped from debris on shore of Lake Sijung-ho, extracted with Berlese-funnel. Three individuals, Mt. Kumgang-san, Hotel Kumgang, Collection no. 725, 20 Sept. 1980, sampled from the forest soil behind the hotel. Five individuals,

Bagyon Falls, Kaesong City, Collection no. 878, 30 July 1982. Moss sample taken from rocks above the falls, and extracted in Budapest.

Remarks. This species is related to *Isotoma infuscatus* Yosii, 1963 from Japan except for the conical sensilla in the Ant. IV segment, quadridentate of mucron, with 3-4 spinous process of manubrium in the Japanese species.

***Isotomurus myohyangsanus* Lee et Kim, n. sp.** (Fig. 3)

Length up to 1.3 mm. Body elongate, pale yellow in alcohol, with eye patch and central spot in the head. Lateral edge line of Th. and Ant. pigmented (Fig. 3A). Furcula and intersegmental bands still paler in color. Antenna 1.7 times as long as head, with its segments, in lengths, related as about 34:47:48:70. Fourth antennal segment with terminal bulb. Third antennal organ with curved 2 sense rods (Fig. 3B). Postantennal organ close to eyes, oval and larger than ocelli in length (Fig. 3C,D).

Eyes 8 + 8 with dark blue patch, ocelli G, H smaller than others (Fig. 3D). Labral edge with 4 processes (Fig. 3E). Unguis simple, curving at apex, but with 1 pair of lateral teeth. Unguiculus broadly lanceolate, approximately 1/2 external margin of unguis in length, but shorter on fore and middle feet, and, on the hind feet, inner basal lamella strongly curved and untoothed (Fig. 3F). With 2 tenent hairs (Fig. 3F). Ventral tube with 11+11 setae. Rami of tenaculum quadridentate, corpus with 8 setae arranged longitudinally (Fig. 3G). Furcula relatively long and yellow in color, appended to 5th abdominal segment, reaching ventral tube. Anterior face of manubrium with 30 setae on warty bases (Fig. 3H). Manubrium:dentes:mucron ratio as 11:24:1. Dentes slightly more than 2 times as long as manubrium, slender, crenulated dorsally. Dentes crenulated, with 4 pairs of setae in dorsal side, and with 1 lateral seta longer than mucron in ventral side (Fig. 3I). Mucro tridentate, with smoothly curved ventral margin, and shorter than unguiculus of hind feet (Fig. 3I).

Clothing of dense simple, erect setae unequal in length, dispersed among shorter ones, and longer stiff setae characterizing general appearance, especially serrated on posterior abdomen (Fig. 3J).

Type data. Holotype ♂, Mt. Myohyang-san, North Pyongan Prov., Collection no. 792, 14 July 1982. Moss sample from rock standing beside Unsam waterfall, extracted with Berlese-funnel.

Paratypes. 6, same data as holotype.

Additional material examined. Four individuals, Mt. Kumgang-san, Manmul sang, Kangwon Prov., Collection no. 63, 30 May 1970, sampled from litter of montane oakwoods. Three individuals, Mt. Ryongak-san, Pyongyang City, Collection no. 779, 12 July 1982. Soil sample taken from a mixed forest and extracted with Berlese-funnel. Five individuals from Mt. Kumgang-san, Onjong-ri, Kangwon Prov., Collection no. 1339, 19 Jun. 1988, sampled from forest litter and rotten trunks of *Pinus densiflora*, extracted with Winkler-Moczarsky funnel.

Remarks. This species resembles *Isotomurus punctiferus* Yosii, 1963 from Japan in bearing black head spot but is easily distinguished by the presence of dorsal tooth on unguis and mucronal teeth, and by the absence of inner tooth on unguiculus and tenent hair. It is also close to *I. infuscatus* Yosii, 1963 from Japan but distinguished by manubrium not hirsute and without spinous process in the present material.

***Isotoma grana* Lee et Kim, n. sp.** (Fig. 4)

Length up to 0.9 mm. Body elongate, grayish yellow in alcohol, mottled with blue pigment

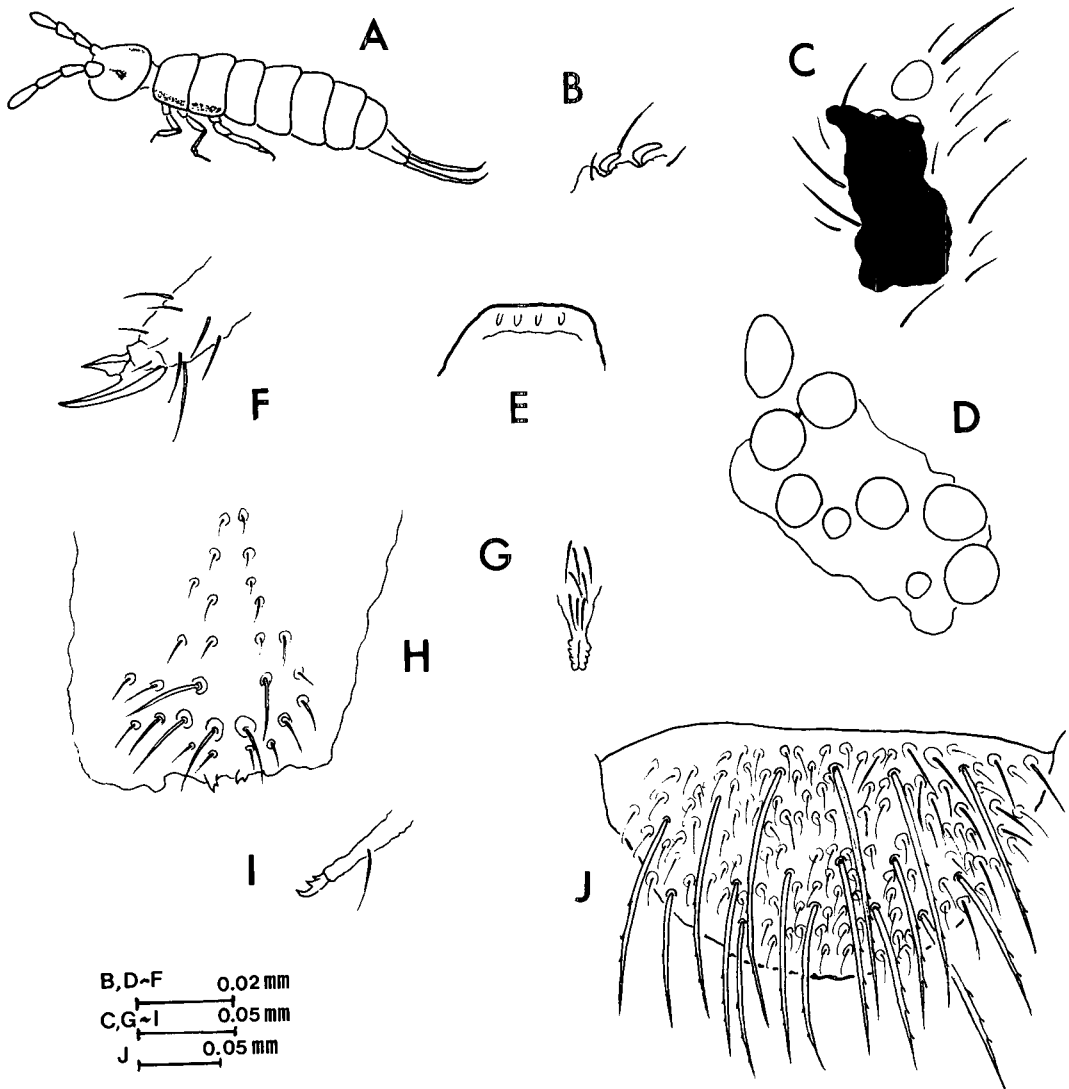
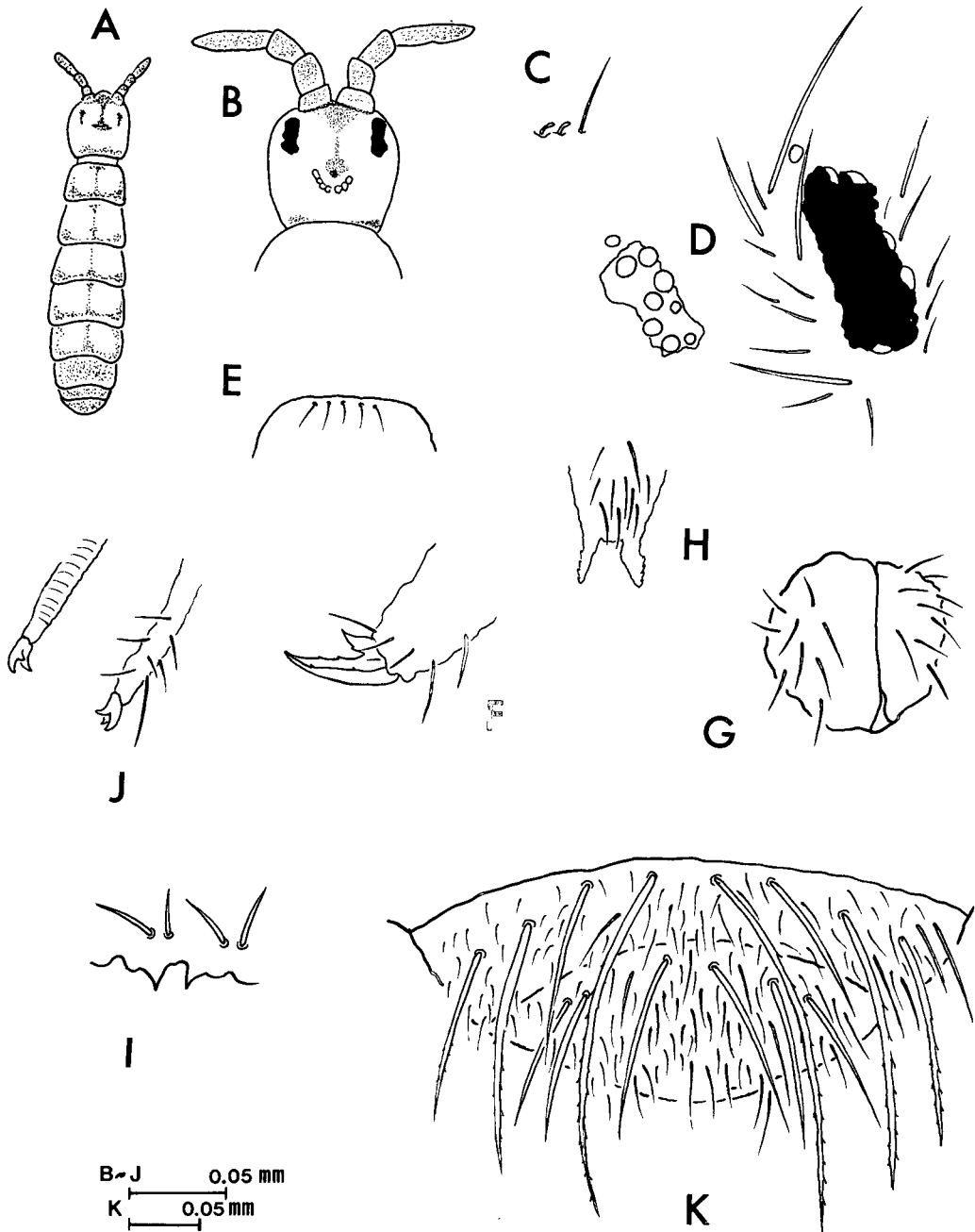


Fig. 3. *Isotomurus myohyangsanus* Lee et Kim, n. sp. A: whole insect, B: third antennal organ, C, D: postantennal organ and eye patch, ocelli, E: labral edge seta, F: hindclaw, G: rami, H: anterior face of manubrium, I: dentes and mucro, J: abd. V + VI segment

randomly dispersed. Antenna, Th.I., furcula and intersegmental bands still paler in color (Fig. 4A). A dark spot present in head center (Fig. 4B). Antenna 1.3 times as long as head, with its segments, in lengths, related as about 11:12:16:34. Third antennal segment longer than second segment. Third antennal organ with 2 curved sense rods and 2 guard setae (Fig. 4C). Postantennal organ close to eyes, oval and smaller than ocelli in length (Fig. 4D, E). Eyes 8 + 8 with dark blue patch, ocelli G, H smaller than others (Fig. 4E). Labral edge with 5 setae (Fig. 4E). Unguis simple, curving at apex, but with 1 pair of lateral teeth and 2 inner teeth (Fig. 4F). Unguiculus broadly lanceolate, approximately 1/2 external margin of unguis in length, inner basal lamella strongly curved and with 1 inner tooth (Fig. 4F). Tenent hair absent. Ventral tube with 9 + 9 setae (Fig. 4G). Rami of tenaculum



B~J 0.05 mm
 K 0.05 mm

Fig. 4. *Isotoma grana* Lee et Kim, n. sp. A,B: whole insect and central spot of head, C: third antennal organ, D: postantennal organ and ocelli, E: labral edge seta, F: midclaw, G: venral tube, H: rami, I: distal end of manubrium, J: dentes and mucro, K: abd. V, VI segment

quadridentate, corpus with 10 setae arranged longitudinally (Fig. 4H). Furcula relatively long and yellow in color, appended to 5th abdominal segment, reaching ventral tube. Anterior face of manubrium with 30 setae. Manubrium with acute process on distal end (Fig. 4I). Manubrium:dentes: mucron related as 11:23:1 in length. Dentes slender, crenulated dorsally, and with lateral seta, longer than mucro (Fig. 4J). Mucro tridentate, with smoothly curved ventral margin (Fig. 4J). Abd. III and IV segments unequal, and Abd. IV segment slightly longer than Abd. V and Abd. VI segment. Ant. V and Ant. VI segment well demarcated.

Clothing of dense simple setae, unequal in length, erect setae dispersed among shorter ones and longer stiff setae characterizing general appearance, especially on posterior abdomen. Long setae of posterior abdominal segments often feathered (Fig. 4K).

Type data. Holotype ♀, Mt. Myohyang-san, North Pyongan Prov., Collection no. 782, 13, July 1982, sifted litter taken from a mixed forest at the road to Manpokdong, extracted with Moczarsky-Winkler apparatus.

Paratypes. 5, same data as holotype.

Additional material examined. Two individuals, Mt. Myohyang-san, North Pyongan Prov., Collection no. 791, 14, July 1982, sifted litter taken from a mixed forest near Unsam waterfall, extracted with Moczarsky-Winkler apparatus. Two individuals, Bagyon Falls, Kaesong City, Collection no. 879, 30 July 1982. Moss sample taken from rocks near the falls, extracted in Budapest. One individual, Mt. Ryongak-san, Pyongyang City, Collection no. 779, 12 July 1982, soil sample taken from a mixed forest, extracted with Berlese-funnel. Four individuals, Mt. Kungang-san, Kangwon Prov., Collection no. 701, 18 Sept. 1980, from moss sample. Three individuals, Mt. Kungang-san, Kangwon Prov., 25 Sept. 1979, from sample of moss growing on a big stone on the bank of a brook, extracted with Berlese-funnel.

Remarks. This species closely resembles *Isotoma pinnata* Börner, 1909 from Japan but is distinguished by swollen four granules in labral edge, the presence of tenent hair on claw, feathered setae on the posterior part of Abd. in the present specimens.

This species is characterized by the black spot present in the head center with guard tubercular granules in contact on the posterior side.

***Isotoma agrana* Lee et Kim, n. sp.** (Fig. 5)

Length up to 1.5 mm. General color of body grayish yellow in alcohol, with a median line in the dorsal from Th. to Abd. IV segment. Body swollen in posterior abdomen (Fig. 5A). Furcula and intersegmental bands still paler in color. Antenna 1.5 times as long as head, with its segments, in lengths, related as about 26:45:42:98. Third antennal segment shorter than second segment. Third antennal organ with 2 curved sense rods and 2 guard setae (Fig. 5B). Postantennal organ close to eyes, oval and slightly larger than nearby ocelli in length (Fig. 5C). Eyes 8 + 8 with dark blue patch, ocelli G, H smaller than others (Fig. 5C). Labral edge with 4 processes (Fig. 5D). Unguis simple, curving at apex, but with 1 pair of lateral teeth (Fig. 5E). Unguiculus broadly lanceolate, approximately 1/2 external margin of unguis in length, inner basal lamella strongly curved and with 1 inner tooth. One tenent hair present (Fig. 5E). Ventral tube with 7 + 7 setae. Rami of tenaculum quadridentate, corpus with 7 setae arranged longitudinally (Fig. 5F). Furcula relatively long and yellow in color, appended to 5th abdominal segment, reaching ventral tube. Anterior face of manubrium

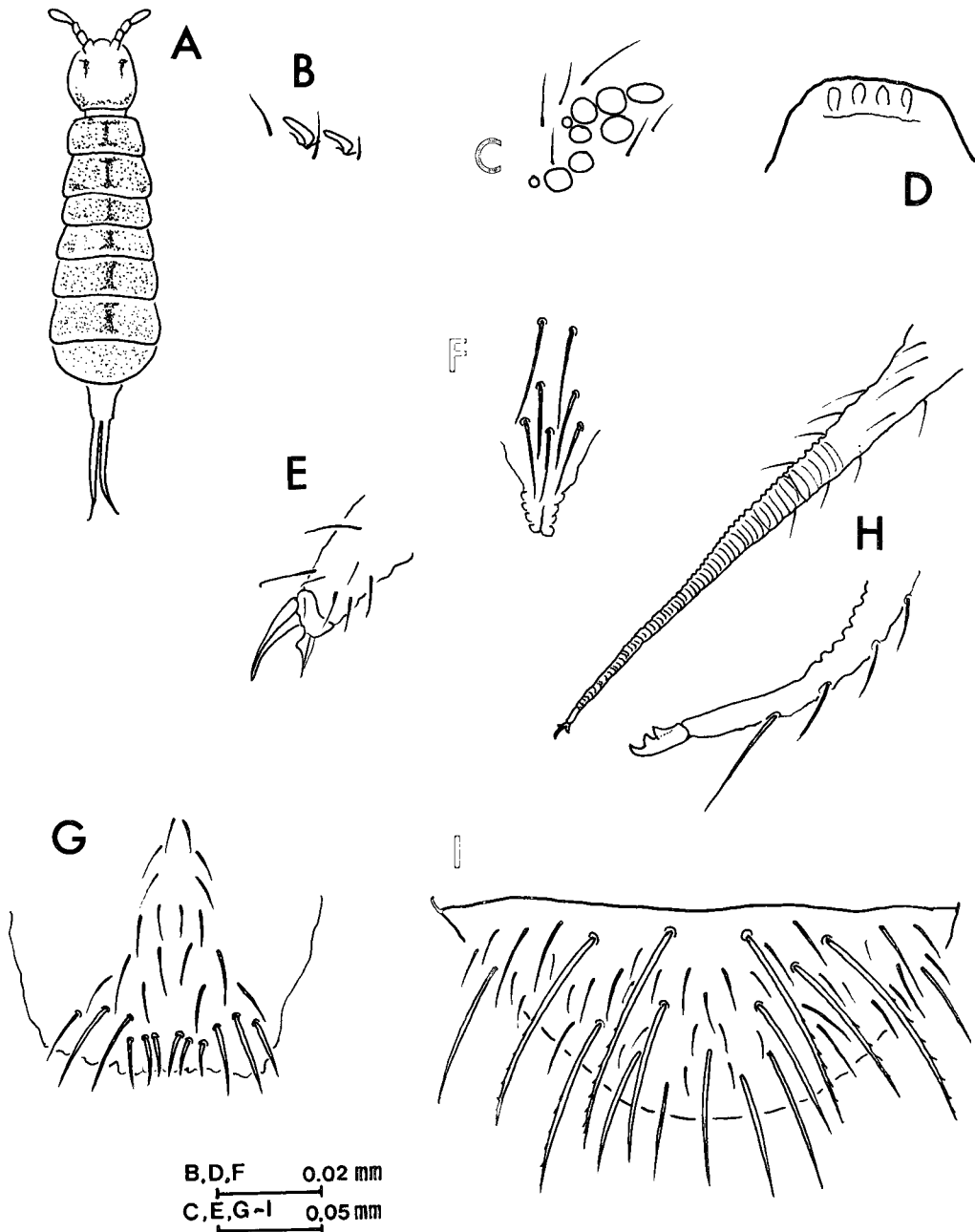


Fig. 5. *Isotoma agrana* Lee et Kim, n. sp. A: whole insect, B: third antennal organ, C: postantennal organ and ocelli, D: labral edge seta, E: midclaw, F: rami, G: anterior face of manubrium, H: dorsal and ventral face of dentes, and mucro, I: abd. V + VI segment

with 30 setae in 7 rows including 3 + 3 spiny setae in distal end of ventral side (Fig. 5G). Manubrium: dentes:mucron related as 11:23:1. Dentes slightly 2 times as long as manubrium, slender, crenulated dorsally, and with lateral seta, longer than mucro (Fig. 5H). Mucro tridentate, with smoothly curved ventral margin (Fig. 5H). Abd.III and IV segments equal, and Abd. IV segment slightly longer than Abd. V + VI segment in length. Abd.V and VI ankylosed.

Clothing of dense simple, unequal in length, erect setae dispersed among shorter ones and longer stiff setae characterizing general appearance, especially on posterior abdomen. Long seta of posterior abdominal segments often serrated (Fig. 5I).

Type data. Holotype ♀, Bagyon Falls, Kaesong City, Collection no. 879, 30 July 1982, moss sample taken from rocks near the falls, extracted in Budapest.

Paratypes. 4, same data as holotype.

Additional material examined. Three individuals, Mt. Myohyang-san, North Pyongan Pro. V, Collection no. 802, 15, July 1982, sifted litter taken below the Ryongyon waterfall, extracted with Moczarsky-Winkler apparatus. Two individuals, Bagyon Falls, Kaesong City, Collection no. 879, 30 July 1982, moss sample taken from rocks near the falls, extracted in Budapest. Four individuals, Mt. Ryongak-san, Pyongang City, Collection no. 779, 12 July 1982, soil sample taken from a mixed forest floor, extracted with Berlese-funnel. Five individuals, Mt. Kumgang-san, Kangwon Prov., Collection no. 713, 19 Sept. 1980, moss sample collected along foot-path to Manmulsang Rocks, 7-800m a.s.l., extracted with Berlese-funnel.

Remarks. This species closely resembles *Isotoma setinornata* Lee, 1977 from South Korea but is distinguished by having tenent hair and feathered seta on the Abd. posterior part in this specimens. It is also related to *I. setispinosa* Lee, 1977 from South Korea sharing the serrated setae of Abd. posterior segment.

DISCUSSION

It was revealed that all the four new species from the present specimens demonstrate strong affinities with either Japan or South Korean species. *Folsomia octocolata* Handschin, 1925 from North Korea, meanwhile, did not show any significant difference from the southern materials.

The present study, therefore, enabled us to list 19 species in six genera as total Isotomidae from the Korean peninsula. Even though it would be too early to characterize the isotomid fauna of Korea relevant to adjacent countries only 20% of the Korean species are shown to be shared by Japanese fauna wherein more than seventy species have so far been known.

Korean isotomid species are listed as follows.

Anurophorus ganghwaiensis Lee, 1977

Folsomia fimetaria (Linné, 1758)

**Folsomia octocolata* Handschin, 1925

Folsomia hexasetasa Lee, 1977

Folsomia bidenetata Lee, 1977

Folsomia onychiurina Denis, 1931

Folsomia regularis Hammer, 1953

- Folsomides exiguus* Folsom, 1932
Isotomurus balteatus (Reuter, 1876)
Isotomurus palustris (Muller, 1776)
Isotomurus griseus Lee et Kim, n. sp.
Isotomurus myohyangsanus Lee et Kim, n. sp.
Isotomiella minor madeirensis Da Gama, 1959
Isotoma viridis Bourlet, 1839
Isotoma setispinosa Lee, 1977
Isotoma setinornata Lee, 1977
Isotoma choi Lee, 1977
Isotoma grana Lee et Kim, n. sp.
Isotoma agrana Lee et Kim, n. sp.

*: Identified from the present material

ABSTRACT

Five species of Isotomidae from North Korea, including four new species *Isotomurus griseus* n.sp., *I. myohyangsanus* n.sp., *Isotoma grana* n.sp., *I. agrana* n. sp. and one new record for North Korea, *Folsomia octoculata* Handschin, 1925 are described and discussed.

The Korean Isotomidae, therefore, come to list 19 species in 6 genera including 15 species in six genera from South Korea.

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