

Tomocerid Collembola (Insecta) from Korean Caves Including a New Species

Kyung-Hwa Park and Byung-Hoon Lee

(Division of Biological Science, Chŏnbuk National University, Chŏnju 560-756, Republic of Korea)

ABSTRACT

Five species of Tomoceridae from Korean caves are reviewed, including one species described as new to science. *T. (M.) odongnyeensis* n. sp. belongs to the subgenus of new record for Korea. The present study eventually resulted in listing eight species in five subgenera of Korean cave Tomoceridae, and all Collembola from Korean caves now enumerate 23 species (or subspecies) in nine genera of eight families.

Key words: Insecta, Collembola, Tomoceridae, Taxonomy, Cave

INTRODUCTION

There have been only a few works on cave Collembola from Korean caves (Yosii, 1966; Lee, 1974; Lee and Park, 1984, 1986; Lee and Thibaud, 1987). It began with report by Yosii (1966) who studied much of collembolan materials collected by the Korea-Japanese joint party for the speleological survey of 21 caves in South Korea. He reported 16 species and/or subspecies, including 10, new to science. Afterward, the authors of the present paper reported four species as new to science and one of new record for Korea (Lee, 1974; Lee and Park 1984, 1986). These resulted in enumeration of 21 species and/or subspecies of Collembola falling into nine genera in eight families.

Concerning cave Tomoceridae from Korea, on the other hand, Yosii and Lee (Yosii, 1966; Lee, 1974) dealt with six species including four, new to science.

The present investigation has revealed one species of Tomoceridae, new to science as well as the subgenus of new record for the Korean peninsula, in addition to discussing four additional species previously recorded from Korean caves or soil which were made available by having been collected for study.

The holotype and paratypes will be deposited in the Insect Collection, Division of Biological Science, Chŏnbuk National University, Chŏnju, Republic of Korea.

MATERIALS AND METHODS

Materials for this paper were collected from five Korean caves from 1979 to 1991 (Fig. 1). Specimens were directly collected using brush or aspirator, and then preserved in 95% ethanol. We made preparations using Marc André I (or 10% KOH) for decoloration of materials and Marc André II for mounting them on slide glasses. Then we examined them under the microscope.

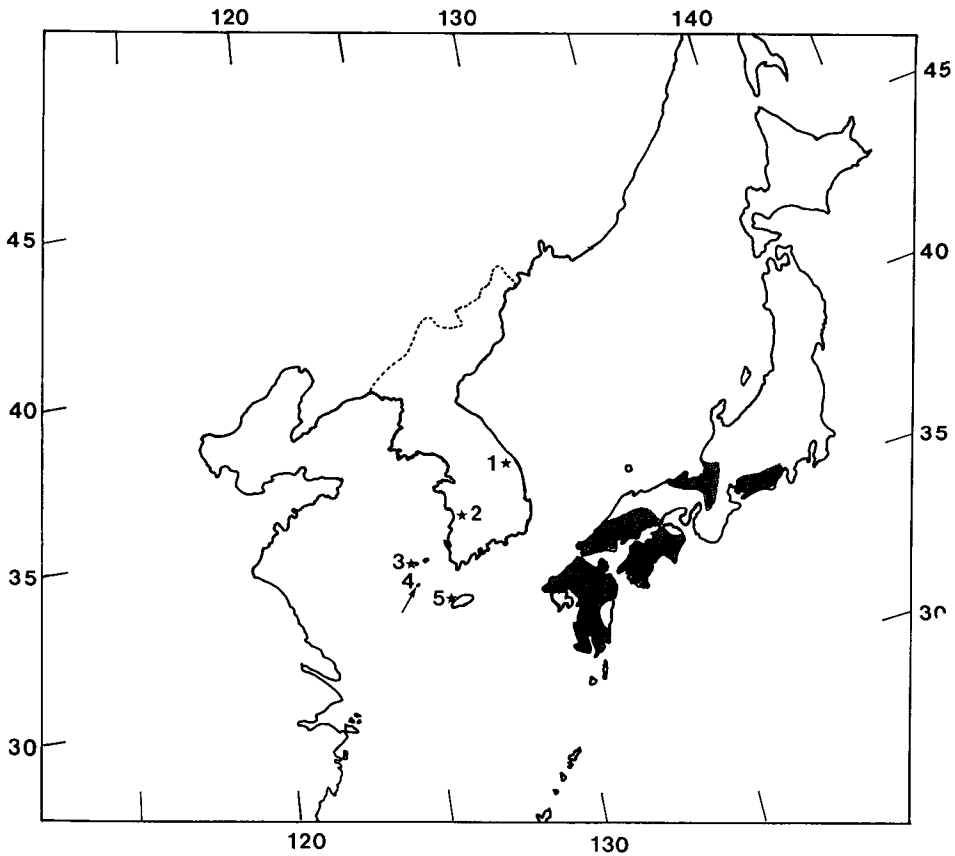


Fig. 1. Collection localities of Tomoceridae from Korean caves and *T. modificatus* from Japan.

1, Samchŏk-gun, Ch'odang-gul cave; 2, Iksan-gun, Ch'ŏnho-dong gul cave; 3, Hong-do Is., Soomgol-gul cave; 4, Sohŭksan-do Is., Odongnyŏ-gul cave (→: Collection locality of *T. odongyeoensis* from Korea; ■, collection localities of *T. modificatus* from Japan); 5, Cheju-do Is., Ssangnyong-gul lava tunnel.

DESCRIPTION AND REVIEWS

1. *Tomocerus (Monodontocerus) odongnyeoensis* n. sp. (오동녀굴가시톡토기, 신칭) (Fig. 2)

Type Material. *Holotype.* ♀, Chŏllanam-do Province, Shinan-gun, Hŭksan-myŏn, Sohŭksan-ri, Hang-ri, Odongnyŏ-gul cave. Collected from a crevice of the wall 10 m deep from the entrance of Odongnyŏ-gul cave, using aspirator. 27 July 1979, Collection no. 79-7, *Paratypes.* 5 ♂♂, 7 ♀♀, the same data as holotype.

Additional material examined. 2 ♂♂, 7 ♀♀, the same locality and data as holotype. 2 Aug. 1986, Collection no. 86-20.

Description. Body up to 3.5 mm long and milky white except eye patches dark and antenna purple. Full grown adults bear, also, some purplish speckles on head, tergites of thorax and anterior segments of abdomen and coxae. Antenna purple. Length of four antennal segments as approximately related as 1.0:2.0:9.0:1.5. Antenna and diagonal of head 2.8:1.0. Ocelli 6+6 in number. Labral setae arrangement as 4/5,5,4.

Trochanteral organ, 1/1. Unguis straight in form, carrying 3,1,1 inner teeth with some variation in number, and a pair of lateral teeth. Unguiculus lanceolate, reaching one half of inner margin of unguis, with or without inner tooth (Fig. 2C, D). Clavate tenent hair, relatively short, slightly longer than unguiculus.

Ventral tube with numerous setae on lateral flaps up to 45 each side, anterior and posterior faces furnished with almost the same number of setae as on lateral side. Tenaculum quadridentate, with 2-3 setae on corpus. Ratio of furcular segments, 4:6:1. Dens without outer setae with compound spines, its dental formula, 4-6/2-5, I, 3-4, I (Fig. 2G). Mucrone provided with only one inner basal tooth, without toothlet on the basal one. Intermittent teeth, 2-7 (Fig. 2E, F). As for head chaetotaxy, it shows anteriorly 2,4 large setae, and a row of numerous simple setae along the posterior border (Fig. 2B).

Etymology. The specific name is derived from the type locality, Odongnyŏ-gul cave.

Remarks. With a single basal tooth in mucron it should belong to subgenus *Monodontocerus* sensu Yosii which is monotypic and, therefore, most resembling the nominal species *Tomocerus modificatus* (Yosii, 1955). It is to be noted, however, that the present species displays some peculiarity by having the head chaetotaxy as 2.4 in the anterior part, for instance, and a full row of setae in the posterior side, which are not the case with the cited species.

2. *Tomocerus (s. str.) liliputanus* Yosii, 1967

Tomocerus (Tomocarina) liliputanus Yosii, 1967, p. 18, fig. 8; Yosii, 1969, p. 554; Lee, 1975, p. 955, fig. 6.

Tomocerus (s. str.) liliputanus: Lee, 1983, p. 5, fig. 7; Lee and Park, 1992, p. 103.

Material examined. 3 ♂♂, 1 ♀, Kang-won-do Province, Samch'ŏk-gun, Kŭndŏk-myŏn, Hamaengbang-ri, Ch'odang-gul cave, 12 Jan. 1982. Collection no. 82-51.

Remarks. They were collected already from several top soils of Korea (Lee, 1975, 1983; Lee and

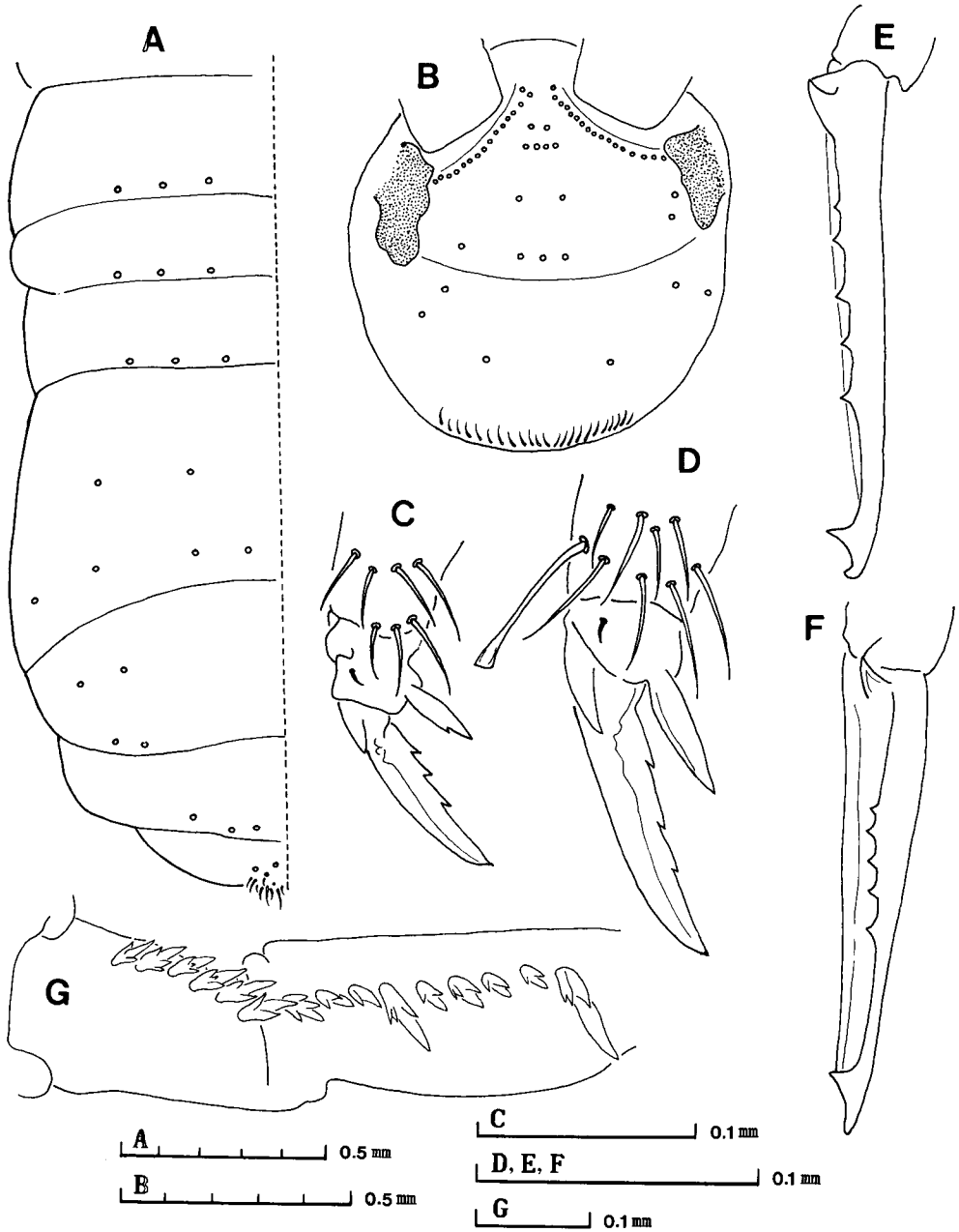


Fig. 2. *Tomocerus (Monodontocerus) odongnyeoensis* n. sp: A, chaetotaxy of Th. III — Abd. VI; B, chaetotaxy of head; C, D, claws; E, F, mucro in lateral and dorsal view; G, dental spines.

Park, 1992). It has never been, however, collected from cave environment. This species is the first record for Korean caves. We found characters of the present material are the same as those described by Yosii (1967) and Lee (1975) from Japan and Korea, respectively. The present material has 5 + 5 eyes.

Distribution. Japan and Korea.

3. *Tomocerus* (s. str.) *kinoshitai kinoshitai* Yosii, 1954

Tomocerus kinoshitai Yosii, 1954, p. 814, fig. 29; Yosii, 1956, p. 90; Yosii, 1967, p. 20, Fig. 10; Martynova, 1969, p. 307, fig. 7; Lee, 1974, p. 412, fig. 4; Lee, 1975, p. 951; Lee, 1983, p. 5, fig. 6.

Tomocerus kinoshitai kinoshitai: Lee & Park, 1992, p. 103.

Material examined. 3 ♂♂, 1 ♀, Chöllanam-do Province, Shinan-gun, Hüksan-myöŋ, Hongdo-ri, Soomgol-gul cave, from litter sample of a camellia leaves in the cave entrance, 29 July 1979. Collection no. 79-9-2.

Remarks. The present material agreed well with the description by Yosii (1954, 1967), based on his material from Japan.

This species was already reported from soil and litter as well as from cave environment.

Distribution. Japan, USSR and Korea.

4. *Tomocerus* (*Aphaenomurus*) *interpositus* Yosii, 1954

Tomocerus interpositus: Yosii, 1956, p. 86, pl. XLI, fig. 240, pl. XLIII, figs. 259-261, pl. XLV, figs. 287-288; Nomura, 1957, p. 68; Yosii, 1967, p. 34, fig. 19, A-G; Yosii, 1969, p. 554.

Tomocerus (*Aphaenomurus*) *vicinus*: Yosii, 1966, p. 541; Lee, 1974, p. 416, fig. 8; Lee, 1983, p. 11, fig. 21.

Material examined. 6 specimens, Kang-won-do Province, Samch'ök-gun, Kündök-myöŋ, Hamaengbang-ri, Ch'odang-gul cave, 12 Jan. 1982. Collection no. 82-51. 6 specimens, Cheju-do Province, Pukcheju-gun, Hallim-üp, Hyöpchae-ri, Ssangnyong-gul cave, 11 Oct. 1991. Collection no. 91-23.

Remarks. This species was already recorded from various caves in Korea (Yosii, 1966, 1967; Lee, 1974, 1983) and Japan (Nomura, 1957; Yosii, 1954, 1956, 1967, 1969) revealing a wide range of the variability. The characters of the present materials are the same as those described by Yosii from Japan and Korea (Yosii, 1967). It is usually to be found from the interior of caves, but often from edaphic localities in Japan. The present materials were collected from the interior of the caves.

Distribution. Japan and Korea.

5. *Tomocerus* (*Plutomurus*) *diversispinus* Yosii, 1966

Tomocerus (*Plutomurus*) *diversispinus* Yosii, 1966, p. 554, fig. 7; Lee, 1974, p. 417.

Material examined. 10 specimens, Chöllabuk-do Province, Iksan-gun, Yösan-myöŋ, Hosan-ri, Ch'önho-donggul cave, 11 March 1979. Collection no. 79-2.

Remarks. Our collection agreed well with the description by Yosii (1966) with the materials of various caves from Korea.

Distribution. Korea.

Table 1. Korean cave Tomoceridae (Collembola) and their distribution in Japan.

TAXA	REGIONS	KOREA	JAPAN	REMARKS
<i>Tomocerus (Plutomurus) gul</i>	Yosii, 1966	O	O	Troglobiont
<i>Tomocerus (Plutomurus) leei</i>	Yosii, 1966	O		Troglobiont
<i>Tomocerus (Plutomurus) diversispinus</i>	Yosii, 1966	O		Troglobiont
<i>Tomocerus (Plutomurus) vigintiferispina</i>	Lee, 1974	O		Troglobiont
<i>Tomocerus (Aphaenomurus) interpositus</i>	Yosii, 1954	O	O	Troglophile
<i>Tomocerus (s. str.) kinoshitai kinoshitai</i>	Yosii, 1954	O	O	Troglophile
<i>Tomocerus (s. str.) liliputanus</i>	Yosii, 1967	O	O	Troglophile
<i>Tomocerus (Monodontocerus) odongnyeoensis</i>	n. sp.	O		Troglophile
Total		8 spp.	4 spp.	

DISCUSSION

This study on cave Tomoceridae fauna revealed one species (*Tomocerus (Monodontocerus) odongnyeoensis*) as new to science and another (*Tomocerus (s. str.) liliputanus*) as the first record for Korean caves, in addition to three species already on record. As a result of the present study the cave Tomoceridae fauna of Korea came to be represented by eight species in five subgenera. They revealed a quite close affinity to the Japanese fauna. A half of all the known species of Korean cave Tomoceridae are anophthalmic, as cave-adapted forms and, presumably, troglobionts (Table 1).

Tomocerus (Monodontocerus) odongnyeoensis was collected from a marine cave of Sohüksando Island located in southwestern end of the Yellow sea. This species was most resembling the nominal species *T. (Monodontocerus) modificatus* (Yosii, 1955). *T. (M.) modificatus* is endemic to the caves of the western Japan and has never been collected outside caves. *T. (M.) odongnyeoensis* and *T. (M.) modificatus* are probably related by sharing the similar oceanographic and climatic environment of the regions (Fig. 1).

The present study brings the Korean faunal list of cave Collembola to 23 species and/or subspecies in nine genera of the eight families (see Appendix). These species were mostly reported from limestone caves in the mid-east of the Korean peninsula and the species of Onychiuridae and Tomoceridae were predominant, eight species respectively among 23 from the Korean caves.

REFERENCES

- Lee, B.-H., 1974. Etude de la faune Coréenne des Insectes Collemboles V. — Inventaire des grottes de Corée et étude sur les Tomoceridae cavernicoles avec la description d'une nouvelle espèce. Ann. Spéléol., **29**(3): 403-418.
- Lee, B.-H., 1975. Etude de la faune Coréenne des Insectes Collemboles VI. Sur la famille des Tomoceridae, édaphiques, avec la description de quatre nouvelles espèces et d'une nouvelle sous-espèce. Bull. Mus. Nat.

- Hist. Nat., **3**(317): 945-961.
- Lee, B.-H., 1983. Korean Collembola (Insecta) Monograph II. Family Tomoceridae. Ann. Rep. Biol. Res., **4**: 27-57.
- Lee, B.-H. and K.-H. Park, 1984. Some Entomobryidae including six new species and one new record of cave form (Collembola) from Korea. Korean J. Zool., **27**(3): 177-188.
- Lee, B.-H. and K.-H. Park, 1986. Three new species of Onychiuridae (Collembola) from a Korean cave. Kor. J. Syst. Zool., **2**(1): 11-20.
- Lee, B.-H. and K.-H. Park, 1992. Collembola from North Korea, II. Entomobryidae and Tomoceridae. Folia Entomol. Hungarica Rovartani Közlemények, **53**: 93-111.
- Lee, B.-H. and J.-M. Thibaud, 1987. A critical review of the taxonomy of *Gulgastrura reticulosa* (Collembola: Hypogastruridae), a cave springtail from Korea. Syst. Entomol., London, **12**: 73-79.
- Martynova, E.F. 1969. Springtails of the Family Tomoceridae (Collembola) from the fauna of the USSR. Rev. Entomol. USSR, **68**(2): 299-314.
- Nomura, 1957. Collembolas from the limestone caves in Oita Prefecture. Nat. Sci. Mus., **24**(5-6): 66-71.
- Yosii, R., 1954. Springschwänze des ozé-Naturschutzgebietes. Sci. Res. Oze. Moor. Tokyo, pp. 777-830.
- Yosii, R., 1955. Meeresinsekten der Tokara Inseln. VI. Collembolen nebst Beschreibungen terrestrischer Formen. Publ. Seto mar. Biol. Lab., **4**: 379-401.
- Yosii, R., 1956. Monographie der Höhlencollembolen Japans. Contr. Biol. Lab. Kyoto Univ. 109 pp.
- Yosii, R., 1966. Results of the Speleological survey in South Korea 1966. IV. Cave Collembola of South Korea. Bull. Nat. Sci. Mus., Tokyo, **9**(4): 541-561.
- Yosii, R., 1967. Studies on the Collembolan Family Tomoceridae, with special reference to Japanese forms. Cont. Biol. Lab. Kyoto Univ., **20**: 1-54.
- Yosii, R., 1969. Collembola Arthropleona of the IBP-station in the Shiga Heights, Central Japan, I. Bull. Nat. Sci. Mus., **12**(3): 532-556.
- Yosii, R., 1977. Critical check list of the Japanese species of Collembola. Contr. Biol. Lab. Kyoto Univ., **25**(2): 141-170.

RECEIVED: 19 September 1995

ACCEPTED: 10 November 1995

한국 동굴산 가시톡토기과(곤충강)의 분류학적 연구

박 경 화 · 이 병 훈

(전북대학교 생물과학부)

요 약

한국의 동굴산 가시톡토기과 5종을 기재, 논의한다. 이들 종은 *Tomocerus* (*Monodontocerus*) *odongnyeoensis*, *T.*(*s. str.*) *liliputanus*, *T.*(*s. str.*) *kinoshitai kinoshitai*, *T.*(*Aphaenomurus*) *interpositus* 및 *T.* (*Plutomurus*) *diversispinus*이다. 이 중에서 *T.*(*M.*) *odongnyeoensis*는 신종이며, *T.*(*s. str.*) *liliputanus*는 한국의 동굴에서는 처음으로 보고되는 종이다. 이로써 한국의 동굴산 가시톡토기는 8종이 되며, 한국의 동굴산 톡토기는 총 8과 9속 23종(또는 아종)에 이른다.

Appendix. Collembola from Korean caves and their localities.

Scientific Name	Ocelli	Locality	Remarks
Hypogastruridae			
<i>Gulgastrura reticulosa</i> Yosii, 1966	0	Kosshi-gul Cave (Yöng-wol-gun, **K-W Prov.), Sanho-donggul Cave (Chöngsön-gun, K-W Prov.)	limestone cave limestone cave
Neanuridae			
<i>Micranurida pygmaea</i> (Börner, 1901)	2+2	Kosshi-gul Cave (Yöng-wol-gun, K-W Prov.)	limestone cave
<i>Anurida plurihaetotica plurihaetotica</i> Yosii, 1966	0	Yöngyön-gul Cave (Samchök-gun, K-W Prov.)	limestone cave
<i>Anurida plurihaetotica decipiens</i> Yosii, 1966	0	Kosshi-gul Cave (Yöng-wol-gun, K-W Prov.)	limestone cave
Onychiuridae			
<i>Onychiurus uenoi</i> Yosii, 1954	0	Yöngyön-gul Cave (Samchök-gun, K-W Prov.)	limestone cave
<i>Onychiurus brevispinatus</i> Yosii, 1966	0	Kosshi-gul Cave (Yöng-wol-gun, K-W Prov.)	limestone cave
<i>Onychiurus izuruensis</i> Yosii, 1956	0	Sinyöng-gul Cave (Samchök-gun, K-W Prov.), Sanho-donggul Cave (Chöngsön-gun, K-W Prov.)	limestone cave limestone cave
<i>Onychiurus flavescens</i> Kinoshita, 1916	0	Daeya-gul Cave (Yöng-wol-gun, K-W Prov.), Söng-gul Lava Tunnel (Pukcheju-gun, C-J Prov.)	limestone cave lava cave
<i>Onychiurus yongyeonensis</i> Yosii, 1966	0	Yöngyön-gul Cave (Samchök-gun, K-W Prov.)	limestone cave
<i>Onychiurus polychaetosus</i> Lee & Park, 1986	0	Sanho-donggul Cave (Chöngsön-gun, K-W Prov.)	limestone cave
<i>Onychiurus longisetosus</i> Lee & Park, 1986	0	Sanho-donggul Cave (Chöngsön-gun, K-W Prov.)	limestone cave
<i>Onychiurus oblongatus</i> Lee & Park, 1986	0	Sanho-donggul Cave (Chöngsön-gun, K-W Prov.)	limestone cave
Isotomidae			
<i>Folsomia candida</i> Willem, 1902	0	Yöngchi-gul Cave (Ulchin-gun, K-B Prov.) Hwaam-gul Cave (Chöngsön-gun, K-W Prov.) Driven well at Wangrüng-ri (Kaiin-myön, Munk-gyöng-gun, K-B Prov.)	limestone cave limestone cave driven well

Appendix. Collembola from Korean caves and their localities.

Scientific Name	Ocelli	Locality	Remarks
Entomobryidae			
<i>Sinella dubiosa</i> Yosii, 1956	0	Yöngchi-gul Cave (Ulchin-gun, K-B Prov.), Söng-gul Lava Tunnel (Pukcheju-gun, C-J Prov.), *Ch'odang-gul Cave (Samch'ök-gun, K-W Prov.)	limestone cave lava cave limestone cave
Oncopoduridae			
<i>Oncopodura gul</i> Yosii, 1966	0	Hogyehang'tigi-gul Cave (Mun-gyöng-gun, K-B Prov.)	limestone cave
Tomoceridae			
<i>Tomocerus (Plutomurus) gul</i> Yosii, 1966	0	Yöngyön-gul Cave (Samch'ök-gun, K-W Prov.), Daeya-gul Cave, Yongdam-gul Cave, Kosshi-gul Cave, Hakchön-gul Cave (Yöng-wol-gun, K-W Prov.) Kwangchönsön-gul Cave, To-gul Cave (P'yöngch'ang-gun, K-W Prov.), Piryong-gul Cave, Namp'yöngbuk-gul Cave, Hwaam-gul Cave (Chöngsön-gun, K-W Prov.) Mosan-gul Cave (Mun-gyöng-gun, K-B Prov.), Yöngchi-gul Cave (Ulchin-gun, K-B Prov.) Daeryong-gul Cave, Soryong-gul Cave (Chung-won-gun, C-B Prov.), Simbok-gul Cave (Koesan-gun, C-B Prov.), Sinryöng-gul Cave (Samch'ök-gun, K-W Prov.), Namp'yöngbuk-gul Cave (Chöngsön-gun, K-W Prov.), Kümmong-am-gul Cave (Yöng-wol-gun, K-W Prov.)	limestone cave limestone caves limestone caves limestone caves limestone cave limestone cave limestone caves
<i>Tomocerus (Plutomurus) leei</i> Yosii, 1966	3+3		
<i>Tomocerus (Plutomurus) diversispinus</i> Yosii, 1966	2+2		

Appendix. Collembola from Korean caves and their localities.

Scientific Name	Ocelli	Locality	Remarks
<i>Tomocerus (Plutomurus) vigintiferispina</i> Lee, 1974	6+6	*Ch'ŏnho-donggul Cave (Iksan-gun, C-B Prov.), Namp'yŏngbuk-gul Cave (Ch'ongsŏn-gun, K-W Prov.)	limestone cave
<i>Tomocerus (Aphaenomurus) interpositus</i> Yosii, 1954	6+6	Kwangch'ŏnsŏn-gul Cave (P'yŏngch'ang-gun, K-W Prov.), Mosan-gul Cave (Mungyŏng-gun, K-B Prov.), Goyang'i-gul Cave (Yŏung-wol-gun, K-W Prov.), To-gul Cave (P'yŏngch'ang-gun, K-W Prov.)	limestone cave limestone cave limestone cave limestone cave
<i>Tomocerus (s. str.) kinoshitai</i> Yosii, 1954	6+6	*Ch'odang-gul Cave (Samch'ŏk-gun, K-W Prov.), *Ssangnyong-gul Lava Tunnel (C-J Prov.)	limestone cave
<i>Tomocerus (s. str.) liliputanus</i> Yosii, 1967	5+5 (or 6+6)	Baet'il-gul Cave (P'yŏngch'ang-gun, K-W Prov.), *Soomgol-gul Cave (Is. Hong-do, C-N Prov.) *Ch'odang-gul Cave (Samch'ŏk-gun, K-W Prov.)	limestone cave burrow limestone cave
<i>Tomocerus (Monodontocerus) odongnyeoenensis</i> n. sp.	6+6	*Odongnyŏ-gul Cave (Is. Solhŭksan-do, C-N Prov.)	marine cave
Sminthuridae			
<i>Arrhopalites gul</i> Yosii, 1966	1+1	Hwaam-gul Cave (Ch'ongsŏn-gun, K-W Prov.), Yŏngyŏn-gul cave (Samch'ŏk-gun, K-W Prov.), Kosshi-gul cave (Yŏng-wol-gun, K-W Prov.)	limestone cave limestone cave limestone cave
TOTAL 8 Fam., 9 Gen., 23 spp. and (or) ssp.			

*designates the collection localities of the species studied in the present paper.

**Abbrev.: C-J Prov.: Cheju-do Province, C-B Prov.: Ch'ungch'ŏngbuk-do Province, K-W Prov.: Kang-wŏn-do Province, C-N Prov.: Ch'ŏllanam-do Province, C-B Prov.: Ch'ŏllabuk-do Province, K-B Prov.: Kyŏngsangbuk-do Province.