

Some Entomobryidae Including Six New Species and One New Record of Cave Form (Collembola) from Korea

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韓國產 黴蟎托基科의 6新種 및 洞窟產 1未記錄種등에 관한
分類學的 研究

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요 약

남한의 30여개 지역의 삼림토양에서 黴蟎托基과를 채집하여 동정한 결과 3속 10종을 얻은 바 이 가운데 6신종 (*Entomobrya jirisana* n. sp., *Entomobrya quadrata* n. sp., *Entomobrya vigintisetata* n. sp., *Entomobrya monopunctata* n. sp., *Homidia heugsanica* n. sp., *Homidia bilineata* n. sp.) 및 1 한국미기록종 (*Sinella curviseta* Brook, 1882)을 확인하였다. 그러나 *Entomobrya monopunctata* n. sp.는 잣나무에서 채집되었고 *Sinella dubiosa* Yosii, 1956는 눈이 없는 진동굴성으로 삼척의 초당굴미기록종이다. 본 연구결과 한국산 黴蟎托基는 모두 3속 23종이 된다.

INTRODUCTION

Korean Entomobryidae have so far been represented only by 16 species in 3 genera through the works of Yosii and Lee (1963), Yosii (1966), Szeptycki (1973), and Lee and Lee (1981). The present account comes from the study done for Collembola of soil and litter samples from almost 30 different localities of South Korea, dealing with 10 species, including 6, new to science, and one of new record. Much of the materials come from mountain forests but there are also collections from seashore area, cave environment and cone pines, taken mostly using aspirators and Berlese funnels.

The holotypes and the paratypes will be deposited in the Insect Collection of Biology Education Department of Jeonbug National University, Jeonju, Korea. All the species

dealt with in the present article are as follows.

- Sinella curviseta* Brook, 1882
Sinella dubiosa Yosii, 1956
Entomobrya pulcherrima Yosii, 1942
Entomobrya striatella Börner, 1909
Entomobrya jirisana n. sp.
Entomobrya quadrata n. sp.
Entomobrya viginiseta n. sp.
Entomobrya monopunctata n. sp.
Homidia heugsanica n. sp.
Homidia bilineata n. sp.

DESCRIPTIONS

Sinella curviseta Brook, 1882

Uchida, 1954; Yosii, 1956; Yosii, 1964; Stach, 1964; Stach, 1965

Diagnosis: Body, white in color, its length up to 1.6 mm. Ratio of antennae to head diagonal, 1.8 : 1. Antennal segments related as 7:15:13:19. Ocelli 2+2 in number but each of the two widely separated. General body chaetotaxy the same as *Sinella stalagmitorum* Yosii, 1954 and *S. umesaoi* Yosii, 1952. Smooth setae present on tibiotarsus. Inner tooth of unguis winglike but less developed sometimes. Unguiculus without outer tooth.

Material examined: 10, Mt. Imogdae (alt. 150 m), Jeonju, collection no. 79-29-1, from litter and soil of mixed arboreal vegetation, 8. XI. 1979. 7, Peak Wansanchil-bong (alt. 100 m), Jeonju, collection no. 79-21-1, from litter and soil of a thicket of various trees, 9. IX. 1979.

Remarks: As compared to individuals reported from Japan (Uchida, 1954, Yosii, 1956, 1964) inner tooth of unguis is found less developed but resembles that from China (Stach, 1964). No remarkable variation from those of other localities were observed. This is a new record to Korea.

Distribution: China, North America, Costa Rica, India, Japan, Europe, Russia, North Vietnam, Java, Korea (new record).

Sinella dubiosa Yosii, 1956

Yosii, 1956; Yosii, 1964; Yosii, 1966

This species of complete cave adapted form was already recorded from Yeongji-gul cave (Province of Gyeongsangbug-do) and the Seong-gul cave (Province of Jeju-do), the latter being lava cave in the southernmost island of the country (Yosii, 1966) and it agrees well with the description by Yosii (1956) of Japanese material.

Material examined: 2, Chodang-gul cave, Hamaengbang-ri, Geundeog-myeon, Samcheog-gun, Gangweon-do Province, 12. I. 1982. Collection no. 82-51.

Distribution: Japan, Korea

***Entomobrya pulcherrima* Yosii, 1942**

Yosii, 1942; Yosii, 1956; Yosii & Lee, 1963

Our collection agreed well with the description by Yosii and Lee (1963) of Korean material.

Material examined: 10, Is. Daeheugsan-do, Province of Jeonranam-do. Collection no. 79-9, from litter and soil of a thicket of various trees, 29. VII. 1979. 4, Mt. Moag-san (alt. 500 m), Wanju-gun, Province of Jeonrabug-do, Collection no. 80-2, from litter and soil of a forest of mixed arboreal composition, 8. I. 1980. 12, Yongjung-ri, Sang-gwan-myeon, Wanju-gun, Province of Jeonrabug-do, Collection no. 80-21, from litter and soil of a forest of mixed arboreal composition, 14. XI. 1980. 4, Mt. Namgo-san, Jeonju, Province of Jeonrabug-do, Collection no. 82-8, from litter sample of a pine stand halfway up the slope (alt. 240 m), 29. V. 1982. 4, Mt. Yongmun-san, Yangpyeong-gun, Gyeonggi-do Province, Collection no. 82-52, from cone pine trees, VIII. 1982.

♀ specimens only were collected.

Distribution: Japan, Korea

***Entomobrya striatella* Börner, 1909**

Börner, 1909; Yosii, 1942; Yosii, 1956; Yosii & Lee, 1963

Our collection agreed well with the description by Yosii and Lee (1963) of Korean material.

Material examined: 14, Daecheon, Boryeong-myeon, Province of Chungcheongnam-do, Collection no. 83-34, from dry soil of mixed arboreal stand, 6. VIII. 1983. 2, Yongdam-myeon, Jinan-gun, Province of Jeonrabug-do, Collection no. 83-47, from litter and soil of a pine stand, 18. X. 1983.

♂ and ♀ specimens were collected.

Distribution: Japan, Korea

***Entomobrya jirisana* n. sp.**

Length of body up to 2.2 mm. Ground color yellow in life and in alcohol with distinct black pattern on Th. III, Abd. III and Abd. IV, and a round spot quite noticeable in the head between two antennal bases. The hind femur, characterized by black in color (Fig. 1, b).

Antennae, longer than half the length of the body measured together with the head, about 3.4 times head length. Four antennal segments related as 1.0:1.6:1.4:2.2. Ocelli 8+8, G and H very small. Labral setae: 4/5, 5, 4, prelabral ones smooth. Labral margin with 4 papillae (Fig. 1, d).

Thoracic tergites with numerous clavate collar setae forming a mane, general chaetotaxy of which seen in Fig. 1, a. Macrosetal formula of coxae, 3/4+1, 3/4+2 (Fig. 1, e, f).

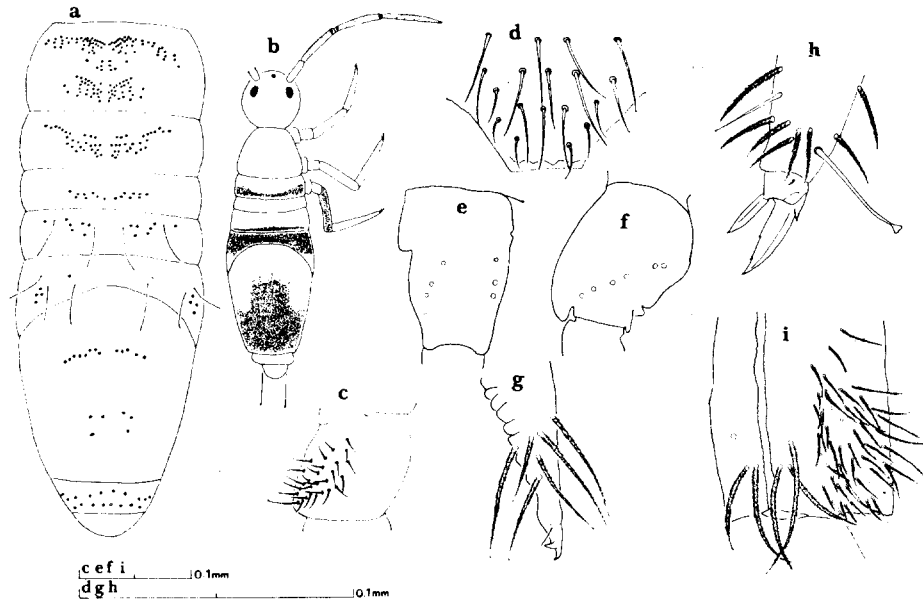


Fig. 1. *Entomobrya jirisana* n. sp. a: chaetotaxy of thoracic and abdominal tergites., b: body pattern., c: trochanteral organ, d: labral chaetotaxy, e: mid-coxal chaetotaxy, f: hind-coxal chaetotaxy, g: distal part of dens and mucron, h: hind claw, i: ventral tube.

Trochanteral organ developed only in the hind leg, composed of 19–28 stiff, smooth setae (Fig. 1, c). Unguis with two inner teeth less developed than in other species. A clavate tenent hair, almost as long as outer margin of unguis (Fig. 1, h).

Anterior face of ventral tube with 3+3 macrosetae, external two in oblique position as to median furrow and the posterior side with numerous setae but not so much differentiated (Fig. 1, i). Furcal segments ratio, Manubrium: Dens+Mucro=1:1.2. Mucro bidentate, with a basal spine (Fig. 1, g).

Type data: Holotype ♀, Mt. Jiri-san, Banseon-ri, Sannae-myeon, Namweon-gun, Jeon-rabug-do Province, Collection no. 82-42, from litter sample of a thicket (alt. 600 m), 23. XII. 1982. Paratypes: 9, same data as holotype.

♀ specimens only were collected.

Remarks: This species seems most allied to *Entomobrya triangularis* Schött, 1896 from North America sharing black transversal patch on the tergite of Abd. III. It is separated, however, from the American species by the general pattern of the body and chaetotaxy of Abd. III and V.

***Entomobrya quadrata* n. sp.**

Length of body up to 2.2 mm. Ground color yellow in life and in alcohol, with distinct black longitudinal stripe along the lateral edge of the head and thoracic segments, and a shieldlike patch on Th. II, two rectangular ones on Th. III and a small blotch on Abd.

V and VI. In dorsal view four blotches all on the tergites well noticeable (Fig. 2, b).

Antennae longer than half the length of the body and about 4 times head diagonal. Four antennal segments related as 1.0:1.6:1.6:2.7. Apical bulb at the tip of Ant. IV bilobed. Third antennal organ with two blunt sensory rods. Chaetotaxy of head as in *Homidia mediaseta*: 3 antennal, 3 ocellar, and 5 sutural macrosetae on the frontal area. Ocelli 8+8, G and H very small. Labrum with 4/5, 5, 4, prelabral ones smooth. Labral margin with four conical papillae, each armed at the tip with a minute, sharply pointed process (Fig. 2, f).

Thoracic tergites with numerous clavate setae, forming a mane, chaetotaxy in Fig. 2, a. Trochanteral organ developed only on the hind leg, composed of 30-40 stiff, smooth setae. Claws with two inner teeth in unguis and a clavate tenent hair, almost as long as outer margin of unguis (Fig. 2, d).

Abd. IV is long, about 5.7 times longer than Abd. III. Anterior face of ventral tube with 3+3 macrosetae, external two in oblique position as to median furrow and the posterior side with 15 to 20 ciliate setae except 2 strong smooth setae in lower margin (Fig. 2, c, g). Furcal segments ratio, Manubrium : Dens + Mucro = 1 : 1.3. Mucro bidentate.

Type data: Holotype ♀, Temple Gangcheon-sa, Sunchang-gun, Jeonrabug-do Province,

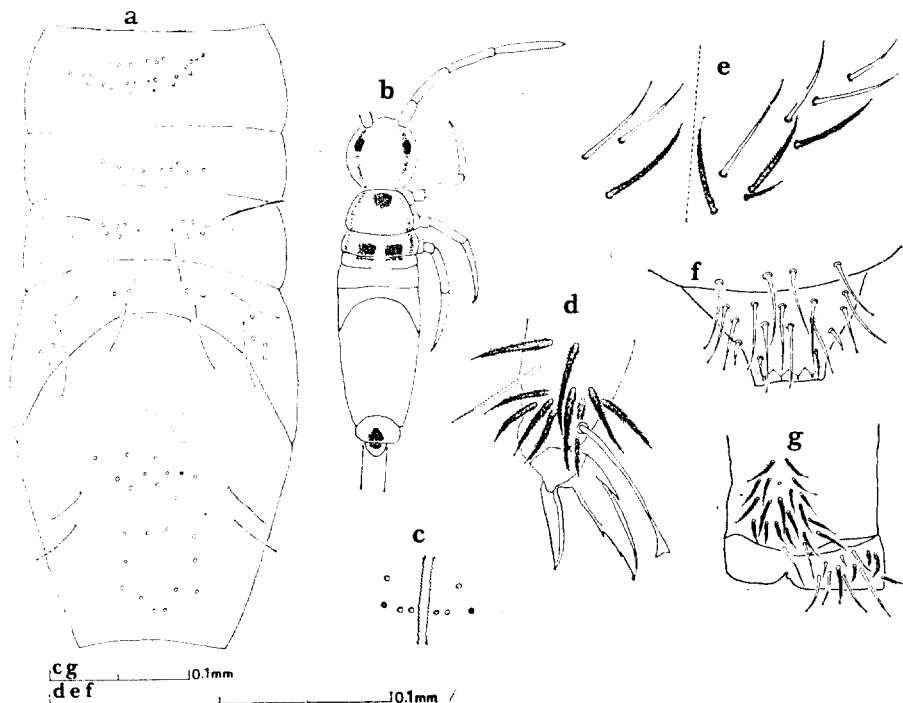


Fig. 2. *Entomobrya quadrata* n. sp. a: chaetotaxy of thoracic and abdominal tergites., b: body pattern, c: frontal face of ventral tube, d: hind claw, e: labial chaetotaxy, f: labral chaetotaxy, g: posterior face of ventral tube.

Collection no. 83-41, from litter sample of a thicket (alt. 300 m), 17, IX. 1983. Paratypes: 7, same data as holotype.

♂ and ♀ specimens were collected.

Additional material: Mt. Jiri-san, Banseon-ri, Sannae-myeon, Jeonrabug-do, collection no. 83-42, from litter of a thicket, 16. X. 1983.

Remarks: This species is very similar to *Entomobrya elegans* Stach, 1963 from Caucasus in body segments ratio and labral papillae. Body patterns, however, differentiate them definitely as does the length ratio of Abd. III and Abd. IV. In other word, Abd. IV is 8-9 times as long as Abd. III in the cited species while in the present species it is 5.7 times as long.

***Entomobrya vigintisetata* n. sp.**

Length of body up to 2.3 mm. Ground color in life and in alcohol light yellow, with characteristic pattern on tergites (except Abd. I & VI), antennae, and mid and hind tibiae (Fig. 3, b). General chaetotaxy as shown in Fig. 3, a., composed of mostly clavate collar setae.

Antennae length about 3.2 times longer than head. Ant. IV without annulation. Chaetotaxy of head as in *Homidia mediaseta*: 3 antennal, 3 ocellar, and 5 sutural macrosetae on the frontal area. Ocelli 8+8, G and H very small. Labrum with setae 4/5, 5, 4, prelabral setae ciliate.

On the thoracic tergites numerous setae forming a mane. Trochanteral organ developed only in the hind leg, composed of 20 stiff, smooth setae. Claws with 2, 1, 2, inner teeth

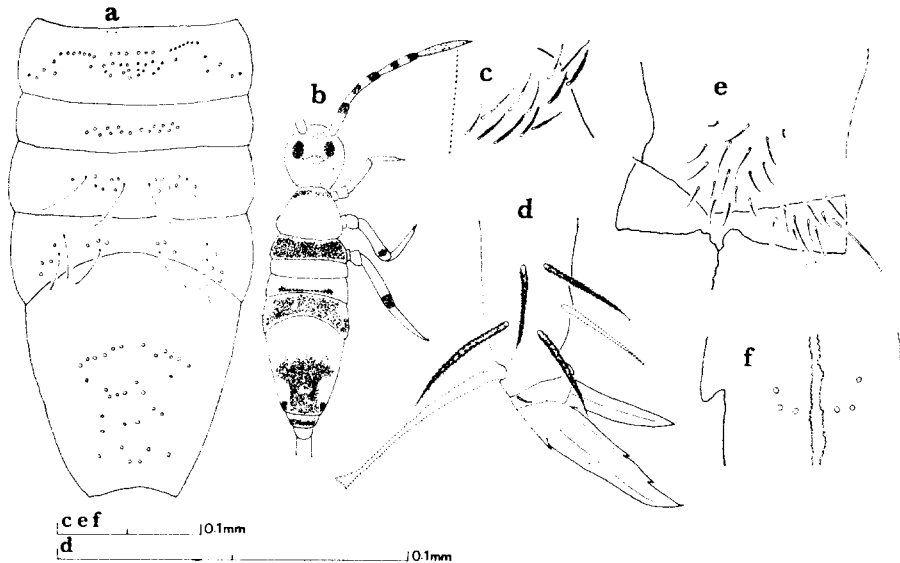


Fig. 3. *Entomobrya vigintisetata* n. sp. a: chaetotaxy of thoracic and abdominal tergites, b: body pattern, c: labial chaetotaxy, d: hind claw, e: setae on posterior face of ventral tube, f: setae on anterior face of ventral tube.

in unguis and a clavate tenent hair (Fig. 3, d).

Abd. IV, about 4.6 times longer than Abd. III. Anterior face of ventral tube with 3+3 macrosetae, external two in oblique positions as to median furrow (Fig. 3, f). Furcal segments ratio, Manubrium: Dens+Mucro=1:1.4. Mucro bidentate, apical and subapical teeth subequal.

Type data: Holotype♀, Daechon, Boryeong-gun, Chuncheongnam-do Province, Collection no. 83-34, from dry soil of mixed arboreal stand (alt. 20 m), 6. VIII. 1983. Paratype: 1, same data as holotype.

Only ♀ specimens collected.

Remarks: The present species seems most closely related to *Entomobrya imitabilis* Stach, 1963 from China, sharing the same length ratio of Abd. III and IV, and manubrial segments. They are, however, different in the patterns on Abd. II, Abd. III and Abd. IV and the number of stiff setae of trochanteral organ being about 20 in the present species while that is half as many, or about 10 in the cited species.

***Entomobrya monopunctata* n. sp.**

Body relatively plump, somewhat spindle shaped, its length up to 1.9 mm. All the body, in alcohol, pale yellow, black pigment limited to a small spot between the bases of antennae and eye patches (Fig. 4, b).

Antennae lightly purple colored, about half as long as the body, and 2.8 times longer than head diagonal. Ant. IV with a unilobed apical bulb (Fig. 4, g). Third antennal

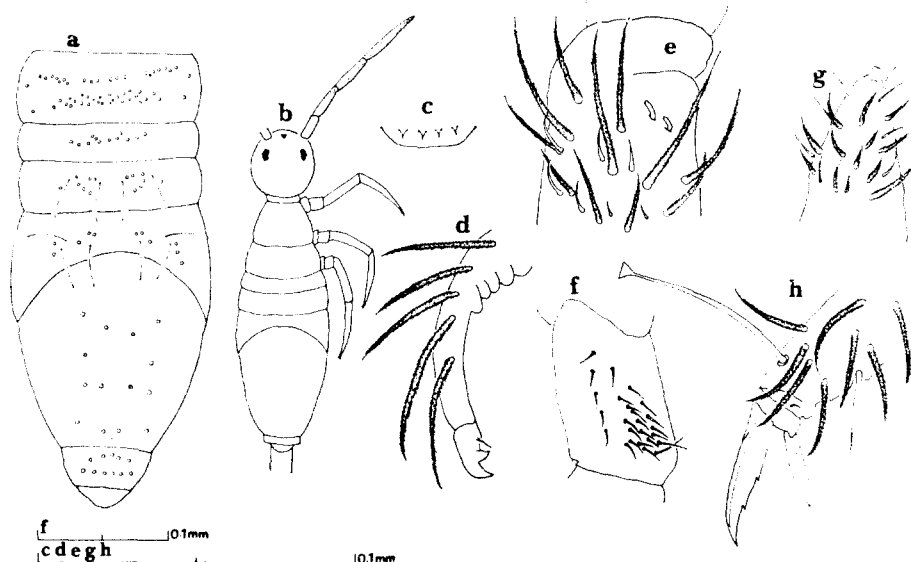


Fig. 4. *Entomobrya monopunctata* n. sp. a: chaetotaxy of thoracic and abdominal tergites, b: body pattern, c: labral papillae, d: distal part of dens and mucron, e: third antennal organ, f: trochanteral organ, g: Ant. IV., h: hind claw.

organ provided with two blunt sensory rod (Fig. 4, e). Four antennal segments related as 13:24:23:28. Ocelli 8+8, G and H very small. Labral setae: 4/5, 5, 4, prelabral setae ciliate. Labral margin with four conical papillae, each armed, at the tip, with a minute sharply pointed process (Fig. 4, c).

On the thoracic tergites numerous clavate collar setae forming a mane, chaetotaxy of which as seen in Fig. 4, a. Trochanteral organ developed only in the hind leg, composed of 17-25 stiff, smooth setae (Fig. 4, f). Claws with 1-2 inner teeth in unguis and a clavate tenent hair longer than unguis (Fig. 4, h).

Anterior face of ventral tube with 4+4 setae and the posterior side with numerous ones. Furcal segments ratio, Manubrium: Dens+Mucro=5:6. Mucro bidentate, with a basal spine (Fig. 4, d).

Type data: Holotype ♀, Mt. Yongmun-san, Yangpyeong-gun, Gyeong-gi-do Province, Collection no. 82-52, from cone pine trees, VIII. 1982. Paratypes: 6, same data as holotype.

♂ and ♀ specimens were collected.

Remarks: This species strikingly resembles *Entomobrya lanuginosa* (Nicolet, 1842) from Europe by having pigments on the body uniquely between antennal basis as a spot in addition to eye patches and sharing almost the same length ratios of antennal segments, Abd. III and IV, and antenna against body and so on. However conical shape and the setae of labral papillae differentiate the present species from the cited one which shows only plain rounded papillae without setae in labrum.

They were collected from cone pines by spraying pesticides which dropped down the springtails. Further study on the arboreal populations will be of great interest from ecological as well as systematic point of view as suggested by the work of Hisamatsu with *Tomocerus cuspidatus* Börner (久松外 二人, 1982).

***Homidia heugsanica* n. sp.**

Length of body to 1.5 mm. Ground color light yellow, with somewhat dark patches on the tergites Abd. IV-VI (Fig. 5, b).

Antennae, longer than half the length of the body, about 3.3 times head length. Ant. IV with an bilobed apical bulb. Four antennal segments related as 1.0:1.8:1.7:3.0. Ocelli 8+8, G and H very small. Labral setae: 4/5, 5, 4, prelabral ones smooth. Labral seta: a_2 shorter and thinner than a_1 , but longer than b_2 . Labral margin with 4 minute papillae (Fig. 5, c).

Thoracic tergites with numerous clavate collar setae forming a mane, general chaetotaxy of which seen as in Fig. 5, a. Macrosetal formula of coxae, $3/4+1, 3/4+2$ (Fig. 5, e, f, g). Trochanteral organ developed only in hind leg, composed of 15-22 stiff, smooth setae. Unguis with two inner teeth and a clavate tenent hair, almost as long as outer margin of unguis (Fig. 5, d).

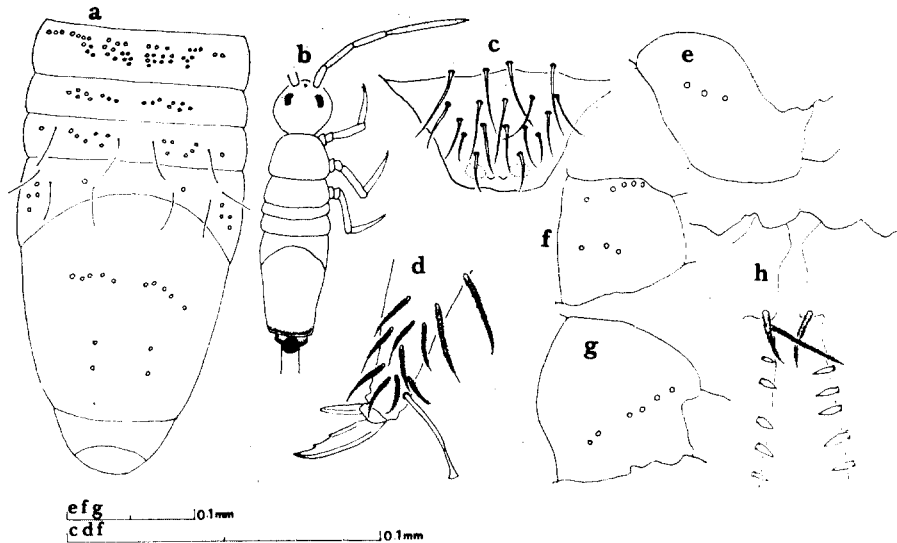


Fig. 5. *Homidia heugsanica* n. sp. a: chaetotaxy of thoracic and abdominal tergites, b: body pattern, c: labrum d: hind claw, e, f, g: macrosetae of pre-coxa, mid-coxa and hind coxa, h: proximal part of dens.

Anterior face of ventral tube with 3+3 macrosetae, external two in oblique positions as to median furrow and the posterior side with numerous serrate setae. Furcal segments ratio Manubrium: Dens+Mucro=1:1.2. Dental spines 10 in average (Fig. 5, h).

Type data: Holotype ♂, Ganeunge, Ye-ri, Is. Daeheugsan-do, Heugsan-myeon, Shinan-gun, Province of Jeonranam-do, Collection no. 79-10, from litter sample of a camellia stand, 30. VII. 1979. Paratypes: 5, same data as holotype.

Additional material examined: 2, Is. Hong-do, Heugsan-myeon, Shinan-gun, Province of Jeonranam-do, Collection no. 79-9-3, from litter sample of a thicket, 29. VII. 1979.

♂ and ♀ specimens were collected.

Remarks: This species seems most closely related to *Homidia bilineata* n. sp. of the present article by resembling body pattern. However abdominal chaetotaxy definitely separate them in addition to antennal segments length ratio and labral papillae.

Homidia bilineata n. sp.

Length of body up to 2.4 mm. Ground color in life light yellow but in alcohol a little paler. A dark transversal band along posterior marginal end of Abd. IV and Abd. V respectively (Fig. 6, a).

Antennae, about 4 times longer than head. Ant. IV without annulation. Four antennal segments related as 1.0:1.3:1.2:1.8. At the tip of Ant. IV bilobed. Chaetotaxy of head as in *Homidia mediaseta*: 3 antennal, 3 ocellar, 5 sutural macrosetae on the frontal area. Ocelli 8+8, G and H very small, even not clear at times. Labrum without any papillae,

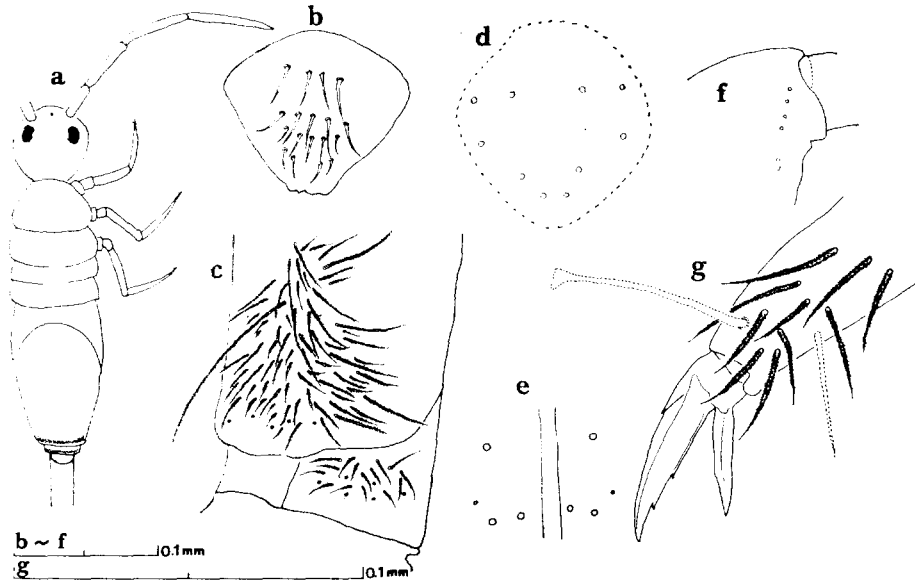


Fig. 6. *Homidia bilineata* n. sp. a: body pattern, b: labrum, c: posterior face of ventral tube, d: chaetotaxy of mid posterior part of Abd. IV., e: macrosetae of anterior face of ventral tube, f: macrosetae of hindcoxa, g: hind claw.

seta a_2 shorter than a_1 , longer than b_2 (Fig. 6, b). Setal formula of the base of labium, M R e L₁ L₂.

On thoracic tergites numerous clavate collar setae forming a mane, Macrosetal formula of coxae $3/4+1$, $3/4+2$ as in *Homidia chosonica* (Fig. 6, f). Trochanteral organ developed only in the hind leg, composed of 36-72 stiff, smooth setae. Claws with two inner teeth in unguis and a clavate tenent hair (Fig. 6, g).

Setal arrangements of fourth abdominal segment as in Fig. 6, d. Anterior face of ventral tube with 3+3 macrosetae, external two in parallel with median furrow as in *Homidia similis* Szeptycki, 1973 (Fig. 6, e) and the posterior side with numerous setae. Lateral flap bears 6 smooth and 14 ciliate setae each. (Fig. 6, c). Furcal segments ratio, Manubrium: Dens+Mucro=1:1.15. Dental spines 33 in average. Mucro bidentate, with a basal spine. Basal setae of dens multilaterally ciliate, the upper seta longer than the lower ones.

Type data: Holotype ♂, Mt. Odae-san (alt. 700 m), Dongsan-ri, Doam-myeon, Pyeongchang-gun, Gangweon-do Province, Collection no. 81-13-1, from litter sample of a thicket, 26. IV. 1981. Paratypes: 2, same data as holotype.

♂ and ♀ specimens were collected.

Additional material: numerous specimens collected from south Korea from July 1979 until October 1983 (Collection no. 79-14, 80-2, 80-10, 81-18, 81-19-1, 82-42, 83-34).

Remarks: This species resembles *Homidia koreana* Lee et Lee, 1981 by almost the

same body pattern, labial and coxal chaetotaxies, and so on. However ground color of the body, chaetotaxy of Abd. IV and length ratio of Ant.: Head diagonal are different.

CONCLUSION

As a result of the present study the fauna of Korean Entomobryidae comes to be represented by 23 species in 3 genera and it is obvious that the knowledge is still poor in view of 56 species in 9 genera from Japan (Yosii, 1977), thus, far from general understanding of the family in the Korean peninsula. The endemicity has been revealed very high, however, with 16 species unique to Korea among 23, and the affinities of the remaining species are mostly direct with Japan.

In addition to the new species described already *Sinella curviseta* Brook was found to be a new record and the collection of *Sinella dubiosa*, an anophthalmic cave adapted form is recording the third cave as its localities from Korea.

Entomobrya monopunctata n. sp. of the above is unique, having been collected from cone pines in contrast to edaphic milieus where the most present species derived from.

Entomobrya vigintiseta n. sp., on the other hand, comes from lowland area near seashore as compared with most other taxa of alpine habitats in the present article. This species, based on the only two female individuals, moreover, is considered to need further checking for confirmation. However, the authors are convinced that they had better be presented as potential taxa rather than entirely neglected from actual knowledge.

The present study brings the Korean faunal list of Entomobryidae to 23 species in 3 genera, of which 16 are endemic to the country.

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SUMMARY

The Entomobryidae comprising one new record from Korea, six new species (4 *Entomobrya*, 2 *Homidia*) and a cave form of *Sinella* genus have been studied. One of the *Entomo-*

brya comes from cone pines, hence considered an arboreal species. The present study brings Korean faunal list of Entomobryidae to 23 species in 3 genera, of which 16 are endemic to the country.

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