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A STUDY OF THE COLLEMBOLA FAUNA OF KOREA

IV. The Family Isotomidae (Insecta), with description of five new species

By Byung-Hoon Lee¹

Abstract: Five new species of Isotomidae are described. Additional descriptions are given with illustrations of *Isotomiella minor madeirensis* Da Gama, 1959, *Folsomia exiguus* Folsom, 1932 and *Folsomia regularis* Hammer, 1953. The occurrence of *Folsomia onychiurina* Denis, 1931 and *Folsomia octoculata* Handschin, 1925 is remarked as new to the country.

The present work deals with describing the collembolan materials collected by me in South Korea as part of my serial work on the systematics of this group of insects from that country. Tullgren funnels were used for extracting the specimens from soil and litter samples. Holotypes and some paratypes will be deposited in the collection of the Biology Department of Korea University in Seoul, while some paratypes will be deposited in the Bernice P. Bishop Museum in Honolulu and the National Museum of Natural History in Brunoy, France.

The specimens examined include the following species: *Anurophorus ganghwaensis*, n. sp., *Folsomia hexasetosa*, n. sp., *Folsomia octoculata* Handschin, 1925, *Folsomia onychiurina* Denis, 1931, *Folsomia regularis* Hammer, 1953, *Folsomides exiguus* Folsom, 1932, *Isotomiella minor madeirensis* Da Gama, 1959, *Isotoma setispinosa*, n. sp., *Isotoma setinornata*, n. sp., *Isotoma choi*, n. sp.

Anurophorus ganghwaensis Lee, n. sp.

FIG. 1

Length up to 0.8 mm. Grayish blue, in alcohol, throughout the tergites except 1st thoracic segment pigmented only at mid-dorsal and lateral sides. Other tergites, however, mottled with small white specks, and intersegmental areas of body, antenna and legs pale in color as well as ventral face of body and interior face of legs. Antenna longer than diagonal of head (7:6). Fourth antennal segment with a single terminal bulb (FIG. 1,C). Sensory organ of 3rd segment with 2 sense rods and a few simple guard setae (FIG. 1,B). Postantennal organ elongate, situated between antenna and eye, 5/3 – 4/3 as long as diameter of ocellus A (FIG. 1,A). Eye patch dark blue, with 8 ocelli on each side (FIG. 1,A), assembled in 3 somewhat separated groups, AB, CDH and EFG. Ocelli G and H much smaller than others and seem to be in the course of regression, their contours being less distinct than those of others. Labral setae as formulated by 3/5, 5, 4. Both unguis and unguiculus without teeth (FIG. 1,D). Unguis stout and curving at apex. Unguiculus tapering, acuminate, reaching almost 2/3 of internal margin of unguis, slightly less than 1/2 external margin of unguis in length. Tenent hairs, feebly knobbed, often hard to recognize, longer than unguis, appear as 2, 3, 3, in number on fore, mid and hind legs. Ventral tube with 3 + 3 setae on lateral flaps, 4 on posterior and nothing on anterior face. Tenaculum and furcula absent.

Clothing of short and simple setae throughout the tergites, growing somewhat longer on posterior segments. A pair of straight, remarkably long setae (about 5 X as long as ordinary short setae

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in Th.II) on the lateral sides of each segment of Th.II, Th.III and Abd.IV, and 6 pairs of them on ankylosed last 2 segments, Abd.V + VI (FIG. 1,F). On most posterior part of last abdominal segment, however, are observed some serrated and curved setae of medium length. 4 + 4 "abdominal sensory setae" present on upper part of V + VI segment, even shorter than other ordinary short setae, about 1/5 length of macrosetae of segment (FIG. 1,F), and they are observed also on Abd.II, III and IV as 2 + 2 each.

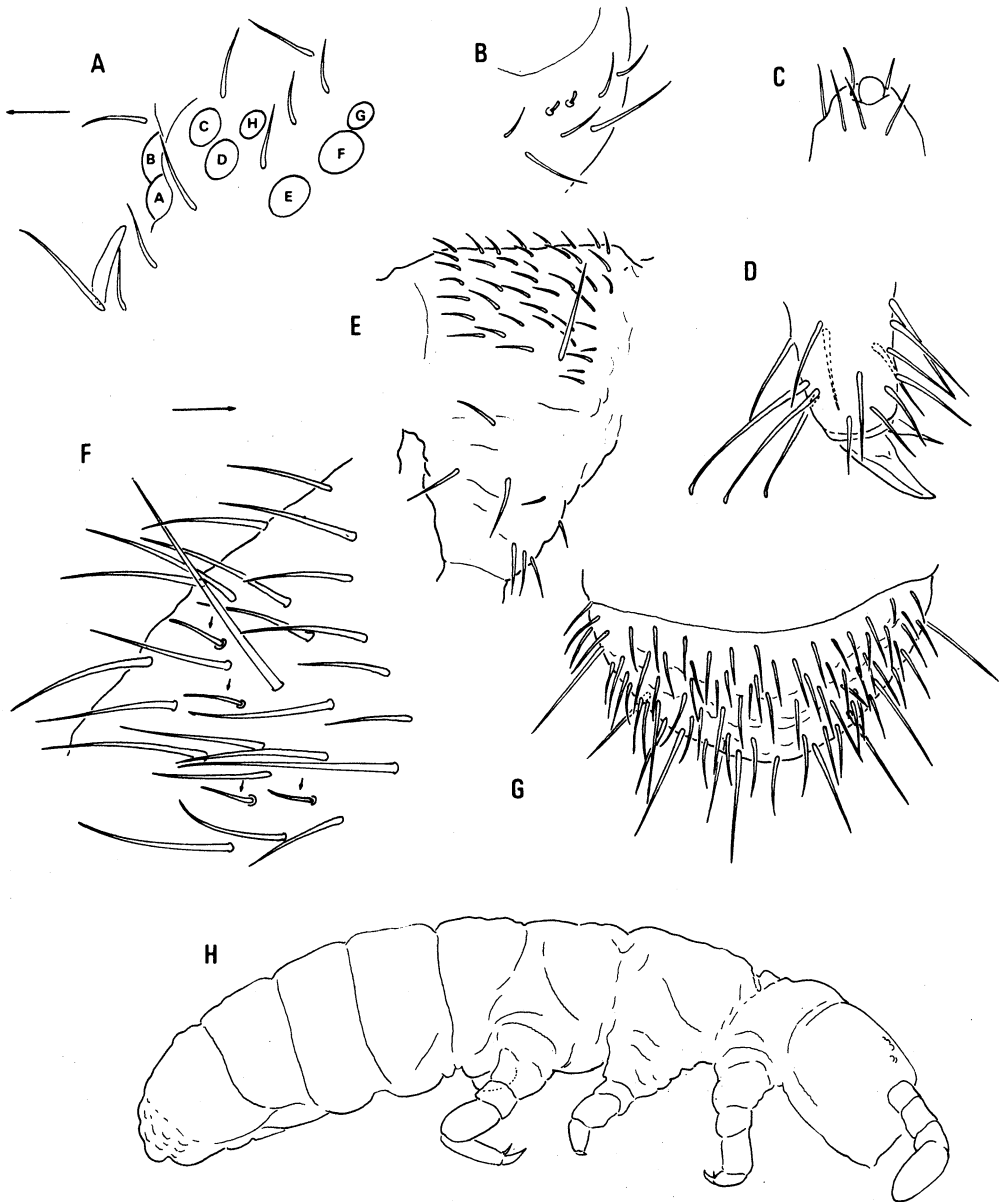


FIG. 1. *Anurophorus ganghwaensis*, n. sp. A: postantennal organ and ocelli (X 295). B: 3rd antennal organ (X 295). C: ant. IV, apex. (X 295). D: foot, posterior (X 295). E: thorax II and coxae in profile (X 118). F: upper part of the posterior abdominal segment corresponding to Abd.V in profile (X 295), arrows indicating "abdominal sensory setae" (X 295). G: Abd.V + VI, dorsal view (X 118). H: whole insect.

Type data: Holotype ♀, Is. Ganghwa-do, Province of Gyeong-gido, from soil and litter of a small forest of mixed plant composition, immediately adjacent to the Temple Jeongsu-sa, collection no. 71-15-1, 14.XI.1971. Paratypes: 11 ♀♀, same data as holotype.

Remarks: They much resemble *Anurophorus montanus* from Tadzhikie and Kirghizie of Middle Asia of southern U.S.S.R., reported by Martynova (1968). Both have in common 8 + 8 ocelli, and the way of grouping of the ocelli is almost the same. However, the Korean examples are distinguished from them by the different relative length of unguis to unguiculus (unguiculus less than 1/2 the internal margin of unguis in Martynova's collection) and the long setae, being always simple and pointed while they are curved and clavate at the tip in the Middle Asian species. Furthermore, the occurrence of "abdominal sensory setae" in the present collection was not noted for the Russian examples.

Folsomia hexasetosa Lee, n. sp.

FIG. 2

Length up to 1.2 mm. Dirty pale gray to grayish blue in alcohol, pigmented with dark bluish spots, irregular in form, size and distribution, pale still across intersegmental regions, less pigmented ventrally, and on antenna, legs and manubrium. Body stout, abdominal segments IV-VI completely ankylosed. Antenna almost equal in length to diagonal of head, 4 antennal segments related as 1:2.0: 1.5:3. Antenna IV with terminal bulb, numerous tapering, simple setae interposed by long thick sensory seta 7 + 7 in number, and also with equal number of thin, blunt setae (FIG. 2,C). Sense organ of 3rd antennal segment as in FIG. 2,B, with 2 sense rods, flanked by 2 stout, blunt setae of medium length and a straight, simple seta in front. Ocelli 4 + 4; 3 located on anterior patch near postantennal organ, the remaining 1 on a small pigment spot behind (FIG. 2,A). Postantennal organ long, narrow, constricted at center to the extent of being divided completely and about 1.5 X the greatest width of 1st antennal segment (FIG. 2,A). Unguis almost straight but mildly curving at distal 1/3, without any teeth (FIG. 2,E). Unguiculus slender, tapering, untoothed, extending to about 3/5 the inner margin of unguis, with inner lamella broader than outer one. Tenent hairs absent, but an extremely fine, simple, long seta observed in their place. Rami of tenaculum quadridentate: corpus with a single stout seta (of 27 examples examined, a single individual was found to possess 2 setae). Furcula reaching posterior margin of 2nd abdominal segment. Manubrium:dens:mucro as about 7:6:1.5. Manubrium with 2 pairs of strong chitinous hooks and 3 + 3 long anterior setae (FIG. 2,D). Dens stout, not tapering greatly, with a few crenulations near proximal 1/3 of anterior sides, provided with 10 setae each side on anterior face (I observed each single specimen possessing 9 + 9, 11 + 11, and 9 + 10 setae, respectively). Mucro bidentate: subapical tooth usually larger than the 1st, curving slightly forward (FIG. 2,G).

Clothing of rather long, stiff, dense, simple setae, becoming longer toward posterior part of each segment and of abdomen. Abdominal segments with long, slender, simple, erect dorsal setae (FIG. 2,F).

Type data: Holotype ♀, the peak Chilseong-bong (alt. 1000 m), Mt Seolag-san, Province of Gang-weon-do, collection no. 72-3-5, from litter and soil sample of a pine forest, 4.VI.1972. Paratypes: 17, same data as holotype; 4, Mt Seolag-san, Province of Gang-weon-do, from litter and soil of a forest in the valley between the Peak Chilseong-bong and the cascade Towangseong-pogpo, collection no. 72-3-6, 4.VI.1972.

Additional material examined: 4 specimens, the peak Daecheong-bong (alt. 1700 m), Mt Seolag-san, from litter and soil of a forest with various trees and herbs, collection no. 72-3-7, 4.VI.1972. 31 specimens, same data as holotype.

♂ and ♀ specimens were collected.

Remarks: This species seems very closely related to *Folsomia octoculata* Handschin, 1925, sharing the number of ocelli, the ratio of the antennal length to the diagonal of the head, etc. It is easily separated from *octoculata* by having 3 + 3 manubrial setae and 10 + 10 dental setae on the anterior faces (2 + 2 and 9 + 9 in *octoculata*).

Folsomia octoculata Handschin, 1925

The specimens examined showed a considerable correspondence with that described by Yosii (1956), as was the case with my collection from Geumgog-neung, Gyeong-gi-do Province (collection no. 72-1) in the 1st report of the present study (Lee 1973). It is notable, however, that the number of setae on the body of tenaculum showed variation to some

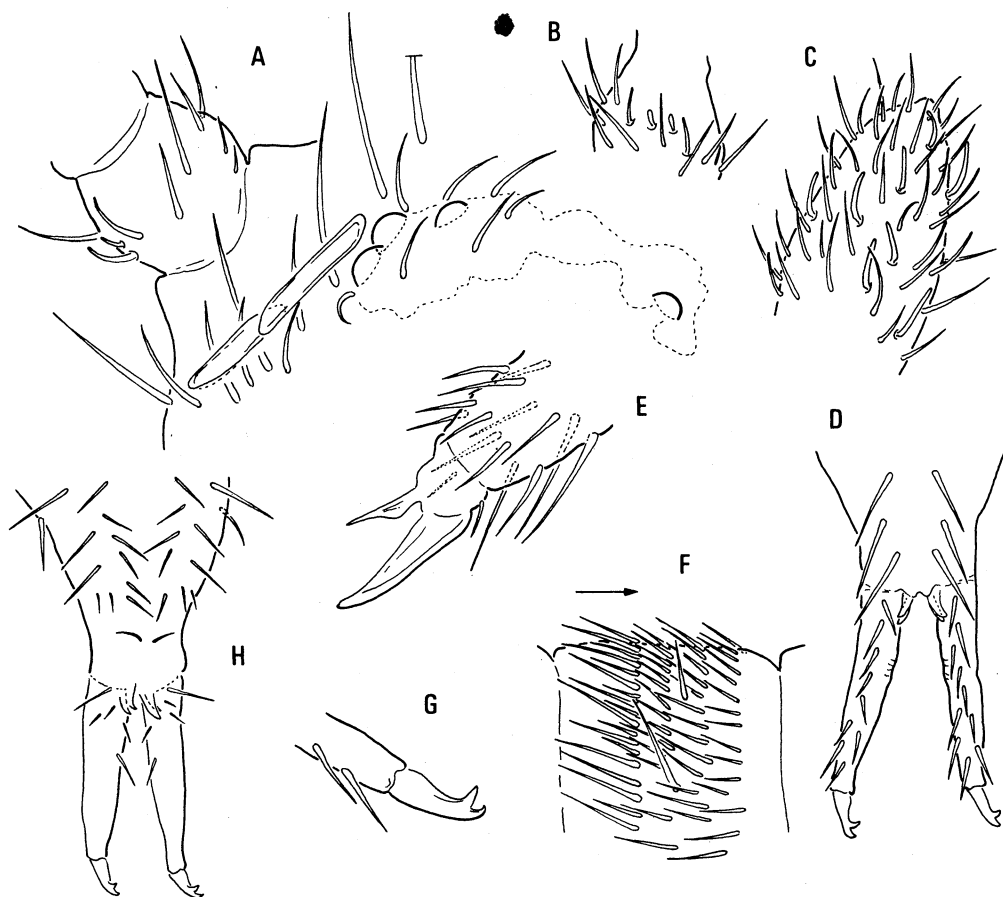


FIG. 2. *Folsomia hexasetosa*, n. sp. A: antenna 1, postantennal organ and ocelli (X 300). B: 3rd antennal organ (X 300). C: antenna IV (X 300). D: anterior face of furcula (X 300). E: foot, posterior (X 300). F: tergite of Abd. III in profile (X 120). G: mucro and distal part of dens (X 300). H: posterior face of furcula (X 120).

degree: of the 50 specimens examined, there were 2 individuals possessing 3 setae, and 12 individuals with 2 setae, respectively, while all the rest had but 1 seta. Manubrial and dental setae on the anterior face demonstrated a constant number 2 + 2 and 9 + 9 setae each. Also, color variations were observed by being bluish in the collection from Mt Seolag-san (collection no. 72-3-5 and 72-3-7) while the other examples were mottled in gray throughout the body except intersegmental zones.

Material examined: 26 specimens: the peak Chilseong-bong (alt. 1000 m), Mt Seolag-san, Province of Gang-weon-do, collection no. 72-3-5, from litter and soil of a pine forest, 4.VI.1972. 4 specimens: the peak Daechong-bong, (alt. 1700 m), Mt Seolag-san, from litter and soil of a forest of mixed arboreal composition, collection no. 72-3-7. 4.VI.1972. Numerous specimens, Gyeongju, Province of Gyeongsangbug-do, from litter of bamboo leaves in good aeration and humidity, just adjacent to the Buddhist Shrine Seog-gul-am, collection no. 72-4-2, 8.VII.1972. 3 specimens: the garden Bi-weon, Seoul, from humus and litter layer of a forest of diverse arboreal composition, collection no. 72-5-1, 18.VII.1972.

♂ and ♀ specimens were collected.

Distribution: Java, Malaya, India, Pakistan, Nepal, China (Canton), Japan, Korea.

***Folsomia onychiurina* Denis, 1931**

My collection agrees well with the original description, showing 2 large sense clubs surrounded by 4 sensory setae on the 4th antennal segment.

Material examined: 2 ♀♀, the garden Bi-weon, Seoul, from litter and soil of a pine stand, collection no. 72-5-2, 8.VII.1972.

Distribution: Central and North America, Europe, Australia, New Zealand, Japan, China (Canton), Korea (new record).

***Folsomia regularis* Hammer, 1953**

FIG. 3

My collection agreed well with the description by Yosii (1969) of Japanese material. The only difference which attracted my attention was the ratio of the postantennal organ in length to the width of the 1st antennal segment, 29:23 (FIG. 3,C), which was represented by ca 1:1 following the figure by Yosii. Of the 10 individuals examined, I found 2 carrying only 3 + 3 manubrial setae on the anterior face, in place of the normal 4 + 4 (FIG. 3,A). Another individual showed an asymmetry, 3 + 4.

Material examined: 20 specimens: Waseon-dae, Mt Seolag-san, Province of Gang-weon-do, from humus and litter layer of a forest with diverse arboreal composition, collection no. 72-3-3, 3.VI.1972.

♂ and ♀ specimens were collected.

Distribution: Arctic Canada, Japan, Korea (new record).

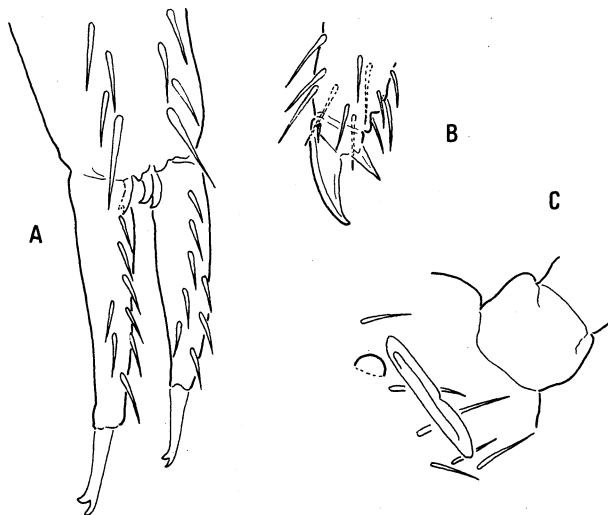


FIG. 3. *Folsomia regularis* Hammer, 1953. A: anterior face of manubrium (X 344). B: foot, posterior (X 344). C: postantennal organ and ocellus (X 344).

***Folsomides exiguus* Folsom, 1932**

FIG. 4

White in alcohol. Maximum length 0.77 mm. Body elongate (FIG. 4). Ocelli, 2 on each side, without pigment, the anterior of the 2 situated just behind dorsal end of postantennal organ, diameter of which

is bigger than that of posterior one by $1/6 - 2/6$ (FIG. 4,A). Distance from anterior ocellus to posterior one slightly longer than length of postantennal organ. Postantennal organ as long as width of base of 1st antennal segment, and with a slight notch at middle of the anterior margin. Antenna as long as diagonal of head. Unguis curving, acuminate (FIG. 4,E). Unguiculus with internal lamella much curved, less than $1/3$ of external margin of unguis and slightly less than $1/2$ internal margin of unguis in length. Mucrodens $3/5$ as long as manubrium. Manubrium posteriorly with $7 + 7$ setae, 2 pairs of which located quite near manubrial articulation with abdomen while another nearby inserted more laterally (FIG. 4,C). Ventral tube with $3 + 3$ setae on lateral flaps, posterior face with $1 + 1$ setae (FIG. 4,B). Rami of tenaculum tridentate, corpus without seta. Body setae simple and fairly uniform except for several longer ones on abdominal segments, those on last 2 segments being longest, almost $2X$ as long as common setae on the anterior row at mid-dorsal part of Abd.II. Abd.I-III, V and VI with almost 3 transversal rows of setae, Th.II, 6 rows, while Th.III and Abd.IV with 4 rows, respectively.

Material examined: 2 ♀♀, Gyeongju, Province of Gyeongsangbuk-do, from soil of a pine forest near the Temple Bulgug-sa, collection no. 72-4-4, 8.VII.1972. 2 ♀♀ Songjeong-ri, Is. Namhae-do, Province of Gyeongsangnam-do, from litter of a forest floor of mixed vegetational composition, just adjacent to Songjeong Primary School, situated almost at the bank of the seashore, collection no. 72-6-8, 8.VI.1972.

Remarks: My specimens have some differences from those recorded so far: a slight constriction of the postantennal organ as compared to "feebly curving" of the Hawaiian example (Folsom 1932) and "elliptical" of those from North Vietnam (Stach 1965). Furthermore, the Korean examples do not possess any pigment on the ocular areas, antenna

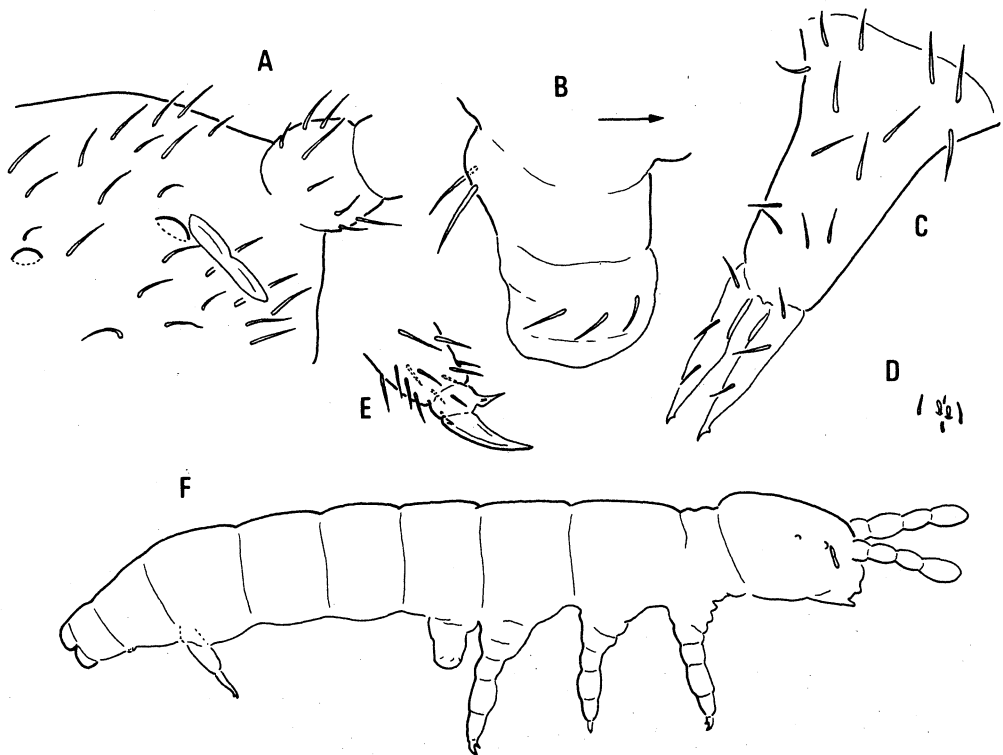


FIG. 4. *Folsomides exiguus* Folsom, 1932. A: antenna 1, postantennal organ and ocelli (X 313). B: ventral tube in profile (X 313). C: posterior face of furcula (X 313). D: 3rd antennal organ (X 313). E: foot (X 313). F: whole insect (X 125).

is only $1/2$ as long as the head, and $7 + 7$ setae are on the posterior face of manubrium. The last 3, apparently not having been observed elsewhere, seem to characterize Korean populations.

Distribution: Hawaii, Australia, Malaya, North Vietnam, Philippines, Solomon Is., Korea (new record).

***Isotomiella minor madeirensis* Da Gama, 1959**

FIG. 5

As far as specific characters are concerned, Korean examples (FIG. 5) agree well with *Isotomiella minor* (Schaeffer, 1896), redescribed by Folsom in 1932 and 1937. However, there were some notable differences: 3rd abdominal segment always a little longer than 4th (9:8), as was true of the Polish examples reported by Stach (1947); 2nd antennal segment almost equal in length to 3rd one, with a slight variation, however, by being often a little longer or shorter than the latter; ventral tube anteriorly with $3 + 3$ setae, on lateral flaps $4 + 4$, and on posterior face 4 setae respectively (FIG. 5C), thus, resembling the specimens from the Himalaya (Yosii 1966); and subapical seta of dens barely exceeding the mucro.

Since 6 out of 10 specimens of my collection examined for manubrial setae agree well with *Isotomiella minor* var. *madeirensis* erected by Da Gama (1959), I regard them as the corresponding subspecies, as recognized by Winter (1967) for the specimens from Peru.

The variation of the manubrial anterior setae in Korean examples is as follows:

Manubr. setae				Size of indiv. in mm
1,1,1,	1 + 1,	2 + 2,	2 + 2.	side 4 + 4: 0.96:0.88:0.82:0.78:9.7:0.72
1 + 1,	1 + 1,	(2,1,2)*,	2 + 2.	side 4 + 4: 0.87
1,1,	1 + 1,	2 + 2,	2 + 2.	side 4 + 4: 0.8
	1 + 1,	2 + 2,	2 + 2.	side 4 + 4: 0.6
1,1,	(1,1,1),	2 + 2,	2 + 2.	side 4 + 4: 0.58

*numbers in parentheses indicate the setal arrangement in the same transverse row.

Insufficient as the number of samples may be, the above data do not seem to demonstrate any regular way of development of manubrial chetotaxy with growing instars as suggested by Gisin (1942) for *Isotomiella minor*, and are not comparable, either, with that given by Winter (1967) for Peruvian examples of the subspecies *madeirensis*.

The question must remain unsolved until an extensive study with reared specimens is performed, which hopefully will determine the validity of the synonymization of this subspecies, by Da Gama (1964), with *Isotomiella paraminor* Gisin, 1942.

Material examined: 1 specimen: Geumgog-ri, Yangju-gun, Province of Gyeonggi-do, from soil of a small forest of diverse arboreal composition adjacent to the royal tomb Geumgog-neung, collection no. 72-1, 7.IV.1972. 6 specimens: Jinae-ri, Shinbug-myeon, Province of Gangweon-do, from soil of a forest, collection no. 72-2, 14.V.1972, 2 specimens: Waseon-dae, Mt Seolag-san, Province of Gang-w-on-do, from humus and litter layer of a forest nearby, collection no. 72-3-3, 3.VI.1972. 2 specimens: Gyeongju, Province of Gyeongsangbug-do, from soil of a pine stand near the temple Bulgug-sa, collection no. 72-4-4, 8.VII.1972. 2 specimens: garden Bi-weon, Seoul, from soil and litter of the forest, collection no. 72-5-4, 18.VII.1972. 1 specimen: garden Bi-weon, Seoul, from soil and litter of a bush with various creepers and herbs, 72-7-2, 29.VIII.1972.

♂ and ♀ specimens were examined.

Distribution: Madeira, Portugal, Peru, Korea (new record).

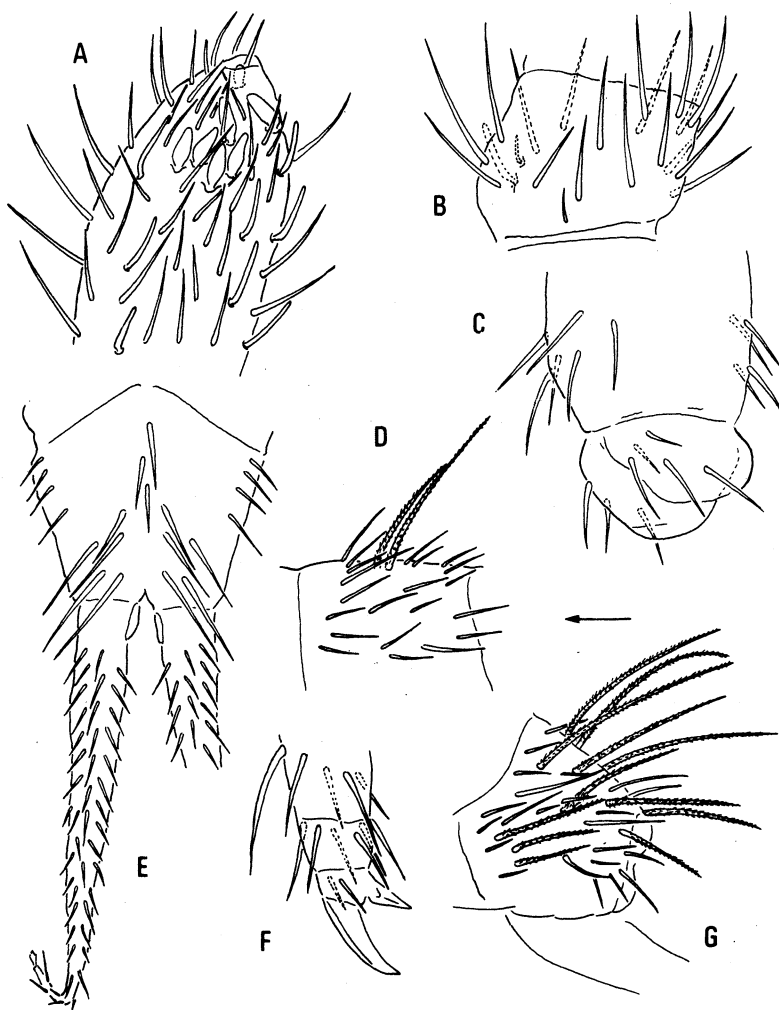


FIG. 5. *Isotomiella minor madeirensis* Da Gama, 1959. A: antenna IV (X 405). B: antenna 1, left. (X 405). C: ventral tube (X 405). D: tergite of abdomen III (X 162). E: anterior face of manubrium (X 162). F: foot, middle (X 405). G: abdomen V and VI, in profile (X 162).

***Isotoma setispinosa* Lee, n. sp.**

FIG. 6, 7

Length up to 0.65 mm. Body elongate and rather scanty (FIG. 7,C). General color of body grayish yellow in alcohol, mottled with blue pigment randomly dispersed and antenna, Th.I, furcula and intersegmental bands still paler in color. Antenna, 1.6X as long as head, with its segments, in lengths, related as about 5:8:8:14. Fourth antennal segment without terminal bulb, provided with 4 sensory setae of moderate thickness (FIG. 6,A). Third antennal organ with 2 sense rods, flanked by 2 blunt setae and 1 straight and long simple seta in the front (FIG. 6,F). Postantennal organ close to eyes, oval, with a slight notch in middle of anterior margin, subequal in length (5:6) to width of base of 1st antennal segment (FIG. 6,B).

Eye patch dark blue, divided into a bigger anterior one and a small posterior one, each bearing an ocellus, but the posterior one often difficult to recognize and 1/2 as large as anterior ocellus (FIG. 6,B). Unguis simple, curving at apex, but with 2 minute lateral teeth visible only in internal view (FIG. 6,D). Unguiculus broadly lanceolate, approximately 1/3 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. Tenent hair absent, but represented by a very fine simple seta in its place. Ventral tube with 6 setae on anterior face, 3 + 3 on lateral flaps, 3 on the posterior face (FIG. 6,C). Rami of tenaculum quadridentate, corpus with 2 setae arranged longitudinally. Furcula appended to 5th abdominal segment, reaching ventral tube. Anterior face of manubrium with numerous setae (FIG. 7,A). Dentes slightly more than 2X as long as manubrium, slender, finely crenulate dorsally. Mucro tridentate, with smoothly curved ventral margin, as long as unguiculus of hind feet (FIG. 6,E). Abdominal segments subequal to one another but Abd.III longest, Abd.IV slightly shorter than the latter. Abd.V and VI ankylosed together, anterior border of the combined tergite slanting forward as it progresses toward ventral side of abdomen (FIG. 7,C).

Clothing of dense stiff setae, unequal in length, erect setae dispersed among shorter ones (FIG. 6,G), longer stiff setae characterizing general appearance, being spine-like throughout body segments, especially on vertex (FIG. 6,B) and occipital part of head and posterior setae of each segment. Long setae of posterior abdominal segments often serrate while mildly flexed in distal 1/2.

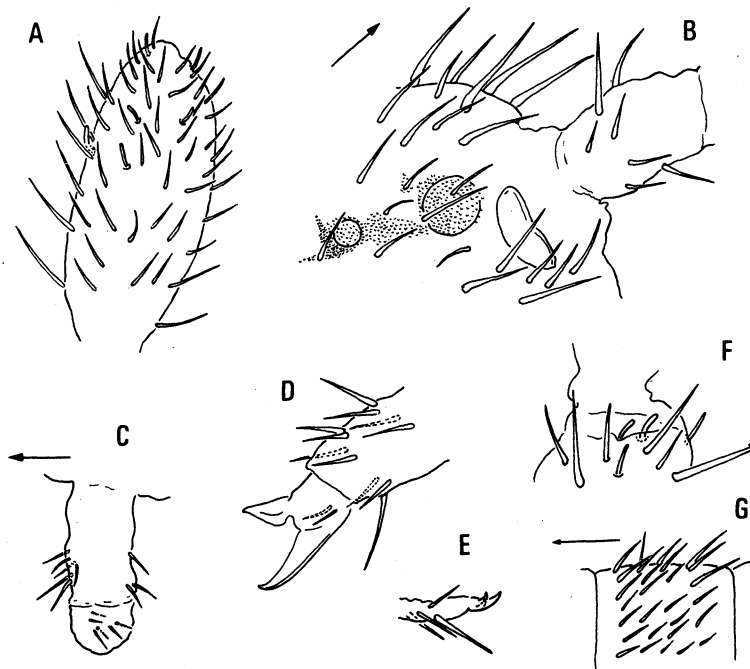


FIG. 6. *Isotoma setispinosa*, n. sp. A: antenna IV (X 405). B: antenna 1, postantennal organ ocellus and setae on the vertex (X 405). C: ventral tube (X 162). D: foot, posterior (X 405). E: mucro, right, internal view (X 405). F: 3rd antennal organ (X 405). G: tergite of abdomen II, in profile (X 162).

Type data: Holotype ♀, Geumgog-ri, Yangju-gun, Province of Gyeong-gi-do, from soil of a small forest of diverse arboreal composition just adjacent to the royal tomb Geumgog-neung, collection no. 72-1, 7.IV.1972. Paratypes: 13 ♀♀, same data as holotype; 1 ♀ from each collection 71-6, 72-4-4, and 72-6-1 (see below for data).

Additional material examined: 2 ♀♀, Seoul, campus of the Hanyang University, from soil of a small pine stand, collection no. 71-6, 27.VIII.1971, 1 ♀, Gyeongju, Province of Gyeong-sangbug-do, from soil of a pine forest near the temple Bulgug-sa, collection no. 72-4-4, 8.VII.1972. 3 ♀♀, Sangju-ri, Idong-myeon, Namhaegun, Province of Gyeongsangnam-do, from soil of a pine forest, collection no. 72-6-1, 3.VII.1972.

Remarks: The new species closely resembles *Isotoma hyonosenensis* from Japan (Yosii 1939) but is distinguished from it by the well developed internal lamella of unguiculus, its relative length to unguis, and fewer number of setae on the corpus of the tenaculum. The name of this new species is taken from the characteristic setal appearance.

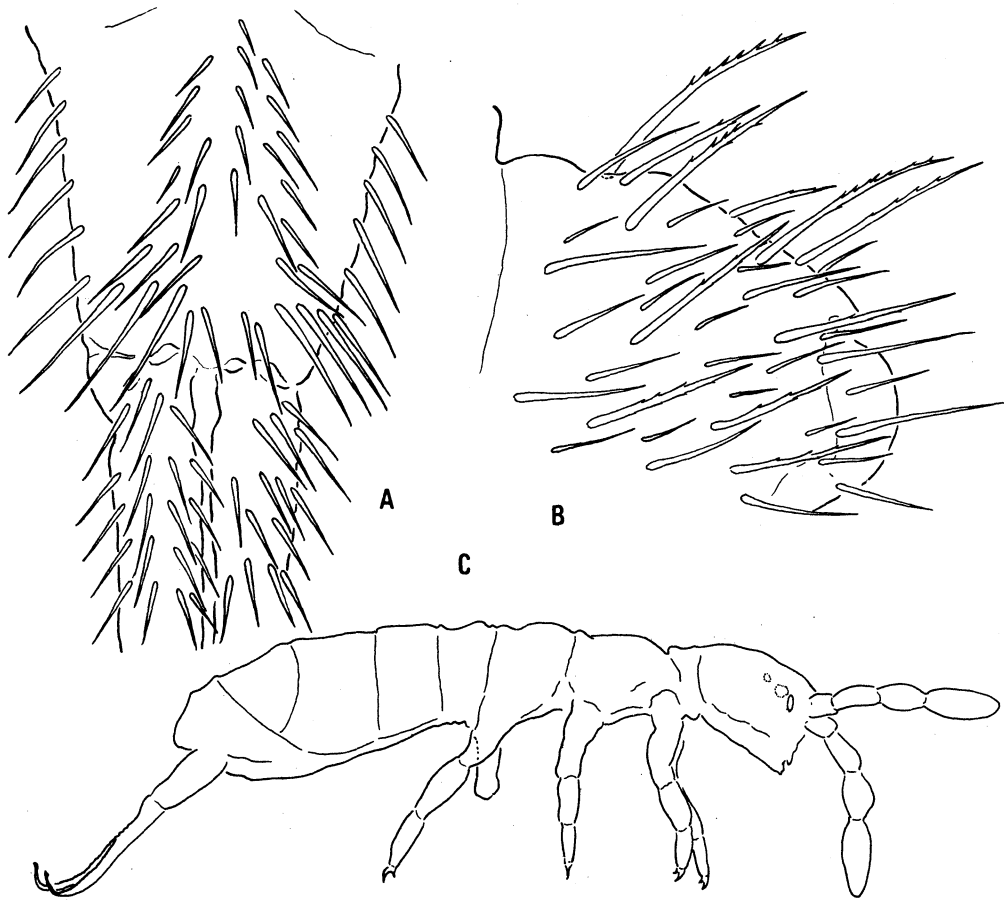


FIG. 7. *Isotoma setispinosa*, n. sp. A: anterior face of manubrium and proximal part of dens (X 185). B: abdomen V and VI in profile (X 185). C: whole insect in profile (X 37).

***Isotoma setinornata* Lee, n. sp.**

FIG. 8, 9

Length up to 1.1 mm. Grayish in alcohol, body, antenna, legs with pale intersegmental bands, furcula also pale except somewhat pigmented in lateral part. Antenna longer than diagonal of head (5:3) (FIG. 9,D), ratio of segments related as about 4:7:7.5:12, but 3rd segment occasionally slightly shorter than 2nd. Sense organ of 3rd antennal segment as represented in FIG. 8,E. Fourth antennal segment without terminal bulb but 8 to 9 sensory setae of rather moderate thickness. Postantennal organ ovoid, slightly bigger than ocellus A (6.5:6). Eight ocelli on each side, of which G and H are smaller than the others, often hard to recognize (FIG. 8,C). Unguis with a pair of very minute lateral teeth, unguiculus less than 1/2 the external margin of unguis of hind claw (13:28) (FIG. 8,B). Unguiculus broadly lanceolate, acuminate, with inner basal lamella strongly curved and untoothed. Tenent hairs absent but a simple, very fine seta in their place, subequal to unguiculus in length. Rami of tenaculum quadridentate, corpus with 5 to 6 setae (FIG. 8,A). Furcula appended to 5th abdominal segment, extending to ventral tube. Anterior setae of manubrium numerous (FIG. 9,A). Dens 2X as long as manubrium, slender, gradually

tapering, finely crenulate dorsally, subapical seta exceeding mucro. Mucro tridentate, with mildly curving ventral margin (FIG. 8,D).

Clothing of dense short setae, interposed by moderately longer ones, all simple but spine-like on vertex, occipital part of head, posterior rows on tergites and posterior abdominal segment (FIG. 8,C and F, FIG. 9,B and C). Specimens from collection no. 71-14-1 show marked difference, in length, of macrosetae and microsetae (FIG. 9,B) as compared to some of those from other localities (FIG. 9,C). Body segments of Th.II-III, Abd.II-III almost equal in length, Abd.I slightly shorter while Abd.IV slightly longer than other major segments. Abd.V and VI reduced in length, with a demarcation between the 2, although sometimes not very clear.

Type data: Holotype ♂, Gyeongju, Mt Toham-san, Province of Gyeongsangbug-do, from soil and litter in a bush of mixed vegetation, roadside halfway up to the Shrine Seog-gul-am from the town of the temple Bulgug-sa, collection no. 72-4-3, 8.VII.1972. Paratypes: 2, same data as holotype; 7, collection no. 72-5-3 (see below for data); 1, collection no. 72-6-7; 1, Mt Yongmun-san, Yangpyeong-gun, Province of Gyeong-gi-do, from litter and soil of a bush, roadside at the base of the mountain, in good aeration and humidity, collection no. 71-14-1, 8.XI.1971.

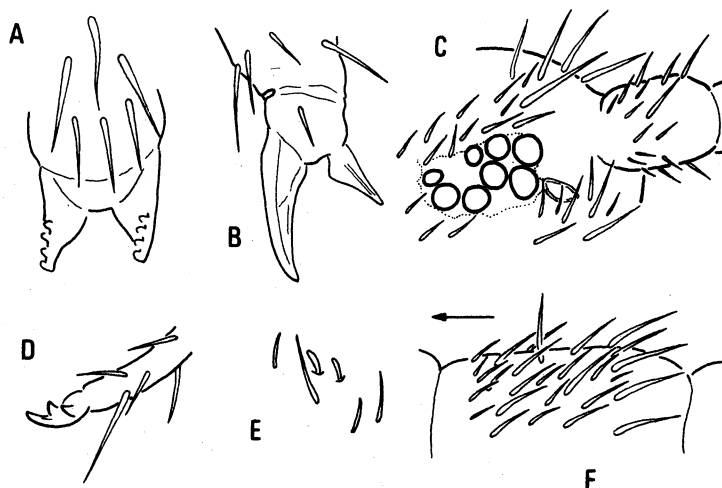


FIG. 8. *Isotoma setinornata*, n. sp. A: tenaculum (X 405). B: foot, posterior (X 405). C: antenna 1, postantennal organ and ocelli (X 162). D: mucro and distal part of dens, right, latero-external view (X 405). E: 3rd antennal organ (X 405). F: tergite of abdomen II, in profile (X 162).

Additional material examined: 1, same data as holotype. 2, Seoul, the garden Bi-weon, from litter of elm stands beside the brook Ogryu-cheon, with good aeration and humidity, collection no. 72-5-3, 18.VII.1972. 6, Sangju-ri, Idong-myeon, Namhae-gun, Province of Gyeongsangnam-do, from soil of a pine stand, collection no. 72-6-1, 31.VII.1972. Numerous specimens, Songjeong-ri, Namhae-gun, from a heap and manure of barley straw, collection no. 72-6-7, 3.VIII.1972.

Remarks: The new species resembles *Isotoma setispinosa*, described in the present paper, by its general appearance. However, it is differentiated from it by the number of ocelli, setae of corpus of the tenaculum, absence of the serrated setae on the posterior abdominal segments and division between Abd.V and VI. *Isotoma maritima* Tullberg, with 8 ocelli on each side, seems close to the new species, but it possesses distinct lateral teeth and fewer setae on the corpus of tenaculum.

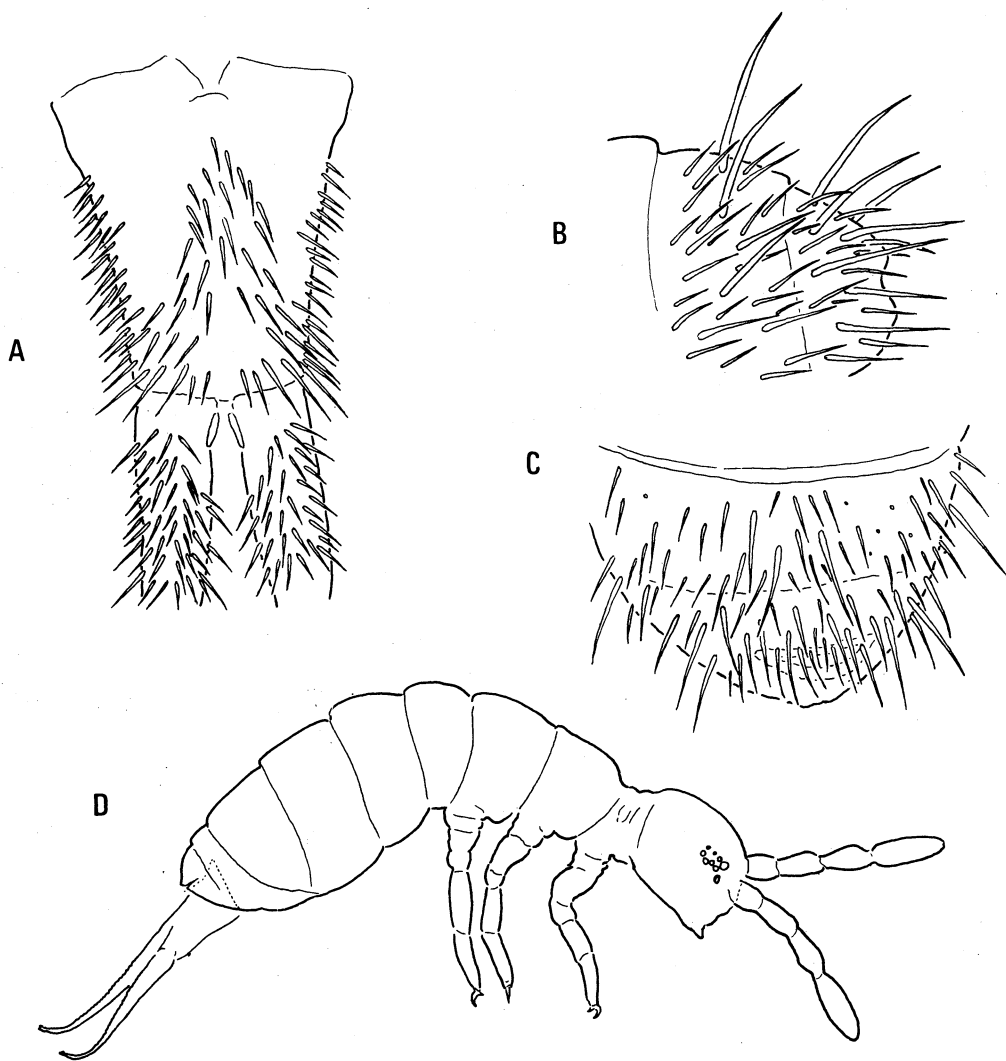


FIG. 9. *Isotoma setinornata*, n. sp. A: anterior face of manubrium and proximal part of dens (X 138). B: abdomen V and VII in profile (X 138). C: abdomen V and VI of other individual, dorsal view (X 138). D: whole insect (X 35).

***Isotoma choi* Lee, n. sp.**

FIG. 10

Length up to 1.9 mm. Body gray in general but dark bluish in distal 4/5 of each antennal segment, gray background mottled with dark blue pigment, forming an elliptical patch at center of head dorsum, subequal in size to ocular one, and a small inverted triangular dark area situated at anteromedial part of each segment of Th.II-Abd.V. Th.II and Th.III with dark pigmented lateral margins while each segment of Abd.II-Abd.V bordered anteriorly with bands of the same color. Limbs and furcula still paler than gray background, almost white. The anteromedial triangular patches of each thoracic tergite noted above absent in young individuals, and a considerable amount of variation seems to be present in degree of coloration for younger ones. Antenna far longer than diagonal of head (ca 1.8:1), ratio of the 4 different segments related as about 9:15:17:20. Fourth antennal segment with a number of simple setae and some sensory setae not well developed, barely recognizable. Terminal papilla not differentiated as bulb. Third antennal organ with 2 typical curved sense rods (FIG. 10,B). 6 + 6 ocelli, subequal in

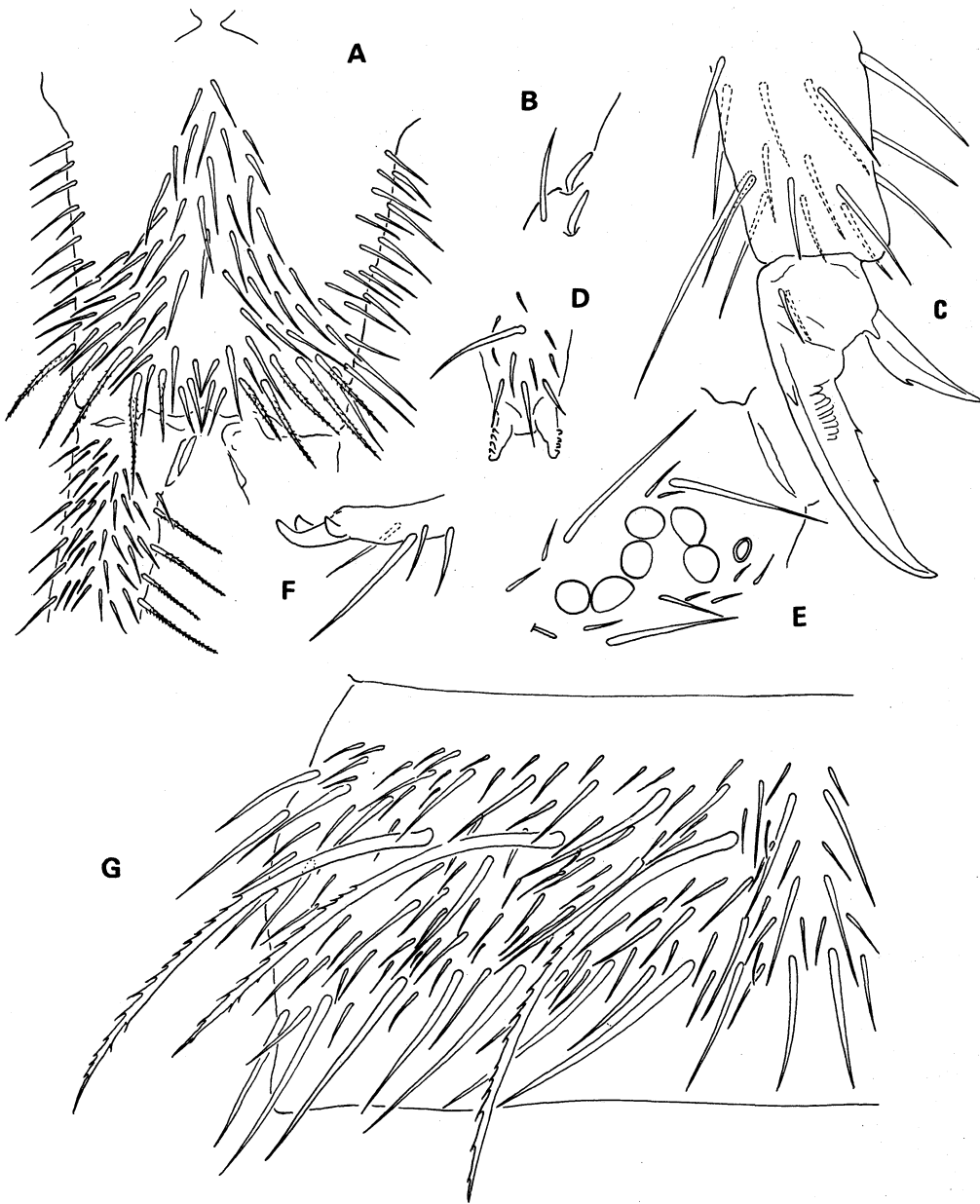


FIG. 10. *Isotoma choi*, n. sp. A: anterior face of manubrium and proximal part of dens (X 123). B: 3rd antennal organ (X 309). C: foot, posterior (X 309). D: tenaculum (X 123). E: postantennal organ and ocelli (X 309). F: mucro, lateral view (X 309). G: chetotaxy of tergite Abd.II, left $\frac{1}{2}$ (X 123).

size, in a well-developed dark blue patch on each side (FIG. 10,E). Postantennal organ, oval in shape, slightly longer than $\frac{1}{2}$ the diameter of adjacent ocellus (4:7) (FIG. 10,E). Labral setae as formulated by 4/5.5.4. Unguis elongate but curving at apex, with 2 minute internal teeth and a pair of distinct lateral teeth (FIG. 10,C). Unguiculus slightly longer than $\frac{1}{2}$ internal margin of unguis, with a distinct, tapering angular tooth at internal lamella. Tenent hairs, pointed, simple setae, as long as internal margin of unguis (FIG. 10,C). Ventral tube with setae, 12 + 12 on anterior face, 12 + 12 on lateral flaps,

15 on posterior, but somewhat variable in their number in different individuals. Tenaculum with 4 + 4 teeth with setae on corpus varying in number from 10 to 20, the largest individual observed having 20 (FIG. 10,D). Furcula long and tapering, reaching ventral tube, attached to the 5th abdominal segment. Ratio of manubrium to dens and mucro as related as about 1:2.3. Manubrium and dens with numerous simple setae on anterior face but some of the macrosetae in distal part of manubrium serrated and on interior sides of dens proximally observed 4 + 4 serrated setae (FIG. 10,A). Dens with minute crenulations almost all along the posterior face. Mucro tridentate, subapical setae of dens slightly exceeding mucro (FIG. 10,F).

Clothing of simple and serrated setae: simple ones with varying lengths and thickness, serrated setae always long and, in Abd.II, 10X as long as ordinary microsetae on anteromedial area of tergite. Most of serrated long setae serrated only on anterior side, their distribution being 2 + 2 on each of the last 2 thoracic segments, 3 + 3 on each of Abd.I-III, 4 + 4 on Abd.V, and on the last abdominal segment observed, 7 pairs in addition to a central unpaired one. Abd.III and IV subequal in length and last 2 abdominal segments reduced and each segment only 1/2 as long as 4th abdominal segment.

Type data: Holotype ♀, I. Ganghwa-do, Province of Gyeonggi-do, from soil and litter of a small forest immediately adjacent to the temple Jeongsu-sa, collection no. 71-15-1, 14.XI.1971. Paratypes: 4, same data as holotype; 3, collection no. 71-15-2 (see below for data).

Additional material examined: 4 specimens, same data as holotype. 5 specimens, Onsu-ri, Gilsang-myeon, I. Ganghwa-do, Province of Gyeonggi-do, from soil of pine stand, collection no. 71-15-2, 14.XI.1971. 2 specimens, Seolag-dong, Province of Gangweon-do, from soil of the dry bed of the brook Ssang-cheon, collection no. 72-3-1, 3.VI.1972. 5 specimens, Waseon-dae, Mt Seolag-san, Province of Gangweon-do, from humus and litter layer of a forest with diverse arboreal composition, collection no. 72-3-3, 3.VI.1972.

♂ and ♀ specimens examined.

Remarks: The new species resembles *Isotoma himalayana* described by Yosii (1971) from the Himalaya, sharing the number of ocelli and angular tooth of unguiculus. However the Himalayan species does not possess internal teeth of unguis while having clavate tenent hairs. Furthermore the setae in the latter species are all simple and never serrate according to the original description.

I take great pleasure in naming this species *Isotoma choi* after my former professor of entomology, the late Dr Pok-Sung Cho.

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