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Systematic Studies on Chinese Collembola (Insecta) II. Five New Species and Two New Records from Taiwan in the Family Neanuridae

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中國產 톡토기目(昆蟲綱)에 關한 分類學的 硏究 II. 臺灣產 혹무늬톡토기科 5新種과 2대만未記錄種

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적 요

대만산 혹무늬톡토기과(Neanuridae) 6속 8종에 대한 관찰결과 5신종, 2대만미기록종이 밝혀져 이를 보고 하고져 한다. 본 연구로 밝혀진 5 신종은 *Neanura kentingensis* n.sp., *Womersleya formosana* n.sp., *Crossodonthina montana* n.sp., *Vitronura tubercula* n.sp., *Lobella nana* n.sp이고, 2 대만미기록종은 *Pseudachorudina nepalica* Yosii, 1966와 *Lobella perfusa* Denis, 1934이다. 따라서 본 연구결과를 포함한 대만산 혹무늬톡토기과는 모두 7속 13종이 된다. 아울러 인접 국가인 일본, 베트남에 분포하는 종과의 지리적 근연 관계도 살펴보았다.

Key words: Collembola, Neanuridae, taxonomy, Taiwan

INTRODUCTION

The collembolan fauna of Taiwan has been examined by only a few workers, firstly by Denis (1929a, b), Yosii (1954a, b, 1965, 1976, 1977), Uchida (1956, 1957) and Lee and Park (1989) and a general list

list of the Taiwanese Collembola was made by Chi (1981). These resulted in enumeration of 34 species of Collembola falling into 22 genera in 8 families.

The present study is dealing with the family Neanuridae. Only minor contribution to our understanding

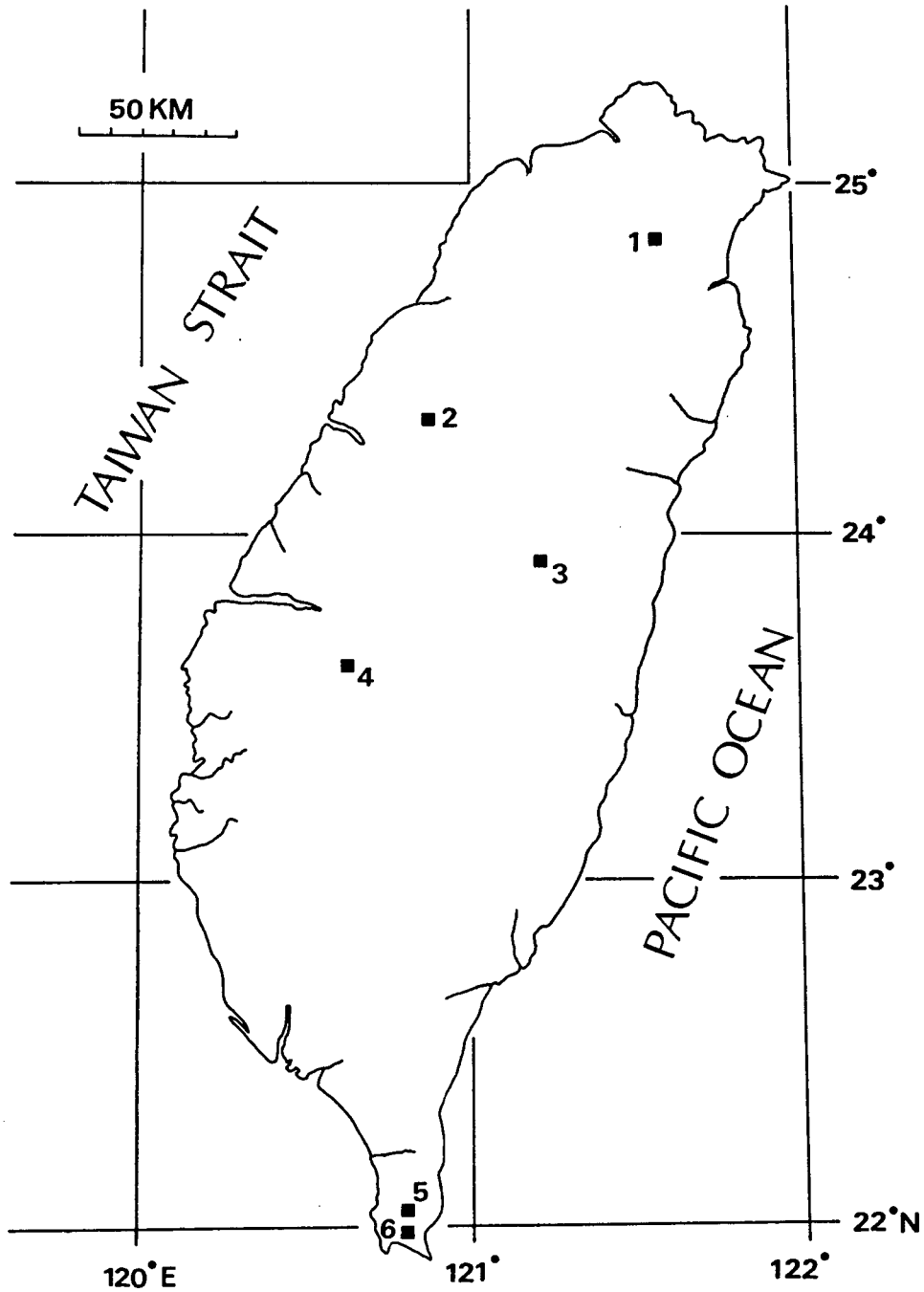

Fig. 1. Collection localities of the specimens examined.

1, Wulai; 2, Kantaoshan; 3, Wushe; 4, Chitou; 5, Manchou; 6, Kenting Park.

has so far been made by Yosii (1954a, b, 1965, 1976) and Uchida (1956, 1957), reporting five and one species respectively. This, therefore, puts merely six species in four genera to the familial list.

The present study is based on collections from six different localities of the island (Fig. 1).

The taxonomical study of the materials has given rise to five new species to science as well as two new records for the island in addition to six species already on record. Description, revisions and some systematic accounts were given as follows.

Type specimens are to be retained in the Insect Collection of the Department of Biology Education, Jeonbug National University, Jeonju 560-756, Korea. Some paratypes, have been deposited in the Department of Entomology, National Chunghsing University, Taichung 40098, Taiwan, the Republic of China.

DESCRIPTIONS

1. *Pseudachorudina nepalica* Yosii, 1966

We find most major characters of the present material the same as those described by Yosii with materials from Nepal (Yosii, 1966). But it is different by lateral tooth number of claw and dens:mucron ratio of furca.

Materials examined: 3, Chitou, Nantou; from mosses and under the stone. Collection No. 88-16, 21. III. 1988.

Distribution: Nepal, Taiwan (new record)

2. *Neanura kentingensis* n. sp. (Fig. 2)

Body length up to 1.5mm, red color in living and white in alcohol. Body oval shape, body setae simple (Fig. 2A). Antenna relatively conical form and length almost same to head diagnoal, the ratio being 17:16. IIIAO consisting of 2 curved sensory rods in a groove. Ant. III and IV segments fused, antennal segments I:II:III+IV as 1:1:2.4. Ant. IV with 8 blunt, curved sensory setae, apical bulb trilobed (Fig. 2D). Ocelli 2+2, unpigmented. PAO absent. Labium small, conical type (Fig. 2E). Mandible tridentate, with 2 minute apical teeth (Fig. 2B). Maxilla styliform (Fig. 2C). Unguis carinate, without any tooth (Fig. 2F). Unguiculus and tenent hair absent. Ventral tube with 3+3 setae. Furcal rest with 2+2 setae (Fig. 2G). Anal spine absent. Abdomen VI bilobed and close to each other.

Chaetotaxy of tergites follows:

	D.I.	D.E.	D.L.	L.
Th. I		1	2	1
Th. II-III	3	s.s+3	3+s.s	3
Abd. I-III	2	3+s.s	2	3
Abd. IV	2	2+s.s	3	
Abd. V	2			
Abd. VI	7			

Type data: Holotype, ♀, Kenting Park, Pingtung; from dry soil of scrub trees. Collection No. 88-11-1, 16. III. 1988. Paratypes: 2, same data as holotype, ♂, 1 and ♀, 1 specimens were collected.

Remarks: This species is similar to *Neanura pygmaea* Yosii, 1954 from Japan, Taiwan in mandible, maxilla and claw. But this species is different from *Neanura pygmaea* Yosii, 1954 by Abd. V tubercle number,

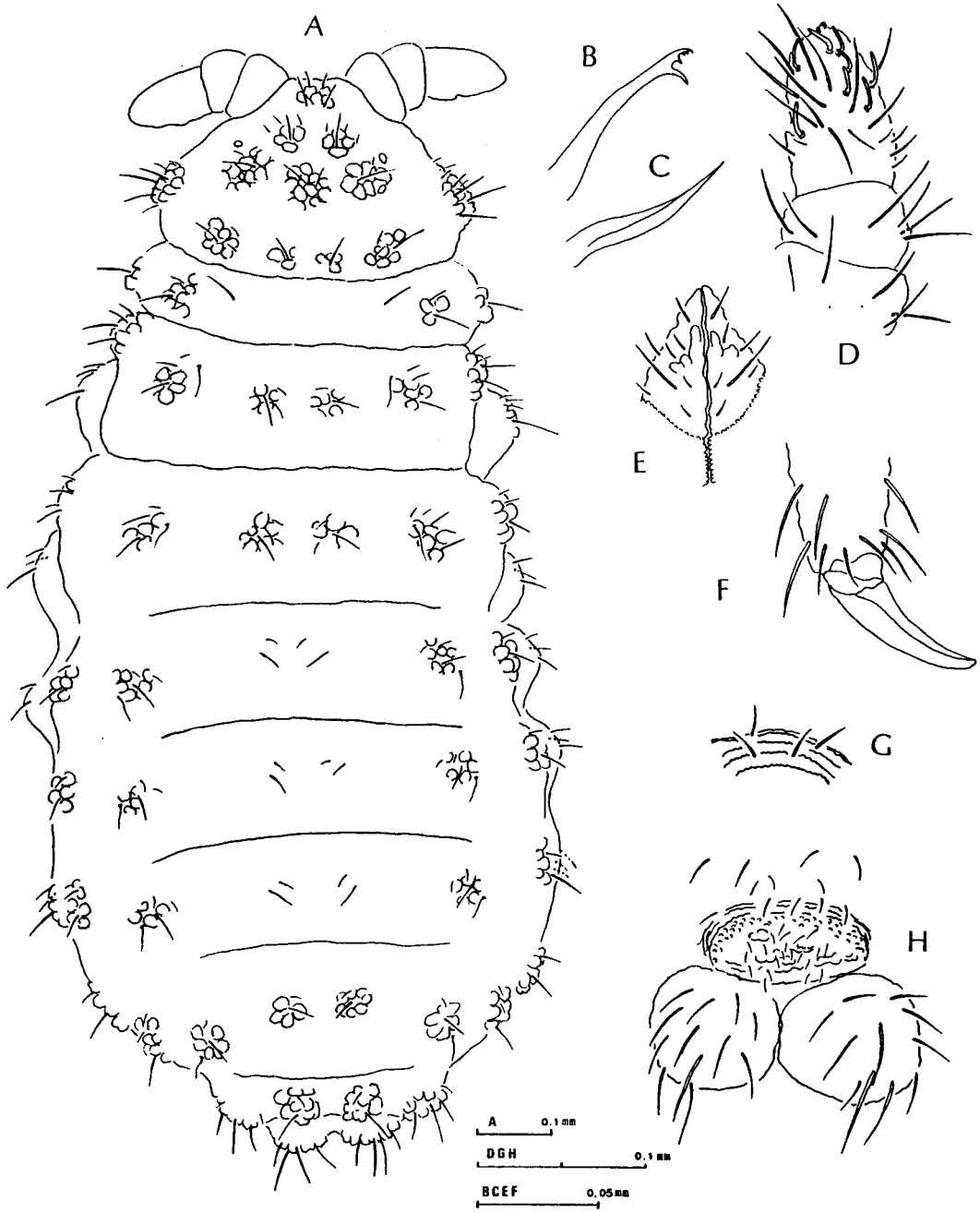

Fig. 2. *Neanura kentlingensis* n.sp.
A, chaetotaxy of *Neanura kentingensis* n.sp; B, mandible; C, maxilla; D, Ant. I,II,III + IV segments; E, labium; F, hindclaw; G, furcal rest; H, genital plate and anal lobe.

and setae number of D.I. tubercle. It is also similar to *Neanura mandarina* Yosii, 1954 from Japan in Abd. V tubercle number, and D.I. tubercle setae but it is differentiated by chaetotaxy of head and body.

Etymology: Named after the type locality.

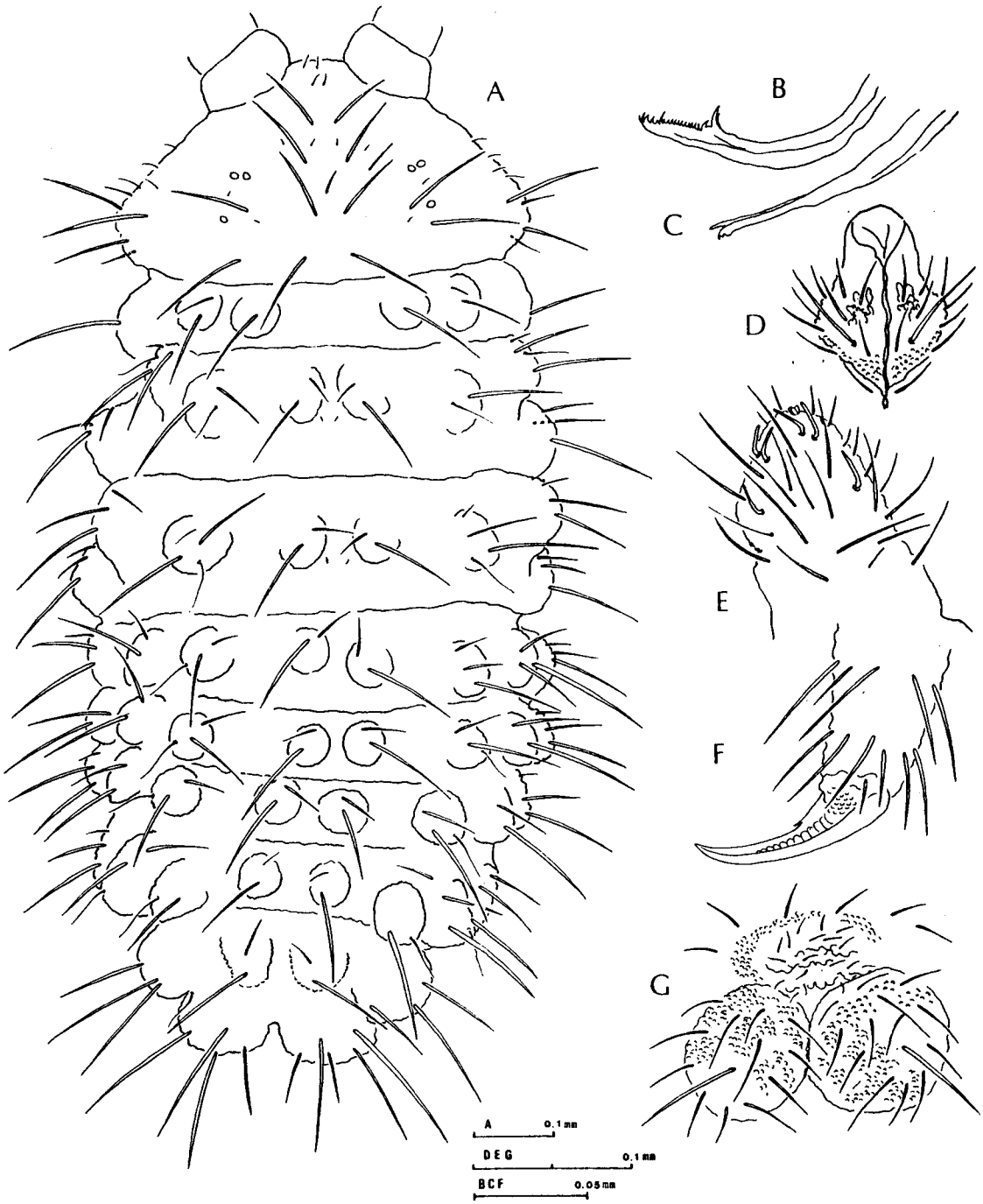

Fig. 3. *Womersleya formosana* n.sp.

A, chaetotaxy of *Womersleya formosana* n.sp; B, mandible; C, maxilla; D, labium; E, Ant. III+IV segment; F, foreclaw; G, genital plate and anal lobe.

3. *Womersleya formosana* n. sp. (Fig. 3)

Body length up to 1.3mm. Body covered with developed tubercles except head (Fig. 3A). Body red col-

or in living and white in alcohol. Body oval shape. Body setae simple and pointed. Antenna relatively shorter than head diagnoal, the relation of these lengths as 23:27. Ant. III and IV segments fused, relative length of antennal segments I:II:III + IV as 1:1:2.4 (Fig. 3E). Apical bulb trilobed. IIIAO consisting of 2 curved sensory rods. Ant. IV with 7 blunt, curved sensory setae (Fig. 3D). Ocelli 3 + 3. PAO absent. Labium relatively conical and rounded (Fig. 3D). Mandible elongate and with many intermittent teeth between apical teeth and 2 basal teeth. Teeth arranged in one longitudinal row (Fig. 3B). Maxilla almost styliform and consisting of 2 lamella, one with 1 apical tooth, the other without any tooth trace (Fig. 3C). Unguis with 1 inner tooth (Fig. 3F). Unguiculus and tenent hair absent. Ventral tube with 4 + 4 setae. Furcal rest with 3 setae. Anal spine absent.

Chaetotaxy of tergites as follows;

	D.I.	D.E.	D.L.	L.
Th. I		1	2	1
Th. II-III	i+2	s.s+2	3+s.s	3
Abd. I-III	2	3+s.s	2	3
Abd. IV	2	1+s.s	3	s.s+6
Abd. V	2	s.s+3		
Abd. VI	7			

Type data: Holotype, ♂, Manchou, Pingtung; from soil of scrub trees. Collection No. 88-12. 17. III. 1988. Paratypes: 8, same data as holotype. ♂, 4 and ♀, 4 specimens were collected.

Remarks: This species shows a typical mandible of the genus *Womersleya* and similar to *Womersleya hongkongensis* Yosii, 1976 from Hongkong in the shapes of mandible and maxilla but it is different from the latter species by chaetotaxy of tergites and head tubercle.

Etymology: The specific name derives from Taiwan of the Republic of China, to which the type locality belongs.

4. Crossodonthina montana n.sp. (Fig. 4)

Body length up to 2.0mm (Fig. 4A), red in living and white in alcohol. Ant.: Head ratio as 1:1.3. Ant. III and IV segments dorsally ankylosed. Ant. IV bearing trilobed and 6 curving, sensory setae. IIIAO consisting of 2 curved sensory rods in a groove (Fig. 4E). Labium rounded (Fig. 4D). Mandible deeply branched, intensely feathered and with 1 basal tooth (Fig. 4B). Maxilla consisting of 2 lamella, one with 3 minute apical teeth, the other with 3 branched apically (Fig. 4C). Ocelli 2 + 2, unpigmented. PAO absent. Unguis basally granulated and dorsally carinated with one inner tooth, inner side with many transverse striae (Fig. 4F). Unguiculus and tenent hair absent. Ventral tube with 4 + 4 setae. Furcal rest with 2 + 2 setae (Fig. 4G). Anal spine absent.

Chaetotaxy of tergites as follows;

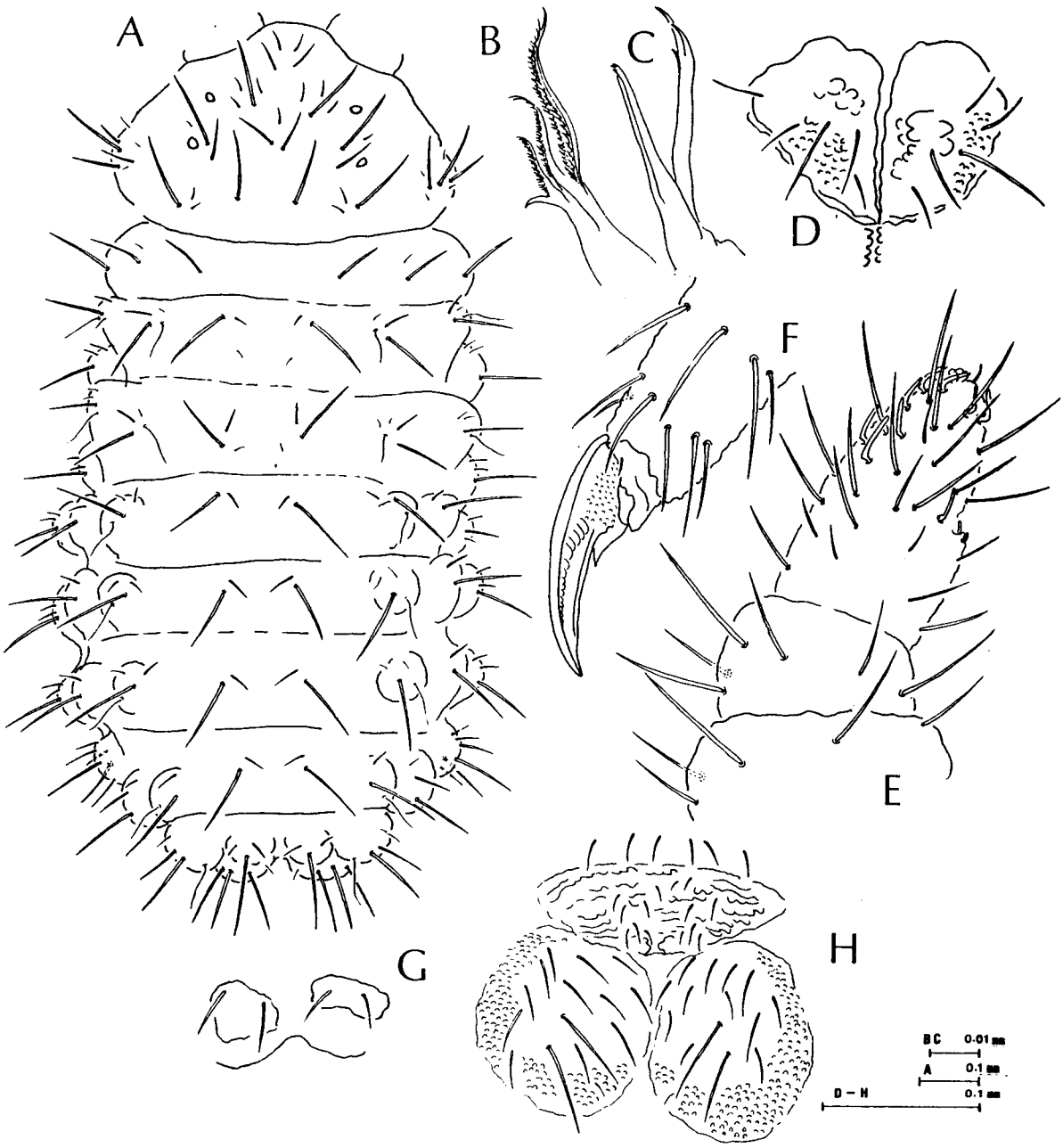

Fig. 4. *Crossodonthina montana* n.sp.

A, chaetotaxy of *Crossodonthina montana* n.sp; B, mandible; C, maxilla; D, labium; E, Ant. I,II,III + IV segments; F, foreclaw; G, furcal rest; H, genital plate and anal lobe.

	D.I.	D.E.	D.L.	L.
Th. I		1	2	1
Th. II-III	2+i	i+s.s+2	3+s.s	3
Abd. I-III	2	3+s.s	2	3
Abd. IV	2	2+s.s	3	6
Abd. V	3	s.s+i+3		
Abd. VI	7			

Type data: Holotype, ♂, Kantaoshan, Nantou; from litter soil of mixed arboreal vegetation. Collection No. 88-15, 20. III. 1988. Paratypes: 14, same data as holotype, ♂, 7 and ♀, 7 specimens were collected.

Remarks: This species looks similar to *Crossodonthina alatoserrata* Yosii, 1965 from Taiwan with respect to well developed body setae, mandible, ventral tube setae, claw and so on. But it is differentiated by ocelli number, maxilla, chaetotaxy of tergites.

Etymology: The specific name is from the Latin montanus (meaning "mountains"), which refers to type locality.

5. *Crossodonthina formosana* Yosii, 1965

We find most major characters of the present material are same as those described by Yosii with materials from Taiwan (Yosii, 1966).

Materials examined: 3, Wulai, Taipei; from soil and litter of mixed arboreal vegetation. Collection No. 82-47, 24. XII. 1982; 7, from soil and litter of bamboo forest. Collection No. 88-17-2, 25. III. 1988; 11, Kenting Park, Pintung, from poor soil and litter of scrub trees. Collection No, 88-11-1, 16. III. 1988.

Distribution: Taiwan.

6. *Lobella nana* n.sp. (Fig. 5)

Body length up to 1.6mm, light yellow color in living and white in alcohol. Body surface covered with tubercles. Body with both long and short setae relatively feathered. (Fig. 5A). Antenna shorter than head diagonal, the ratio as 1:1.3. Ant. III and IV segments fused, antennal segments ratio I:II:III+IV as 1:1:2.3. Ant. IV with an apical bulb trilobed, and with 8 blunt and curved sensory setae. IIIAO consisting of 2 sense rods, curved in same direction. Ant. I, II with a row of simple and point setae (Fig. 5F). Labium small and rounded (Fig. 5D). Mandible with 3 apical teeth, 4 median teeth and 1 basal tooth (Fig. 5B). Maxilla with 2 lamella, so one of which with 2 apical teeth, the other without any tooth (Fig. 5C). Ocelli 3+3, one of which far apart behind, PAO absent. Unguis carinated and with 1 inner tooth (Fig. 5E). Unguiculus and tenent hair absent. Ventral tube with 4+4 setae. Furcal rest with 2 setae (Fig. 5G). Anal spine absent.

Chaetotxy of tergites as follows:

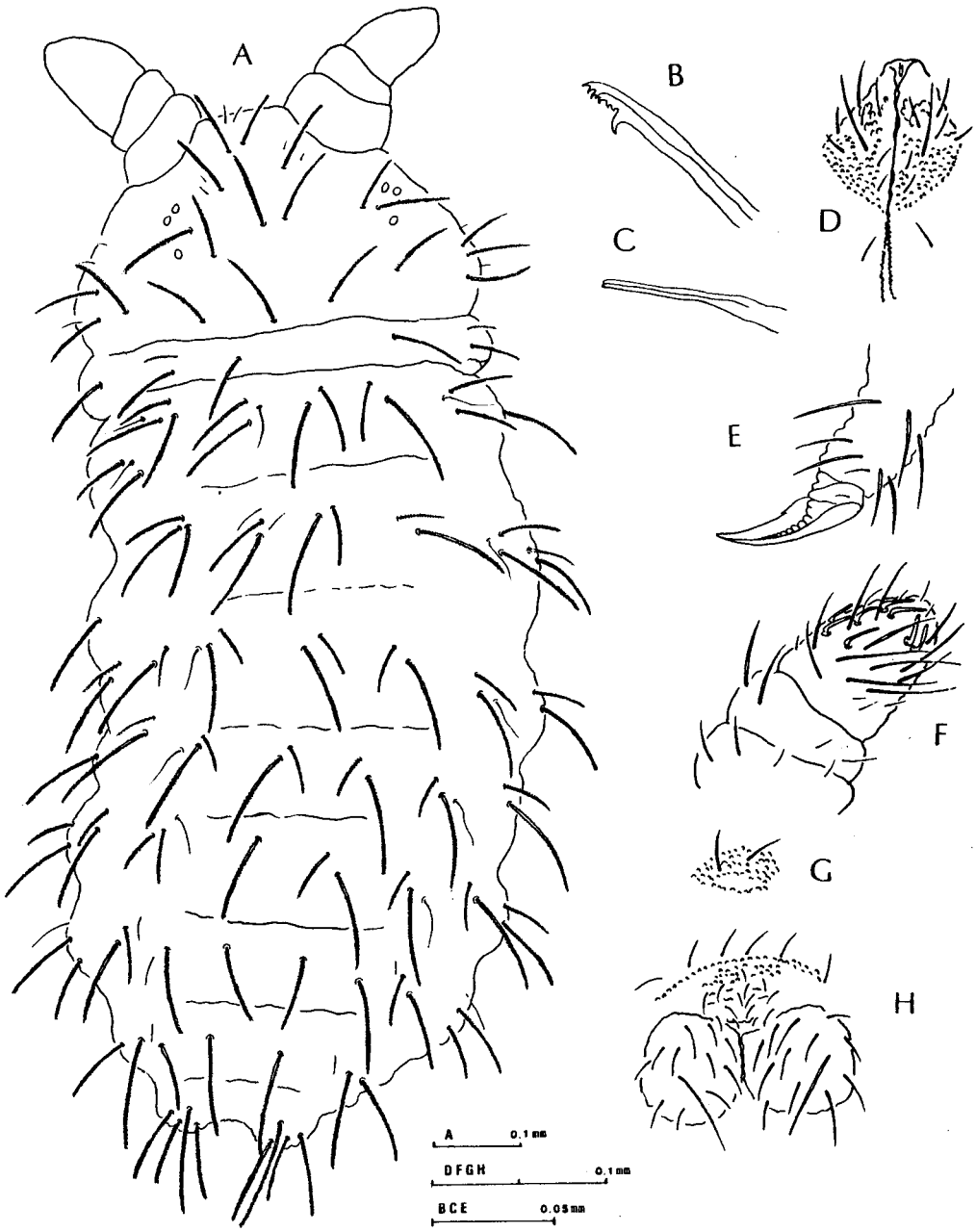

Fig. 5. *Lobella nana* n.sp.

A, chaetotaxy of *Lobella nana* n.sp.; B, mandible; C, maxilla; D, labium; E, hindclaw; F, Ant. I,II,III + IV segments; G, furcal rest; H, genital plate and anal lobe.

	D.I.	D.E.	D.L.	L.
Th. I		1	2	1
Th. II-III	2	i+s.s+2	s.s+3	4
Abd. I-III	2	s.s+2	2	2
Abd. IV	1	1+s.s+i+2	3	3
Abd. V	1	s.s+i+2		
Abd. VI	7			

Type data: Holotype, ♀, Wushe, Nantou; from litter of pine forest. Collection No. 89-57, 30. IX. 1989. Paratypes:6, same data as holotype, ♂, 1 and ♀, 5 specimens were collected.

Remarks: This species is similar to *Lobella roseola* (Yosii, 1954) from Japan in ocelli number, claw, Ant. IV and apical bulb. But it is different from the latter species by maxilla, chaetotaxy of tergites and body setae. This species is also similar to *Lobella (Propeanura) sandakanensis* Yosii, 1981 from Sabah in body setae, ocelli number.

Etymology: The specific name is from the Latin "nana", for its pretty color and shape.

7. Lobella perfusa: Denis, 1934;1948:204, Fig. 7 (Fig. 6A-H)

Biloba perfusa: Stach, 1951:32

Lobella perfusa: Yosii, 1959:17

This species is same as that described by Denis with materials from Vietnam (Denis, 1948). But it is differentiated by head tubercles, setae number of D.L. tubercle in Abd. I-IV segment and D.I. tubercle setae number in Th. II. We find IIIAO, furcal rest with 3 setae and ventral tube with 4+4 setae.

Materials examined: 4, Chitou, Nantou, from litter of bamboo forest. Collection No. 82-44-1, 17. XII. 1982; 9, from litter and soil of mixed arboreal vegetation and root of herbage. Collection No. 88-16, 21.III.1988; 8, Wushe, Nantou, from litter of pine forest. Collection No. 89-54, 30. IX. 1989.

Distribution: Vietnam, Indo-China, Taiwan (new record)

8. Vitronura tubercula n.sp. (Fig. 7)

Body length up to 3.0mm, body covered with feathered setae and well developed tubercles (Fig. 7A), red in living and white in alcohol. Ant. III and IV segments fused, relative length of antennal segments I:II:III+IV as 1:1:1.8. Ant. IV segment with 8 blunt, curved sensory setae. Apical bulb trilobed, IIIAO conisting of 2 curved sensory rods, separated each other (Fig. 7F). Head relatively longer than antenna diagonal, Ant.: head ratio as 38:48. Ocelli 2+2, unpigmented (Fig. 7A). PAO absent. Head bearing typical arrangement of tubercles. Antennal tubercle with one large seta and 3+3 minute seta anterior to it. Ocular tubercle with 2 barbed setae. Ocular tubercles and dorsal tubercles separated from both the median tubercle. Body setae feathered (Fig. 7H). Labium conical shape (Fig. 7E). Mandible tridentate (Fig. 7B). Maxilla styliform and consisting of 2 lamella (Fig. 7C). Unguis with no inner tooth and uniformly granular on its inner side (Fig. 7D). Unguiculus and tenent hair absent. Ventral tube with 4+4 setae. Furcal rest with 3 setae. Abd. VI with paired tubercles but separated. Anal spine absent.

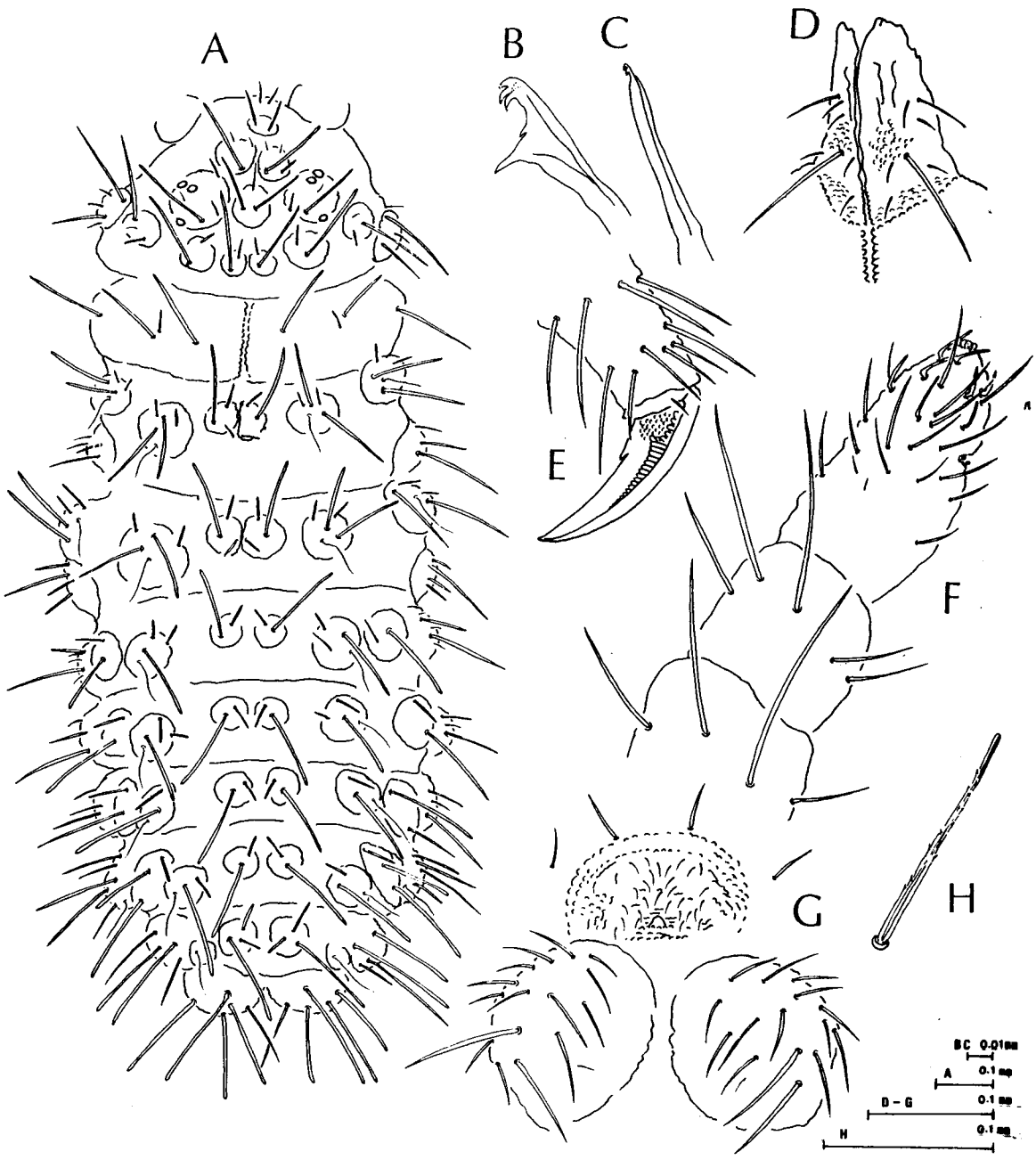

Fig. 6. *Lobella perfusa* Denis, 1934

A, chaetotaxy of *Lobella perfusa* Denis, 1934; B, mandible; C, maxilla; D, labium; E, claw; F, Ant. I,II,III + IV segments; G, genital plate and anal lobe; H, body seta of Th.II.

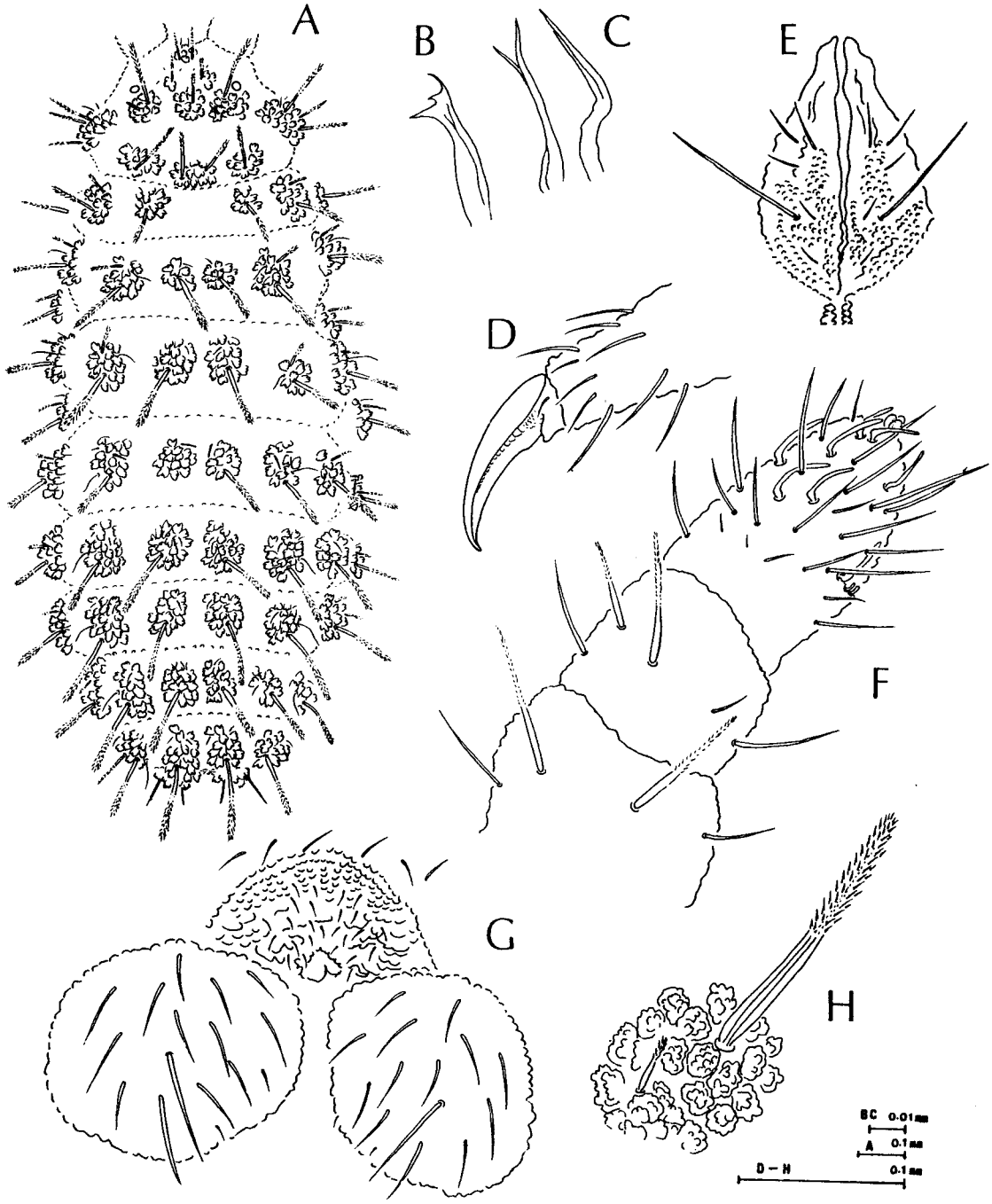

Fig. 7. *Vitronura tubercula* n.sp.

A, chaetotaxy of *Vitronura tubercula* n.sp.; B, mandible; C, maxilla; D, foreclaw; E, labium; F, Ant. I,II,III + IV segments; G, genital plate and anal lobe; H, seta of D.I. tubercle on Th.II.

Chaetotaxy of tergites as follows:

	D.I.	D.E.	D.L.	L.
Th. I		1	2	1
Th. II-III	3	s.s+3	3+s.s	3
Abd. I-III	2	2+i+s.s	2	3
Abd. IV	2	s.s+2	5+i	
Abd. V	2+i	s.s+i+3	3	
Abd. VI	7			

Type data: Holotype, ♀, Wulai, Taipei; from soil and litter of mixed arboreal vegetation. Collection No. 82-47, 24. XII. 1982. from litter of mixed arboreal vegetation. Collection No. 88-17-2, 25. III. 1988. Paratypes; 10, same data as holotype, ♂, 4 and ♀, 6 specimens were collected.

Remarks: The present species is characterized by body setae and well developed tubercles, but it is different from *V. singaporiensis* Yosii, 1976 from Wulai, in chaetotaxy, mandible, maxilla and head tubercles. This species looks similar to *V. sinica* Yosii, 1976 from Hongkong in the shapes of mandible and maxilla.

Etymology: Named for the well developed dorsal tubercles.

DISCUSSION

As can be noted from the list the Neanurid fauna is characterized by its alliance with that in tropical regions in South-East Asia.

One of the neanurid member, *Lobella perfusa* Denis, 1934 was known to occur in Indo-China and it is also identified from the present collection as new record for the island.

Table 1. Geographical Distribution of Taiwanese Neanuridae (Collembola).

Taxa	Taiwan	Vietnam	Japan	Remarks
Pseudachorudina nepalica Yosii, 1965	o			Nepal
Paranura formosana Yosii, 1965	o			Endemic
Neanura rosea (Gervais), 1842	o		o	Europe
Neanura kentingensis n.sp.	o.			Endemic
Womersleya formosana n.sp.	o			Endemic
Crossodonthina formosana Yosii, 1965	o			Endemic
Crossodonthina alatoserrata Yosii, 1965	o			Endemic
Crossodonthina montana n.sp.	o			Endemic
Lobella perfusa Denis, 1934	o	o		Indo-China
Lobella nana n.sp.	o			Endemic
Vitronura pygmaea Yosii, 1954	o		o	Malay, Java, Borneo
Vitronura singaporiensis Yosii, 1976	o	o		Singapore, Malay, Java
Vitronura tubercula n.sp.	o			Endemic

Although it may be too early to get a good outline view of biogeographical distribution of the neanurid fauna in Taiwan, an attempt to analyze them may worth doing which may give some suggestion characterizing the fauna (Table. 1). Here from the Table. 1, we find that 8 out of all the 13 species are endemic to Taiwan (62%). Four more species occur also in Japan, Vietnam and in other regions of the globe.

Eventually we are impressed with a strong endemicity of the Taiwanese fauna. This feature is apparently related with topography of the island as well as oceanographic and climatic connection of region as already discussed in the previous work (Lin and Tsai, 1984; Lee and Park, 1989).

In view of the geographic characterization as mentioned above it is highly probable that Collembolan fauna would be represented by additional species, far exceeding those known up to the present from the island.

ABSTRACT

This study deals with 8 species in 6 genera including 5 new species and 2 new records from Taiwan. The new ones are *Neanura kentingensis* n.sp., *Womersleya formosana* n.sp., *Crossodonthina montana* n.sp., *Vitronura tubercula.* sp., *Lobella nana* n.sp., and 2 new records are *Pseudachorudina nepalica* Yosii, 1966 and *Lobella perfusa* Denis, 1934. The Neanuridae fauna of Taiwan accordingly is listed as 13 species in 7 genera. The biogeographic affinities with the Japan, Vietnam and adjacent countries are discussed.

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