

THE GENUS *TOMOCERUS* NICOLET (COLLEMBOLA: TOMOCERIDAE) FROM SICHUAN, CHINA, WITH DESCRIPTIONS OF TWO NEW SPECIES

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Abstract.—Three species of the genus *Tomocerus* Nicolet are described from Sichuan, China, *Tomocerus (Tomocerina) tridentatus*, n. sp., *Tomocerus (Tomocerus) wushanensis*, n. sp. and *Tomocerus (Tomocerus) kinoshitai* Yosii, 1954. The new species are described and illustrated. A key to the species of *Tomocerus* from Sichuan, China, is provided.

Key Words: Collembola, Tomoceridae, *Tomocerus*, new species, Sichuan, China

The family Tomoceridae is divided into two weakly defined subfamilies, Tomocerinae and Lepidophorellinae. The former is largely limited to the Northern Hemisphere while the latter is limited to Australia, New Zealand, and the Antarctic Region. There are nine genera in the Tomocerinae: *Aphaenomurus* Yosii, 1956, *Lethemurus* Yosii, 1970, *Monodontocerus* Yosii, 1955, *Plutomurus* Yosii, 1956, *Pogonognathellus* Paclt, 1944, *Tomocerina* Yosii, 1955, *Tomocerus* Nicolet, 1842, *Tomolonus* Mills, 1949, and *Tritomurus* Frauenfeld, 1854. Many of these genera were treated as subgenera of *Tomocerus* by earlier authors.

Yosii (1967) made a comprehensive study on the family Tomoceridae with special reference to the Japanese fauna. Based on mucronal morphology, Yosii redefined the genera (treated as subgenera) *Tomocerus*, *Monodontocerus*, and *Tomocerina*. Until now, 63 species have

been described of the subgenus *Tomocerus*, with 30 species described or recorded from China (Sun et al. 2006a, b, c).

Nine species of *Tomocerus* have been reported from Sichuan Province (Li 1987, Liu and Li 2003, Liu et al. 1999). In the subgenus *Tomocerina*, eleven world species are known. Six species have been described or recorded in China (Ma et al. 2003a, b), among which four species have been reported from Sichuan Province and two from Xinjiang Province. The percentage of species reported in Sichuan makes it obvious that *Tomocerus* is rich in this region.

This study on the genus *Tomocerus* of Sichuan reveals two new species belonging to two subgenera, *Tomocerus* and *Tomocerina*. They are *Tomocerus (Tomocerina) tridentatus*, n. sp., and *Tomocerus (Tomocerus) wushanensis*, n. sp. A key to the species of *Tomocerus* from Sichuan, China, is provided.

MATERIALS AND METHODS

The specimens studied in this work are deposited in the Institute of Zoology, Chinese Academy of Sciences, Beijing, China (IZCAS).

Abbreviations used include: Ant. III = Antennal segment III; Th. II = Thoracic segment II; Abd. I = Abdominal segment I. The terminology and morphological interpretations follow Yosii (1967). Measurements are in millimeters (mm).

KEY TO THE SPECIES OF *TOMOCERUS* FROM SICHUAN, CHINA

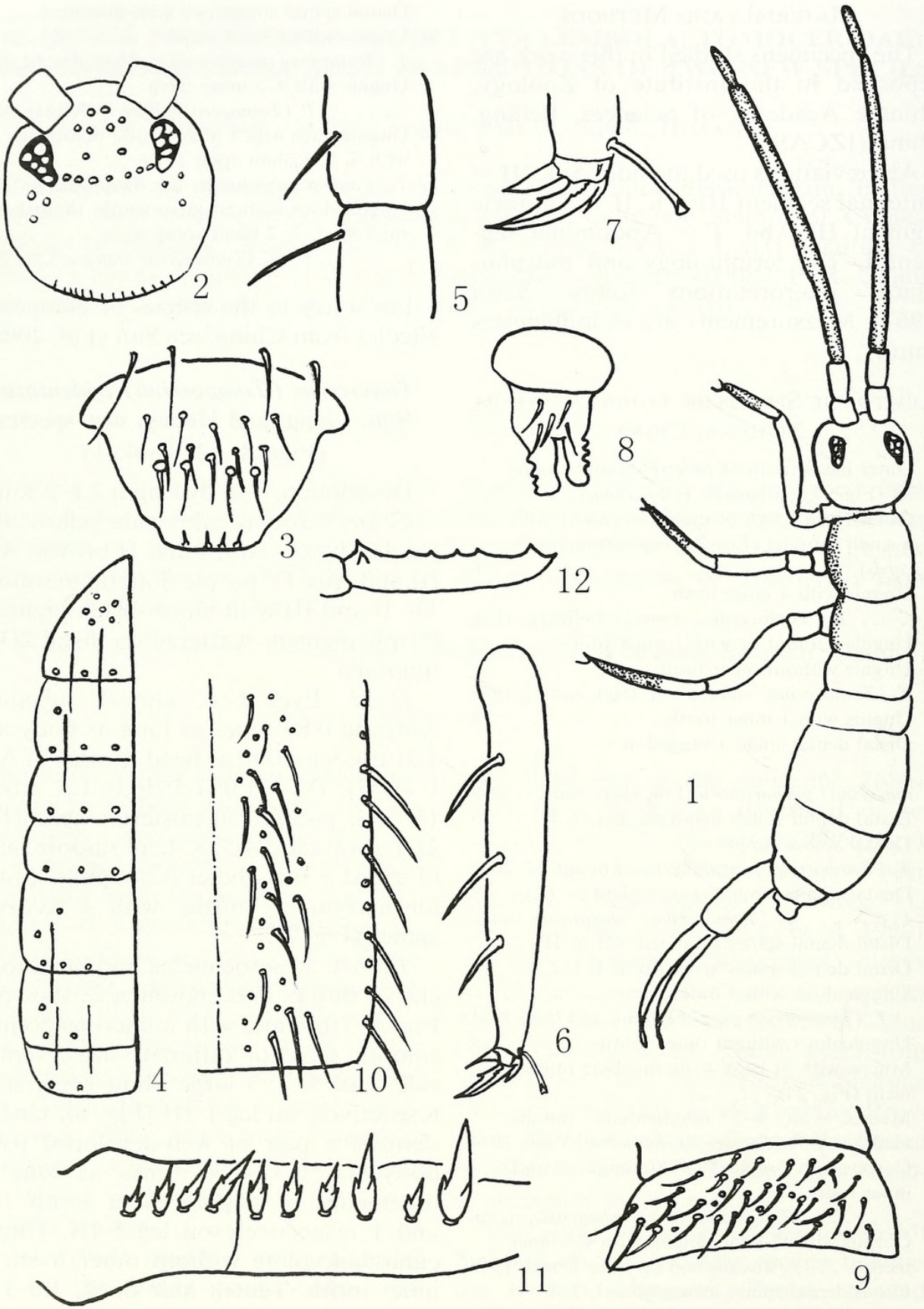
- 1. Outer basal tooth of mucro without toothlet (Fig. 12) (subgenus *Tomocerina*) 2
- Outer basal tooth of mucro normally with a small toothlet (Fig. 24) (subgenus *Tomocerus*) 6
- 2. Unguis with 4 inner teeth
 *T. (Tomocerina) minutus* Tullberg, 1876
- Unguis without or with 1 inner tooth 3
- 3. Unguis without inner tooth
 T. (Tomocerina) calceus Liu, Hou, and Li, 1999
- Unguis with 1 inner tooth 4
- 4. Distal dental spine arranged as I
 *T. (Tomocerina) purpurithorus* Liu, Hou, and Li, 1999
- Distal dental spines arranged as I, 1, I 5
- 5. Dental spines simple
 T. (Tomocerina) wanglangensis Liu and Li, 2003
- Dental spines compound, tridentate (Fig. 11) *T. (Tomocerina) tridentatus*, n. sp.
- 6. Distal dental spines arranged as I or II 7
- Distal dental spines arranged as I, 1–2, I 10
- 7. Unguiculous with 1 outer tooth
 *T. (Tomocerus) parvus* Huang and Yin, 1981
- Unguiculous without outer tooth 8
- 8. Mucro with at least 4 intermediate minute teeth (Fig. 24) 9
- Mucro with 0–3 intermediate minute teeth *T. (Tomocerus) kinoshitai* Yosii, 1954
- 9. Corpus with 7 setae (Fig. 20); unguis with 1 inner tooth
 *T. (Tomocerus) wushanensis*, n. sp.
- Corpus with 15 setae; unguis with 4–5 inner teeth *T. (Tomocerus) ocreatus* Denis, 1948
- 10. Distal dental spines arranged as I, 2, I
 *T. (Tomocerus) vulgaris* (Tullberg, 1871)
- Distal dental spines arranged as I, 1, I 11
- 11. Unguiculous with 1 inner tooth
 *T. (Tomocerus) minor* Lubbock, 1862
- Unguiculous without inner tooth 12
- 12. Dental spines simple without plication 13

- Dental spines compound with plications 14
- 13. Unguis with 1 inner tooth
 T. (Tomocerus) maximus Liu, Hou, and Li, 1999
- Unguis with 4–5 inner teeth
 *T. (Tomocerus) sibiricus* Reuter, 1891
- 14. Unguiculous with 1 inner tooth; tibiotarsus with 5, 5, 5 blunt spiny setae
 T. (Tomocerus) emeicus Liu, Hou, and Li, 1999
- Unguiculous without inner tooth; tibiotarsus with 1, 2, 2 blunt spiny setae
 *T. (Tomocerus) shuense* Liu, 2003

For a key to the species of *Tomocerus* Nicolet from China, see Sun et al. 2006b.

Tomocerus (Tomocerina) tridentatus
Sun, Liang, and Huang, new species
(Figs. 1–12, Table 1)

Description.—Body length 2.1–2.5 mm.
Color: Ground color pale yellow. Eye patches black. Ant. I and II brown. Ant. III and Ant. IV purple. Lateral margin of Th. II and III with bluish-black pigment. Purple pigment scattered on distal 2/3 of tibiotarsi.
Head: Eyes 6+6, almost subequal. Antenna 0.89 times as long as body and 4.21 times as long as head. Ratios of Ant. I: II: III: IV = 1.0: 1.5: 10.0: 1.5. About 14 setae present on posterior head (Fig. 2). Labral setae 4/5, 5, 4, all smooth; each of distal 3 rows beset on papilla. Anterior margin of labrum with 4 recurved spines (Fig. 3).
Thorax: Macrochaetae and bothriotricha of thorax and abdomen as shown in Fig. 4. Tibiotarsi with numerous pointed smooth setae of different sizes; ventral side with 0, 0, 3 large blunt spiny setae respectively on leg I–III (Fig. 6). Unguis slender; a pair of well-developed pseudonychia, 0.33–0.40 times as long as inner edge of unguis; inner tooth 1, 1 and 1 respectively on leg I–III. Unguiculus lanceolate without outer tooth or inner tooth. Tenent hair thick, 1.0–1.07 times as long as inner edge of unguis, apex spatulate (Fig. 7). Trochanteral organ reduced to 1, 1 seta (Fig. 5).
Abdomen: Tenaculum unscaled, 4+4 teeth, with 5 smooth setae on corpus



Figs. 1-12. *Tomocerus (Tomocerina) tridentatus*. 1, Habitus. 2, Dorsum of head. 3, Labrum. 4, Dorsal chaetotaxy of body (Th. II-Abd. V). 5, Trochanteral organ. 6, Hind tibiotarsus and hind claw. 7, Detail of hind foot complex. 8, Tenaculum. 9, Lateral flap of ventral tube. 10, Distal part of manubrium (dorsal view). 11, Dental spines. 12, Mucro.

Table 1. Comparison between *T. (Tomocerina) tridentatus*, *T. (Tomocerina) wanglangensis*, and *T. (Tomocerina) simplex*.

Characters	<i>T. (Tomocerina) tridentatus</i>	<i>T. (Tomocerina) wanglangensis</i>	<i>T. (Tomocerina) simplex</i>
Dental spines formula	4/3–4, I, 1, I	2/1, I, 1, I	4/3, I
Dental spine pattern	Compound, tridentate	Simple, unplicated	Simple, unplicated
Mucronal intermediate teeth	3–4	2	1

(Fig. 8). Ventral tube unscaled, lateral flap with about 38 smooth setae in different sizes (Fig. 9). Ratios of manubrium/dens/mucro = 2.86–3.14/4.57–4.72/1.0. Manubrium scaled, with 12 large setae on each dorsolateral side, all mildly ciliate and sharply tapered near apex; dorsally with 2 setaceous stripes (Fig. 10). Dentes without large setae on outer edge and basal scalelike spine on inner edge. Dental spines formula as 4/3–4, I, 1, I, pale brown, tridentate (Fig. 11). Mucro elongate covered with numerous ciliate setae; outer basal tooth without a corner toothlet. Outer dorsal lamella bearing 3–4 intermediate minute teeth; apical and anteapical teeth subequal (Fig. 12). Upper anal valve of Abd. VI with 12 large ciliate cylindrical setae arranged in 2 irregular transverse rows.

Types.—Holotype: ♀, China, Sichuan, Guanxian, Lidui (31.0°N, 103.6°E), 800 m, 8 May 1986, collected by Huang Fu-Sheng (IZCAS). Paratypes: 2 ♀, all on slides, same data as holotype (IZCAS).

Etymology.—The new species is named after the dental spine pattern.

Remarks.—This species is similar to *T. (Tomocerina) wanglangensis* Liu and Li, 2003, and *T. (Tomocerina) simplex* Yosii, 1966, but it can be separated from them by the characters listed in Table 1.

***Tomocerus (Tomocerus) wushanensis* Sun, Liang, and Huang, new species**
(Figs. 13–24, Table 2)

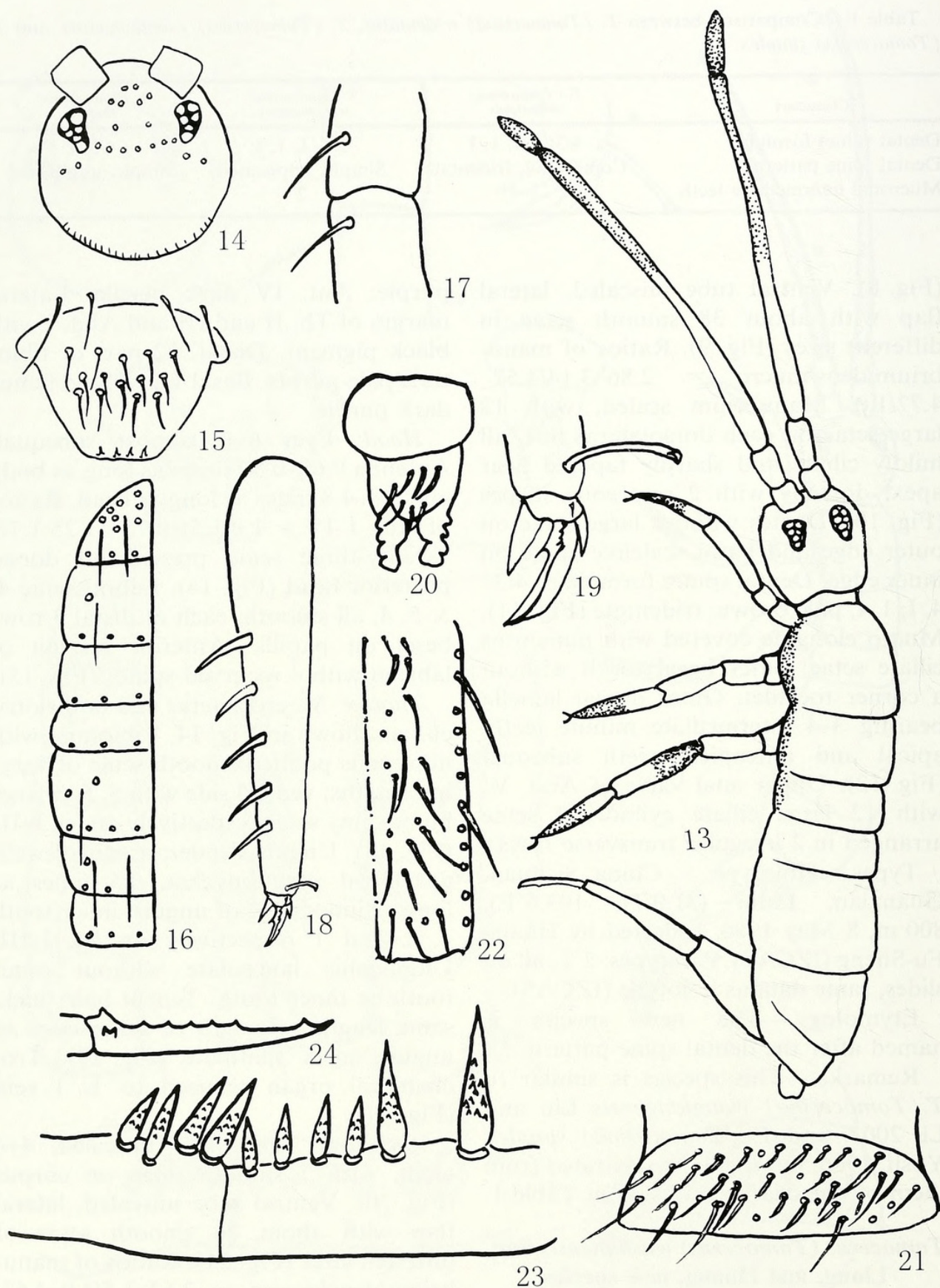
Description.—Body length 2.8–2.9 mm. Color: Ground color pale yellow. Eye patches black. Distal 1/2 of Ant. III pale

purple. Ant. IV dark purple. Lateral margin of Th. II and III and Abd. I with black pigment. Distal 1/2 part of tibiotarsi pale purple. Basal 1/2 of hind femur dark purple.

Head: Eyes 6+6, almost subequal. Antenna 0.68–0.89 times as long as body and 3.8–4.8 times as long as head. Ratios of Ant. I–IV = 1.0:1.5:10.75–11.25:1.75. Twenty-three setae present on dorsal posterior head (Fig. 14). Labral setae 4/5, 5, 4, all smooth; each of distal 3 rows beset on papilla. Anterior margin of labrum with 4 recurved spines (Fig. 15).

Thorax: Macrochaetae and bothriotricha as shown in Fig. 14. Tibiotarsi with numerous pointed smooth setae of varying lengths; ventral side with 5, 5, 5 large blunt spiny setae respectively on leg I–III (Fig. 18). Unguis slender; a pair of well-developed pseudonychia, 0.5 times as long as inner edge of unguis; inner tooth 1, 1 and 1 respectively on leg I–III. Unguiculus lanceolate without outer tooth or inner tooth. Tenent hair thick, same length as length of inner edge of unguis, apex spatulate (Fig. 19). Trochanteral organ reduced to 1, 1 seta (Fig. 17).

Abdomen: Tenaculum unscaled, 4+4 teeth, with 7 smooth setae on corpus (Fig. 20). Ventral tube unscaled, lateral flap with about 26 smooth setae of different sizes (Fig. 21). Ratios of manubrium/dens/mucro = 2.67–3.5/4.0–4.63/1.0. Manubrium scaled, with 12 large setae on each dorsolateral side, all mildly ciliate and sharply tapered near apex; dorsally with 2 setaceous stripes



Figs. 13-24. *Tomocerus (Tomocerus) wushanensis*. 13, Habitus. 14, Dorsum of head. 15, Labrum. 16, Dorsal chaetotaxy of body (Th. II-Abd. V). 17, Trochanteral organ. 18, Hind tibiotarsus and hind claw. 19, Detail of hind foot complex. 20, Tenaculum. 21, Lateral flap of ventral tube. 22, Distal part of manubrium (dorsal view). 23, Dental spines. 24, Mucro.

Table 2. Comparison between *T. (Tomocerus) wushanensis*, *T. (Tomocerus) ocreatus*, and *T. (Tomocerus) ishibashi*.

Characters	<i>T. (Tomocerus) wushanensis</i>	<i>T. (Tomocerus) ocreatus</i>	<i>T. (Tomocerus) ishibashi</i>
Color pattern on head, body, and legs	Distal 1/2 of Ant. III pale purple. Ant. IV dark purple. Lateral margin of Th. II and III and Abd. I with black pigment. Distal part of tibiotarsi pale purple. Basal 1/2 of hind femur dark purple.	Thorax often diffusely violet. Antennae violet distally. Leg pale, but tibiotarsus often diffusely violet.	Head and Ant. I, II intensely pigmented to purple. Antennae violet distally. No pigment upon other places.
Length ratio of antennae to body	<1	>1	=1
Unguis inner teeth	1, 1, 1	4-5, 4-5, 4-5	6, 6, 6

(Fig. 22). Dentes without large setae on outer edge and basal scalelike spine on inner edge. Dental spines arranged as 4/3-4, II, pale yellow, spines with smaller teeth on surface (Fig. 23). Mucro elongate covered with numerous ciliate setae; outer basal tooth with a corner toothlet. Outer dorsal lamella with 4-5 intermediate minute teeth; apical and anteapical teeth subequal (Fig. 24). Upper anal valve of Abd. VI with 16 large ciliate cylindrical setae arranged in 2 irregular transverse rows.

Types.—Holotype ♀, China, Sichuan, Wushan, Liziping (31.0°N, 109.9°E), 1800 m, 4 August 1993, collected by SUN Bao-Wen (IZCAS). Paratypes: 2 ♀, all on slides, same data as holotype (IZCAS).

Etymology.—The name refers to the type locality.

Remarks.—This species is similar to *T. (Tomocerus) ocreatus* Denis, 1948, and *T. (Tomocerus) ishibashi* Yosii, 1954, but it can be separated from them by the characters listed in Table 2.

Tomocerus (Tomocerus) kinoshitai
Yosii, 1954

Tomocerus kinoshitai Yosii 1954: 814, fig. 29; 1956: 90; 1967: 20, fig. 10;

Martynova 1969: 307, fig. 7; Lee 1975: 951; Park and Lee 1995: 439; Liu and Hou 1998: 1; Huang and Liu 1999: 20, fig. 2-3.

Specimens examined.—China: 1 ♂, Sichuan, Qingcheng Shan (30.9°N, 103.5°E), 600 m, 8 May 1975; 2 ♀, Jiangxi, Lu Shan (29.4°N, 115.9°E), 1,000 m, 23 April 1978; 4 ♀, Jilin, Changbai Shan (42.0°N, 128.1°E), 1100 m, 3 August 1980, collected by Huang Fu-Sheng (IZCAS).

Remarks.—This species can be separated from the others by the following characters: short antennae, often less than half the body length; mucro typical in structure often with 0-3 intermediate minute teeth; corpus unscaled with only 1 seta; and dental spine formula 3-4/1-2, II, with 3-5 spikes near the basis. While examining the specimens, we find that this species is widely distributed in mideastern China, both in the north (Jilin Province) and south (Chongqing, Fujian Province, Hunan Province, Sichuan Province, Jiangxi Province). It is not endemic to Japan according to Yosii (1967). This species was reported from soil and litter as well as from a cave environment in Korea (Park and Lee 1995).

Distribution.—China (Chongqing, Fujian, Hunan, Sichuan, Jiangxi, Jilin) Japan, Korea, Russia.

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