

A new species in the subgenus *Simulium* (Diptera: Simuliidae) from Yunnan, China

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Abstract: A new species, *Simulium* (*Simulium*) *setiferorum* sp. nov., is described from Yunnan Province, China. This species is assigned to the *venustum* species-group in the subgenus *Simulium* and is morphologically most similar to *S. (S.) xinbinen* Sun, 1994 from Liaoning in China. However, it is clearly differentiated by the shape of the genitalia. A key to the female adults of the *venustum* species-group of China is provided.

Keywords: *Simulium venustum* species-group; taxonomy; key

中国云南蚋亚属 *Simulium* 一新种 (双翅目: 蚋科)

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摘要: 记述采自云南省蚋属 *Simulium* 蚋亚属 *Simulium* 脉蚋组 *venustum* 1 新种, 以腹部特征命名为毛腹蚋 *Simulium* (*Simulium*) *setiferorum* sp. nov., 对其雌虫特征进行了描述。该新种与来自中国辽宁的新宾蚋 *S. (S.) xinbinen* Sun, 1994 形态相似, 但新种的生殖器与上述蚋种明显不同。文章还编制了中国蚋亚属脉蚋组雌虫的分种检索表。

关键词: 脉蚋组; 分类; 检索表

Introduction

The genus *Simulium* is widely distributed throughout the world. There were 541 known species in the subgenus *Simulium* (Adler 2021). The morphological characteristics of this subgenus are: antenna composed of 2+9 segments, costa with dark spinules and hairs, basal portion of radius usually bare, pleural membrane and katapisternum bare, calcipala well-developed, pedisulcus well defined, fore basitarsus 4–6 times as long as its greatest width (Chen 2016).

The *venustum* species-group, defined by Say (1823), is one of the 33 species-groups of the subgenus *Simulium* (*Simulium*) (Adler 2021). The female morphological characteristics of this species-group are: face silver-white, fore tibia usually with silver-white spots, sternite of segment 2 with silver-white spots. They are mainly distributed in Palearctic and Nearctic Regions (Chen 2016). There were 35 species in the *venustum* species-group including 8

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species in China (Adler 2021): *S. (S.) aemulum* Rubtsov, 1940a; *S. (S.) arakawae* Matsumura, 1921; *S. (S.) curvitarise* Rubtsov, 1940b; *S. (S.) enhense* Chen, 2016; *S. (S.) longipalpe* Beltukova, 1955; *S. (S.) morsitans* Edwards, 1915; *S. (S.) promorsitans* Rubtsov, 1956 and *S. (S.) xinbinen* Sun, 1994. No species in this group have been previously reported from Yunnan Province, China.

Recently, we collected one undescribed species of this species-group from Yunnan Province, China. It is described as a new species based on the female. The morphology and taxonomy of this new species (subgenus *Simulium*) is reported and discussed. A key to female species of the *S. venustum* species-group (subgenus *Simulium*) from China is presented.

Material and methods

The materials used in this study were collected from Yunnan Province, China. All colors are based on specimens in ethanol since they were stored in 95% ethanol. The abdomen of the female was dissected and soaked in a 5% NaOH solution for about 12 hours until the clear features of each part of the genitalia were observed. They were then preserved with 1 : 1 glycerol ethanol. Habitus photos of insects were taken using an $\alpha 7$ RIII SONY camera (25 μ m LAOWA Shot). Hand-drawn genital illustrations were scanned and saved to the computer.

Body length of the insect is the distance from the front end of head to the end of the abdomen excluding the length of the antennae of the head and the external genitalia at the end of the abdomen. Wing length refers to the distance between the apex horns. All measures are in millimeters (mm). Methods of description and illustration as well as terms for morphological features used here follow Takaoka (2003) and Adler *et al.* (2004).

Specimens were collected by Liang WANG in Lushui County, Yunnan Province, China on July 10, 2016. The holotype and paratypes of the new species are deposited in the College of Plant Protection, Hebei Agricultural University (Baoding).

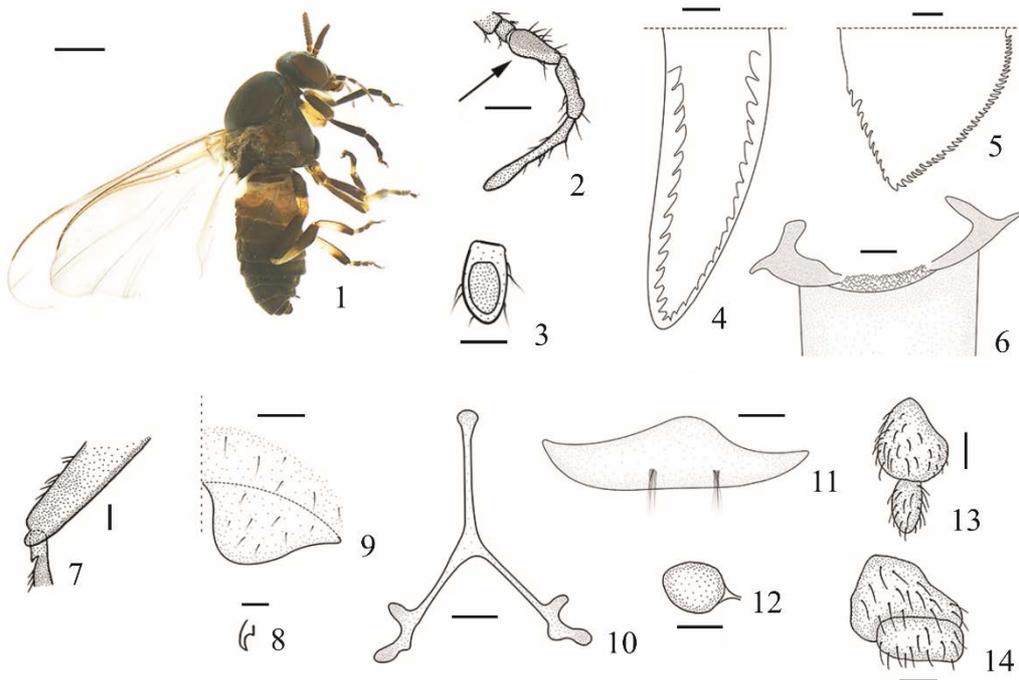
Taxonomy

Key to species (female) of the *Simulium venustum* species-group from China

1. Sternite of segment 7 without 2 tufts of long black hairs 2
- Sternite of segment 7 with 2 tufts of long black hairs 8
2. Outer margin of hind tibia concave in the middle; basitarsus with inner margin curved and wave-shaped at basal 1/2 *S. (S.) curvitarise*
- Hind tibia and tarsus normal 3
3. Scutum without silver-white spots 4
- Scutum with silver-white spots 6
4. Genital plate inner margins concave; arms of genital fork with underdeveloped outside projections
..... *S. (S.) enhense*
- None of the above characteristics 5
5. A tear in the middle of the anterior edge of the paraproct *S. (S.) aemulum*
- Paraproct normal in shape *S. (S.) arakawae*
6. Fifth palpomere short and as long as fourth palpomere; genital plate inner margins concave
..... *S. (S.) morsitans*

- Fifth palpomere significantly longer than fourth palpomere; genital plate inner margins straight 7
- 7. First flagellomere of antenna about 2 times as long as following one..... *S. (S.) longipalpe*
- First flagellomere of antenna about 1.6 times as long as following one *S. (S.) promorsitans*
- 8. Genital plate triangular, inner margins parallel-sided; arms of genital fork with outside projections.....
..... *S. (S.) xinbinen*
- Genital plate subtriangular, apex widely separated; arms of genital fork with inner projection and outside projections.....*S. (S.) setiferorum* **sp. nov.**

***Simulium (S.) setiferorum* An, Wang & Yang sp. nov.** (Figs 1–14)



Figures 1–14. Female of *Simulium (S.) setiferorum* **sp. nov.** 1. Female adult, right lateral view; 2. Maxillary palpus with sensory vesicle (arrow); 3. Sensory vesicle; 4. Maxilla; 5. Mandible; 6. Cibarial pump; 7. Basitarsus with calcipala and second tarsomere with pedisulcus of hind leg; 8. Claw; 9. Genital plate; 10. genital fork; 11. Segment 7; 12. Spermatheca; 13, 14. Paraprocts and cerci (right side; 13. ventral view; 14. lateral view). Scale bars = 0.5 mm (Fig. 1); 0.05 mm (Figs 2, 3, 7, 8, 12); 0.02 mm (Figs 6, 9–11, 13, 14); 0.01mm (Figs 4, 5).

Description. Female. Body length: 2.8 mm.

Head. Slightly narrower than width of thorax. Brown black. Frons moderately covered with short gray hairs interspersed with dark longer hairs along each lateral margin. Fronto-ocular area well-developed. Antenna composed of scape, pedicel and nine flagellomeres, brownish black. Mouth parts brownish black. Maxillary palp composed of five palpomeres, medium brown, proportional lengths of third, fourth, and fifth palpomere 1.00 : 1.00 : 2.07; third palpomere not swollen; sensory vesicle elongate (0.6–0.7 times as long as third palpomere). Mandible with 36 inner teeth and 10 outer teeth; maxilla with 17 and 14

teeth on inner and outer edge respectively. Cibarium armed with minute denticles.

Thorax. Brownish black with grey hairs. Scutum without longitudinal stripe, covered with long black hairs and short loose golden hairs, without silver-white spots. Pleural membrane and katepisternum bare. Postscutellum bare; scutellum lateral margin with black and long pubescence; anapleural sulcus narrow.

Legs. Foreleg: coxa yellow, trochanter and femora black; tibia yellow except apical 1/3 brownish black, with silver-white spots; tarsi black. Midleg: coxa, trochanter and femora black; tibia brown yellow except basal 1/2 yellow; tarsi brownish black except basitarsus basal 1/2 yellow. Hind leg: coxa brownish black; trochanter brownish yellow; femur brownish black; tibia dark brown except basal 1/2 brown yellow; basitarsus yellow except apical 1/3 brownish black, 2nd tarsomere brownish black except basal 1/2 yellow, the rest of tarsi brown. Claws with small basal tooth. Calcipala well-developed. Pedisulcus well-defined.

Wing. Length 2.4 mm. Transparent. Veins nearly transparent except costa and radius brown. Costa with dark spinules and hairs. Basal portion of radius bare, hairy at end.

Abdomen. Thorax brownish black with grey hairs. Sternite of segment 7 with 2 tufts of long black hairs. Sternite of segment 2 with silver-white spots.

Genitalia. Genital plate with black hairs, subtriangular, inner margins basally closed, apically widely separated. Genital fork of usual inverted-Y form, with slender stem; arms of genital fork with distinct stout inner projection at middle and 2 outer projections. Paraproct in ventral view rounded, strongly pigmented on anterior surface, with short to medium-long hairs on lateral and ventral surfaces. Cercus in lateral view with posterior margin rounded, and with numerous short to medium-long hairs. Spermatheca oblong, 1.8 times as long as its greatest width, dark brown except duct unpigmented.

Male. Unknown.

Pupa. Unknown.

Larva. Unknown.

Holotype. ♀, **China**, Lushui, Yunnan Province, 98.86°E, 25.84°N, 2887 m, 10-VII-2016, Liang WANG. **Paratypes.** 13♀, same data as the holotype.

Etymology. The specific epithet refers to the sternite of segment 7 having 2 tufts of long black hairs.

Remarks. This new species belongs to the *Simulium* (*Simulium*) *venustum* species-group as defined by Crosskey (1988) according to the scutum lacking longitudinal stripe and silver-white spots, sternite of segment 2 with silver-white spots, fore tibia with silver-white spots, fronto-ocular area well-developed and shape of female genitalia. It is closely related to *S. (S.) xinbinen* Sun, 1994 by the fifth palpomere being significantly longer than fourth palpomere, fore tibia with silver-white spots and sternite of segment 7 with 2 tufts of long black hairs. But there are some differences. First, the fifth palpomere of *S. (S.) xinbinen* is about 1.7 times as long as fourth palpomere and fifth palpomere of *S. (S.) setiferorum* **sp. nov.** is about 2.1 times as long as fourth palpomere. Second, the genital plate of *S. (S.) xinbinen* inner margins is parallel-sided while the genital plate of *S. (S.) setiferorum* **sp. nov.** inner margins are basal closed, apex widely separated. Third, the arm of the genital fork of *S. (S.) xinbinen* has 1 outside projection while the arm of the genital fork of *S. (S.) setiferorum* **sp. nov.** has 2 outside projections.

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References

- Adler PH. 2021. *World Blackflies (Diptera: Simuliidae): A Comprehensive Revision of the Taxonomic and Geographical Inventory [2021]*. Available from: <http://biomia.sites.clemson.edu/pdfs/blackflyinventory.pdf> (Accessed 1 October 2021).
- Adler PH, Currie DC & Wood DM. 2004. *The Black Flies (Simuliidae) of North America*. Cornell University Press, Ithaca, 941 pp.
- Beltukova KN. 1955. On studying of blood-sucking blackflies (Simuliidae) of Molotov district. 1. fauna and ecology of Kishert region and control measures. *Uchenye Zapiski Molotovsk University*, 7(3): 23–43.
- Chen HB. 2016. *Chinese Blackflies (Diptera: Simuliidae)*. Guizhou Science and Technology Press, Guiyang, 672 pp.
- Crosskey RW. 1988. An annotated checklist of the world blackflies (Diptera: Simuliidae). *Journal of Natural History*, 22: 321–355.
- Edwards FW. 1915. On the British species of *Simulium*. -I. The adults. *Bulletin of Entomological Research*, 6: 23–42.
- Matsumura. 1921. Family Simuliidae. *Dai Nippon Gaichu Zensho*, 2: 83–85.
- Rubtsov IA. 1940a. Blackflies (fam. Simuliidae) (2ed.). *Fauna of the USSR (New Series No. 64) Diptera*, 6(6): 531.
- Rubtsov IA. 1940b. Blackflies (family Simuliidae) [Moshki (sem. Simuliidae)]. *Fauna of the USSR (New Series No. 23) Diptera*, 6(6): 519.
- Rubtsov IA. 1956. Blackflies (family Simuliidae) [Moshki (sem. Simuliidae)]. *Fauna of the USSR (New Series No. 64) Diptera*, 6(6): 785.
- Say T. 1823. Descriptions of dipterous insects of the United States. *Academy of Natural Sciences of Philadelphia*, 3(1): 28.
- Sun YX & Wang YL. 1994. Supplemental descriptions of 4 species (Diptera: Simuliidae). *Chinese Journal of Vector Biology and Control*, 5(3): 220–222.
- Takaoka H. 2003. *The Black Flies (Diptera: Simuliidae) of Sulawesi, Maluku and Irian Jaya*. Kyushu University Press, Fukuoka, 581 pp.