



The genus *Zygoneura* Meigen in China, with descriptions of three new species (Diptera, Sciaridae)

SU-JIONG ZHANG, HONG WU¹ & JUNHAO HUANG

Institute of Forest Protection, Zhejiang Forestry University, Lin'an, Zhejiang 311300, China

¹Corresponding author. E-mail: wuh8977@sohu.com

Abstract

The taxonomy of the genus *Zygoneura* Meigen in China was studied. Seven species are recognized, including three new species that are described and illustrated: *Zygoneura disparilis* Zhang & Wu **sp. nov.**, *Z. longa* Zhang & Wu **sp. nov.**, and *Z. occidentis* Zhang & Wu **sp. nov.** In addition, *Z. sajanica* Mamaev, 1976, and *Z. sciarina* Meigen, 1830 are reported for the first time from China. A key to the Palaearctic and Oriental regions species is also provided.

Key words: Diptera; Sciaridae; *Zygoneura*; new species; China

Introduction

The genus *Zygoneura* Meigen, 1830 is distributed mainly in the Palaearctic region, with few species recorded from Oriental and Australian regions. There are three subgenera (Menzel & Mohrig 1998, 2000), including about 14 species: two species in the subgenus *Allozygoneura* Menzel & Mohrig, 1998; five species in the subgenus *Pharetratula* Mamaev, 1968; three species in the subgenus *Zygoneura* Meigen, 1830 s. str., and several species *incertae sedis*. The subgenus *Allozygoneura* is characterized by a flagellomere body twice as long as the flagellomere neck and short subequal setae, a basally weakly bowed M_1 , and a gonostylus with 4–5 megasetae; the subgenus *Zygoneura* has long setae of subequal length on the flagellomere body; the subgenus *Pharetratula* has mostly short setae on the flagellomere body and a distinctly long row near the neck (Menzel & Mohrig 2000).

Previously, only two species had been recorded from China: *Zygoneura* (*Pharetratula*) *bidens* (Mamaev, 1968) from Inner Mongolia (Yang & Zhang 1990; Menzel & Mohrig 2000) and *Z.* (*Pharetratula*) *transferata* Rudzinski, 2005 from Taiwan (Rudzinski 2005). In an investigation of Chinese Sciaridae, we found a number of specimens of *Zygoneura* in various localities, including three species new to science.

Material and methods

All specimens were collected by sweeping in the field and preserved in 75% ethanol, and all of them were mounted on glass slides in xylol-based Canada balsam after clearing in creosote. The specimens were observed and measured under a Nikon SMZ1500 stereoscopic microscope, with a Nikon DS-L1 Digital Sight Camera System attached. The illustrations were prepared under a Nikon Eclipse 50i optical microscope, with an attached drawing tube. The terminology follows Menzel & Mohrig (2000) and Hippa & Vilkkamaa (2007). The length of 4th flagellomere is taken from the apex of the neck to the base of the body. The wing length is the straight distance from the humeral angle to the apical angle. The body length is the straight distance between the apex of the head and the apex of the hypopygium. All of the type specimens in this study were deposited at the Laboratory of Forest Protection, Zhejiang Forestry University, Hangzhou, Zhejiang province, China.

Taxonomy

Key to the species of *Zygoneura* (Palearctic and Oriental regions, male)

(Mamaev 1968, 1976, 1985; Mohrig *et al.* 1990; Yang & Zhang 1990; Sasakawa 1997; Menzel & Mohrig 2000; Rudzinski 2005)

1. Flagellomere neck 1/2 as long as the body. The base of M_1 weakly bowed (subgenus *Allozygoneura*) 2
- Flagellomere neck nearly as long as the body. The base of M_1 strongly bowed 3
2. Gonostylus with two megasetae *Z. petasitidis*
- Gonostylus with five megasetae *Z. calthae*
3. Setae long subequal in length on flagellomeres (Fig. 3A). Ventral mesial margin of gonocoxa with two groups of weak setae (Fig. 3E). Gonostylus with 2–3 megasetae (subgenus *Zygoneura*) 4
- Setae mostly short on flagellomeres, except a longer row near the flagellomere neck (Fig. 1A, 2A). Ventral mesial margin of gonocoxa with two distinct groups of setae (Fig. 1E, 2E) Gonostylus with two megasetae (subgenus *Pharetratula*) 7
4. Gonostylus with two megasetae *Z. sajanica*
- Gonostylus with three megasetae 5
5. Gonostylus oblong, not attenuated at apex (Fig. 2F) 6
- Gonostylus oval, attenuated at apex (Fig. 3F) *Z. occidentis* **sp. nov.**
6. Gonostylus with two megasetae arising from apical forth and another megasetae at the apical third of the gonostylus *Z. sciarina*
- Gonostylus with one short megasetae arising from apical forth and two other long megasetae at the apical third, close to each other *Z. mohrigi*
7. The two megasetae close to each other on gonostylus, both at the subapical or middle part 8
- The two megasetae widely apart on the gonostylus, with the distance at least longer than the length of the megasetae 10
8. The two megasetae of the gonostylus at the subapical part are subequal in length 9
- The two megasetae of the gonostylus at the middle part are of unequal in length (Fig. 1F) *Z. disparilis* **sp. nov.**
9. Gonostylus with megasetae on long dorsal lobe, about two times as long as the megasetae *Z. flavicornis*
- Gonostylus with megasetae on short dorsal lobe, nearly as long as the megasetae *Z. bidens*
10. Gonostylus stout, with two megasetae subequal length 11
- Gonostylus slender, with two megasetae of unequal length (Fig. 2F) *Z. longa* **sp. nov.**
11. Gonostylus with megasetae at the apical third and middle parts *Z. transferata*
- Gonostylus with megasetae at apical third and basal parts 12
12. Ventral mesial margin of the gonocoxa with pair of distinct lobes. Gonostylus with two megasetae near the dorsal side *Z. subdivergens*
- Ventral mesial margin of gonocoxa without distinct lobes. Gonostylus with two megasetae near the ventral side *Z. divergens*

Genus *Zygoneura* Meigen, 1830

Type species: *Zygoneura sciarina* Meigen, 1830

Diagnosis (Male) (Menzel & Mohrig 2000). **Head:** Eye bridge 3–5 facets wide. Flagellomeres bearing long setae, about 4.5 times as long as the flagellomere body. Forth flagellomere 2.8–3.5 times as long as wide, flagellomere neck extended, and 0.5–1.7 times as long as flagellomere body (Fig. 1A, 2A, 3A). Palpus with two or three-segment, basal segment two setae and with no distinct sensory pit, 2nd segment short, 3rd segment elongate (Fig. 1B, 2B, 3B). **Thorax:** Posterior pronotum mostly bare. Katepisternum wedge-shaped and extended. Scutellum with two setae. Tarsal claws toothed. **Wings** (Fig. 1D, 2D, 3D): R_1 short. M_1 , M_2 , and CuA_1 with no setae. M_1 strongly bowed at base. Cu_1 -stiel short than bM. Haltere with 1–2 rows of setae. **Terminalia:** Ventral mesial margin of the gonocoxa with two groups of setae (Fig. 1E, 2E, 3E). Gonostylus almost as long as gonocoxa, with 2–5 megasetae (Fig. 1F, 2F, 3F).

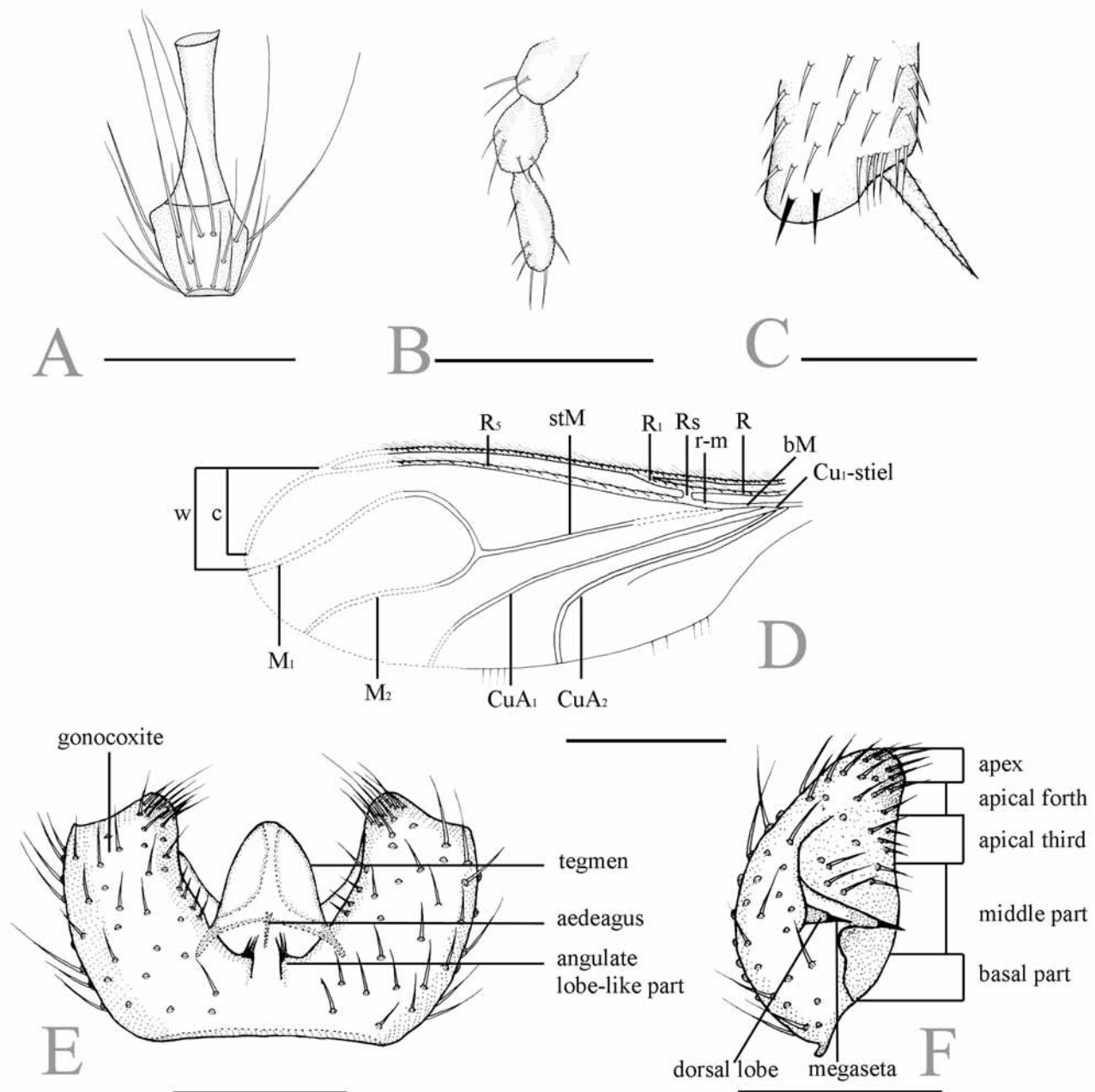


FIGURE 1. *Zygoneura (Pharetratula) disparilis* Zhang & Wu, **sp. nov.**, male. A, 4th flagellomere, lateral view; B, palpus, lateral view; C, apex of front tibia, prolateral view; D, wing, dorsal view; E, part of hypopygium, ventral view; F, left gonostyle, ventral view. Scale 0.05 mm for C, 0.50 mm for D, 0.10 mm for the others.

Species accounts

Zygoneura (Pharetratula) bidens (Mamaev, 1968)

Pharetratula bidens Mamaev, 1968: 610–611.

Pharetratula sinica Zhang & Yang, 1990: 267.

Zygoneura (Pharetratula) bidens (Mamaev, 1968); Menzel & Mohrig, 2000: 585.

Specimens examined. 2 Males, China, Heilongjiang province, Mt. Maoershan nature reserve, 45°15'N, 128°13'E, 26.VII.2008, Su-Jiong Zhang [SM00188–00189]. 1 Male, Inner Mongolia, Zhuozi, Baoan-Linchang, 21.VIII.1987, Chi-kun Yang.

Remarks. This species was first recorded in Ussurijsk, Russia (Mamaev 1968) and found in China (Heilongjiang, Inner Mongolia). It can be distinguished by a gonostylus with two subapical megasetae on the short dorsal lobe, subequal in length and close to each other (Menzel & Mohrig 2000).

Menzel & Mohrig (2000) synonymized *Pharetratula sinica* Zhang & Yang, 1990 with *Z. bidens* without explanation. The holotype of the species is in poor condition and the diagnostic characters were difficult to examine. However, the figure plates prepared by Zhang & Yang (1990) show the hook-like apex of the gonostylus, which is strongly attenuated and curved, while the gonostylus of *Z. bidens* is nearly oval, not attenuated but faintly curved. Therefore, we suspect they may represent two different species.

Zygoneura (Pharetratula) disparilis Zhang & Wu, sp. nov.

Specimens examined. *Holotype*, male. China, Yunnan province, Yingjiang, Tongbiguan nature reserve, 24°36.004'N, 97°39.139'E, 16.V.2009, Su-Jiong Zhang [SM00789]. *Paratype*. 2 Males, the same data as the holotype [SM00824, SM00919]. Wings and mid-legs are broken and missing in the holotype. All the wings and legs are missing in the paratypes.

Description (Male). Body length 2.33 mm. **Color:** Head dark brown; antenna, thorax, coxae, abdomen, and hypopygium yellowish-brown; palpus and legs yellow; wing fumose. **Head** (Fig. 1A, B): Eye bridge broad, with three rows of facets. Prefrons with six setae. Palpus three-segmented, basal segment with two setae, 2nd segment with four setae, 3rd segment with six setae. Flagellomeres mostly bearing short setae, except one row of remarkably long setae around the neck. The 4th flagellomere 0.14 mm in length, length/width: 3.5, flagellomere neck 0.08 mm, nearly 1/2 of the length of the flagellomere. **Thorax:** Posterior pronotum and mediotergite bare. Scutellum with one seta. Apex of fore tibia with a narrow comb-like row of setae (Fig. 1C). Length of spur/width of tibia: fore leg 1.39. Length of metatarsus/length of tibia: fore leg 0.53. Length of hind tibia/length of thorax: 1.37. Tarsal claws three-toothed. **Wings** (Fig. 1D): M₁, M₂, CuA₁, r-m with no setae. stM well visible. **Terminalia:** Ventral mesial margin of the gonocoxa with two evident groups of setae (Fig. 1E). Gonostylus almost as long as gonocoxa, with two megasetae at the middle of the inner side, of unequal length (Fig. 1F). Tegmen simple, much broader sub-basally than subapically.

Female. Unknown.

Remarks. The species belongs to the subgenus *Pharetratula*. It is similar to the species *Z. flavicornis* Mamaev, 1968 and the species *Z. bidens* in having a pair of megasetae (Mamaev 1968), but can be recognized by the gonostylus attenuated at the apex, and two megasetae on a shorter dorsal lobe, of unequal in length.

Etymology. The species is named after its distinctive megasetae.

Zygoneura (Pharetratula) longa Zhang & Wu, sp. nov.

Specimens examined. *Holotype*, male. China, Zhejiang province, Lishui, Taishun, Mt. Wuyanling nature reserve, 28°01'N, 120°38'E, 04.VIII.2005, Yi-Ping Wang [SM00948]. *Paratype*. 1 Male, China, Zhejiang, Linan, Mt. Xijingshan nature reserve, Laodian, 30°23'N, 119°43'E, 21.XI.2008, Su-Jiong Zhang [SM00129]; 1 male, China, Fujian province, Mt. Wuyishan nature reserve, Xingcun, 27°46'N, 118°02'E, 17.IV.2009, Su-Jiong Zhang [SM00507].

Description (Male). Body length 2.31 mm. **Color:** The head is bleached, pale brown; antenna, thorax, coxae, abdomen and hypopygium yellowish-brown; legs yellow; wing fumose. **Head** (Fig. 2A, B): Eye bridge broad, with four rows of facets. Prefrons bearing eight setae. Palpus three-segmented, basal segment with two setae, 2nd segment with four setae, 3rd segment with four setae. Flagellomeres mostly bearing short setae, except one row of remarkably long setae around the neck. The 4th flagellomere 0.11 mm in length, length/width: 2.7, flagellomere neck 0.06 mm, nearly 1/2 the length of the flagellomere. **Thorax:** Posterior pronotum with two setae. Mediotergite with three setae. Scutellum with no setae. Apex of fore tibia densely covered by disordered long setae (Fig. 2C): Length of spur/width of tibia: fore leg 1.33, mid leg 0.67, hind leg 1.03;

length of metatarsus/length of tibia: fore leg 0.58, mid leg 0.55, hind leg 0.39; length of hind tibia/length of thorax: 1.13. Tarsal claws two-toothed. **Wings** (Fig. 2D): Wing length 1.38 mm, width/length: 0.41. r-m with two setae on dorsal side. M_1 , M_2 , CuA_1 with no setae. stM not easily visible. c/w : 0.79. R_1/R : 0.52. **Terminalia**: Ventral mesial margin of gonocoxa with two evident groups of setae (Fig. 2E). Gonostylus slender, with one subapical megaseta and another longer sub-basal megaseta in the inner side. Tegmen higher than broad (Fig. 2F).

Female. Unknown.

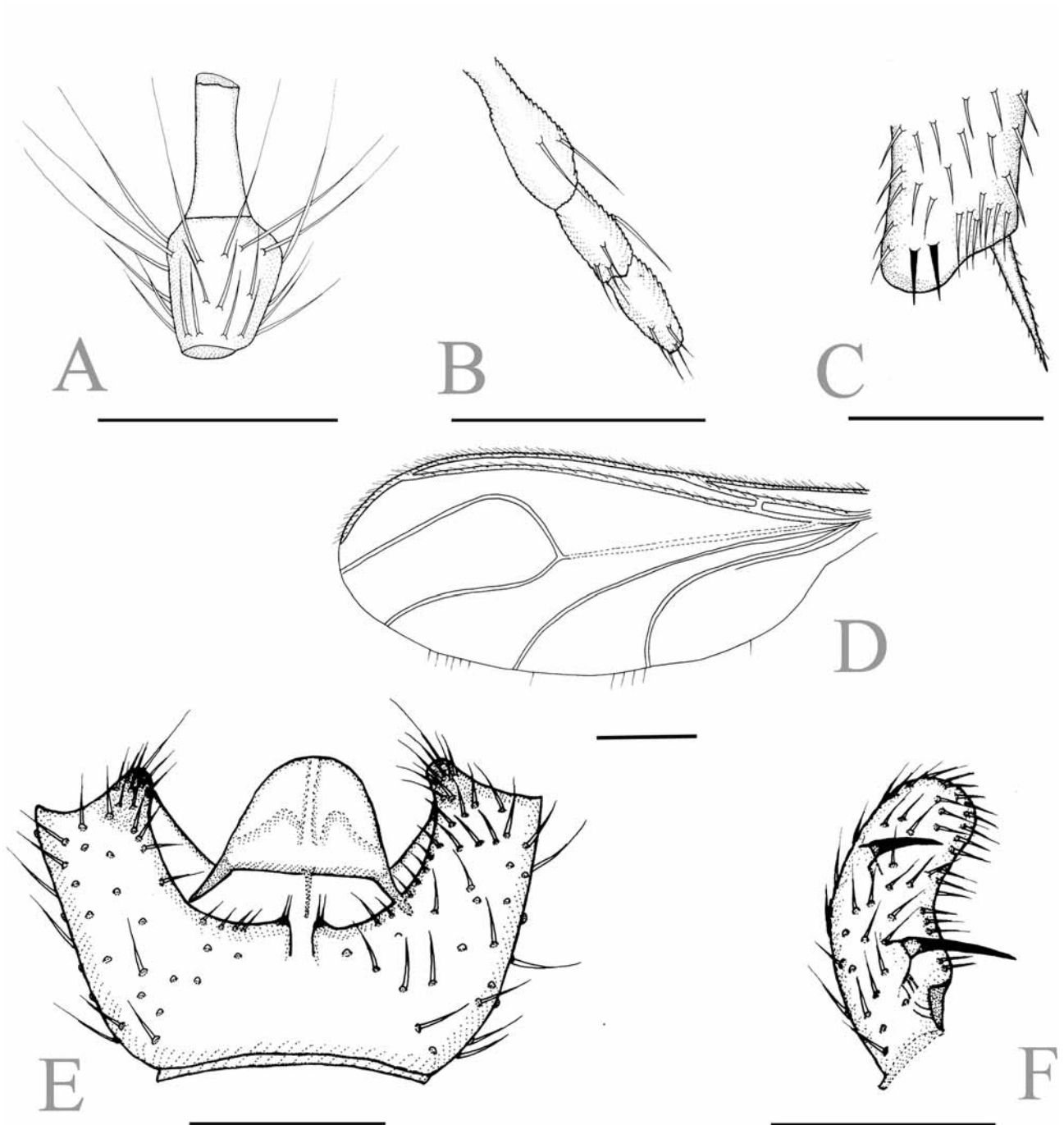


FIGURE 2. *Zygoneura (Pharetratula) longa* Wu & Zhang, **sp. nov.**, male. A, 4th flagellomere, lateral view; B, palpus, lateral view; C, apex of front tibia, prolateral; D, wing, dorsal view; E, part of hypopygium, ventral view; F, left gonostyle, ventral view. Scale 0.05 mm for C, 0.50 mm for D, 0.10 mm for the others.

Remarks. The species belongs to the subgenus *Pharetratula*. It is similar to *Z. divergens* (Mamaev, 1976) and *Z. subdivergens* (Mohrig & Mamaev, 1990), in the subapical and sub-basal megasetae (Mamaev 1976; Mohrig *et al.* 1990), but the new species can be distinguished by the slenderer gonostylus and its two different megasetae, as well as the different tegmen. Moreover, the posterior pronotum has 1–2 setae in *Z. longa*, while it is bare in *Z. subdivergens*.

Etymology. The species is named after its slender gonostylus.

Zygoneura (Pharetratula) transferata Rudzinski, 2005

Zygoneura transferata Rudzinski, 2005: 375–377.

Remarks. This species was recorded in Taiwan (Rudzinski 2005). It can be distinguished by a gonostylus with two megasetae subequal in length arising from the subapical and middle parts, respectively.

Zygoneura (Zygoneura) occidens Zhang & Wu, sp. nov.

Specimens examined. *Holotype*, male. China, Sichuan province, Yaan, Labahe, 1200m, 29°59'N, 102°59'E 16.VII.2006, Xiao-Ling Niu [SM00946]. *Paratype*. 1 Male, China, Tibet province, Linzhi, Mafenggou, 29°50'N, 93°25'E, 3.VI.1978, Fa-Sheng Li [SM00947].

Description (Male). Body length 2.60 mm. **Color:** Head and thorax dark brown; palpus, antenna, coxae, abdomen and hypopygium yellowish-brown; legs yellow; wing fumose. **Head** (Fig. 3A, B): Eye bridge broad, with three rows of facets. Prefrons with eight setae. Palpus three-segmented, basal segment with two setae, 2nd segment with four setae, 3rd segment with seven setae. Flagellomeres with long setae subequal in length. The 4th flagellomere 0.14 mm in length, length/width: 3.2, neck of flagellomere 0.06 mm and nearly 1/2 the length of the flagellomere. **Thorax:** Posterior pronotum and mediotergite bare. Scutellum with two setae. Apex of fore tibia with a broad comb-like row of setae (Fig. 3C): Length of spur/width of tibia: fore leg 1.67, hind leg 1.02; length of metatarsus/length of tibia: fore leg 0.61, hind leg 0.43; length of hind tibia/length of thorax: 1.42. Tarsal claws three-toothed. **Wings** (Fig. 3D): Wing length 1.78, width/length: 0.38. M_1 , M_2 , r-m and CuA_1 with no setae. stM not clearly visible in the specimen. c/w: 0.75. R_1/R : 0.65. **Terminalia:** Ventral mesial margin of gonocoxa with two groups of weak setae, the angulate lobe-like part not conspicuous (Fig. 3E). Gonostylus oval, almost as long as the gonocoxa, bearing a pair of long megasetae and another longer megasetae near the apical third (Fig. 3F). Tegmen somewhat higher than broad.

Female. Unknown.

Remarks. The species belongs to the subgenus *Zygoneura*; it is similar to *Z. sciarina* in having three megasetae at the gonostylus, a bare posterior pronotum, and a scutellum with two setae (Menzle & Mohrig 2000). It can be recognized by the oval gonostylus and pair of long megasetae and another longer megasetae near the apical third. Moreover, the angulate lobe-like part in the new species is inconspicuous, unlike the other species of the subgenus.

Etymology. The species is named after its distribution (western China).

Zygoneura (Zygoneura) sajanica Mamaev, 1976

Zygoneura sajanica Mamaev, 1976: 136–137.

Specimens examined. China, Zhejiang province, Linan, Mt. Tianmushan nature reserve, Laodian, 30°18'N, 119°25'E: 1 male, 18.VII.2008, Xiao-Ling Niu [SM00149]; 1 male, 10.II.2009, Su-Jiong Zhang [SM00343]; China, Sichuan province, Pingwu, Wanglang nature reserve, 32°42'N, 104°52'E, Zhuan Lu: 1 male, 24.VII.2006 [SM00944]; 1 male, 25.VII.2006 [SM00945].

Remarks. This species was first recorded in Russia (Mamaev 1976) and is newly recorded from China (Zhejiang, Sichuan). It has long setae of subequal length on the flagellomeres. The ventral mesial margin of the gonocoxa has two groups of weak setae. It can be distinguished by a gonostylus with two subapical megasetae. The four specimens examined do not show distinct intraspecies variation, but the materials from Zhejiang have stronger megasetae and a more sclerotized body.

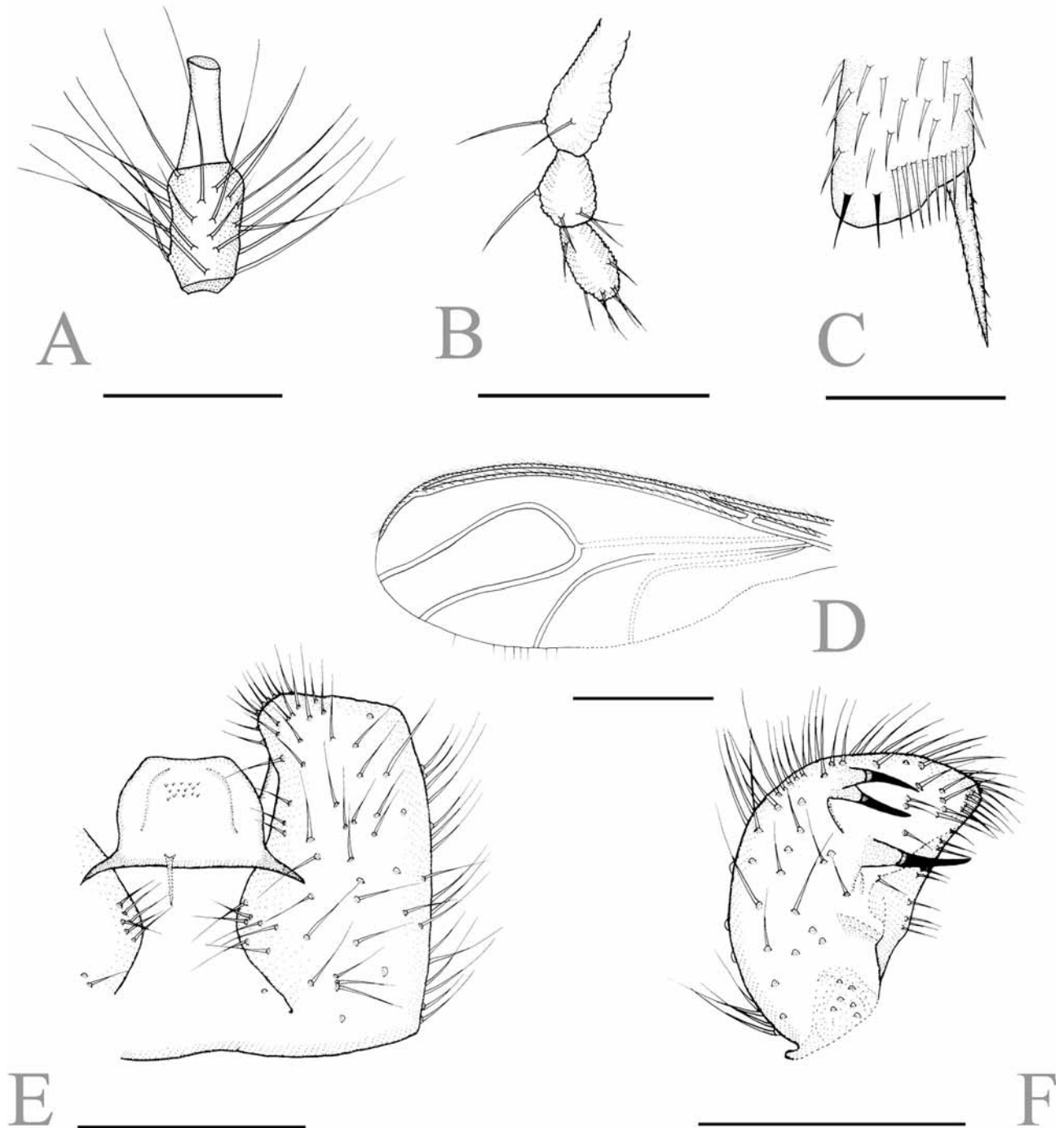


FIGURE 3 *Zygoneura (Zygoneura) occidentis* Wu & Zhang **sp. nov.**, male. A, 4th flagellomere, lateral view; B, palpus, lateral view; C, apex of front tibia, prolateral view; D, wing, dorsal view; E, part of hypopygium, ventral view; F, left gonostyle, ventral view. Scale 0.05 mm for C, 0.50 mm for D, 0.10 mm for the others.

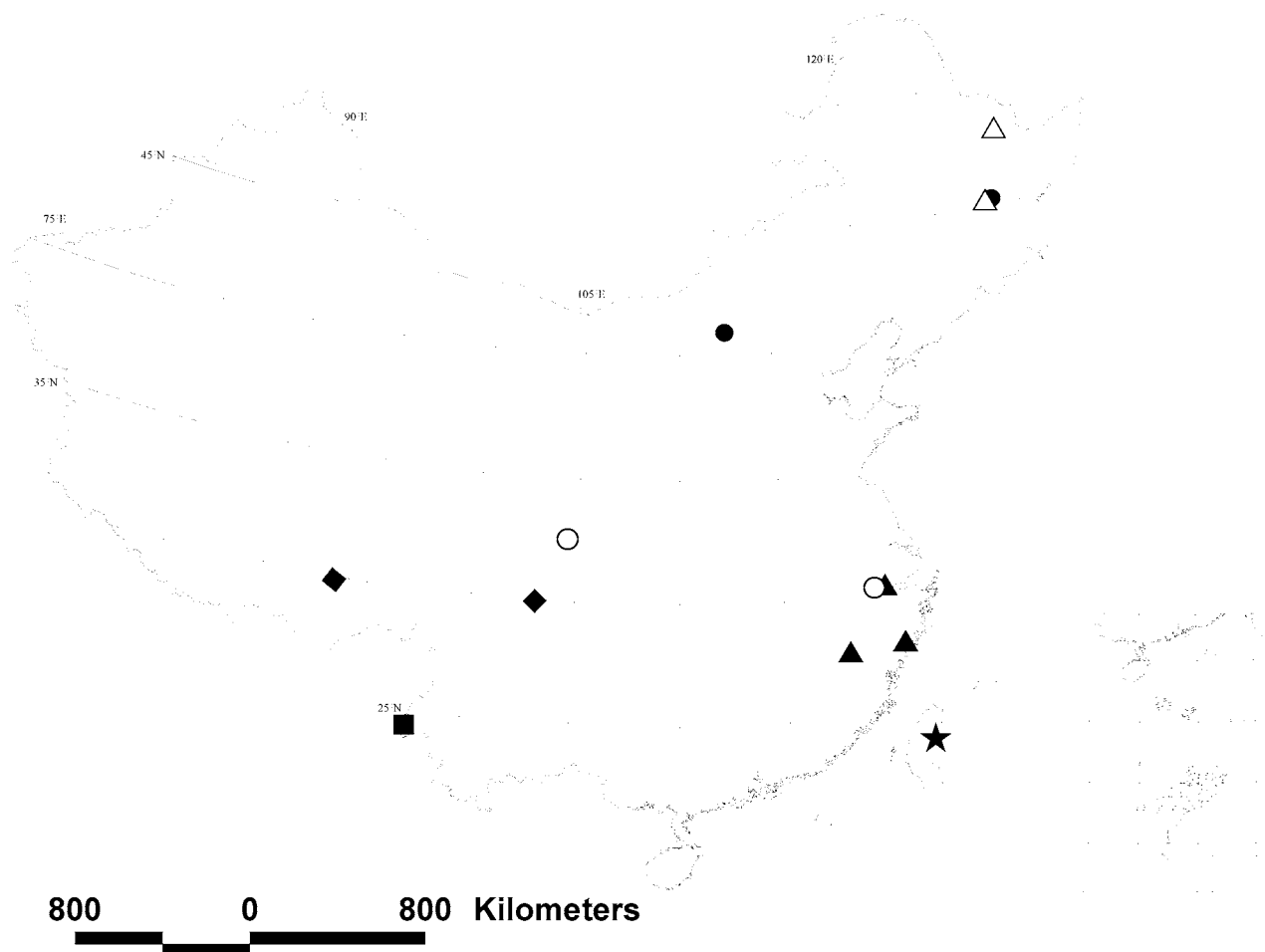


FIGURE 4. Geographical records of *Zygoneura* from China. ●: *Z. (Pharetratula) bidens* (Mamaev); ■: *Z. (Pharetratula) disparilis* Wu & Zhang, **sp. nov.**; ▲: *Z. (Pharetratula) longa* Wu & Zhang, **sp. nov.**; ★: *Z. (Pharetratula) transferata* Rudzinski; ◆: *Z. (Zygoneura) occidentis* Wu & Zhang, **sp. nov.**; ○: *Z. (Zygoneura) sajanica* Mamaev; △: *Z. (Zygoneura) sciarina* Meigen.

Zygoneura (Zygoneura) sciarina Meigen, 1830

Zygoneura sciarina Meigen, 1830: 305.

Specimens examined. 1 Male, China, Heilongjiang province, Yichun, Wuying, Fenglin nature reserve, 68 xiaoban, 48°05'N, 129°19'E, 24.VII.2008, Yi-Ping Wang [SM00190]; 1 male, China, Heilongjiang province, MT. Maershan nature reserve, 45°15'N, 128°13'E, 26.VII.2008, Su-Jiong Zhang [SM00157].

Remarks. This species belongs to the subgenus *Zygoneura*, first recorded from Germany and widely distributed in Europe (Menzel & Mohrig 2000). It is newly recorded from China (Heilongjiang). It is distinguished by a bare posterior pronotum and three megasetae on the gonostylus, one arising from the apical fourth and the other two from apical third. The materials examined show distinct intraspecies variation in body length. The Chinese specimens are 2.36–2.41 mm, much shorter than the European specimens, which are 2.7–3.5 mm (Menzel & Mohrig 2000).

Discussion

A total of seven *Zygoneura* species have been found in China, including the three new species described here. The genus is widespread in China (Fig.4): *Z. sajanica* Mamaev from Sichuan and Zhejiang, *Z. bidens* from Heilongjiang and Inner Mongolia, *Z. longa* from Zhejiang, *Z. sciarina* from Heilongjiang, *Z. transferata* from Taiwan, *Z. disparilis* from Yunnan and *Z. occidentens* from Sichuan and Tibet. Judging from the numbers of specimens and season when they were collected, the genus may be relatively rare and adults emerge year-round in China. The biology of these Chinese species remains unknown, as with most species of the genus, except *Z. (Allozygoneura) petasitidis* Sasakawa, 1997, which is associated with the Japanese butterbur *Petasites japonicus* (Sieb. et Zucc.) Maxim. (Asteraceae) (Sasakawa 1997).

Acknowledgements

We thank Dr. Heikki Hippa (Swedish Museum of Natural History, Sweden) and Dr. Frank Menzel (Senckenberg Deutsches Entomologisches Institut, Müncheberg) for sending references and their kind cooperation. Thanks are also given to Ms. Niu Xiao-Ling from Tianmushan National Natural Reserve and Mr. Lu Zhuan from Zhejiang Forestry University for collecting the material examined. This study was supported by NSFC grant 30870334.

References

- Hippa, H. & Vilkamaa, P. (2007) New species and records of *Keilbachia* Mohrig (Diptera, Sciaridae) from the Oriental region. *Zootaxa*, 1622, 57–68.
- Mamaev, B.M. (1976) Detritnicy podsemejstva Zygoneurinae (Diptera, Sciaridae) v faune Vostocnoj Sibiri i Dal'nogo Vostoka. *Insekte des Fernen Ostens*, 43, 135–139.
- Mamaev, B.M. (1985) New gall midge and sciarid species (Diptera, Cecidomyiidae, Sciaridae) from the USSR. *Vestnik Zoologii*, 3, 24–30.
- Mamaev, B.M. (1968) New nematoceros Diptera of the USSR Fauna (Diptera, Axymyiidae, Mycetobiidae, Sciaridae, Cecidomyiidae). *Revue de Entomologie de URSS*, 47, 605–616.
- Meigen, J.W. (1830) Systematische Beschreibung der bekannte europäischen zweiflügeligen Insekten. *System beschr*, 6, 304–305.
- Menzel, F. & Mohrig, W. (1998) Contributions to taxonomy and faunistics of the Palaearctic sciarid flies (Diptera, Sciaridae). Part 6 – new results from type study and their taxonomic and nomenclatural consequences. *Studia Dipterologica*, 5, 351–378.
- Menzel, F. & Mohrig, W. (2000) Revision der paläarktischen Trauermücken (Diptera, Sciaridae). *Studia Dipterologica*. Supplement 6, 1–761.
- Mohrig, W., Krivosheina, N. & Mamaev, B. (1990) Beiträge zur Kenntnis der Trauermücken (Diptera, Sciaridae) der Sowjetunion. Teil XV. Gattungen *Sciara*, *Trichosia*, *Chaetosciara*, *Pharetratula*, *Parapnyxia*, *Epidapus* und *Caenosciara*. *Zoologische Jahrbucher (Systematik)*. 117, 219–236.
- Rudzinski, H.G. (2005) Beiträge zur Trauermücken fauna Taiwan. Teil III: Gattungen *Xylosciara* Tuomikoski, 1957 und *Zygoneura* Meigen, 1830 (Diptera Nematocera: Sciaridae). *Entomofauna*, 26, 373–380.
- Sasakawa, M. (1997) New leaf miner and stem borer of Sciaridae (Diptera). *The Entomological Society of Japan*, 65, 171–176.
- Zhang, X.-M. & Yang, C.-K. (1990) Five new species of sciarids (Diptera: Sciaridae) from Nei Mengol and a genus new to China. *Entomotaxonomia*, 12, 267–274. (in Chinese)