

ORIGINAL ARTICLE

Three new species of the subgenus *Tipula* (*Sivatipula*) from Yunnan and Tibet, China (Diptera: Tipulidae), with an updated key for Chinese species

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Abstract Three new species of *Tipula* (*Sivatipula*), *T. (S.) pianmaensis* **sp. nov.** and *T. (S.) podenasi* **sp. nov.** from Yunnan, and *T. (S.) pseudofilicornis* **sp. nov.** from Tibet, are described and illustrated. An updated key for Chinese species is provided. The type specimens are deposited in the Systematics and Evolution Laboratory, School of Life Sciences, Anqing Normal University, Anhui, China.

Key words Crane flies, new species, *Sivatipula*, *Tipula*, Tipuloidea.

1 Introduction

The subgenus *Sivatipula* is only restricted in the Oriental Region. It was originally proposed by Alexander (1964) as a subgenus of genus *Tipula* Linnaeus, 1758, based on the type species *Tipula mitocera* Alexander, 1927 from the eastern Himalayas by original designation. As a small group of taxa, it currently includes 14 species as follows: *T. (S.) pullimargo* Alexander, 1951 from Myanmar; *T. (S.) alhena* Alexander, 1953 from Thailand; *T. (S.) filicornis* Brunetti, 1918, *T. (S.) mitocera* Alexander, 1927 and *T. (S.) bhishma* Alexander, 1964 from India; *T. (S.) lackschewitziana* Alexander, 1928, *T. (S.) suensoniana* Alexander, 1940, *T. (S.) parvauricula* Alexander, 1941, *T. (S.) biprocessa* Xue & Men, 2016, *T. (S.) similis* Men, 2016, *T. (S.) tongbiguanensis* Men, 2016, *T. (S.) multidentata* Men, 2018, *T. (S.) tergatruncata* Men, 2018 and *T. (S.) yiyongensis* Yang, Pan & Yang, 2019 from China (Oosterbroek, 2019). The Chinese fauna of *Sivatipula* is relatively well represented with nine species, distributed all in Southern China, including Zhejiang, Fujian, Yunnan, Guizhou, Chongqing, Guangxi, Tibet and Taiwan. The most diagnostic feature for this subgenus is the elongated antennae in the male that are subequal to or even longer than body length (Alexander, 1964; Xue & Men, 2016). Xue & Men (2016) provided a key to separate all known species of the subgenus.

During sorting and identifying crane fly specimens collected from the Northwest Yunnan and Southeast Tibet, three previously unknown taxa of *Tipula* (*Sivatipula*) were noticed. In the present paper, these three new species are described and illustrated. An updated key to the Chinese species of the subgenus is given.

2 Materials and methods

The specimens were collected from Yunnan and Tibet by insect nets. All known species were compared based on the detailed descriptions and illustrations in the literature. Photographs of the male body parts were taken using SOIF XTZ-E stereomicroscope (SOIF, Shanghai, China). The hypopygium of each male was dissected and macerated in 10% NaOH for

one hour at 50°C metal bath, observed in glycerin and illustrated under a SOIF XTZ-E stereomicroscope (SOIF, Shanghai, China). Dissection was made with the aid of two very fine needles, scissors and fine-tipped tweezers. Body measurements are from the tip of nasus to the tip of hypopygium. All measurements were made in millimeters (mm) with the aid of a digital caliper. The terminology and methods of description and illustration followed those of Alexander & Byers (1981) and Frommer (1963).

3 Taxonomy

Key to species of *Tipula* (*Sivatipula*) from China.

1. Outer gonostylus long-attenuate, spiniferous flange present, broad based (see Alexnader, 1940: 110, fig. 11; Li *et al.*, 2016: 31, fig. 1–24) (Zhejiang) *T. (S.) suensoniana* Alexnader, 1940
Outer gonostylus not long-attenuate, spiniferous flange absent 2
2. Mesal margin of the outer gonostylus microscopically serrulate, near the base bearing a slender arm (see Alexander, 1928: 458, pl. II, fig. 5) (Taiwan) *T. (S.) lackschewitziana* Alexander, 1928
Outer gonostylus not as above 3
3. Hypopygium yellow or orange-yellow 5
Hypopygium brownish-black or black 4
4. Mesal margin of outer gonostylus with abundant black teeth (see Yang *et al.*, 2019: 195, fig. 5) (Tibet)
..... *T. (S.) yiyongensis* Yang, Pan & Yang, 2019
Outer gonostylus without teeth 6
5. Semen pump with posterior immovable apodeme not curved dorsally 7
Semen pump with posterior immovable apodeme curved dorsally 8
6. Prescutum brown; sternite nine with one horn-shaped process (Tibet) *T. (S.) pseudofilicornis* sp. nov.
Prescutum brownish-yellow; sternite nine with a pair of finger-shaped processes (Yunnan) *T. (S.) podenasi* sp. nov.
7. Tergite nine truncated at posterior margin; outer gonostylus enlarged at apex (see Men *et al.*, 2018: 199, figs 19, 21) (Chongqing) ...
..... *T. (S.) teratruncata* Men, 2018
Tergite nine shallowly emarginated at posterior margin; outer gonostylus not enlarged apically (see Men *et al.*, 2018: 196, figs 7–8) (Guizhou) *T. (S.) multidentata* Men, 2018
8. Tergite nine terminating in two broad lobes, which are densely covered with black teeth at the apex (see Men *et al.*, 2016: 806, figs 6, 8, 10) (Yunnan) *T. (S.) tongbiguanensis* Men, 2016
Tergite nine not terminating in two lobes 9
9. Tergite nine with finger-shaped or horn-shaped process at posterior margin 10
Tergite nine without such process at posterior margin (see Alexander, 1941:401, pl. 4, fig. 44; Xue & Men, 2016: 35, fig. 7) (Fujian, Guangxi, Guizhou) *T. (S.) parvauricula* Alexander, 1941
10. Tergite nine with a pair of finger-shaped processes which are close to each other 11
Tergite nine with a pair of finger shaped processes which are not close to each other (Yunnan) *T. (S.) pianmaensis* sp. nov.
11. Outer gonostylus curved squarely at apical third, its inner surface densely covered with many black teeth (see Men *et al.*, 2016: 809, fig. 25) (Guangxi) *T. (S.) similis* Men, 2016
Outer gonostylus not curved squarely, its inner surface without tooth (see Xue & Men, 2016: 37, fig. 20) (Guangxi)
..... *T. (S.) biprocessa* Xue & Men, 2016

Tipula (*Sivatipula*) *pianmaensis* sp. nov. (Figs 1–15)

Diagnosis. Body gray in general; thorax gray with three brownish-yellow stripes on prescutum, the median one divided by a broad gray vitta; antenna longer than body length; wing suffused with brownish-yellow, stigma light brown; abdomen brownish-yellow with brown lateral stripes, segments six and seven wholly black, hypopygium yellow, distinctly expanded; tergite nine with a pair of horn-shaped processes at posterior margin, ventral extension of tergite nine densely covered with small black teeth; inner gonostylus terminated into a long black beak; outer gonostylus Y-shaped.

Material examined. Holotype male, China, Yunnan, Lushui, Pianma, Gaoligongshan National Natural Reserve, 26°00'N, 98°37'E, 19 Jun 2019, leg. Qiulei Men. Paratype. 1 male, same data as holotype.

Description. Adult length (male, $n=2$): body 14.5–14.7 mm (not including antenna), wing 16.6–16.8 mm, antenna 16.4–16.6 mm.

Head. Gray with rostrum darker in coloration laterally. Nasus black densely covered with black setae. Vertex gray, unpatterned (Fig. 1). Head including vertex and rostrum densely covered with black setae. Antenna 12-segmented,

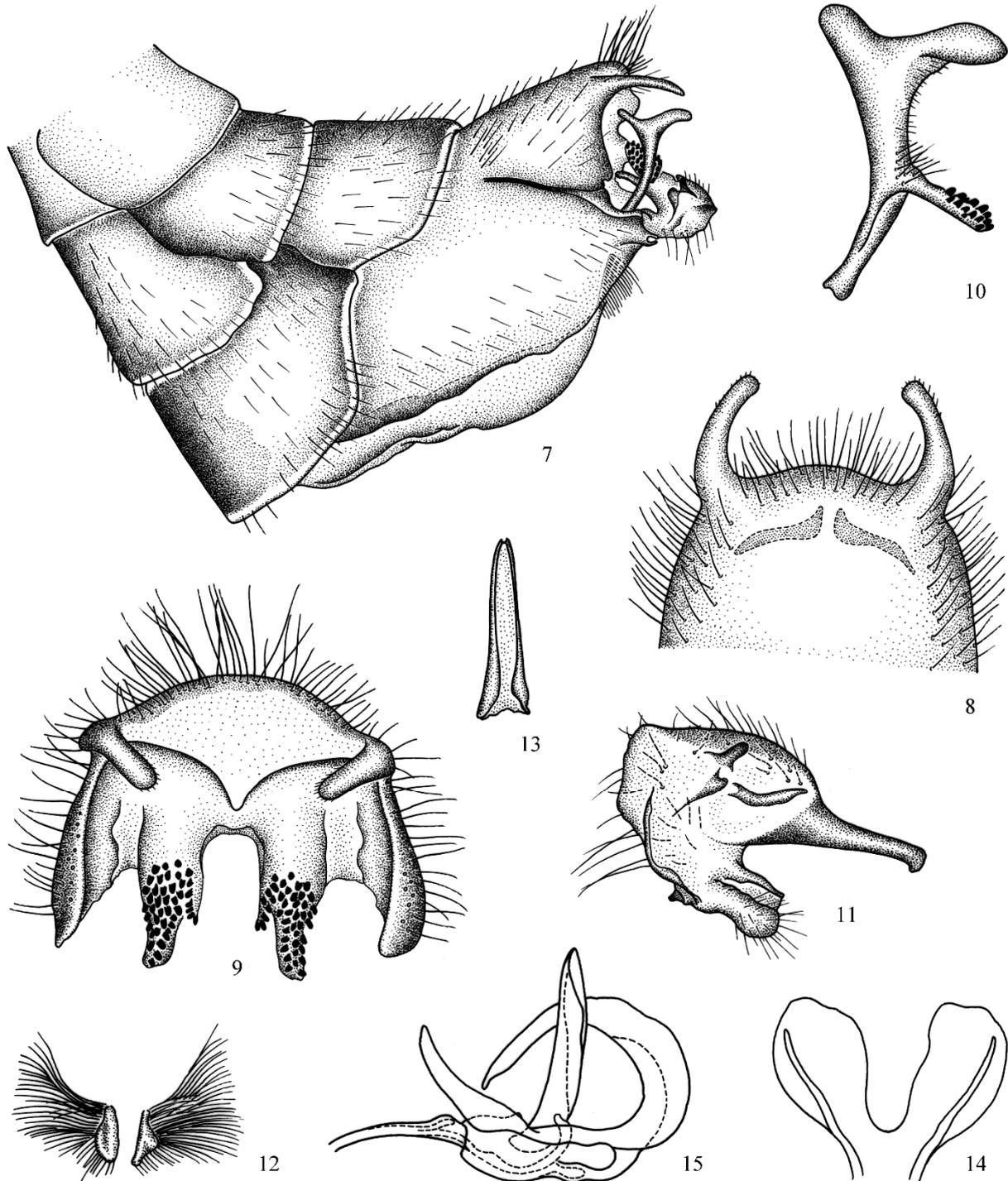
significantly longer than body; scape gray, pedicel and first two flagellomeres yellow, rest flagellomeres brown, each flagellomere subequal in length, cylindrical, with black verticils. Palpus dark gray.

Thorax. Pronotum gray medially, darker in coloration laterally (Fig. 2). Prescutum gray with three brownish-yellow stripes, the median one divided by a broad gray vitta (Fig. 3). Scutum black with two gray triangular marks which are not connected to each other, scutellum and postnotum wholly gray (Fig. 3). Pleuron entirely gray (Fig. 2). Legs very slender, coxae and trochanters gray, femora gray basally and gradually changed into dark brown, tibiae and tarsi dark brown. Halter black. Wing brownish-yellow, cell *sc* darker than ground color, stigma light brown (Fig. 4). *Rs* distinctly longer than *R*₃, petiole of cell *m*₁ subequal in length to *m*-*m*, 1/3 the length of discal cell (Fig. 4).



Figures 1–6. *Tipula* (*Sivatipula*) *pianmaensis* **sp. nov.** 1. Head, dorsal view. 2. Thorax, lateral view. 3. Thorax, dorsal view. 4. Wing. 5. Abdomen and hypopygium, lateral view. 6. Hypopygium, lateral view.

Abdomen. Segments one to five brownish-yellow with black lateral stripes, segments six and seven wholly black, tergite eight yellow, sternite eight mostly black (Fig. 5). Hypopygium yellow, distinctly enlarged (Figs 5–7). Tergite nine slightly protruding medially at posterior margin, terminating in a pair of horn-shaped processes at lateral corners, a pair of biforked lobes from ventral side of tergite nine, densely covered with black teeth apically (Figs 7–9). Outer gonostylus, narrowed, Y-shaped, with a finger-shaped process medially with numerous small black teeth at apex (Fig. 10). Inner gonostylus broad basally, terminating in a long black beak, a small obtuse lobe and two finger-shaped processes arising from its mesal region of outer surface (Fig. 11). Sternite nine with a pair of small median processes which are densely covered with long setae (Fig. 12).



Figures 7–15. *Tipula (Sivatipula) pianmaensis* sp. nov. 7. Hypopygium, lateral view. 8. Tergite nine, dorsal view. 9. Tergite nine, posteroventral view. 10. Outer gonostylus, inner view. 11. Inner gonostylus, outer view. 12. Median processes on sternite nine, dorsal view. 13. Adminiculum, dorsal view. 14. Compressor apodeme, dorsal view. 15. Semen pump, lateral view.

(Fig. 12). Adminiculum broad basally, gradually narrowed to apex (Fig. 13).

Semen pump with compressor apodeme V-shaped (Fig. 14). Posterior immovable apodeme consisting of a median arm which curved dorsally (Fig. 15). Anterior immovable apodeme flattened. Aedeagus narrow, elongated, tubular, more than 5.0 times the length of semen pump (Fig. 15).

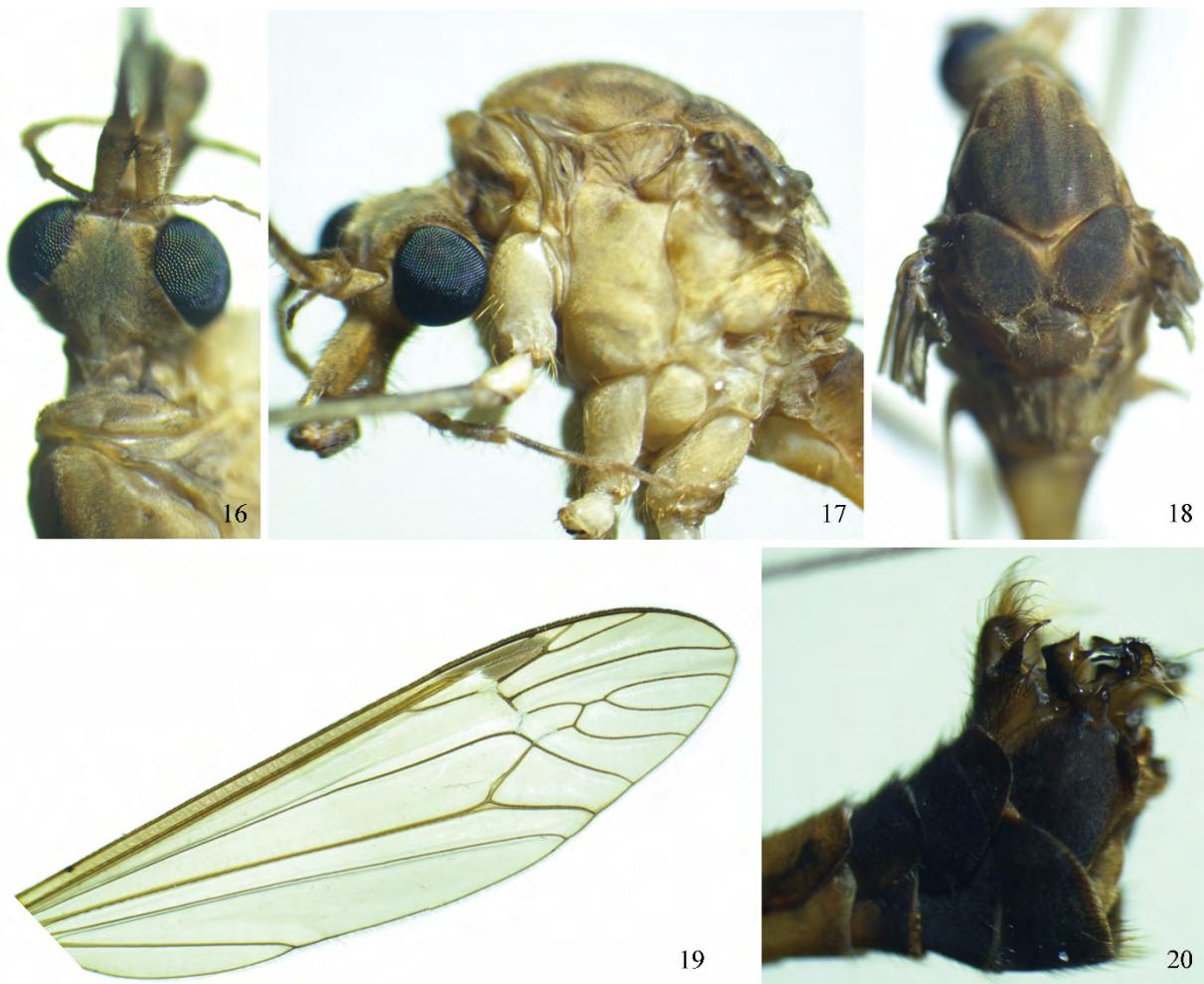
Distribution. China (Yunnan).

Remarks. The new species is mostly similar to *T. (S.) bhishma* Alexander, 1964, a species from Assam, India, by similar structure of hypopygium and body color. It can be easily distinguished from *T. (S.) bhishma* by the outer gonostylus which is Y-shaped with a finger-shaped process (absent in *T. (S.) bhishma*). The latter species has its outer gonostylus not bearing finger-shaped process. There is also a noticeable difference in the shape of process on tergite nine which is narrow in the new species, but broad in *T. (S.) bhishma*.

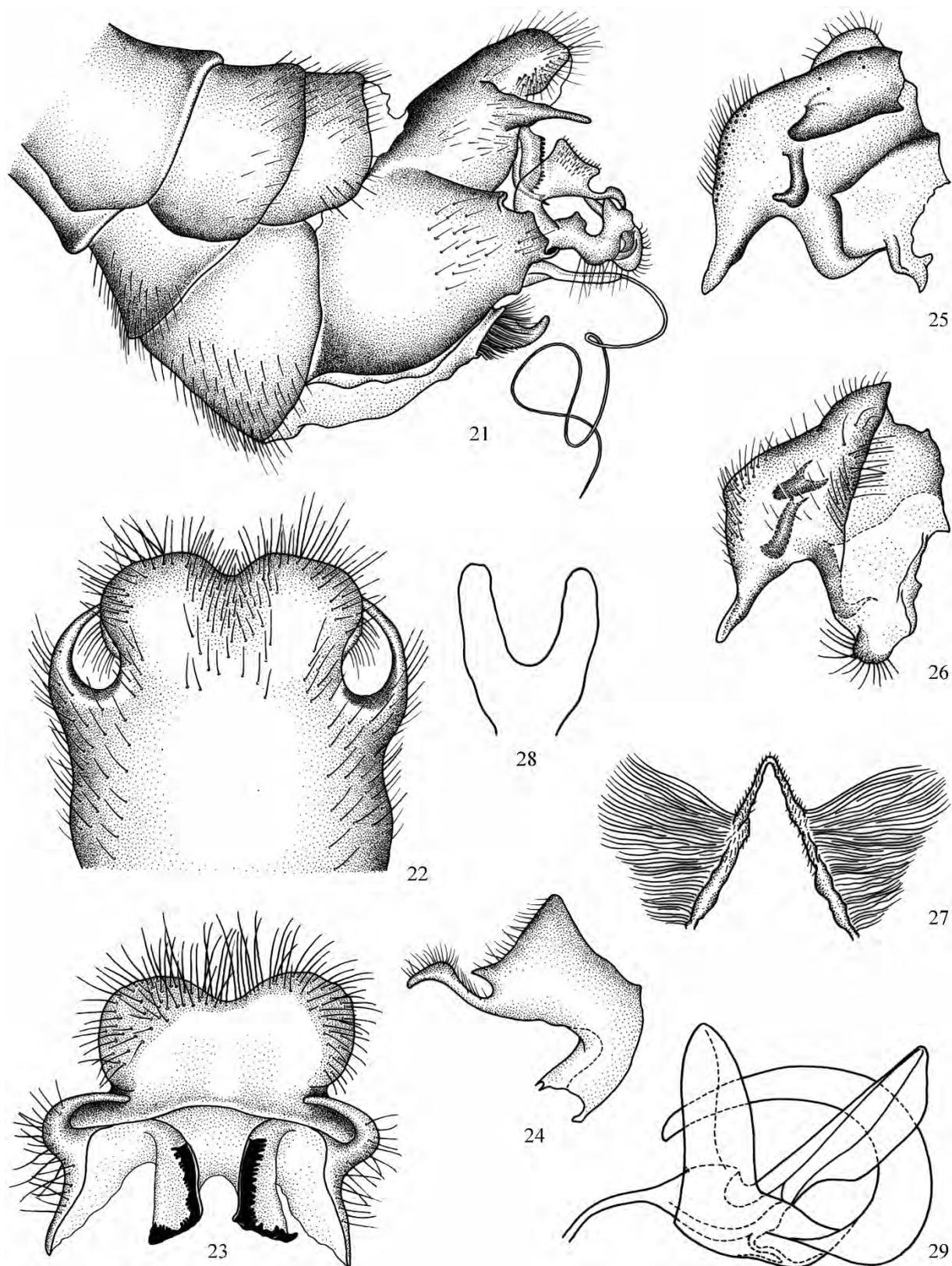
Etymology. The specific epithet is a noun “*pianma*” with Latin suffix “*ensis*”, referring to the type locality of the new species, Pianma.

***Tipula* (*Sivatipula*) *pseudofilicornis* sp. nov.** (Figs 16–29)

Diagnosis. Body brownish-yellow in general; thorax dark brown with three brownish-yellow stripes on prescutum, the median one divided by brown vitta; antenna longer than the body length; wing brownish-yellow with a light brown stigma; abdomen brownish-yellow with lateral stripes brown, segments six to eight entirely black, hypopygium black; tergite nine with a pair of horn-shaped processes on lateral corners and a broad median lobe; inner gonostylus with an obtuse lobe and a finger-shaped process on mesal region of outer surface.



Figures 16–20. *Tipula* (*Sivatipula*) *pseudofilicornis* sp. nov. 16. Head, dorsal view. 17. Thorax, lateral view. 18. Thorax, dorsal view. 19. Wing. 20. Hypopygium, lateral view.



Figures 21–29. *Tipula (Sivatipula) pseudofilicornis* sp. nov. 21. Hypopygium, lateral view. 22. Tergite nine, dorsal view. 23. Tergite nine, posteroventral view. 24. Outer gonostylus, inner view. 25. Inner gonostylus, outer view. 26. Inner gonostylus, inner view. 27. Median processes on sternite nine, dorsal view. 28. Compressor apodeme, dorsal view. 29. Semen pump, lateral view.

Material examined. Holotype male, China, Tibet, Linzhi, Chayu, Shangchayu, 28°43'N, 96°46'E, 8 Jun 2019, leg. Qiulei Men. Paratypes. 3 males, same data as holotype.

Description. Adult length (male, $n=4$): body 13.1–13.3 mm (not including antenna), wing 15.7–15.9 mm, antenna 15.0–15.2 mm.

Head. Brownish-yellow with rostrum dark brown laterally (Fig. 16). Nasus brown with black setae apically. Vertex grayish-brown, lacking of marking (Fig. 16). Head including vertex and rostrum densely covered with black setae. Antenna 12-segmented, significantly longer than body; scape, pedicel and first flagellomere brownish-yellow, rest flagellomeres yellowish-brown, each flagellomere subequal in length, cylindrical, with black verticils. Palpus dark brown.

Thorax. Pronotum brown (Fig. 17). Prescutum brown with three brownish-yellow stripes, the median one divided by brown vitta (Fig. 18). Scutum dark brown with two black marks, scutellum brown, postnotum brown with a grayish median vitta (Fig. 18). Pleuron entirely brownish-yellow (Fig. 17). Legs very slender, coxae and trochanters brownish-yellow, femora brownish-yellow with a darker apex, tibiae and tarsi dark brown. Halter with stem yellow, knob black. Wing brownish-yellow, cell sc darker than ground color, stigma light brown (Fig. 19). Rs distinctly longer than R₃, petiole of cell m₁ subequal in length to m-m, 1/3 the length of discal cell (Fig. 19).

Abdomen. Segments one to five brownish-yellow with black lateral stripes, segments six to eight wholly black. Hypopygium black (Fig. 20). Tergite nine with a pair of horn-shaped processes on lateral corners, median lobe broad, shallowly concaved medially, the flange between horn-shaped processes and median lobe deeply concaved (Figs 21–23). Outer gonostylus with apical margin and anterior margin forming a right angle, posterior margin terminagting in a small lobe (Fig. 24). Inner gonostylus broad basally, protruding into a beak, a small obtuse lobe and a finger-shaped processes from its mesal region of outer surface (Figs 25–26). Sternite nine possessing a horn-shaped process which is densely covered with long setae (Fig. 27).

Semen pump with compressor apodeme V-shaped, with a pair of ridges on its arms (Fig. 28). Posterior immovable apodeme being one median arm which curved dorsally. Anterior immovable apodeme flattened, expanded in lateral view (Fig. 29). Aedeagus narrow, elongated, tubular, more than 10.0 times longer than the length of semen pump.

Distribution. China (Tibet).

Remarks. The new species is closely allied to *T. (S.) filicornis* Brunetti, 1918, another Indian species by similar structure of the hypopygium. It can be easily separated from *T. (S.) filicornis* by the outer gonostylus which forms a right angle on dorsal margin. *T. (S.) filicornis* has its outer gonostylus Y-shaped and lacking of such right angle.

Etymology. The specific epithet is the name of its related species “*filicornis*” with a Latin prefix “*pseudo*”, emphasizing the morphological similarity of the new species and its related species.

***Tipula* (*Sivatipula*) *podenasi* sp. nov.** (Figs 30–43)

Diagnosis. Body brownish-yellow in general; thorax brownish-yellow with three light brown stripes on prescutum, the median one divided by a narrow yellow vitta; antenna longer than the body length; wing brownish-yellow with a light brown stigma; abdomen brownish-yellow with lateral stripes black, segments five to seven wholly black, hypopygium black, distinctly enlarged; tergite nine with a pair of horn-shaped processes at posterior margin; outer gonostylus huge, boomerang-shaped.

Material examined. Holotype male, China, Yunnan, Gongshan, Bingzhongluo, Gongdangshenshan, 28°01'N, 98°37'E, 12 Jun 2019, leg. Qiulei Men. Paratype. 1 male, China, Yunnan, Gongshan, Shuanglawu, 27°46'N, 98°37'E, 13 Jun 2019, leg. Qiulei Men; 1 male, same data to holotype.

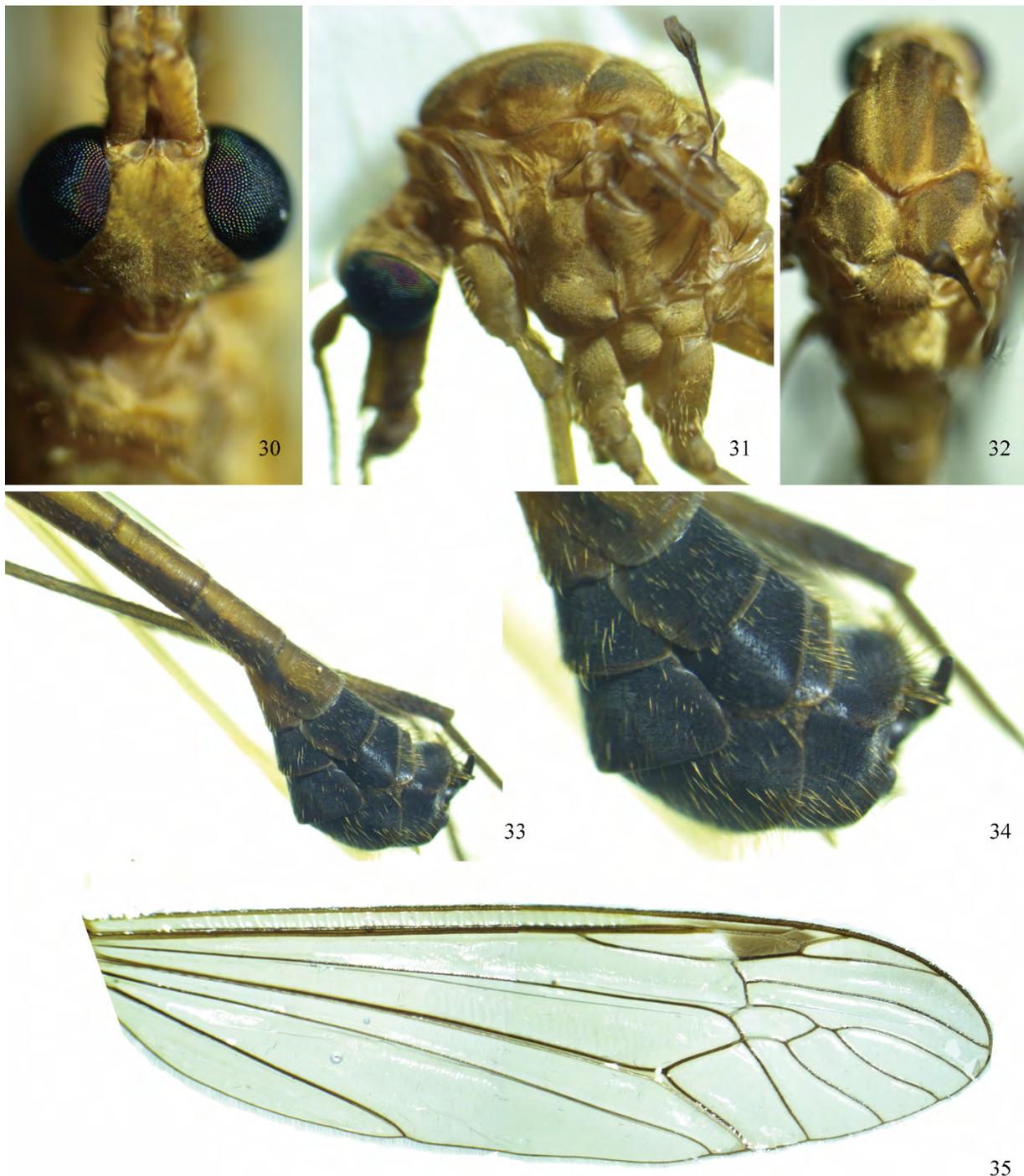
Description. Adult length (male, $n=3$): body 16.1–16.3 mm (not including antenna); wing 15.0–15.2 mm; antenna 17.8–18.0 mm.

Head. Brownish-yellow with rostrum brown in lateral sides. Nasus brownish-yellow densely covered with black setae (Fig. 30). Vertex lacking of marking (Fig. 30). Head including vertex and rostrum densely covered with black setae. Antenna 12-segmented, significantly longer than body; scape and pedicel brownish-yellow, first flagellomeres brownish-yellow at base and brown apically, rest flagellomeres brown, each flagellomere subequal in length, cylindrical, with black verticils. Palpus brown.

Thorax. Pronotum brownish-yellow (Fig. 31). Prescutum brownish-yellow with three light brown stripes, the median one divided by a narrow yellow vitta (Fig. 32). Scutum brownish-yellow with two brown triangular marks which are not connected to each other, scutellum and postnotum brownish-yellow (Fig. 32). Pleuron entirely brownish-yellow (Fig. 31). Legs very slender, coxae and trochanters brownish-yellow, femora brownish-yellow basally and gradually changed into light brown, dark brown at apex, tibiae and tarsi dark brown. Halter with stem yellow, knob darker. Wing brownish-yellow, cell sc not darker than ground color, stigma light brown (Fig. 33). Rs distinctly longer than R₃, petiole of cell m₁ distinctly shorter

than m-m, 1/4 the length of discal cell (Fig. 33).

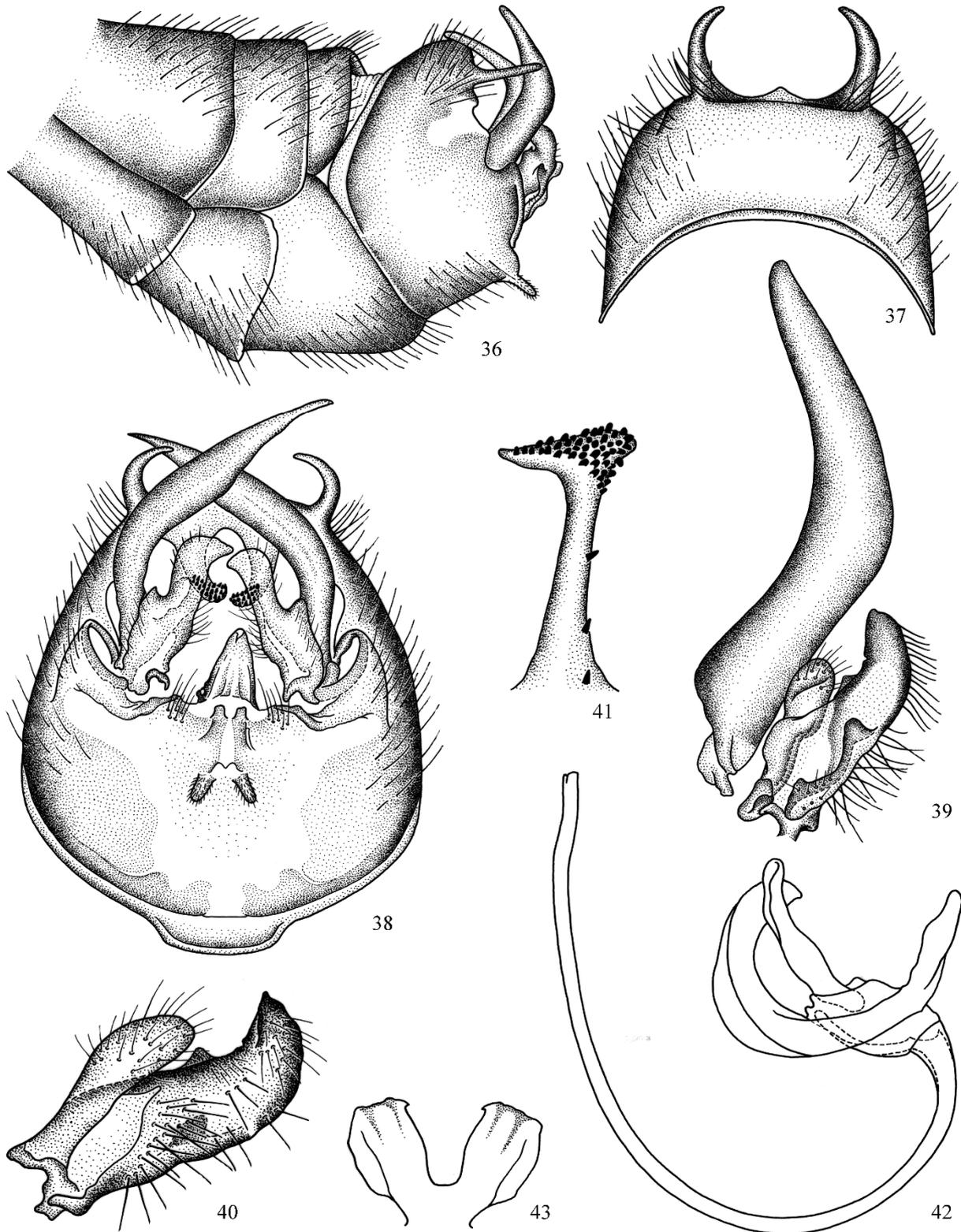
Abdomen. Segments one to five brownish-yellow with black lateral stripes, segments six to eight wholly black (Fig. 34). Hypopygium black, distinctly enlarged (Fig. 35). Tergite nine with a pair of horn-shaped processes, between them with a small angle slightly protruded medially, with a pair of arms on ventral side which expand apically and equipped with many small black teeth (Figs 36–38, 41). Outer gonostylus huge, narrowed, curved, boomerang-shaped, more than two times longer than the length of inner gonostylus (Figs 36, 39). Inner gonostylus broad at base, gradually narrowed to apex, with a small angular lobe on the lateral margin, an elongated obtuse lobe generated from the base, a small lobe arising from its mesal region of inner surface (Figs 39–40). Sternite nine with a pair of short, finger-shaped processes densely covered with



Figures 30–35. *Tipula (Sivatipula) podenasi* sp. nov. 30. Head, dorsal view. 31. Thorax, lateral view. 32. Thorax, dorsal view. 33. Wing. 34. Abdomen and hypopygium, lateral view. 35. Hypopygium, lateral view.

small setae (Fig. 38).

Semen pump with compressor apodeme V-shaped, each arm broad (Fig. 42). Posterior immovable apodeme being single median arm which is curved dorsally (Fig. 43). Aedeagus relatively thick,



Figures 36–43. *Tipula* (*Sivatipula*) *podenasi* sp. nov. 36. Hypopygium, lateral view. 37. Tergite nine, dorsal view. 38. Hypopygium, dorsal view. 39. Outer and inner gonostylus, outer view. 40. Inner gonostylus, inner view. 41. Arm on ventral side of tergite nine. 42. Compressor apodeme, dorsal view. 43. Semen pump, lateral view.

more than 3.5 times longer than semen pump (Fig. 43).

Distribution. China (Yunnan).

Remarks. The new species is most similar to *T. (S.) bhishma* by similar structure of hypopygium. It can be easily distinguished from the latter by outer gonostylus which is broad basally and narrowed to apex. *T. (S.) bhishma* has its outer gonostylus broad at apex. The new species is also distinguished by the horn-shaped process on tergite nine, which is distinctly narrower than that of *T. (S.) bhishma*.

Etymology. The new species is named in honor of famous crane flies researcher, Sigita Podenas (Nature Research Centre, Vilnius, Lithuania).

Funding This study is supported by grant from the National Natural Science Foundation of China (31300551), and the Anhui Outstanding Young Talent Support Program (gxfx2017059).

Acknowledgements I express my sincere appreciation to Dr. Pjotr Oosterbroek (Naturalis, Leiden, the Netherlands) for his valuable web site, the Catalogue of the Craneflies of the World (<http://ccw.naturalis.nl/index.php>), which provides much valuable information about taxonomy, classification, general systematics and distribution. I am also grateful to the staffs of Administrative Bureau of Cibagou National Nature Reserve and Administrative Bureau of Gaoligongshan National Nature Reserve for their help with collecting of material. I also sincerely thank two anonymous reviewers who provided valuable comments and advices on the manuscript.

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