

# Research article

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## Four new crane fly species of the subgenus *Vestiplex* (Diptera: Tipulidae: *Tipula*) from Tibet and Yunnan, China

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**Abstract.** Four new crane fly species of the subgenus *Tipula* (*Vestiplex*) Bezzi, 1924, *T. (V.) medialobata* sp. nov. (Yunnan), *T. (V.) singularis* sp. nov. (Yunnan), *T. (V.) cibagouensis* sp. nov. (Tibet) and *T. (V.) paramonovi* sp. nov. (Tibet) are described and illustrated. Redescription and detailed illustrations of *T. (V.) nestor* Alexander, 1934 are provided with first distributional record in mainland China.

**Keywords.** Tipuloidea, crane fly, hypopygium, taxonomy, Xizang.

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## Introduction

Bezzi (1924) established the subgenus *Vestiplex* with *Tipula cisalpina* Riedel, 1913 as the type species from the West Palaearctic region by original designation. This subgenus includes 173 species and subspecies worldwide, which are distributed in Oriental, Palaearctic and Holarctic regions (Oosterbroek 2021).

The subgenus is generally well represented in mountain systems, such as the Pyrenees, Alps, Caucasus and Himalayas (Savchenko 1960, 1964). A total of 76 species and one subspecies of *Vestiplex* are documented in China, which are mainly associated with the Tibetan Plateau (Tibet, Sichuan, Yunnan, Qinghai and other provinces) (Oosterbroek 2021). Among them, 20 species were described in the last six years (Men *et al.* 2017, 2021a, 2021b, 2021c; Starkevich *et al.* 2019 a, 2019b; Ren *et al.* 2021 and Yang *et al.* 2021).

Its subgeneric characters were summarized by Alexander (1935, 1965), Men *et al.* (2021a) and Starkevich *et al.* (2020).

In the present work, four new species were found from northwest Yunnan and southeast Tibet in southern China, a wide region with high insect species diversity. The present paper provides descriptions and illustrations of the external morphology for new species. Redescription and detailed illustrations of *T. (V.) nestor* Alexander, 1934 are provided based on additional features.

## Material and methods

Adult crane flies were collected in ultraviolet light and with an insect net in Tibet and Yunnan provinces during fieldwork in 2019. Specimens were studied with an Olympus SZ61 (Olympus, Japan) stereo microscope. Photographs of the body parts were taken using an Olympus SZ61 stereo microscope (Olympus, Japan). The hypopygium was removed and macerated in 10% NaOH for one hour in a 50°C metal bath, observed in glycerin and illustrated under same stereo microscope. The body length was measured from the vertex of head to the tip of hypopygium. All measurements were made in millimeters (mm) with the aid of a digital caliper.

Descriptive terminology follows that of Ribeiro (2006) and Cumming & Wood (2017). The term “appendage of sternite nine (A9S)” is adopted from Mannheims (1963), and the terms “ventral lobe” and “dorsal lobe” of A9S were adopted from Gelhaus (2005). The terminology of the wing venation is adopted from de Jong (2017).

## Institutional abbreviations

AQNU = Anqing Normal University, Anqing, China  
 BMNH = Natural History Museum, London, UK  
 USNM = United States National Museum, Washington, D.C., USA  
 ZFMK = Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany  
 ZIN = Zoological Museum of the Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia

## Morphological abbreviations

adm = adminiculum  
 AIA = anterior immovable apodeme  
 ap = anal plate  
 A9S = appendage of sternite nine  
 CG = clasper of gonostylus; dl, dorsal lobe of A9S  
 dp = dorsal portion of tergite nine  
 EA = ejaculatory apodeme  
 gcx = gonocoxite  
 LG = lobe of gonostylus  
 PIA = posterior immovable apodeme  
 s9 = sternite nine  
 t9 = tergite nine  
 vl = ventral lobe of A9S  
 vp = ventral portion of tergite nine

## Results

### Taxonomy

Class Insecta Linnaeus, 1758  
Order Diptera Linnaeus, 1758  
Family Tipulidae Latreille, 1802  
Subfamily Tipulinae Latreille, 1802  
Genus *Tipula* Linnaeus, 1758  
Subgenus *Vestiplex* Bezzi, 1924

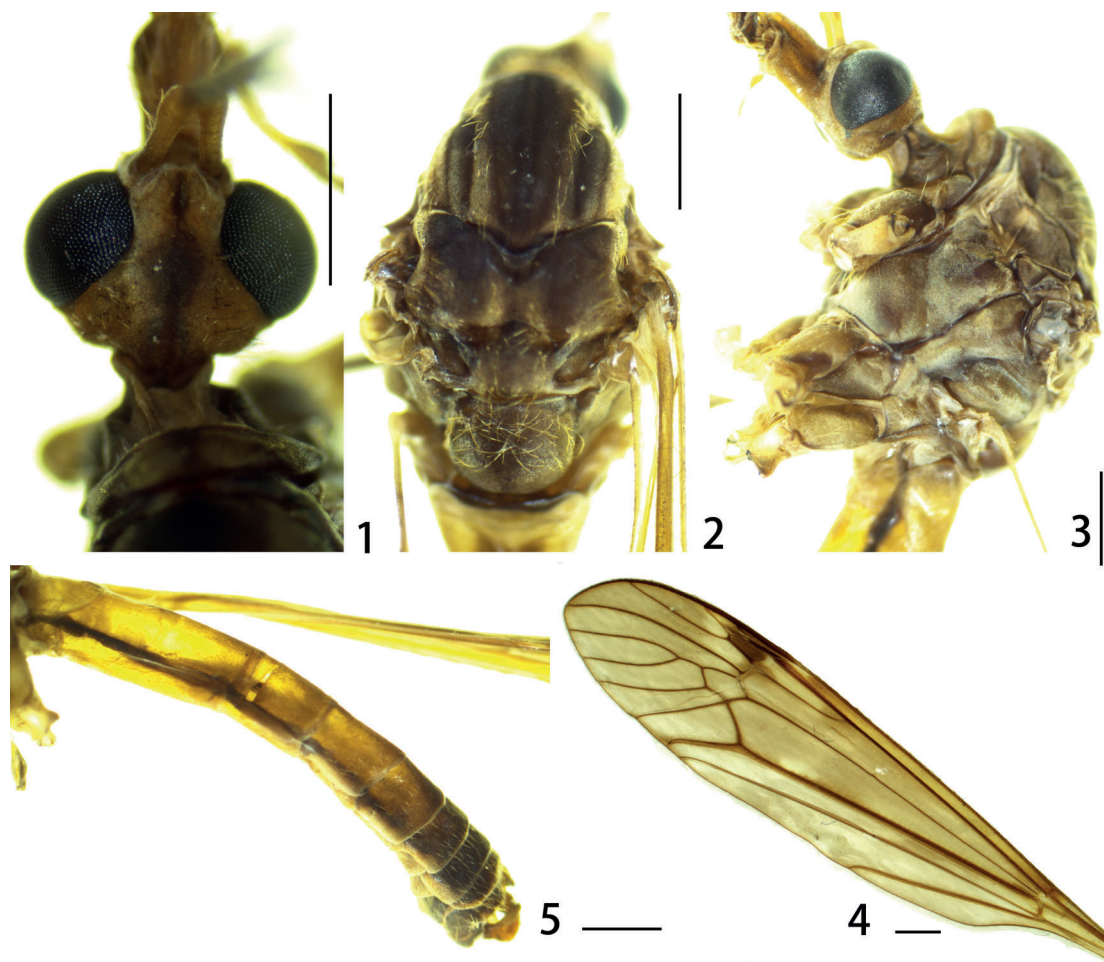
***Tipula (Vestiplex) cibagouensis* sp. nov.**

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Figs 1–15

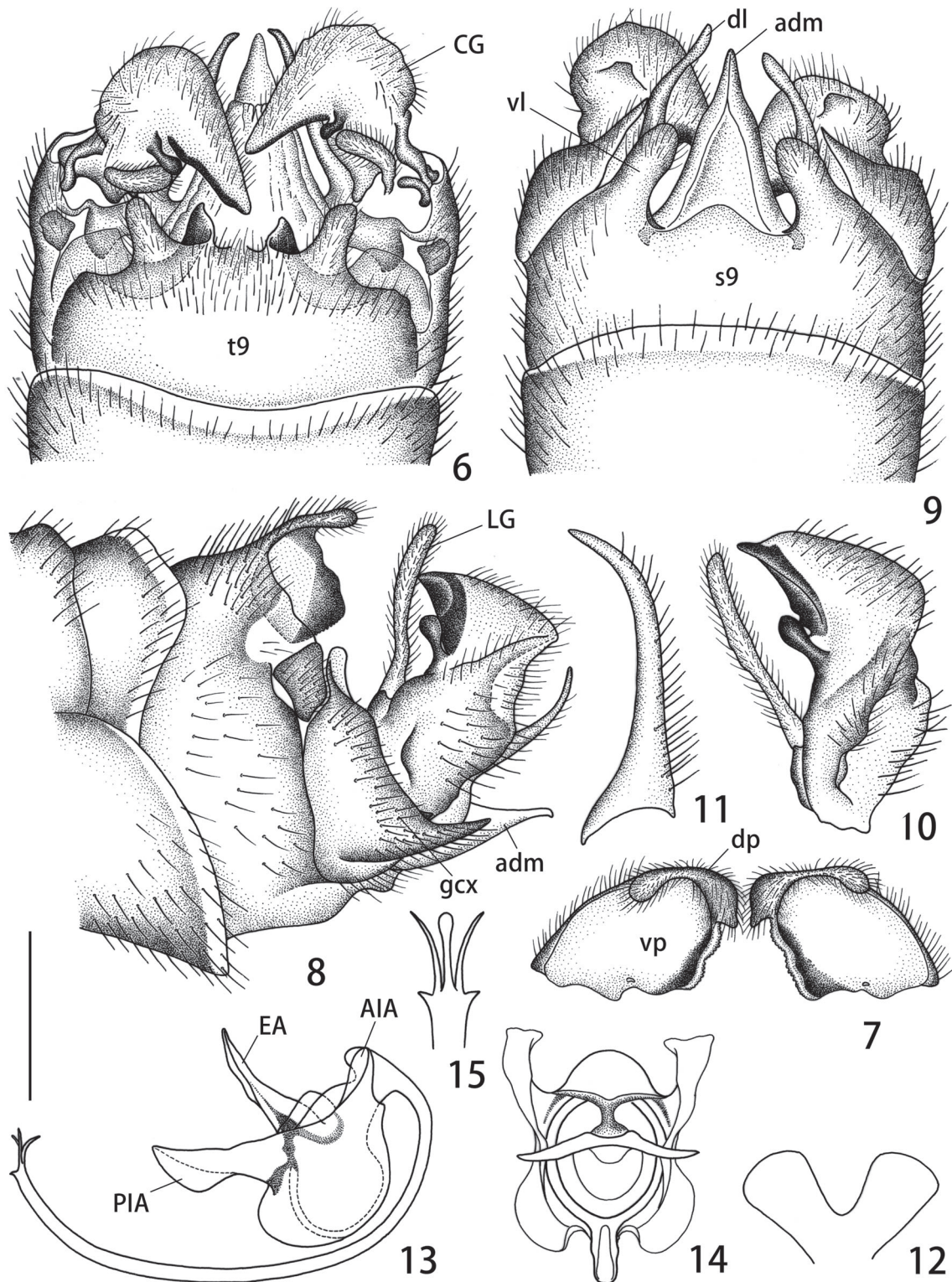
### Diagnosis

*Tipula (Vestiplex) cibagouensis* sp. nov. can be recognized by the tergite nine having a pair of thumb-shaped lobes at posterior border and a pair of black, nearly triangular lobes; gonocoxite bearing caudally pointed spine and blade-shaped, apically obtuse dorsal lobe of A9S; antenna reaching base of wing if



**Figs 1–5.** *Tipula (Vestiplex) cibagouensis* sp. nov., ♂, holotype (coll. Inse-XZ3768). 1. Head, dorsal view. 2. Thorax, dorsal view. 3. Thorax, lateral view. 4. Wing. 5. Abdomen, lateral view. Scale bars = 1.0 mm.





**Figs 6–15.** *Tipula (Vestiplex) cibagouensis* sp. nov., ♂, holotype (coll. Inse-XZ3768). 6. Hypopygium, dorsal view. 7. Tergite nine, ventral view. 8. Hypopygium, lateral view. 9. Hypopygium, ventral view. 10. Left lobe and clasper of gonostylus, lateral view. 11. Dorsal lobe of A9S. 12. Ejaculatory apodeme of semen pump. 13. Semen pump, lateral view. 14. Semen pump, dorsal view. 15. Apex of aedeagus. Abbreviations: see Material and methods. Scale bars: 6–11 = 0.5 mm; 12–14 = 0.6 mm; 15 = 0.25.

bent backward, flagellum brown, except yellow base of the first flagellomere; wing light brown with dark brown stigma; basal five abdominal segments yellow, trivittate, rest abdominal segments including hypopygium dark brown.

### Etymology

The specific epithet refers to the type locality of new species, Cibagou National Nature Reserve, Chayu County, Tibet, China; adjective.

### Material examined

#### Holotype

CHINA • ♂; Tibet, Chayu County; Cibagou National Nature Reserve; 6 Jun. 2019; Q. Men and Lin Lv leg.; AQNU.

#### Paratypes

CHINA • 2 ♂♂; Tibet, Chayu County, Shangchayu; 8 Jun. 2019; Q. Men and Lin Lv leg.; AQNU.

### Comparative Other material examined

INDIA • ♂; holotype of *Tipula (Vestiplex) wahlgrenana* Alexander, 1968; Kumaon, Khumyara, Pauri Garhwal; alt. 4300–5000 feet; 28 May 1958; F. Schmid leg.; antennae, leg, wing and genitalia on slide mounted; USNM.

INDIA • ♂; holotype of *Tipula (Vestiplex) execestyla* Alexander, 1964; Manipur, Sirhoi Kashong; alt. 7500 feet; 13 Jul. 1960; F. Schmid leg.; USNM • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; Manipur, Sirhoi Kasong; alt. 7500 feet; 11 Jul. 1960; F. Schmid leg.; antennae, leg, wing and genitalia on slide mounted; USNM • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; same collection data as for preceding; USNM • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; Manipur, Hkayam Boum; alt. 8500 feet; 21 Jun. 1960; F. Schmid leg.; antenna, leg, wing and genitalia on slide mounted; USNM • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; Manipur, Sirhoi Kasong; alt. 6000 feet; 8 Jun. 1960; F. Schmid leg.; antenna, legs, wing and genitalia on slide mounted; USNM • 2 ♂♂; paratypes of *Tipula (Vestiplex) execestyla*; same collection data as for preceding; USNM • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; Manipur, Sirhoi Kasong; alt. 7500 feet; 11 Jul. 1960; F. Schmid leg.; antennae, leg, wing and genitalia on slide mounted; USNM • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; same collection data as for preceding; ZIN • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; Manipur, Hkayam Boum; alt. 8500 feet; 21 Jun. 1960; F. Schmid leg.; BMNH(E)#246044; BMNH • 1 ♂; paratype of *Tipula (Vestiplex) execestyla*; Manipur, Sirhoi Kasong; alt. 7500 feet; 12 Jul. 1960; F. Schmid leg.; ZFMK.

MYANMAR • ♂; holotype of *Tipula (Vestiplex) gandharva* Alexander, 1951; Adung Valley, Camp I; alt. 8000 feet; 4 Jun. 1931; Kingdon Ward and Lord Cranbrook leg.; antenna, leg, wing and genitalia on slide mounted; USNM.

### Description

#### Male (Figs 1–15)

MEASUREMENTS. Body length 11.5–11.8 mm (excluding antenna,  $n = 3$ ), wing length 17.1–17.4 mm ( $n = 3$ ), length of antenna 3.5–3.7 mm ( $n = 3$ ). General body coloration brownish-yellow.

HEAD (Fig. 1). Rostrum with nasus yellow, densely covered with yellow setae. Eye black. Occiput and vertex yellow, medially with black line and rhombic marking (Fig. 1). Antenna 13-segmented, if

bent backward reaching base of wing. Scape yellow, cylindrical, slightly expanded at apex; pedicel yellow, oval. First flagellomere yellow except apical third brown, rest flagellomeres brown, basal five flagellomeres subequal in length to each other, remaining segments progressively shortened and thinned, last flagellomere oval. Each flagellomere except first one enlarged at base, with five yellow longest verticils. Verticils slightly longer than corresponding flagellomeres, surface of each flagellomere densely covered with short brown setae. Palpus yellow.

**THORAX** (Figs 2–3). Pronotum yellow with lateral regions darker in coloration, medially with darkened vitta. Prescutum and presutural scutum brownish with four brown longitudinal stripes, bordered by darker brown (Fig. 2). Intermediate pair separated, interspaces gray, densely covered with short yellow setae (Fig. 2). Postsutural scutum brown, scutal lobes each with two dark brown spots, lower one distinctly bigger (Fig. 2). Scutellum brownish with dark brown median vitta (Fig. 2). Mediotergite dark brown with broad black median line (Fig. 2). Pleura brownish, thinly dusted with grey (Fig. 3). Leg with coxa and trochanter yellow, femur yellow with darkened tip, tibia and tarsal segments dark brown. Wing light brown, cell c more yellowish than ground color, stigma dark brown, variegated by light areas including apical area of cell c and most part of 1<sup>st</sup> cell of cell  $r_1$ , light band across apical area of cell  $r_1$ , base of cells  $r_3$ ,  $r_4$  and  $r_5$ , and basal area of discal cell; rest light area including basal and medial areas of bm, basal half of posterior cubital cell, and basal area of anal cells (Fig. 4).

**WING VENATION.**  $R_1$  complete,  $R_3$  almost same length to  $R_{2+3+4}$ ,  $R_4$  slightly longer than  $R_s$ ,  $R_5$  curved at apical half, base of  $R_5$   $2.0 \times$  as long as r-m, discal cell narrow, at least  $2.0 \times$  as long as petiole of cell  $m_1$ ,  $M_1$  almost  $4.4 \times$  as long as its petiole (Fig. 4). Halter pale yellow, knob basally black, densely covered with black setae, apically pale yellow.

**ABDOMEN** (Fig 5). Basal five abdominal segments yellow with brown lateral and median stripes, lateral stripes gradually broader and heavier, median stripe broad and intermittent, rest abdominal segments including hypopygium dark brown (Fig. 5).

**HYPOPYGIUM** (Figs 6–15). Hypopygium with tergite nine and sternite nine not separated. Tergite nine completely divided at midline by pale membrane (Figs 6–7). Dorsal portion of tergite nine with pair of thumb-shaped lobes at posterior border, obtuse at lateral corners (Figs 6–8). Ventral portion of tergite nine broad, its inner margin with pair of strongly sclerotized, black, nearly triangular lobes which are protruding and can be observed in dorsal view; inner margin of lobes bearing microscopic serration (Figs 7–8). Gonocoxite separated from sternite nine totally, broad basally and narrowed to caudally pointed spine (Figs 8–9). Lobe of gonostylus narrow and elongated (Figs 6, 8, 10). Clasper of gonostylus slightly elongated and flattened; upper beak black and acute, beneath preceded by black rod; lower beak black, oval lobe; dorsal margin with obtuse angle (Figs 6, 8–10). Sternite nine with ventral lobe of A9S strong, thumb-like, densely covered with long setae (Fig. 9); dorsal lobe of A9S blade-shaped, broad basally, gradually narrowed to obtuse apex (Fig. 11). Adminiculum triangular in ventral view, with broad base and narrow apex; median portion protruded (Fig. 9). Semen pump with central vesicle swollen (Fig. 13). Ejaculatory apodeme with deep V-shaped median incision, lateral arms truncated apically, subequal in length to posterior immovable apodeme (Figs 12, 14). Posterior immovable apodeme basally narrow, truncated at broadened apex (Fig. 14). Anterior immovable apodeme narrow, round at outer margin in dorsal view (Fig. 14). Aedeagus thick, almost same thickness throughout, apex terminating with pair of slender lateral spines and median rod; aedeagus less than  $2.0 \times$  as long as semen pump (Figs 13, 15).

### **Female**

Unknown.



## Remarks

*Tipula (V.) cibagouensis* sp. nov. is considered here as a member of the *T. (V.) subtincta* species group, which was proposed by Savchenko (1964), with a list of species revised by Starkevich (2012) and following the discussion in Pilipenko & Strakevich (2020). The nearest allies are *T. (V.) wahlgrenana* Alexander, 1968 (India), *T. (V.) exechostyla* Alexander, 1964 (India) and *T. (V.) gandharva* Alexander, 1951 (India, Myanmar) based on the shape of the male hypopygium. All species are characterized by their the dorsal portion of tergite nine having a pair of lobes at posterior border and elongated blade-shaped dorsal lobes of A9S. The new species can easily be separated from *T. (V.) wahlgrenana* by a brown flagellum, which is bicolored in the latter (Starkevich & Podenas 2014: figs 1–3). In addition, *T. (V.) wahlgrenana* has two acute, blackened spines on the gonocoxite and dorsal lobe of A9S with a black apex while the new species is characterized by a single spine on the gonocoxite and a yellow apex of dorsal lobe of A9S. *Tipula (V.) exechostyla* can be separated by the gonocoxite ventromesally extended into a long acute black spine, clasper of gonostylus bearing conspicuous blackened lobe (Alexander 1964: pl. 6 fig. 49) while the new species is characterized by a gonocoxite with an apically situated, not blackened spine and a clasper of the gonostylus dorsally with an obtuse angle, without blackened lobe. *Tipula (V.) gandharva* can be separated by a femur having a yellow subterminal ring, the gonocoxite terminating into a short stout spine (Alexander 1953: fig. 8c) while the new species bears a femur without subterminal ring and a gonocoxite having a long spine.

### *Tipula (Vestiplex) medialobata* sp. nov.

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Figs 16–27

## Diagnosis

*Tipula (V.) medialobata* sp. nov. can be recognized by the tergite nine having posterolateral corners ear-like and black narrow, serrated rods; gonocoxite having two small points on apex and a black long spine on mesoventral portion; clasper of gonostylus with medial surface raised into blackened, nearly rectangular lobe and long, blade-shaped dorsal lobe of A9S apically blackened and sharp; antenna reaching base of wing if bent backwards, flagellum brown; wing light brown with dark brown stigma.

## Etymology

The specific epithet is derived from the Latin ‘*lobata*’ with prefix ‘*media*’, referring to the lobe in the middle area of the clasper of the gonostylus.

## Material examined

### Holotype

CHINA • ♂; Yunnan, Gongshan County; Bingzhongluo, Zhanatong; 11 Jul. 2019; Q. Men and Lin Lv leg.; AQNU.

### Paratypes

CHINA • 3 ♂♂; Yunnan, Gongshan County; Bingzhongluo, Gongdangshenshan Mountain; 12 Jul. 2019; Q. Men and Lin Lv leg.; AQNU.

## Comparative material examined

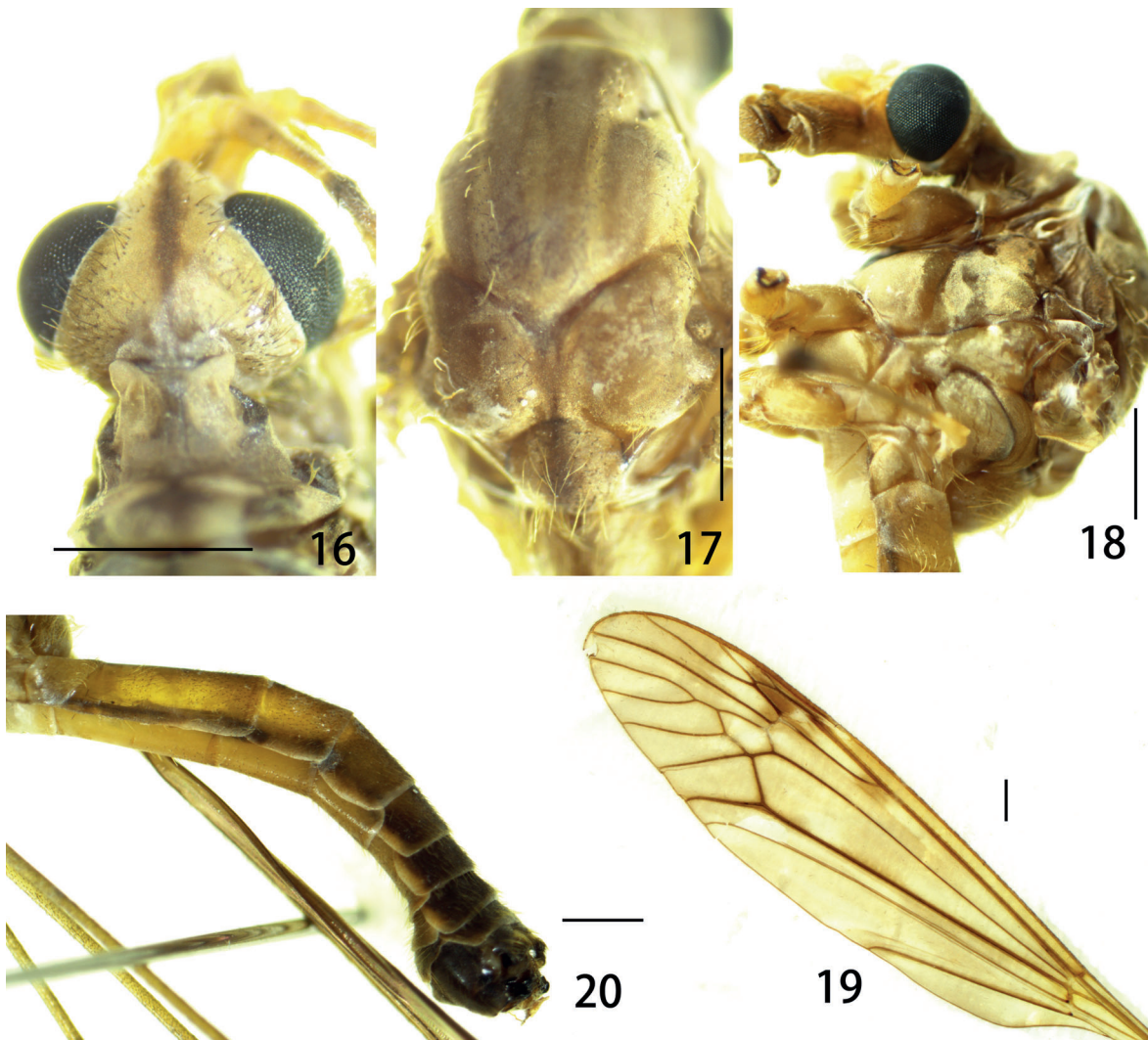
INDIA • 3 ♂♂; holotype of *Tipula (Vestiplex) tillyardana* Alexander, 1970; Assam [Arunachal Pradesh]; Shergaon, Kameng; North East Frontier Agency; alt. 6100 feet; 5 May 1961; F. Schmid leg.; antenna, leg, wing and genitalia on slide mounted; USNM.

## Description

### Male (Figs 16–27)

MEASUREMENTS. Body length 12.5–12.7 mm (excluding antenna,  $n = 4$ ), wing length 18.1–18.3 mm ( $n = 4$ ), length of antenna 3.6–3.7 mm ( $n = 4$ ). General body coloration yellowish-brown.

HEAD (Fig. 16). Rostrum with nasus yellowish, densely covered with brown setae. Eye black. Occiput and vertex yellowish, medially with dark-brown stripe broadened medially and narrowed at each end (Fig. 16). Antenna 13-segmented, if bent backward reaching base of wing. Scape yellow, cylindrical, slightly expanded at apex. Pedicel yellow, oval. First flagellomere yellowish-brown, rest flagellomeres brown, basal four flagellomeres almost same length to each other, remaining segments progressively shortened and thinned, last flagellomere oval. Each flagellomere except first one enlarged at base, with five longest yellow verticils. Verticils slightly longer than corresponding flagellomeres, surface of each flagellomere densely covered with short brown setae. Palpus yellow.



**Figs 16–20.** *Tipula (Vestiplex) medialobata* sp. nov., ♂, holotype (coll. Inse-YN0501). **16.** Head, dorsal view. **17.** Thorax, dorsal view. **18.** Thorax, lateral view. **19.** Wing. **20.** Abdomen, lateral view. Scale bars = 1.0 mm.



**THORAX** (Figs 17–18). Pronotum yellow with lateral regions darker in coloration, medially with dark spot. Prescutum and presutural scutum yellowish-brown, with four brown longitudinal stripes, narrowly bordered by darker brown (Fig. 17). Intermediate pair separated. Interspaces thinly dusted with gray, densely covered with short yellow setae (Fig. 17). Postsutural scutum brown, scutal lobes each with two darker brown separated triangular spots. Scutellum brownish with dark brown median vitta, densely covered with yellow setae (Fig. 17). Mediotergite dark brown with broad black median line (Fig. 17). Pleura brownish-yellow, thinly dusted with grey (Fig. 18). Leg with coxa and trochanter yellow, femur yellow with darkened tip, tibia and tarsal segments dark brown. Wing light brown, cell c more yellowish than ground color, stigma dark brown, variegated by light areas including apical area of cell c, and basal half of 1<sup>st</sup> cell of cell  $r_1$ , light band across apical area of cell  $r_1$ , base of cells  $r_3$ ,  $r_4$  and  $r_5$ , and medial area of discal cell; rest light area including basal and apical areas of basal radial cell, distal and basal areas of bm, and apical area of posterior cubital cell (Fig. 19).

**WING VENATION.**  $R_1$  complete,  $R_3$   $1.2 \times$  as long as  $R_{2+3+4}$ ,  $R_4$   $1.1 \times$  as long as  $R_s$ ,  $R_5$  curved at apical half, base of  $R_5$  distinctly longer than r-m, discal cell narrow, at least  $2.3 \times$  as long as petiole of cell  $m_1$ ,  $M_1$  almost  $4.4 \times$  as long as its petiole (Fig. 19). Halter pale yellow, knob basally black, densely covered with black setae, apically pale yellow.

**ABDOMEN** (Fig. 20). Basal four tergites yellow with brown lateral and intermittent median stripes, tergites 5–8 brown with yellow lateral regions, basal five sternites entirely yellow, sternites six to eight gradually heavier to dark brown, hypopygium dark brown (Fig. 20).

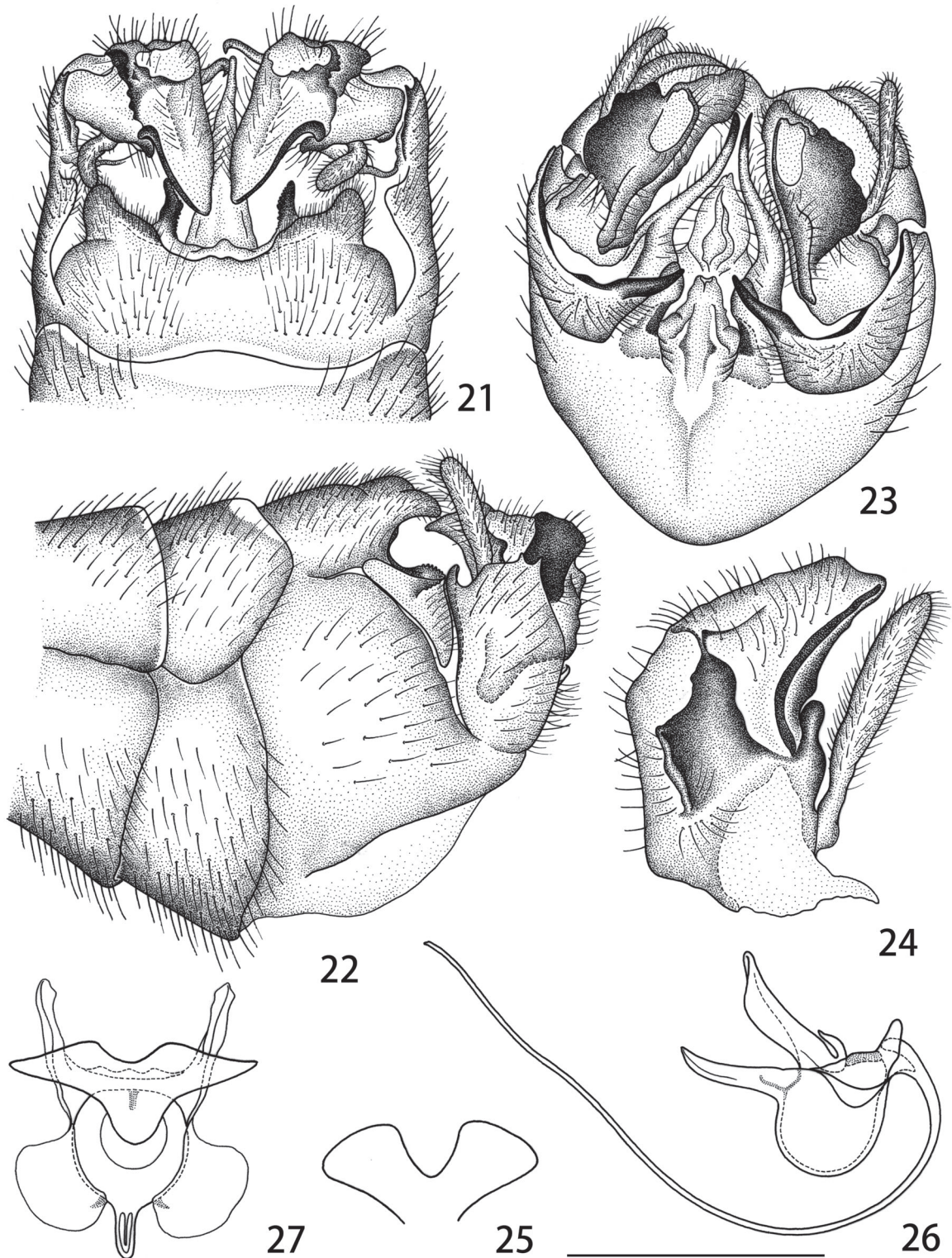
**HYPOPYGIUM** (Figs 21–27). Hypopygium with tergite nine and sternite nine separated except base (Figs 21–22). Tergite nine completely divided at midline by pale membrane (Fig. 21). Dorsal portion of tergite nine shallowly emarginated medially, terminating into pair of ear-like lobes on lateral corners which is densely covered with setae (Fig. 21). Ventral portion of tergite nine possessing pair of black narrow rods which are serrated on inner margins (Fig. 21). Gonocoxite separated from sternite nine except ventral area, massive, with two small points on apex and black long spine on mesoventral portion only observed in ventral view (Figs 22–23). Lobe of gonostylus narrow and elongated (Fig. 24). Clasper of gonostylus with upper beak broad and obtuse, preceded by black ridge along mesal margin; lower beak blackened oval lobe; medial surface raised into blackened, nearly rectangular lobe (Fig. 24). Sternite nine with ventral lobe of A9S thumb-like, dorsal lobe of A9S blade-shaped, broad at base, gradually narrowed to sharp black apex (Fig. 23). Adminiculum relatively short, nearly triangular in ventral view, truncated apically; median portion protruded into distinct sclerite (Fig. 23). Semen pump with central vesicle swollen (Fig. 26). Ejaculatory apodeme with deep V-shaped median incision, lateral arms expanded apically (Fig. 25). Posterior immovable apodeme narrow (Fig. 26). Anterior immovable apodeme distinctly broad, round in dorsal view (Fig. 27). Aedeagus thick at base, gradually narrowed to apex, more than  $3.5 \times$  as long as semen pump (Fig. 26).

### **Female**

Unknown.

### **Remarks**

*Tipula (V.) medialobata* sp. nov. is assigned to the *T. (V.) subtica* species group. The new species is very similar to *T. (V.) tillyardana* Alexander, 1970, from Arunachal Pradesh, India, by details of tergite nine. Posterolateral corners of tergite nine are extended into lobes in both species, but still differs by the shape: *T. (V.) medialobata* sp. nov. has lobes ear-shaped while the lobes are obliquely truncated in *T. (V.) tillyardana* (Alexander 1970: fig. 37). They can also be separated by the gonocoxite which apically has two points in the new species while only a small blackened spine is present in *T. (V.) tillyardana*; the mesoventral portion of the gonocoxite has a black spine in the new species while a curved arm



**Figs 21–27.** *Tipula (Vestiplex) medialobata* sp. nov., ♂, holotype (coll. Inse-YN0501). **21.** Hypopygium, dorsal view. **22.** Hypopygium, lateral view. **23.** Hypopygium, ventral view. **24.** Right lobe and clasper of gonostylus, lateral view. **25.** Ejaculatory apodeme of semen pump. **26.** Semen pump, lateral view. **27.** Semen pump, dorsal view. Scale bars: 21–23 = 1.0 mm; 24 = 0.5 mm; 25–27 = 1.2 mm.



with microscopic points is present in *T. (V.) tylliardana*. Also, the new species is distinguished by a clasper of the gonostylus bearing a blackened lobe on the medial surface while such a lobe is absent in *T. (V.) tylliardana*.

*Tipula (Vestiplex) paramonovi* sp. nov.

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Figs 28–40

**Diagnosis**

*Tipula (V.) paramonovi* sp. nov. can be recognized by unarmed gonocoxite and tergite nine ventrally bearing a pair of strongly blackened elongated rods which are greatly expanded at base; antenna reaching base of wing if bent backward, flagellum brown; wing light brown, cell c more yellowish than ground color, stigma dark brown; basal four abdominal segments yellow, trivittate, rest dark brown.

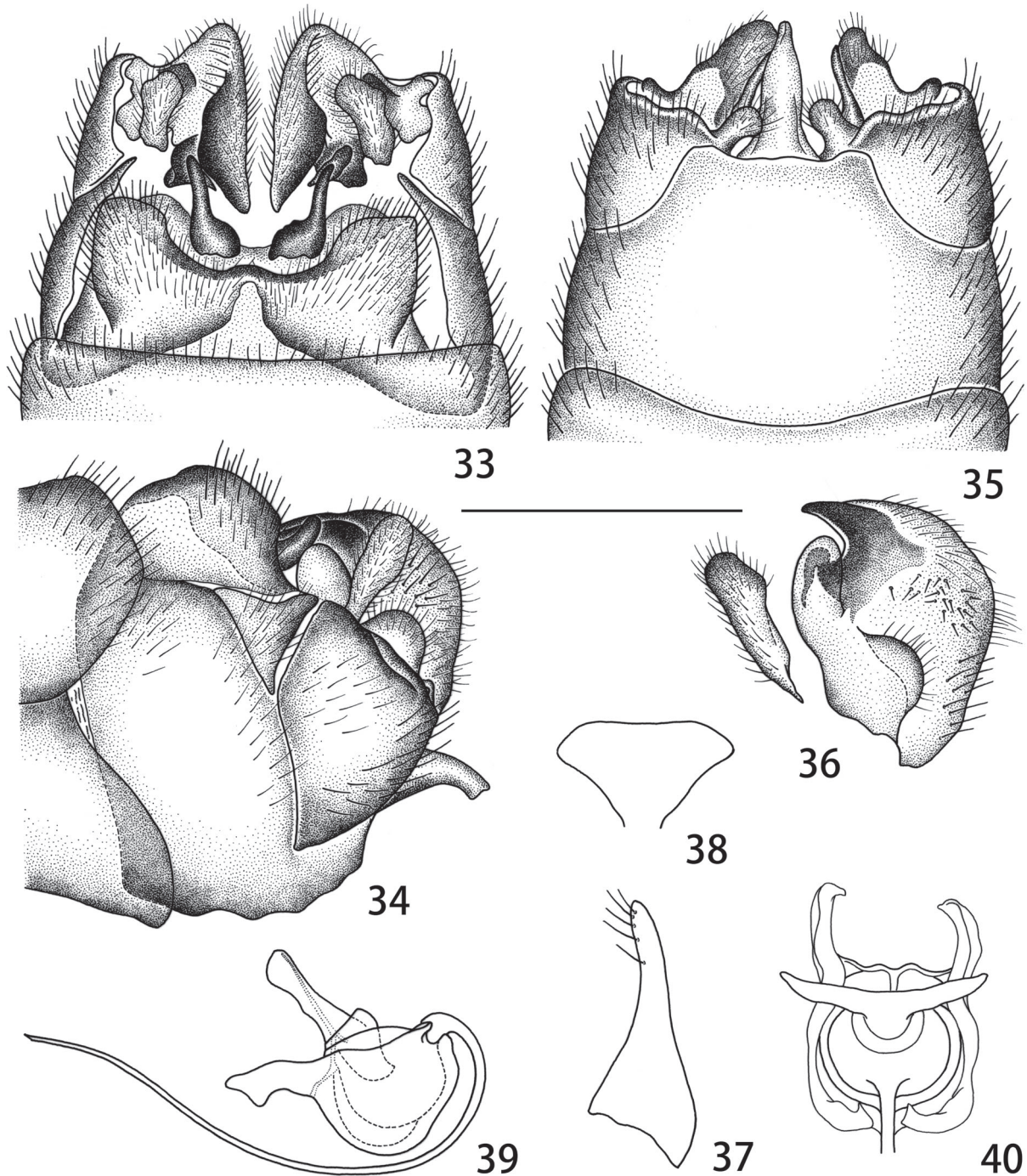


**Figs 28–32.** *Tipula (Vestiplex) paramonovi* sp. nov., ♂, holotype (coll. Inse-XZ3769) . 28. Head, dorsal view. 29. Thorax, dorsal view. 30. Thorax, lateral view. 31. Wing. 32. Abdomen, lateral view. Scale bars = 1.0 mm.



### Etymology

The species is named after our colleague and crane fly researcher Dr Nikolai M. Paramonov (Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia).



**Figs 33–40.** *Tipula (Vestiplex) paramonovi* sp. nov., ♂, holotype (coll. Inse-XZ3769). **33.** Hypopygium, dorsal view. **34.** Hypopygium, lateral view. **35.** Hypopygium, ventral view. **36.** Left lobe and clasper of gonostylus, lateral view. **37.** Dorsal lobe of A9S. **38.** Ejaculatory apodeme of semen pump. **39.** Semen pump, lateral view. **40.** Semen pump, dorsal view. Scale bars: 33–36 = 1.0 mm; 37–40 = 1.2 mm.

## Material examined

### Holotype

CHINA • ♂; Tibet, Bomi, Zhuolonggou; 31 May 2019; Q. Men and Lin Lv leg.; AQNU.

### Paratypes

CHINA • 2 ♂♂; same collection data as for holotype; AQNU.

## Comparative material examined

CHINA • ♂; holotype of *Tipula (Vestiplex) zayulensis* Alexander, 1963; S.E. Tibet, Ata Kang; alt. 8000 feet; 29 May 1933; F. Kingdon Ward and R.J.H. Kaulback leg.; BMNH(E)#246045; BMNH • 1 ♀; paratype of *Tipula (Vestiplex) zayulensis* Alexander, 1963; S.E. Tibet, Zayul; alt. 8000 feet; 6 Jun. 1933; F. Kingdon Ward and R.J.H. Kaulback leg.; BMNH(E)#246046; BMNH • 1 ♂; paratype of *Tipula (Vestiplex) zayulensis* Alexander, 1963; same collection data as for preceding; 3 Jun. 1933; BMNH(E)#246047; BMNH • 1 ♀; paratype of *Tipula (Vestiplex) zayulensis* Alexander, 1963; S.E. Tibet, Lepa Chu Valley; alt. 12000 feet; 6 Jul. 1935; R.J.H. Kaulback leg.; BMNH(E)#246048; BMNH.

### Other material

Listed in Starkevich *et al.* (2019a).

## Description

### Male (Figs 28–40)

MEASUREMENTS. Body length 13.2–13.4 mm (excluding antenna,  $n = 3$ ), wing length 20.0–20.2 mm ( $n = 3$ ), antenna length 3.8–4.0 mm ( $n = 3$ ). General body coloration brownish-yellow.

HEAD (Fig. 28). Rostrum with nasus brown, densely covered with yellow setae. Eye black. Occiput and vertex brown, medially with black vitta (Fig. 28). Antenna 13-segmented, if bent backward reaching base of wing. Scape yellow, cylindrical, slightly expanded at apex. Pedicel yellow, oval. Flagellum entirely brown except first flagellomere having slightly yellow basal third. First flagellomere longest, subequal in length to scape, remaining segments progressively shortened and thinned. Each flagellomere except first one enlarged at base, with five longest yellow verticils. Longest verticils slightly longer than corresponding flagellomeres, surface of each flagellomere densely covered with short yellow setae. Palpus with basal three segments brown, apical segment lighter in coloration.

THORAX (Figs 29–30). Pronotum brown with medial region lighter in coloration. Prescutum and presutural scutum brown with four dark brown longitudinal stripes, intermediate pair fused with black median vitta (Fig. 29). Interspaces gray, densely covered with short white setae (Fig. 29). Postsutural scutum brown, scutal lobes each with two dark brown spots (Fig. 29). Scutellum brown, with darker median line and short white setae (Fig. 29). Mediotergite brown with black median line (Fig. 29). Pleura brown, thinly dusted with grey (Fig. 30). Leg with coxa and trochanter yellow, femur yellow with darkened tip, tibia and tarsal segments dark brown. Wing light brown, cell c more yellowish than ground color, stigma dark brown, variegated by light areas including apical area of cell c, and medial and basal areas of 1<sup>st</sup> cell of cell  $r_1$ , light band across apical area of cell  $r_1$ , base of cells  $r_3$ ,  $r_4$  and  $r_5$ , and median area of discal cell; rest light area including base and apical areas of bm (Fig. 31).

WING VENATION.  $R_1$  complete,  $R_3$  1.4 times as long as  $R_{2+3+4}$ ,  $R_4$  slightly longer than  $R_5$ ,  $R_5$  curved at apical half, r-m as long as base of  $R_5$ , discal cell narrow, at least  $2.3 \times$  as long as petiole of cell  $m_1$ ,  $M_1$  almost  $3 \times$  as long as its petiole (Fig. 31). Halter pale yellow, knob basally brown, apically pale yellow.

ABDOMEN (Fig. 32). Basal four abdominal segments yellow with brown lateral and median stripes, latter broad and intermittent, rest abdominal segments including hypopygium dark brown (Fig. 32).

HYPOPYGIUM (Figs 33–40). Hypopygium compressed, with tergite nine and sternite nine totally separated (Figs 33–34). Tergite nine completely divided at midline by pale membrane (Fig. 33). Dorsal portion of tergite nine deeply emarginated on posterior margin, strongly concaved on anterior margin, almost divided dorsal portion into two lobes. Ventral portion of tergite nine bearing pair of strongly blackened elongated rods; base of rods expanded and broadened (Fig. 33). Gonocoxite short, without projections (Figs 34–35). Lobe of gonostylus small, slightly flattened apically (Fig. 36). Clasper of gonostylus rounded at dorsal margin, terminating into black and acute beak; lower beak splitted into rounded transparent lobe and small, heavily blackened point; rounded lobe generated from base, its margin densely covered with long setae; many short and straight spines covered in medial area (Fig. 36). Sternite nine with ventral lobe of A9S rounded and expanded, densely covered with long setae (Fig. 35); dorsal lobe of A9S broad in basal half, from middle gradually narrowed to obtuse apex (Fig. 37). Adminiculum nearly triangular in ventral view, broadened basally, gradually narrowed to truncated apex; distal part curved ventral in lateral view (Figs 34–35). Semen pump with central vesicle swollen (Fig. 39). Ejaculatory apodeme fan-shaped, truncated apically, as long as posterior immovable apodeme (Fig. 38). Posterior immovable apodeme expanded and truncated at apex in lateral view (Fig. 39); curved directed inward in dorsal view (Fig. 40). Anterior immovable apodeme narrow (Fig. 40). Aedeagus thick basally, gradually thinned to apex, more than  $2.0 \times$  as long as semen pump (Fig. 39).

#### Female

Unknown.

#### Remarks

*Tipula (V.) paramonovi* sp. nov. is considered here as a member of the *T. (V.) divisotergata* species group, which was proposed by Savchenko (1964), with following discussion (Strakevich *et al.* 2019a). The new species is close to *T. (V.) zayulensis* Alexander, 1963 by the shape of the dorsal portion of tergite nine and the compact, rounded clasper of the gonostylus. Both species can be separated by the ventral armatures of tergite nine which are elongated and distinctly expanded at the base in *T. (V.) paramonovi* sp. nov. while small and narrow in *T. (V.) zayulensis* (Alexander 1963: fig. 7). And also, *T. (V.) zayulensis* has a yellow subterminal ring on the femur while such a ring is absent in *T. (V.) paramonovi* sp. nov.

#### Distribution

China (Tibet).

#### *Tipula (Vestiplex) singularis* sp. nov.

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Figs 41–55

#### Diagnosis

The new species can be recognized by unarmed gonocoxite apically bearing small point, tergite nine ventrally bearing flashy lobes and specific narrow blackened ridge on either side of midline, clasper of gonostylus basally having remarkable angular lobe and reduced dorsal lobe of A9S; antenna reaching base of wing if bent backward, flagellum brown, except yellow base of the first flagellomere; wing light brown with dark stigma; basal four abdominal segments yellow, trivittate, rest of segments black.



### Etymology

The specific epithet is an adjective derived from the Latin '*singularis*' meaning 'single', referring to the singular, finger-shaped rod on the gonocoxite.

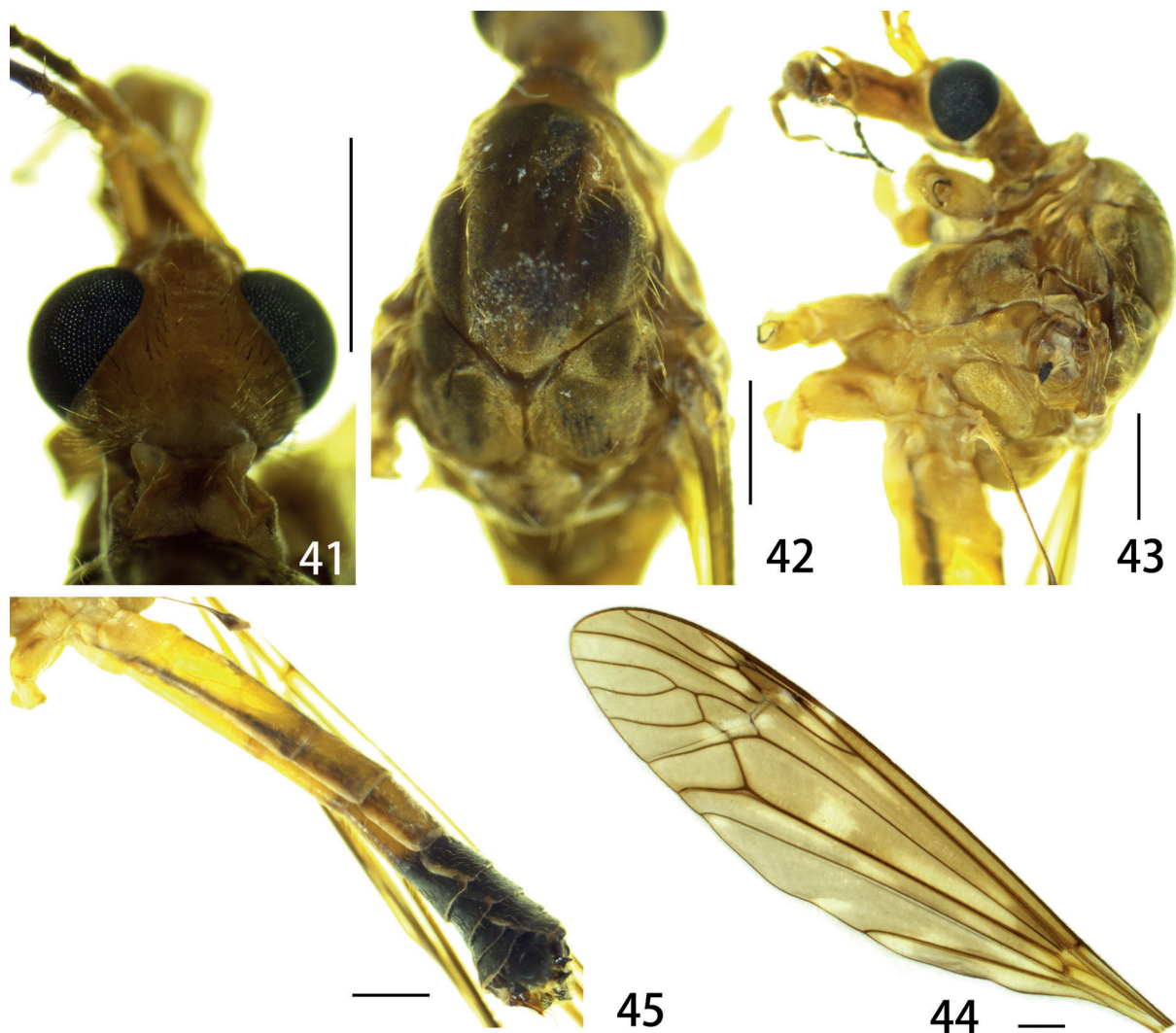
### Material examined

#### Holotype

CHINA • ♂; Yunnan, Gongshan County, Bingzhongluo, Gongdangshenshan Mountain; 12 Jun. 2019; Men Qiulei and Lv Lin leg.; AQNU.

#### Paratype

CHINA • 1 ♂; Yunnan, Lushui County, Pianma; 19 Jun. 2019; Q. Men and Lin Lv leg.; AQNU.



**Figs 41–45.** *Tipula (Vestiplex) singularis* sp. nov., ♂, holotype (coll. Inse-YN0502). **41.** Head, dorsal view. **42.** Thorax, dorsal view. **43.** Thorax, lateral view. **44.** Wing. **45.** Abdomen, lateral view. Scale bars = 1.0 mm.

**Comparative material examined**

INDIA • ♂; holotype of *Tipula (Vestiplex) immsiana* Alexander, 1970; Assam [Arunachal Pradesh]; Talung Dzong, Kameng; North East Frontier Agency; alt. 7600 feet; 5 Jun. 1961; Schmid leg.; antenna, leg, wing and genitalia on slide mounted; USNM • 1 ♂; paratype of *Tipula (Vestiplex) immsiana* Alexander, 1970; same collection data as for holotype; USNM.

**Description****Male** (Figs 41–55)

MEASUREMENTS. Body length 12.0–12.2 mm (excluding antenna,  $n = 2$ ), wing length 18.1–18.3 mm ( $n = 2$ ), antenna length 3.8–3.9 mm ( $n = 2$ ). General body coloration yellowish.

HEAD (Fig. 41). Rostrum with nasus yellow, densely covered with yellow setae. Eye black. Occiput and vertex yellowish, without marking (Fig. 41). Antenna 13-segmented, if bent backward reaching base of wing. Scape yellow, cylindrical, slightly expanded at apex, distinctly longer than first flagellomere. Pedicel yellow, oval. Flagellum entirely brown except first flagellomere having slightly yellow basal fourth. Each flagellomere except first one enlarged at base, with five brown longest verticils. Longest verticils significantly longer than corresponding segments, surface of each flagellomere densely covered with short yellow setae. Palpus yellow.

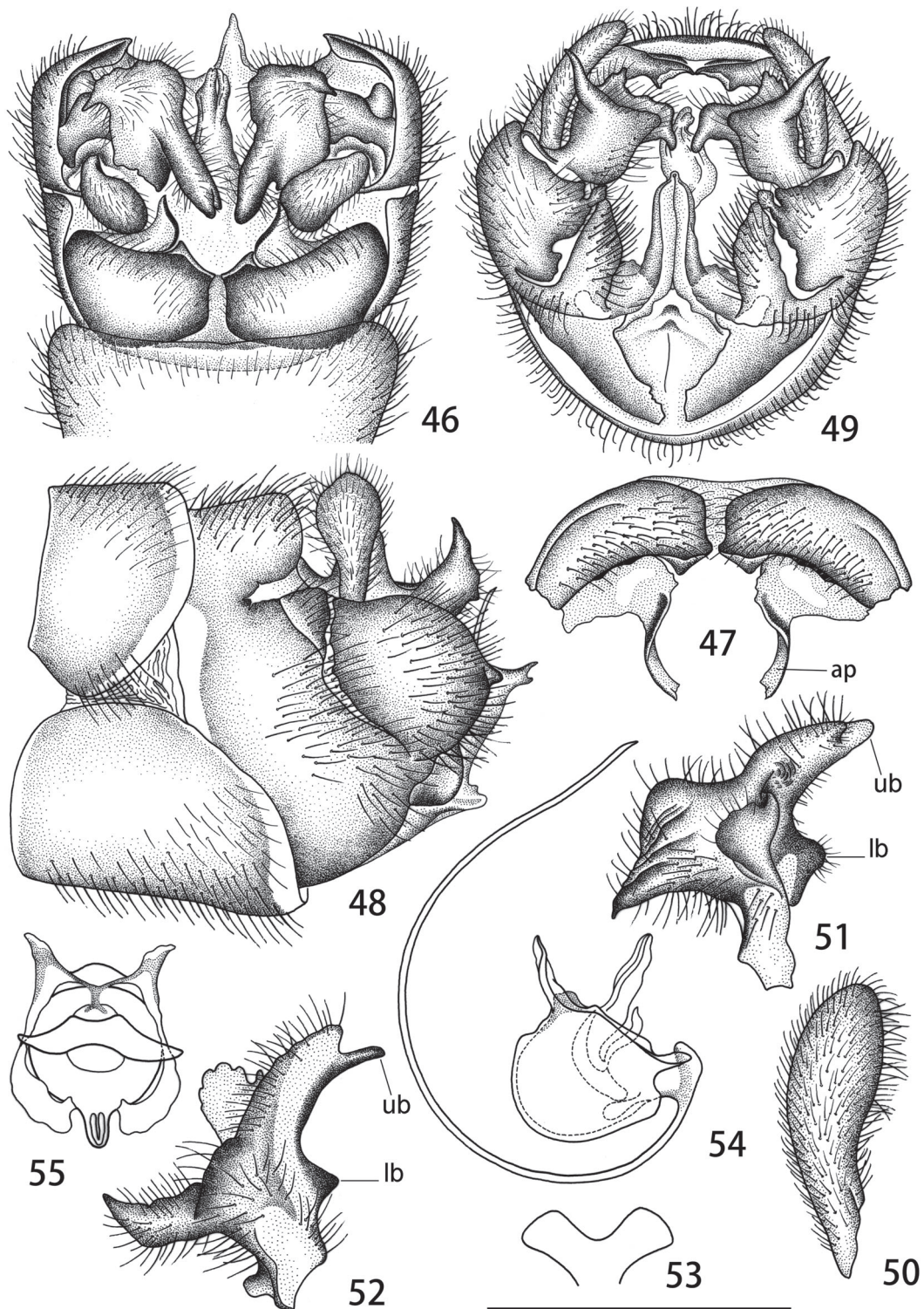
THORAX (Figs 42–43). Pronotum yellow with medial region brown. Prescutum and presutural scutum brownish with four dark brown longitudinal stripes, intermediate fused with narrow median line (Fig. 42). Interspaces gray, densely covered with short white setae (Fig. 42). Postsutural scutum brown, scutal lobes each with two dark brown triangular separated spots (Fig. 42). Scutellum brown with broad black vitta, covered with short yellow setae (Fig. 42). Mediotergite dark brown with black vitta (Fig. 42). Pleura yellowish, thinly dusted with grey (Fig. 43). Leg with coxa and trochanter yellow, femur yellow with darkened and enlarged tip, tibia yellowish at base, gradually changing into dark brown, tip black, tarsal segments dark brown. Wing light brown, cell c slightly more yellowish than ground color, stigma dark brown, variegated by light areas in apical area of cell c, medial and basal areas of 1<sup>st</sup> cell of cell  $r_1$ , light band across apical area of cell  $r_1$ , base of cells  $r_3$  and  $r_4$ , and basal area of discal cell, apical area of basal radial cell and basal area of cell  $m_3$ ; rest light area including medial and basal areas of basal radial cell, medial and basal area of basal medial cell, apical and basal areas of posterior cubital cell, and median region and outer ends of anal cells (Fig. 44).

WING VENATION.  $R_1$  complete,  $R_3$   $1.1 \times$  as long as  $R_{2+3+4}$ ,  $R_4$   $1.4 \times$  as long as  $R_s$ ,  $R_5$  curved at apical half, r-m more than  $2.0 \times$  as long as base of  $R_5$ , discal cell narrow,  $3.3 \times$  as long as petiole of cell  $m_1$ ,  $M_1$  at least  $4.7 \times$  as long as its petiole (Fig. 44). Halter pale yellow, knob brown at basal half, densely covered with short brown setae, pale yellow at apical half.

ABDOMEN (Fig. 45). Basal four abdominal segments yellow with brown ill-defined median and lateral stripes, latter gradually broader and heavier, rest abdominal segments including hypopygium black (Fig. 45).

HYPOPYGIUM (Figs 46–55). Hypopygium with tergite nine separated from sternite nine at apical half (Fig. 46). Dorsal portion of tergite nine broadly emarginated on posterior margin, medially with V-shaped notch (Fig. 46). Tergite nine completely divided at midline by pale membrane (Figs 46–47). Ventral portion of tergite nine with pair of nearly fleshy lobes terminating into narrowed black armatures, between them narrow-blackened ridge on either side of midline produced into triangular black point; pair of narrowed blackened anal plates (ap) fused with ventral armatures (Figs 46–47). Gonocoxite obtuse, divided from sternite nine by suture except ventral area, apically producing into small obtuse point (Figs 48–49). Lobe of gonostylus short, broad apically (Fig. 50). Clasper of gonostylus narrowed,





**Figs 46–55.** *Tipula (Vestiplex) singularis* sp. nov., ♂, holotype (coll. Inse-YN0502). **46.** Hypopygium, dorsal view. **47.** Tergite nine, ventral view. **48.** Hypopygium, lateral view. **49.** Hypopygium, ventral view. **50.** Lobe of gonostylus. **51.** Left clasper of gonostylus, mesal view. **52.** Right clasper of gonostylus, lateral view. **53.** Ejaculatory apodeme of semen pump. **54.** Semen pump, lateral view. **55.** Semen pump, dorsal view. Abbreviations: see Material and methods. Scale bars: 46–49 = 1.0 mm; 50–52 = 0.5 mm; 53–55 = 1.2 mm.



upper beak slender and black, lower beak obtuse and black, with sinuate dorsal crest, basally with big angular lobe, inner surface medially with round lobe (Figs 51–52). Sternite nine with ventral lobe of A9S thumb-like, massive, densely covered with long setae; dorsal lobe of A9S reduced into small rounded sclerite located between ventral lobe and mesoventral margin of gonocoxite (Fig. 49). Adminiculum nearly triangular in ventral view, bifurcated apically in lateral view (Figs 48–49). Semen pump with central vesicle swollen (Fig. 54). Ejaculatory apodeme with V-shaped median incision, lateral arms truncated apically, distinctly longer than posterior immovable apodeme (Fig. 53). Posterior immovable apodeme short, slightly curved dorsally in lateral view, broad basally (Fig. 55). Anterior immovable apodeme, narrow, sinuate at outer margin in dorsal view (Fig. 55). Aedeagus thick, almost same thickness throughout, broad at apex which has a small hork; aedeagus more than  $3.5 \times$  as long as semen pump (Fig. 54).

#### Female

Unknown.

#### Remarks

The new species is very similar to *T. (V.) immsiana* Alexander, 1970, from Arunachal Pradesh, India, by details of tergite nine. Both species have a ventral portion provided by a specific narrowed and blackened ridge located on either side of the midline which separates both ventral armatures. Easily to be separated by the clasper of the gonostylus bearing an angular lobe in *T. (V.) singularis* sp. nov., which is absent in *T. (V.) immsiana*. Also easily distinguished by the dorsal lobe of A9S which is reduced in *T. (V.) singularis* sp. nov. while it bears a distinct blade-shaped dorsal lobe in *T. (V.) immsiana* (Alexander 1970: fig. 35).

#### *Tipula (Vestiplex) nestor* Alexander, 1934

Figs 56–70

*Tipula (Vestiplex) nestor* Alexander, 1934: 28

*Tipula (Vestiplex) nestor* – Alexander & Alexander 1973: 64.

#### Diagnosis

The specimen of male *Tipula (V.) nestor* can be recognized by ventral portion of tergite nine with a pair of black armatures, gonocoxite totally separated from the sternite nine, obtuse apically, without spine; antenna reaching the base of wing if bent backward; wing light brown, cell c more yellowish than ground color, stigma dark brown; basal five abdominal segments yellow with brown ill-defined median lateral and lateral stripes.

#### Material examined

CHINA • 1 ♂; Yunnan, Gongshan County, Bingzhongluo, Gongdangshenshan Mountain; 12 Jun. 2019; Men Qiulei and Lv Lin leg.; AQNU.

#### Redescription

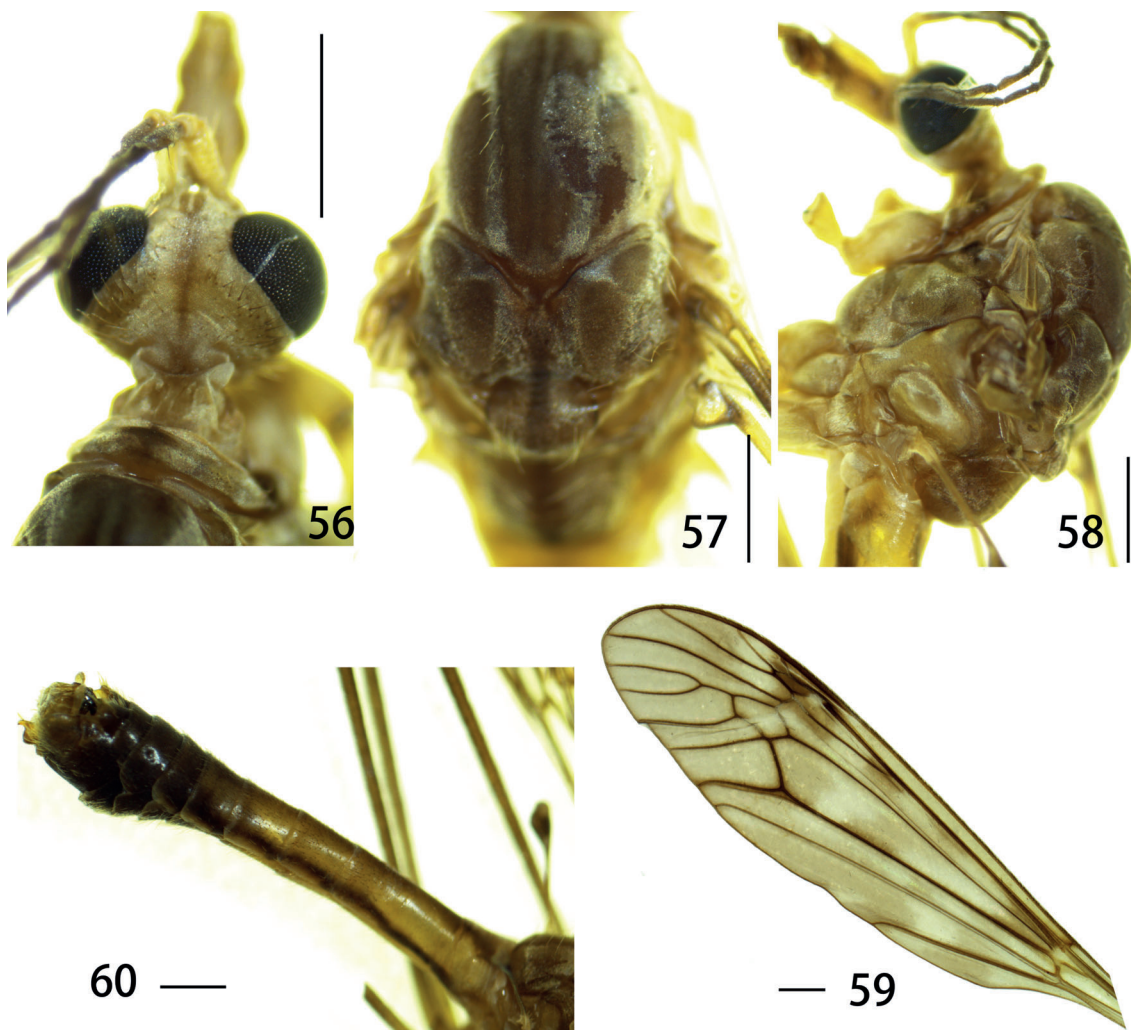
##### Male (Figs 56–70)

MEASUREMENTS. Body length 14.5 mm (excluding antenna,  $n = 1$ ), wing length 19.2 mm ( $n = 1$ ), antenna length 3.9 mm ( $n = 1$ ). General body coloration yellowish-brown.

HEAD (Fig. 56). Rostrum with nasus yellow, densely covered with yellow setae, brown at base. Eye black. Occiput and vertex brownish, with brown median line (Fig. 56). Antenna 13-segmented, if bent backward reaching base of wing. Scape yellow, cylindrical, slightly expanded at apex. Pedicel yellow,

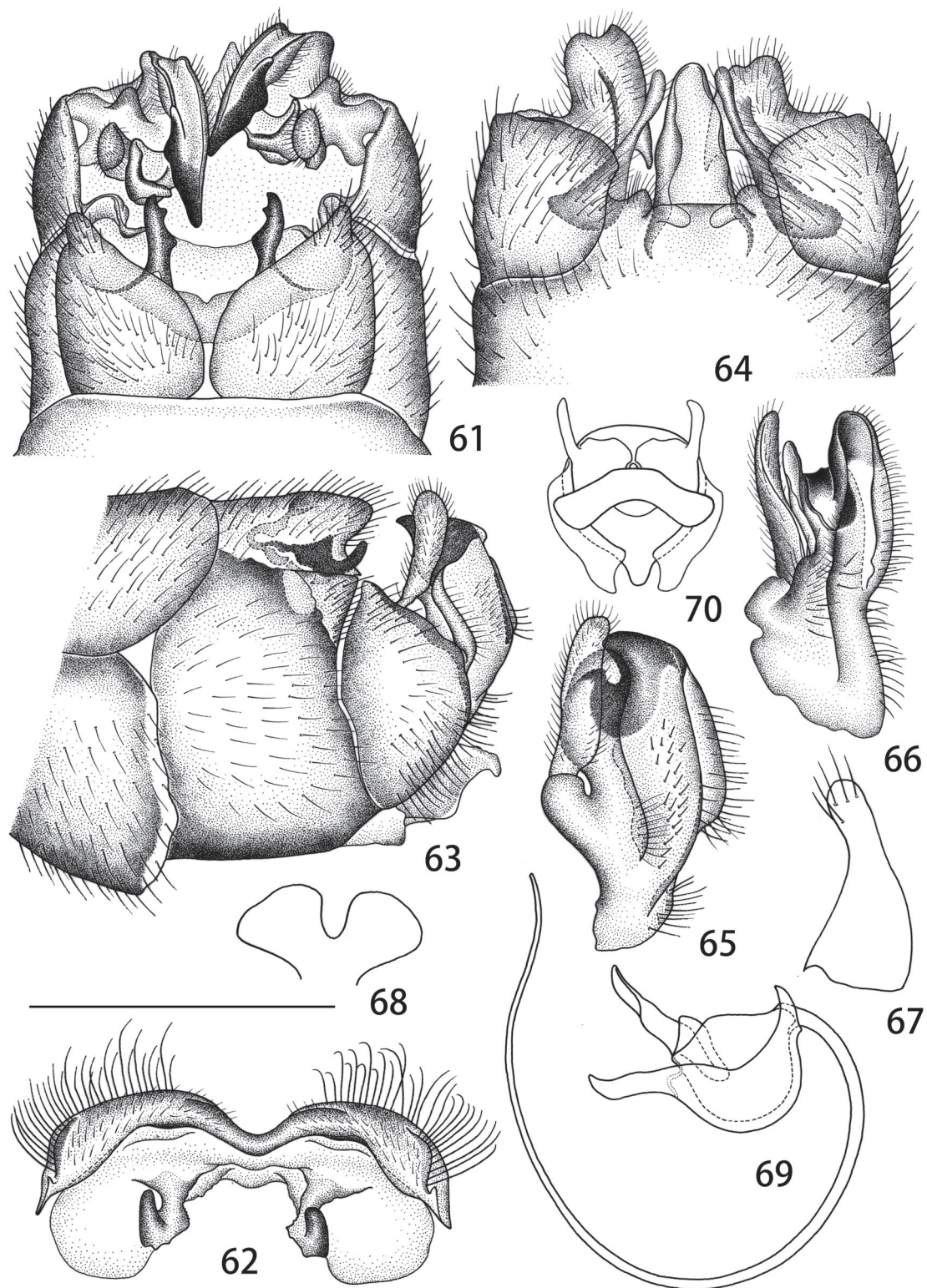
oval. Flagellum entirely brown except first flagellomere having slightly yellow basal fourth. First flagellomere longest, almost same length as scape, remaining segments progressively shortened and thinned, bases of each flagellomere enlarged with five brown longest verticils. Longest verticils slightly longer than corresponding flagellomeres, surface of each flagellomere densely covered with short brown setae. Palpus with first segments brown, apical segments yellow.

THORAX (Figs 57–58). Pronotum yellow with medial region brown. Prescutum and presutural scutum brownish with four brown longitudinal stripes, median pair bordered with black margins, separated by gray vitta, lateral stripes bordered with black margins on inner side (Fig. 57). Interspaces gray, densely covered with short white setae (Fig. 57). Postsutural scutum brown, scutal lobes each with two dark brown triangular separated spots (Fig. 57). Scutellum brown with broad black vitta, covered with short yellow setae on lateral sides (Fig. 57). Mediotergite dark brown with black vitta (Fig. 57). Pleura yellowish, thinly dusted with grey (Fig. 58). Leg with coxa and trochanter yellow; femur yellow with darkened and enlarged tip; tibia yellowish at base, gradually changing into dark brown, tip black; tarsal segments dark brown. Wing light brown, cell c more yellowish than ground color, stigma dark brown, variegated by light areas in medial and basal areas of 1<sup>st</sup> cell of cell  $r_1$ ; light band across apical area of



**Figs 56–60.** *Tipula (Vestiplex) nestor* Alexander, 1934, ♂, AQNU. **56.** Head, dorsal view. **57.** Thorax, dorsal view. **58.** Thorax, lateral view. **59.** Wing. **60.** Abdomen, lateral view. Scale bars = 1.0 mm.





**Figs 61–70.** *Tipula (Vestiplex) nestor* Alexander, 1934, ♂, AQNU. **61.** Hypopygium, dorsal view. **62.** Tergite nine, ventral view. **63.** Hypopygium, lateral view. **64.** Hypopygium, ventral view. **65.** Left lobe and clasper of gonostylus, lateral view. **66.** Left lobe and clasper of gonostylus, dorsal view. **67.** Dorsal lobe of A9S. **68.** Ejaculatory apodeme of semen pump. **69.** Semen pump, lateral view. **70.** Semen pump, dorsal view. Scale bars: 61–64 = 1.0 mm; 65–67 = 0.7 mm; 68–70 = 1.0 mm.



cell  $r_1$ , base of cells  $r_3$ ,  $r_4$  and  $r_5$ , and median area of discal cell; rest light area including base and apical areas of bm, median region and outer ends of anal cells (Fig. 59).

WING VENATION.  $R_1$  complete,  $R_3$   $2.1 \times$  as long as  $R_{2+3+4}$ ,  $R_4$  subequal in length to  $R_s$ ,  $R_5$  curved at apical half, r-m distinctly shorter than base of  $R_5$ , discal cell narrow, at least  $1.9 \times$  as long as petiole of cell  $m_1$ ,  $M_1$  at least  $2.7 \times$  as long as its petiole (Fig. 59). Halter pale yellow, knob basally brown, apically pale yellow.

ABDOMEN (Fig. 60). Basal five abdominal segments yellow with brown ill-defined median lateral and lateral stripes, latter gradually broader and heavier, rest abdominal segments including hypopygium black (Fig. 60).

HYPOPYGIUM (Figs 61–70). Hypopygium with tergite nine separated from sternite nine except base. Tergite nine completely divided at midline by pale membrane, posterior margin with deep V-shaped median notch (Figs 61–62). Posterolateral angles extended into angular lobe, covered with setae. Dorsal portion of tergite nine divided into two parts by membranous area which has shallow V-shaped notch medially, each part of dorsal portion terminating into an angular terminal which has very strong and dense setae (Figs 61–62). Ventral portion of tergite nine broad, with pair of black armatures; armature with obtuse point on inner side and apically incised. Gonocoxite totally separated from sternite nine, relatively short, obtuse apically, without spine, densely covered with long setae (Figs 63–64). Lobe of gonostylus small, blade-shaped (Figs 65–66). Clasper of gonostylus with upper beak obtuse and black, lower beak splitted into flattened, round and transparent lobe and smaller, obtuse and black point; dorsal crest elongated, median area of lobe of gonostylus equipped with strongly straight setae (Figs 65–66). Sternite nine with ventral lobe of A9S small and rounded, densely covered with setae; dorsal lobe of A9S broad at base, gradually narrowed to round apex which bears five long setae (Figs 64, 67). Adminiculum massive, broadened at base, obtuse apically, median portion protruded, shallow preapical incision in ventral view (Figs 63–64). Semen pump with central vesicle slightly swollen (Fig. 69). Ejaculatory apodeme fan-shaped, medially with small V-shaped notch, slightly longer than posterior immovable apodeme (Fig. 68). Posterior immovable apodeme in shape of short arm (Fig. 69). Anterior immovable apodeme narrow plate (Fig. 70). Aedeagus thick at base, gradually narrowed towards apex, more than  $3.5 \times$  as long as semen pump (Fig. 69).

### Female

Unknown.

### Distribution

China: Taiwan (Alexander, 1934); Yunnan, new record for mainland China.

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