

# Three new species of Chinese Bittacidae (Mecoptera)

Lele HE, Jie ZHANG, Yueling WU, Baozhen HUA<sup>①</sup>

Key Laboratory of Plant Protection Resources and Pest Management, Ministry of Education, Entomological Museum, College of Plant Protection, Northwest A&F University, Yangling, Shaanxi 712100, China

**Abstract:** Two species of *Bittacus* Latreille, 1805 and one species of *Terrobittacus* Tan & Hua, 2009 are described as new to science from Guizhou and Guangdong Provinces in China. *Bittacus guanyinshanicus* sp. nov. is recognized from its congeners mainly by the basal part of male upper branch of proctiger stout and broad, central portion constricted, and aedeagal lobe long, spindle-like in lateral view. *Bittacus longifasciatus* sp. nov. is distinguished by the wing with one large dark brown stripe. *Terrobittacus nigrosetus* sp. nov. is differentiated by the nota with a distinct dark median streak, and male epandrial lobe bearing dense long black bristles on basal ventral area.

**Key words:** *Bittacus*; *Terrobittacus*; taxonomy; China

## 中国蚊蝎蛉科三新种记述（长翅目）

何乐乐, 张洁, 吴玥灵, 花保祯<sup>①</sup>

植保资源与病虫害治理教育部重点实验室, 西北农林科技大学植物保护学院昆虫博物馆, 陕西 杨凌 712100

**摘要:** 本研究发现并描述来自中国贵州省和广东省的蚊蝎蛉属 2 新种和地蚊蝎蛉属 1 新种。其中观音山蚊蝎蛉 *Bittacus guanyinshanicus* sp. nov. 的主要鉴别特征是雄性载肛突上瓣基部膨大, 中部缢缩, 阳茎叶较长, 侧面近纺锤形。长带蚊蝎蛉 *Bittacus longifasciatus* sp. nov. 翅面具 1 较大暗棕色带状斑。黑毛地蚊蝎蛉 *Terrobittacus nigrosetus* sp. nov. 具明显暗黑色背中带, 雄性上生殖瓣腹缘基部密生黑色长刚毛。

**关键词:** 蚊蝎蛉属; 地蚊蝎蛉属; 分类; 中国

## Introduction

The hangingflies, family Bittacidae, are unique predators among holometabolous insects for having three pairs of raptorial legs (Thornhill 1978) and feeding on various small flying insects (Palmer 2010). Between flights, the adults usually hang on the edges of leaves or twigs of plants with their prehensile forelegs (Byers 2002). Bittacidae inhabit moist shady forests and are very sensitive to humidity and temperature in that their flagella are equipped with numerous sensilla coeloconica associated with the hygro- and thermo-sensitivity (Wang & Hua 2023), frequently being regarded as ecological indicators (Byers & Thornhill 1983; Hu *et al.* 2010). During mating, male hangingflies usually provide an insect prey or a salivary secretion as a nuptial gift to the female and adopt a unique belly-to-belly hanging mating

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① Corresponding author, E-mail: huabzh@nwafu.edu.cn

position (Iwasaki 1996; Gao & Hua 2013; Wei *et al.* 2020).

The eggs are spherical or cuboidal, and decorated with distinct grid of latitudes in some species of *Terrobittacus* (Tan & Hua 2009a, c). The larvae possess a median ocellus and paired compound eyes, each of which consists of seven ommatidia (Zheng *et al.* 2022), and are equipped with furcated setae-bearing protuberances on the trunk (Jiang *et al.* 2015; Tan & Hua 2009a). The larvae spray mud on their body soon after hatching or molting, the mud being swallowed and excreted from the anus after passing through the digestive tract (Setty 1940; Liu & Hua 2017). The full-grown larvae prepare a soil cell for pupation (He & Hua 2022). The pupae are exarate and dectitious (Tan & Hua 2008).

The Bittacidae are the second largest family of Mecoptera next to Panorpidae, with about 220 species described in 18 genera (Wang & Hua 2017; Bicha 2018; Savitsky & Timokhov 2021; Machado *et al.* 2022; Midgley & Bellingan 2023). Among them, 58 species in three genera have been documented in China, including 45 species in *Bittacus* Latreille, 1805, five species in *Bicaubittacus* Tan & Hua, 2009, and eight species in *Terrobittacus* Tan & Hua, 2009 (Tan & Hua 2009a, b; Chen *et al.* 2013; Du & Hua 2017; Wang & Hua 2017; He & Hua 2022, 2023).

In this paper, two species of *Bittacus* and one species of *Terrobittacus* are described as new to science from China, increasing the number of the known Chinese Bittacidae to 61.

## Material and methods

Adult specimens of the new species were captured from Guangdong and Guizhou Provinces of China. The specimens are deposited in ethanol at the Entomological Museum, Northwest A&F University, China (NWAU).

Photographs of habitus were taken with a Nikon D7100 digital camera. Character pictures were taken using a scientific digital micrography system ZEISS SteREO Discovery V20, equipped with an auto-montage imaging system (AxioCam IC). The pictures were assembled into plates and annotated with Adobe Photoshop 2022. The measurements were quantified using ImageJ software (<https://imagej.net/>).

Terminology follows He & Hua (2023). The following abbreviations are applied in the measurements: AL — antennal length; BL — body length; FL — forewing length; FW — forewing width; HL — hindwing length; HW — hindwing width.

The following abbreviations are used in figures: A — anal vein; AL — aedeagal lobe; Av — apical cross-vein between CuP and 1A; Ce — cercus; Cly — clypeus; CuA — anterior cubitus; CuP — posterior cubitus; Cuv — apical cross-vein between CuA and CuP; EL — epandrial lobe; FM — fork of media; Fr — frons; FRs — first fork of radial sector; Gcx — gonocoxite; Gs — gonostylus; L — labrum; LBP — lower branch of proctiger; LP — labial palp; M — media; MP — maxillary palp; OM — origin of media; ORs — origin of radial sector; Pcv — cross-veins between R<sub>1</sub> and R<sub>2</sub> behind the pterostigma; Pf — penisfilum; Pt — pterostigma; R<sub>1</sub> — first radius; S — sternum; SaP — subanal plate; Sc — subcostal vein; Scv — cross-vein between distal half of Sc and R<sub>1</sub>; SgP — subgenital plate; Sp — spiracle; T — tergum; and UBP — upper branch of proctiger.

## Taxonomy

### 1. *Bittacus guanyinshanicus* sp. nov. (Figs 1, 2)

Description (male). AL 6.08 mm; BL 15.41 mm; FL 18.06 mm, FW 3.81 mm; HL 15.91 mm, HW 3.46 mm.

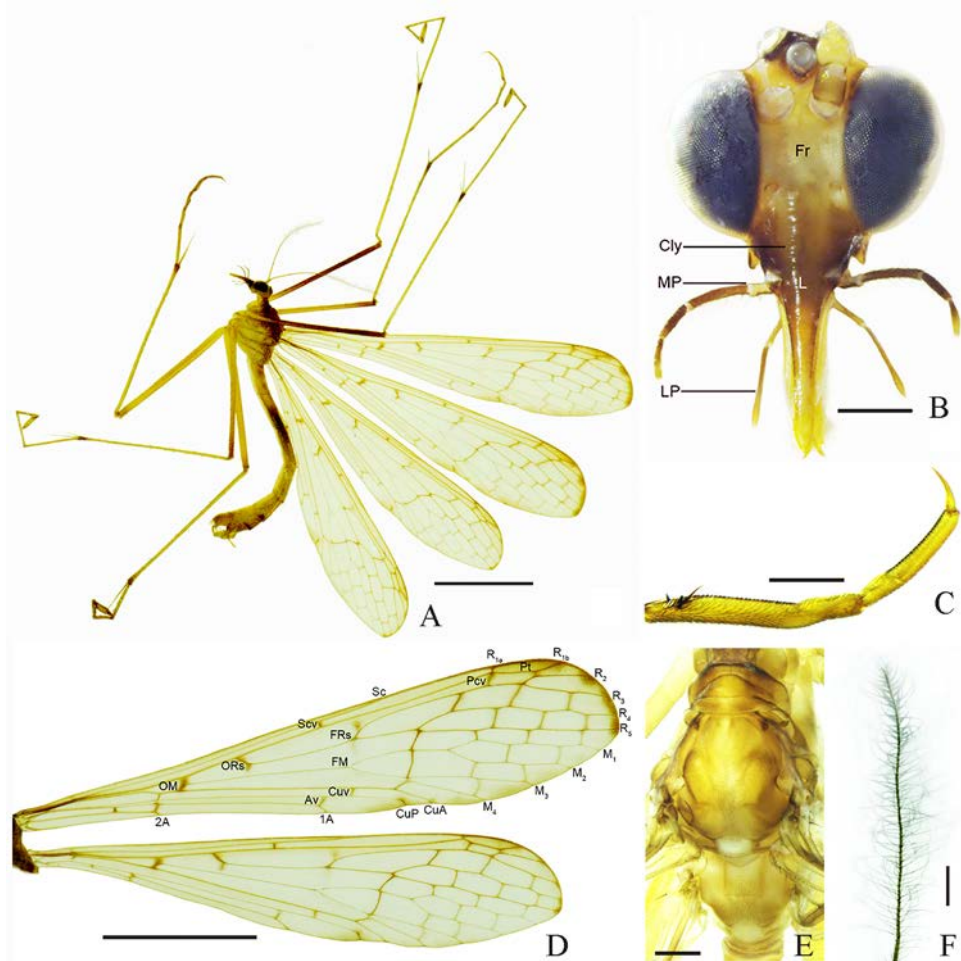


Figure 1. *Bittacus guanyinshanicus* sp. nov. A. Male habitus, lateral view; B. Head, frontal view; C. Tarsomeres IV–V and claw of left foreleg; D. Right wings of male; E. Thorax, dorsal view; F. Distal flagellum of antenna. Scale bars = 5.0 mm (A, D); 0.2 mm (B, C); 0.5 mm (E, F).

Head (Fig. 1B). Vertex and frons yellowish brown. Ocellar triangle blackish brown; lateral ocelli twice as large as median ocellus. Clypeus blackish brown; labrum dark to yellowish brown. Maxillary palp dark brown except terminal segment brown; 3rd segment equal to 4th and 5th segments combined. Labial palp yellowish brown. Antennae yellowish brown; scape cylindrical; pedicel spherical; flagellum filiform ciliated with long hairs, with distinct segments basally and obscure beyond 15th segment (Fig. 1F).

Thorax (Fig. 1E). Notum yellowish brown. Pleura, coxae and mera light brown. Legs yellowish brown (Fig. 1A); tibial apices reddish brown; hind basitarsus longer than

tarsomeres II–III together; three black spines along each proximal side of tarsomere IV (Fig. 1C).

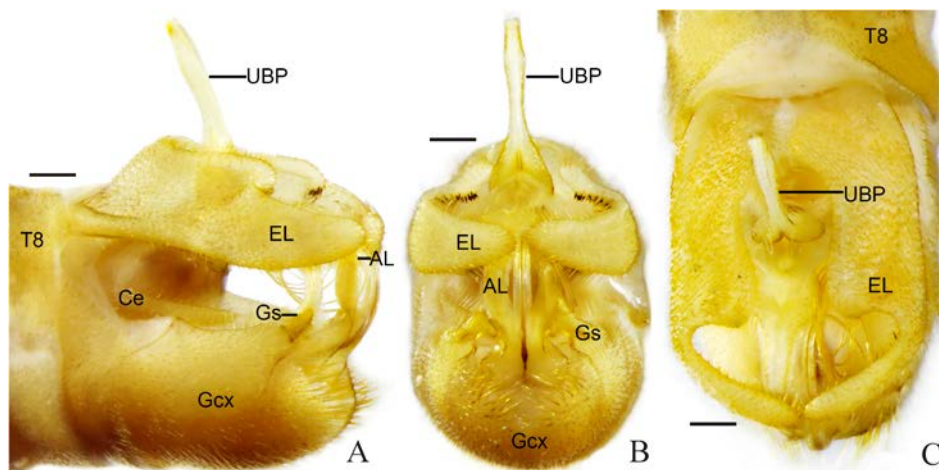


Figure 2. *Bittacus guanyinshanicus* sp. nov. A. Male terminalia, lateral view; B. Ibid, posterior view; C. Ibid, dorsal view. Scale bars = 0.2 mm.

Wings (Fig. 1D). Forewing membrane hyaline with yellowish tinge. Pterostigma brown; disperse small brown flecks at OM, ORs, and FRs; outer margin darker from  $R_{1a}$  to  $R_5$ . Light brown markings from end of  $M_2$  to CuP ending. Pcv two. FRs near level of FM; Sc ending beyond level of FRs; Scv before FRs; CuP ending slightly curved, and near  $FM_{3+4}$ ; Cuv near level of FM; 1A ending before FM; 2A ending before OM; Av one. Hindwing similar to forewing in coloration, but fleck of outer margin paler; Scv at median position of ORs and FRs.

Abdomen of male (Fig. 2). Terga II–VIII yellowish brown; each with a black antecosta (Fig. 1A). Tergum VIII emarginate in V-shape on posterior margin. Epandrial lobe yellowish brown, longer than length of gonocoxite, sub-quadrangular in lateral aspect with rounded apex (Fig. 2A), bearing one row of black spines on inner surface along dorsal margin (Fig. 2B); ventro-distal process elongated into a lobe, half as long as basal process in dorsal view (Fig. 2C). Dorsal part of tergum X vestigial. Upper branch of proctiger elongate; basal part stout and broad; central portion constricted (Fig. 2B). Lower branch of proctiger elongate, tapering toward apex. Cerci clavate, as long as half of gonocoxites. Gonocoxites yellowish brown to reddish brown, apically truncated with yellow hairs. Gonostylus with a small basal process. Aedeagal lobe long, spindle-like in lateral view; basal portion constricted. Penisfilum coiled.

**Holotype.** ♂, **China**, Guizhou Province, Jiangkou County, Guanyinshan, 27°31'10"N, 108°33'19"E, alt. 920 m, 21-VII-2020, leg. Zhengkun HU (NWAU).

**Etymology.** The specific epithet refers to the type locality, Guanyinshan.

**Diagnosis.** The new species can be readily recognized from its congeners by the following characters: 1) dark fleck on outer margin of forewing; 2) male epandrial lobe longer than gonocoxite, sub-quadrangular in lateral aspect with rounded apex, with ventro-distal process elongated into a lobe; 3) basal part of upper branch of proctiger stout and broad, central portion constricted; 4) gonostylus with a small basal process; and 5) aedeagal lobe

long, spindle-like in lateral view.

## 2. *Bittacus longifasciatus* sp. nov. (Figs 3, 4)

Description (male). AL 5.03 mm; BL 14.24 mm; FL 14.87 mm, FW 3.55 mm; HL 12.74 mm, HW 3.17 mm.



Figure 3. *Bittacus longifasciatus* sp. nov. A. Male habitus, lateral view; B. Thorax, dorsal view; C. Tarsomeres IV–V and claw of left foreleg; D. Right wings of male; E. Head, lateral view; F. Ibid, frontal view. Scale bars = 5.0 mm (A); 0.5 mm (B); 0.1 mm (C); 2.0 mm (D); 0.2 mm (E, F).

Head (Figs 3E, 3F). Vertex and frons yellowish brown. Ocellar triangle blackish brown, with two setae above median ocellus; lateral ocelli slightly larger than median ocellus. Clypeus and labrum yellowish brown. Maxillary palp blackish brown except basal and distal ends brown; 3rd segment equal to 4th and 5th segments together. Antennae yellowish brown; scape and pedicel cylindrical; flagellomeres filiform and ciliated with basal 12 segments distinct, but distal segments obscure.

Thorax (Fig. 3B). Pronotum unevenly yellowish brown, with two setae on anterior margin. Cephalic two-thirds of mesonotum blackish brown; posterior mesonotum and

metanotum yellowish brown, with a light median streak. Pleura, coxae, and mera light brown (Fig. 3A). Legs yellowish brown except femora and tibiae apices, and hind leg tarsi reddish brown; hind basitarsus as long as tarsomeres II–IV combined; tarsomere IV with one black spine along each side (Fig. 3C).

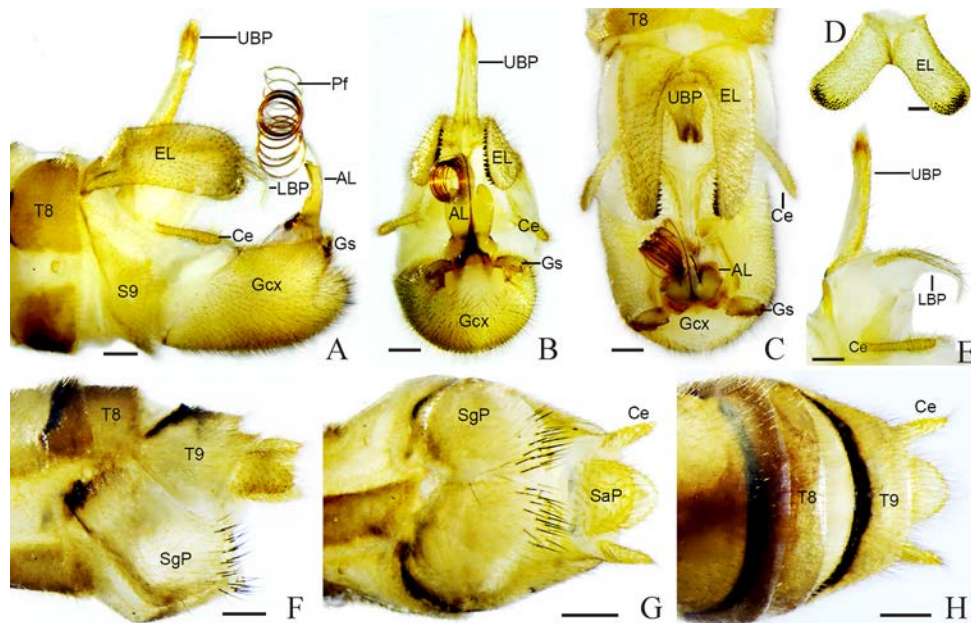


Figure 4. *Bittacus longifasciatus* sp. nov. A. Male terminalia, lateral view; B. Ibid, posterior view; C. Ibid, dorsal view; D. Male epandrial lobes, ventral view; E. Male proctiger and cercus, lateral view; F. Female terminalia, lateral view; G. Ibid, ventral view; H. Ibid, dorsal view. Scale bars = 0.2 mm (A–H).

Wings (Fig. 3D). Forewing membrane hyaline, with yellowish brown tinge. Pterostigma dark brown; conspicuous blackish brown markings at OM, ORs, FRs, and CuP ending; one large dark brown stripe from  $R_{1a}$  to or slightly before  $M_1$ ; clouding flecks along cross-veins. Pcv two. FRs beyond level of FM; Sc ending beyond FRs; Scv before FRs; CuP ending near  $FM_{3+4}$ ; Cuv beyond FM; 1A ending beyond ORs; 2A ending before OM; Av absent. Hindwing similar to forewing in general pattern and coloration, but Sc ending before level of FRs, Pcv one or two.

Abdomen of male (Figs 4A–E). Terga II–VIII yellowish brown to reddish brown, each with a black antecosta (Fig. 3A). Epandrial lobe subtrapezoidal, yellowish brown, shorter than length of gonocoxites, bearing approximately 40 short black spines along apical inner surface (Fig. 4D). Tergum X light yellow, greatly reduced (Fig. 4E); dorsal plate triangular in lateral view. Upper branch of proctiger finger-like, protruding between epandrial lobes, and furnished with a cluster of short hairs distally. Lower branch of proctiger slender, sclerotized dorsally, tapering toward apex, curved ventrad. Cerci clavate, shorter than half length of gonocoxites. Gonocoxites yellowish brown; caudal end rounded. Gonostylus small, curved inward (Fig. 4B). Aedeagal lobes tapering toward apex, with two small apices. Penisfilum coiled.

Abdomen of female (Figs 4F–H). Female abdomen resembles that of male in coloration,

but black antecosta wider. Subgenital plate sclerotized, yellowish brown; anterior margins black (Fig. 4F); two halves almost fused except two ends; each bearing about 18 black setae caudad. Tergum IX slightly truncated posteriorly. Tergum X light yellow, narrow, extending ventrad to posterior region of subgenital plate. Supra- and subanal plates broad basally, tapering toward apex, almost equal length. Cerci tapering toward apex, slightly longer than anal plates.

**Holotype.** ♂, **China**, Guangdong Province, Shaoguan City, Qujiang District, Caojiaowan, 24°43'48"N, 113°52'12"E, alt. 300 m, 06-VI-2023, leg. Lele HE (NWAU).

**Paratypes.** 4♂5♀, **China**, Guangdong Province, Shaoguan City, Qujiang District, Caojiaowan, 24°43'48"N, 113°52'12"E, alt. 250–350 m, 06–13-VI-2023, leg. Lele HE & Hehong WANG (NWAU).

Etymology. The specific epithet “longifasciatus” is derived from the Latin “long-” (long) and “fasciat-” (banded), referring to the long strip on the apical area of the wing.

Diagnosis. The new species is unique in wing having one large dark brown stripe from  $R_{1a}$  to or slightly before  $M_1$ ; epandrial lobe subtrapezoidal, bearing approximately 40 short black spines along apical inner surface; anterior margins of female subgenital plates black, and two halves almost fused except two ends, bearing about 18 black setae caudad.

### 3. *Terrobittacus nigrosetus* sp. nov. (Figs 5, 6)

Description (male). BL 9.37 mm; FL 13.22 mm, FW 2.78 mm; HL 11.36 mm, HW 2.48 mm.

Head (Fig. 5B). Vertex and frons light yellow. Ocellar triangle blackish brown; dark ocellar strip extending to compound eyes; lateral ocelli similar to median ocellus in size. Clypeus light yellow. Labrum unevenly yellowish brown; basal portion and lateral sides darker. Maxillary palp yellowish brown; 3rd segment equal to 4th and 5th segments combined. Antennae yellowish brown; scape cylindrical; pedicel spherical; flagellum broke.

Thorax (Fig. 5E). Pronotum and anterior half of mesonotum reddish brown; posterior half mesonotum and metanotum unevenly yellowish brown, with a distinct dark median streak. Pleura, coxae, mera, and legs yellowish brown (Fig. 5A); femora and tibiae with reddish brown apices; hind basitarsus as long as tarsomeres II–IV together; tarsomere IV with one or two black spines on one side (Fig. 5C).

Wings (Fig. 5D). Forewing membrane hyaline and tinged with light yellow. Pterostigma brown; two small light brown spots at FRs and CuP ending; Pcv one. FRs near level of FM; Sc ending beyond level of FRs; Scv near FRs; CuP ending before  $FM_{3+4}$ ; Cuv before FM; 1A ending before ORs; 2A ending before OM; Av absent. Hindwing similar to forewing in general pattern and coloration, but Sc ending before level of FRs.

Abdomen of male (Fig. 6). Terga II–V light yellow, each with a black antecosta; terga VI–IX reddish brown (Fig. 5A). Tergum VIII deeply emarginate in V-shape posteriorly (Fig. 6D). Epandrial lobe broad basally, tapering towards apex, shorter than gonocoxites, bearing long yellow hairs on surfaces, dense long black bristles on basal ventral margin, and about 50 stout black spines along distal region. Tergum X greatly reduced. Upper branch of proctiger slender, bearing a tuft of short hairs at acute apex, curved caudad. Lower branch of proctiger short, sclerotized dorsally, tapering toward apex, curved ventrad. Cerci light brown, clavate, longer than half length of gonocoxites. Gonocoxites reddish brown, rounded, distal area furnished with about 20 setae. Gonostylus short and small, surrounded by sparse setae.

Aedeagal lobes relatively short, with two small acute apexes; penisfilum coiled.

**Holotype.** ♂, **China**, Guizhou Province, Leigongshan, 26°22'23"N, 108°10'48"E, alt. 1500 m, 28-V-2018, leg. Guilin HU (NWAU).

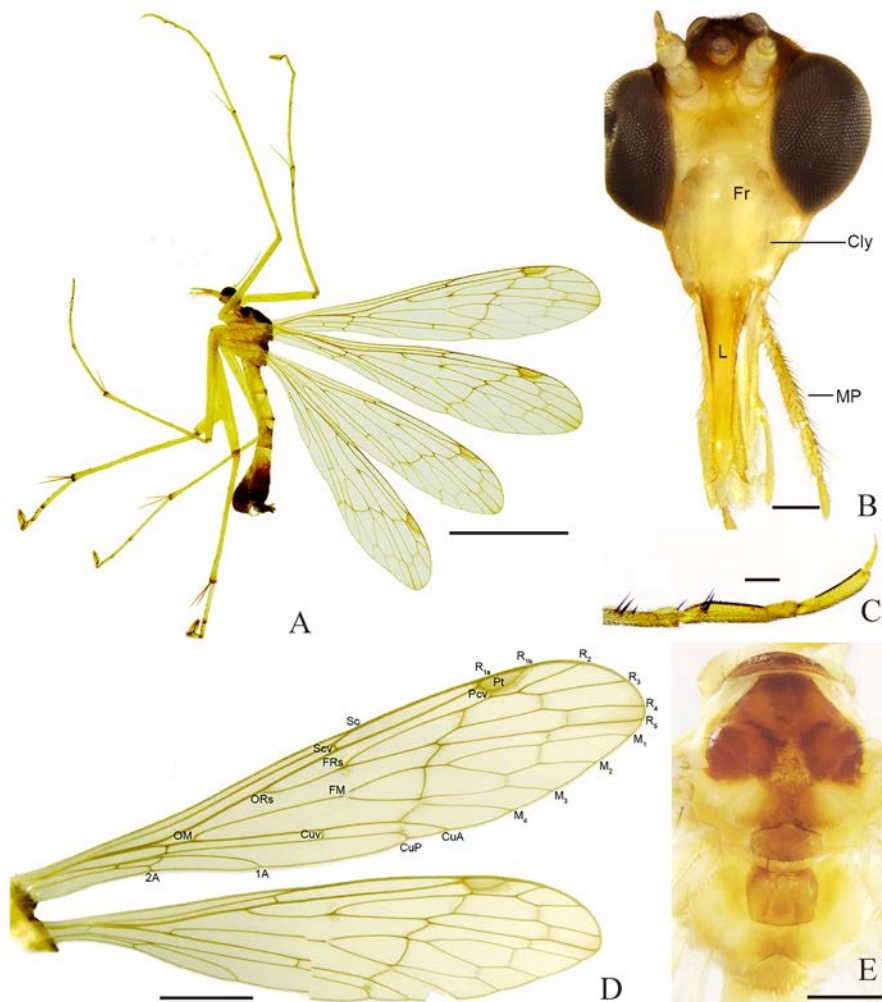


Figure 5. *Terrobittacus nigrosetus* sp. nov. A. Male habitus, lateral view; B. Head, frontal view; C. Tarsomeres IV–V and claw of left foreleg; D. Right wings of male; E. Thorax, dorsal view. Scale bars = 5.0 mm (A); 0.2 mm (B, C); 2.0 mm (D); 0.5 mm (E).

**Etymology.** The specific epithet ‘nigrosetus’ is derived from the Latin ‘nigro-’ (black, dark) and ‘seta’ (a bristle), referring to the dense long black bristles on the basal ventral area of the male epandrial lobes.

**Diagnosis.** The new species is distinguishable from its congeners by the nota unevenly yellowish brown to reddish brown, with a distinct dark median streak; terga VI–IX reddish brown; epandrial lobe tapering towards apex, bearing long yellow hairs on surfaces, dense long black bristles on basal ventral area, and about 50 stout black spines along distal region.



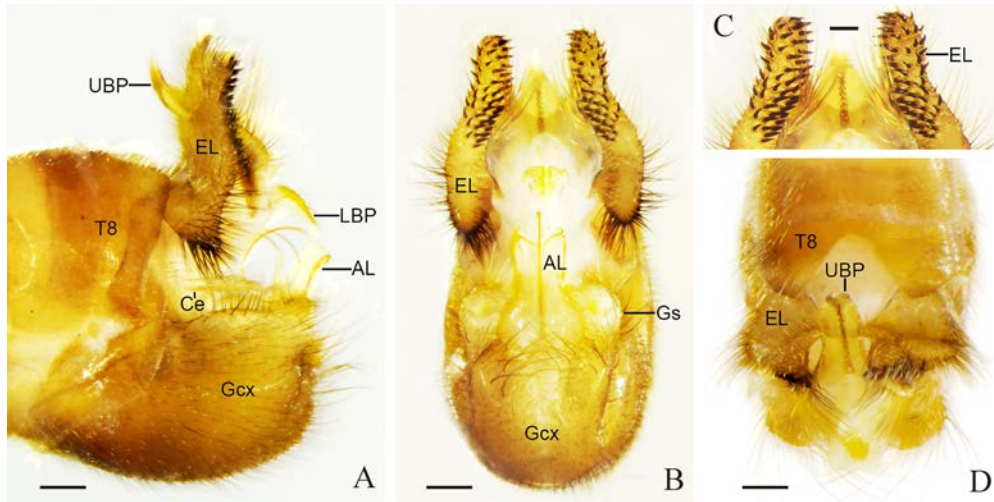


Figure 6. *Terrobittacus nigrosetus* sp. nov. A. Male terminalia, lateral view; B. Ibid, posterior view; C. Distal epandrial lobes with stout spines, posterior view; D. Male terminalia, dorsal view. Scale bars = 0.2 mm (A, B, D); 0.1 mm (C).

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