

## *Chrysotus* Meigen (Diptera: Dolichopodidae) from Guangxi of China with descriptions of three new species

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### ABSTRACT

Previously only two species of *Chrysotus* were known to occur in Guangxi of China. Here a revision of the genus from Guangxi is presented. Eight species are herein reported. The following three species are described as new to science: *Chrysotus guangxiensis* sp. nov., *Chrysotus triprojiciens* sp. nov. and *Chrysotus xiaominae* sp. nov. Three species are recorded from Guangxi for the first time: *Chrysotus biprojiciens* Wei et Zhang, *Chrysotus shanxiensis* Liu et Yang, and *Chrysotus motuoensis* Liu et Yang. A key to the species of *Chrysotus* from Guangxi of China is provided. The relationship of the two genera *Dubius* and *Chrysotus* is discussed.

**Key words:** Diptera, Dolichopodidae, *Chrysotus*, *Dubius*, Guangxi, China, new species

### INTRODUCTION

The genus *Chrysotus* Meigen, 1824 is the largest genus of the subfamily Diaphorinae, with 464 species now and the genus were distributed worldwide. Among them, 153 species are known from the Oriental Region (Yang *et al.* 2011, Wei et Zhang 2010, Wei 2012a, Liu *et al.* 2013, Wei *et al.* 2014, Liu *et al.* 2016 a). Though the Oriental Region with the most species, most parts of Oriental China are still poorly investigated. So far as known 180 species occur in China (Yang *et al.* 2011, Wei & Zhang 2010, Wei 2012a, Liu *et al.* 2013, Wei *et al.* 2014, Liu *et al.* 2015a, Liu *et al.* 2016a, Liu *et al.* 2016b) but mainly in Guizhou province.

Guangxi is located in the Oriental Region the southern part of China, and has a subtropical climate. Summers are generally long and hot. Average annual temperature is 17 to 23°C, while average annual precipitation is 1250 to 1750 mm. Two species of the genus *Chrysotus* were known to occur in Guangxi

before. In this paper, three species of *Chrysotus* are described as new to science and three species are recorded from Guangxi for the first time. A key to the species of *Chrysotus* from Guangxi is presented. The relationship of the two genera *Dubius* and *Chrysotus* is discussed.

### MATERIAL AND METHODS

This study was based on specimens collected mainly in 2005 to 2014 from Guangxi (some from Chongqing, Yunnan and Taiwan) of China using sweep nets. The specimens were stored in 75% ethanol, and they are deposited in the Entomological Museum of China Agricultural University (CAU), Beijing.

Morphological terminology for adult structures mainly follows McAlpine (1981). Terms for the structures of the male genitalia follow Cumming *et al.* Wood (2009). The following abbreviations are used: acr – acrostichal bristle, ad – anterodorsal

bristle, av – anteroventral bristle, d – dorsal bristle, dc – dorsocentral bristle, LI – fore leg, LII – mid leg, LIII – hind leg, pd – posterodorsal bristle, v – ventral bristle, CuAx ratio – length of m-cu / length of distal portion of CuA.

## TAXONOMY

### Genus *Chrysotus* Meigen

*Chrysotus* Meigen, 1824: 40. Type species: *Musca nigripes* Fabricius, 1794.

*Lyroneurus* Loew, 1857: 38. Type species: *Lyroneurus coeruleascens* Loew, 1857.

*Diagnosis* — The genus has been described by numerous of authors. Here we follow Robinson and Vockeroth (1981)'s delimitation of the genus, with the following combination of characters: Vertex of head not or only slightly excavated. Vein C continuous to tip of Vein M; Vein M not weak, and not discontinuous in last part. Vein M nearly parallel or converging with Vein R<sub>4+5</sub> beyond crossvein dm-cu; Vein M ending at most slightly behind wing tip. Disc of scutum evenly convex or at most slightly flattened immediately before scutellum. Upper part of proepisternum bare. Bristles of calypter dark or pale. Male with face narrowed below or parallel-sided, with or without claws on fore tarsus. Tergite 6 bearing at least one bristle near each lateral margin and usually with many bristles and sometimes with strong marginal bristles, and with bristles on sternite 8 not longer nor stronger than those on tergite 6. Female with narrowest part of face slightly to very markedly narrower than widest part of frons. First flagellum of male with arista subapical in notch or to side of tip. Lower postocular surface of male with only marginal and small central rows of hairs, or with many rows of fine pale hairs.

*Remarks* — Yang *et al.* (2006) provided a list of synonyms of the genus.

The genus *Chrysotus* includes the following species in Guangxi China:

*Chrysotus biprojicienus* Wei *et* Zhang, 2010

*Chrysotus degener* Frey, 1917

*Chrysotus guangxiensis* sp. nov

*Chrysotus motuoensis* Liu *et* Yang, 2013

*Chrysotus shanxiensis* Liu *et* Yang, 2015

*Chrysotus triprojicienus* sp. nov.

*Chrysotus xiaominae* sp. nov.

*Chrysotus xinanus* Wei *et* Zhang, 2010

### Key to species (males) of *Chrysotus* from Guangxi of China

- 1 Epandrium with characteristic angular projection posteriorly . . . . . *Chrysotus laesus*-group *sensu* Wei *et* Zhang (2010) . . . . . 2
  - Epandrium without or only with weak angular projection posteriorly . . . . . other species group . . . . . 3
- 2 Apex of phallus with ventral projection rounded . . . . . *Chrysotus xinanus*
  - Apex of phallus with two ventral lateral lobes . . . . . *Chrysotus biprojicienus*
- 3 Apex of phallus wide or expanded, never bifurcated or with lobes . . . . . 4
  - Apex of phallus never expanded, with lobes or bifurcated . . . . . 5
- 4 Apex of hypandrium with a sickle-shaped structure; surstylus wide at base and apex, narrow at middle . . . . . *Chrysotus xiaominae*
  - Apex of hypandrium without sickle-shaped structure; surstylus wide at base, slightly tapered apically, never narrow at middle . . . . . *Chrysotus guangxiensis*
- 5 All femora yellow . . . . . *Chrysotus degener*
  - Femora mainly black or brown . . . . . 6
- 6 Apex of phallus with a sheet-shaped structure and 3 palm-shaped swollen lateral lobes . . . . . *Chrysotus triprojicienus*
  - Apex of phallus with 2 sheet-like structure . . . . . 7

- 7 Fore tibia with 1 ad at basal 1/4; apex of phallus with 2 fin-shaped structures . . . . .  
 . . . . . *Chrysotus shanxiensis*  
 — Fore tibia without ad; apex of phallus with 2 sheet-shaped structures . . . . .  
 . . . . . *Chrysotus motuoensis*

### 1. *Chrysotus biprojicienus* Wei et Zhang, 2010

*Chrysotus biprojicienus* Wei et Zhang, 2010: 10. Type locality: China: Guizhou (Shibing: Yuntaishan).

*Diagnosis* — Femora blackish; all tibiae yellow except bases, apex of hind tibia blackish. Epandrium with angular projection posteriorly. Hypandrium with somewhat pointed end, slightly projecting beyond level of waved distal margin of lateral epandrial lobe. Apex of phallus with two lateral lobes.

*Specimens examined* — 3 males, China, Guangxi: Damingshan mountain, 23°33'N, 108°21'E, 1230 m, 2013.V.21, G. Q. Wang; 2 males, China, Guangxi: Nanning, Guangxi Academy of Forestry, 22°55'N, 108°21'E, 120 m, 2013.VI.15, Y. Q. Xi.

*Distribution* — China (Inner Mongolia, Guangxi, Guizhou, Hainan, Shanxi, Tibet, Yunnan).

*Remarks* — The species is first reported in Guangxi.

### 2. *Chrysotus degener* Frey, 1917

*Chrysotus degener* Frey, 1917: 11. Type locality: Sri Lanka: Anuradhapura.

*Diagnosis* — Legs mainly yellow; fore coxa yellow with black base, mid and hind coxae black with yellow apex. Tarsomere 1 of mid and hind legs with row of short v. Hypandrium short and sharp. Surstylus with curved base. Apex of phallus bifurcated.

*Distribution* — China (Beijing, Guangxi, Henan, Taiwan, Yunnan); India, Myanmar, Pakistan, Russia, Sri Lanka.

### 3. *Chrysotus guangxiensis* sp. nov.

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(Figs. 1–3)

*Diagnosis* — Legs mainly brown; fore tibia dark yellow with brown base, mid tibia brown with dark yellow apex, hind tibia brown with somewhat dark yellow apex. Hind femur with about 10 bristles at ventral side. Lateral epandrial lobe protruded on upper part, degraded on lower part. Surstylus wide at base, slightly tapered apically. Apex of phallus wide.

*Description* — Male. Body length 1.6–1.7 mm, wing length 1.3–1.4 mm.

Head metallic green with pale gray pollinosity; eyes contiguous on face. Hairs and bristles on head black, postocular bristles (including postero-ventral hairs) brown. Antenna brown to dark brown, scape and pedicel dark brown, first flagellum brown; first flagellum subtrapezoidal, 1.5 times wider than long; arista brown, short pubescent. Proboscis brown with pale hairs; palpus brown with 1 brown bristle at apex.

Thorax metallic green with pale gray pollinosity. Hairs and bristles on thorax black; 6 dc (5 strong and anterior 1 weak), 5–6 irregularly paired acr short and hair-like; scutellum with two pairs of bristles, basal pair long, lateral pair short and hair-like; proepisternum with 1 long black bristle on lower part and 1 short black bristle on upper part.

Legs mainly brown; fore tibia dark yellow with brown base, mid tibia brown with dark yellow apex, hind tibia brown with somewhat dark yellow apex; all tarsi dark yellow. Hairs and bristles on legs brown or black. Fore coxa with short or long hairs; hind coxa with 1 outer bristle at base. Hind trochanter with 1 bristle at middle. Mid femur with bristles on ventral side; hind femur with about 10 bristles on ventral side. Mid tibia with 1 ad at basal 1/4; apically with 4 bristles. Hind tibia with 1 pd at basal 1/2; apically with 4 bristles. Relative length of tibia and 5 tarsomeres of legs LI : 3.1 : 1.8 : 0.9 : 0.5 : 0.3 : 0.3 ; LII : 4.0 : 3.2 : 0.9 : 0.7 : 0.4 : 0.3 ; LIII : 4.5 : 1.2 : 1.0 : 0.6 : 0.4 : 0.4 .

Wing hyaline, tinged with brown; veins blackish, R<sub>4+5</sub> and M parallel apically; CuAx ratio 0.3. Squama brown with brown hairs. Halter brown.

Abdomen short, just slightly longer than thorax. Abdomen metallic green with pale gray pollinosity; hairs and bristles on abdomen dark brown. Male genitalia: Epandrium somewhat rounded, without obvious angular projection posteriorly. Lateral epandrial lobe protruded on upper part, degraded on lower part. Surstylus wide at base, slightly tapered apically. Cercus with moderately long bristles. Apex of phallus wide.

Female. Body length 1.6–1.9 mm, wing length 1.4–1.5 mm. Similar to male, but eyes widely separated.

*Specimens examined* — HOLOTYPE male, China, Guangxi: Maoershan mountain, Daxiagu valley, 25°48'N, 111°1'E, 340 m, 2005.VIII.8, Y. J. Zhu. PARATYPES: 2 males 3 females, the same as HOLOTYPE.

*Distribution* — China (Guangxi).

*Etymology* — The specific epithet refers to the locality of the holotype “Guangxi”, and the species is only found in Guangxi now.

*Chinese name* — 广西小异长足蛇

*Remarks* — The new species is similar to *Chrysotus sublongicornus* Wei in the similar sharp apex of hypandrium and wide apex of phallus, but can be separated from the latter by the apex of lateral epandrial lobe far behind the apex of hypandrium. In *C. sublongicornus*, the apex of lateral epandrial lobe is nearly parallel with the apex of hypandrium (Wei, 2012a).

#### 4. *Chrysotus motuoensis* Liu et Yang, 2013

*Chrysotus motuoensis* Liu et Yang, 2013: 173. Type locality: China (Tibet: Linzhi, Motuo).

*Diagnosis* — All trochanters yellow; base and apex of fore femur yellow, especially ventral side with more yellow at base and apex, basal 1/4 and apical 1/5 of mid femur yellow, basal 1/3 of hind femur brownish yellow; fore and mid tibiae yellow, hind tibia yellow to dark brown from base to apex. Apex of phallus with 2 sheet-like structures, one

short and the other relatively long.

*Specimens examined* — 1 male, China, Guangxi: Damingshan mountain, 23°33'N, 108°21'E, 1230 m, 2013.V.21, G. Q. Wang.

*Distribution* — China (Guangxi, Inner Mongolia, Tibet).

*Remarks* — The species is first reported in Guangxi.

#### 5. *Chrysotus shanxiensis* Liu et Yang, 2015

*Chrysotus shanxiensis* Liu et Yang, 2015: 88. Type locality: China (Shanxi: Qinshui, Xiachuan).

*Diagnosis* — Base and apex of fore and mid femora yellow, especially ventral side with more yellow at base and apex, hind femur yellow at basal 1/2; fore and mid tibiae yellow, hind tibia yellow with brown apex. Hairs on apex of hind tibia and hind tarsomere 1 dense and long. Apex of phallus with 2 fin-shaped structures.

*Specimens examined* — 4 males 1 female, China, Guangxi: Daqingshan mountain, Lanhuagu valley, 24°57'N, 106°45'E, 1110 m, 2014.V.7, S. Su.

*Distribution* — China (Guangxi, Shanxi).

*Remarks* — The species is first reported in the Oriental region, Guangxi.

#### 6. *Chrysotus triprojicienus* sp. nov.

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(Figs. 4–6)

*Diagnosis* — Legs mainly brown; all femora brown with yellow apex; all tibiae yellow (but sometimes with brown base). Apex of phallus with a sheet-shaped structure and 3 palm-shaped swollen lateral lobes.

*Description* — Male. Body length 1.9–2.2 mm, wing length 1.7–2.0 mm.

Head metallic green with pale gray pollinosity; eyes contiguous on face. Hairs and bristles on head black, postocular bristles (including postero-ventral hairs) dark brown to black. Antenna brown to dark brown, scape and pedicel dark brown, flagellum brown; first flagellum nearly subtriangular, 1.9 times wider than long; arista brown, short pubescent. Proboscis brown with pale hairs; palpus yellow with 1 black bristle at apex.

Thorax metallic green with pale gray pollinosity. Hairs and bristles on thorax black; 5 strong dc, 5–6 irregularly paired acr short and hair-like; scutellum with two pairs of bristles, basal pair long, lateral pair short and hair-like; proepisternum with 1 long black bristle on lower part and 1 short black bristle on upper part.

Legs mainly brown; all femora brown with yellow apex; all tibiae yellow (but sometimes with brown base); all tarsi from base of tarsomere 1 onwards yellow to brown. Hairs and bristles on legs brown to black. Fore and mid coxae with hairs and bristles; hind coxa with 1 outer bristle at base. Hind trochanter with 1 bristle in the middle. Fore femur with 4 pv apically; mid femur with 4–5 av and 4–5 pv apically; hind femur with lots of bristles on ventral side and 4–6 strong av apically. Mid tibia with 1 ad at basal 1/4; apically with 3–4 bristles. Hind tibia with row of av and a, 1–2 ad and 1–2 pd; apically with 4 short bristles. Relative length of tibia and 5 tarsomeres of legs LI : 4.4 : 2.2 : 1.1 : 0.9 : 0.5 : 0.5; LII 5.4 : 2.8 : 1.2 : 0.9 : 0.5 : 0.5; LIII 5.8 : 1.8 : 1.5 : 0.9 : 0.5 : 0.5.

Wing hyaline; veins blackish,  $R_{4+5}$  and M parallel apically; CuAx ratio 0.3. Squama brown with brown hairs. Halter pale.

Abdomen metallic green with pale gray pollinosity; hairs and bristles on abdomen black. Male genitalia: Epandrium somewhat rounded, without obviously angular projection posteriorly. Lateral epandrial lobe protruded, bearing 3 short bristles. Surstylus stout, tapered apically. Cercus trapezoidal with moderately long bristles. Apex of phallus with a sheet-shaped structure and 3 palm-shaped swollen lateral lobes.

Female. Body length 2.1–2.5 mm, wing length 2.0–2.2 mm. Similar to male, but eyes widely separated. Hind femur without bristles on ventral side and hind tibia without row of av and a.

*Specimens examined* — HOLOTYPE male, China, Chongqing: Luojiashaba, 29°28'N, 105°40'E, 370 m, 2012.VIII.11, Z. F. Li. PARATYPES: 2 males 2 females the same as HOLOTYPE; 1 male, China, Taiwan: Taizhong, Baxianshan Mountain, 24°10'N, 121°1'E, 2360 m, 2013.VII.30, X. Y. Liu; 1 male 1 female, China, Guangxi: Daqingshan mountain, Lanhuagu valley, 24°57'N, 106°45'E, 1110 m, 2014.V.8, X. M. Lu.

*Distribution* — China (Chongqing, Guangxi, Taiwan).

*Etymology* — The specific epithet means the apex of phallus with three lobes.

*Chinese name* — 三突小异长足虻

*Remarks* — The new species is similar to *Chrysotus biprojicienus* Wei et Zhang in the similar apex of phallus with lateral lobes, but can be separated from the latter by male genitalia without characteristic angular projection posteriorly and apex of phallus with three lobes. In *C. biprojicienus*, male genitalia has a characteristic angular projection posteriorly and the apex of phallus has two lobes (Wei et Zhang, 2010).

#### 7. *Chrysotus xiaominae* sp. nov.

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BED-96D5-D4A2D6CF28A2

(Figs. 7–9)

*Diagnosis* — Legs brown; fore and mid trochanters yellow; fore and mid tibiae yellow (occasionally brown at base), hind tibia yellow with somewhat brown base. Apex of hypandrium with a sickle-shaped structure. Surstylus wide at base and apex, narrow at middle. Cercus flattened, with long bristles. Apex of phallus expanded.

*Description* — Body length 1.4–1.7 mm, wing length 1.3–1.6 mm.

Head metallic green with pale gray pollen; eyes contiguous on face. Hairs and bristles on head black, postocular bristles (including postero-ventral hairs) pale. Antenna brown to black, scape and

pedicel black, first flagellum brown; first flagellum subtrapezoid, 1.3 times wider than long; arista brown, short pubescent. Proboscis brown with pale hairs; palpus yellow with 1 brown bristle at apex.

Thorax metallic green with pale gray pollinosity. Hairs and bristles on thorax brown; 6 dc (5 strong and anterior 1 weak), 5–6 acr short and hair-like; scutellum with two pairs of bristles, basal pair long, lateral pair short and hair-like; proepisternum with 1 long black bristle on lower part and 1 short black bristle on upper part.

Legs brown; fore and mid trochanters yellow; fore and mid tibiae yellow (occasionally brown at base), hind tibia yellow with somewhat brown base; all tarsomere 1 and base of tarsomere 2 yellow. Hairs and bristles on legs pale brown to brown. Fore coxa with long hairs, mid coxa with 1 strong bristle, hind coxa with 1 outer bristle at base. Hind trochanter with 1 bristle at middle. Mid femur with row of pv and some weak av; hind femur with 5–6 strong v. Mid tibia with 1 ad at basal 1/5; apically with 4 weak bristles. Hind tibia with 3 weak pd; apically with 4 weak bristles. Relative length of tibia and 5 tarsomeres of legs LI : 3.4 : 1.1 : 0.8 : 0.5 : 0.4 : 0.4 ; LII : 3.8 : 1.8 : 1.0 : 0.5 : 0.4 : 0.4 ; LIII : 4.7 : 1.2 : 1.0 : 0.5 : 0.4 : 0.4 .

Wing hyaline, tinged with brown; veins blackish,  $R_{4+5}$  and M parallel apically; CuAx ratio 0.25. Squama yellow with yellow hairs. Halter pale.

Abdomen metallic green with pale gray pollinosity; hairs and bristles on abdomen pale or brown. Male genitalia: Epandrium somewhat rounded, without angular projection posteriorly. Lateral epandrial lobe short, with 3 hairs at apex. Apex of hypandrium with a sickle-shaped structure. Surstylus wide at base and apex, narrow at middle. Cercus flattened, with long bristles. Apex of phallus expanded.

Female. Unknow.

*Specimens examined* — HOLOTYPE male, China, Guangxi: Daqingshan mountain, Lanhuagu valley, 24°57'N, 106°45'E, 1110 m, 2014.V.7, S. Su. PARATYPES: 3 males, China, Yunnan: Xishuangbanna, Mengla county, 21°27'N, 101°34'E, 630 m, 2011.V.2, L. H. Wang.

*Distribution* — China (Guangxi, Yunnan).

*Etymology* — The species is named after the first author Liu's mother Yin Xiaomin, who helped him much in many ways in entomology and passed away last year. The name is given at the birthday of Ms. Yin.

*Chinese name* — 晓敏小异长足虻

*Remarks* — The new species is similar to *Chrysotus largipalpus* Wei in the expanded apex of phallus and end of hypandrium with a sickle-shaped structure, but can be separated from the latter by the apex of phallus not divided and without dents. In *C. largipalpus*, the apex of phallus is divided dorsally and with dents ventrally (Wei, 2012a).

### 8. *Chrysotus xinanus* Wei et Zhang, 2010

*Chrysotus xinanus* Wei et Zhang, 2010: 20. Type locality: China (Yunnan: Lijing Yuquan Park).

*Diagnosis* — Eyes contiguous on face. Proboscis black, palpus black. All coxae blackish; femora blackish; apex of hind tibia brownish. Squama pale with brown bristles. Halter pale. Male terminalia: epandrium with characteristic angular projection posteriorly. Surstylus thick and strong, with slightly wide base; apex of phallus with single lobe rounded apically.

*Distribution* — China (Guangxi).

### DISCUSSION

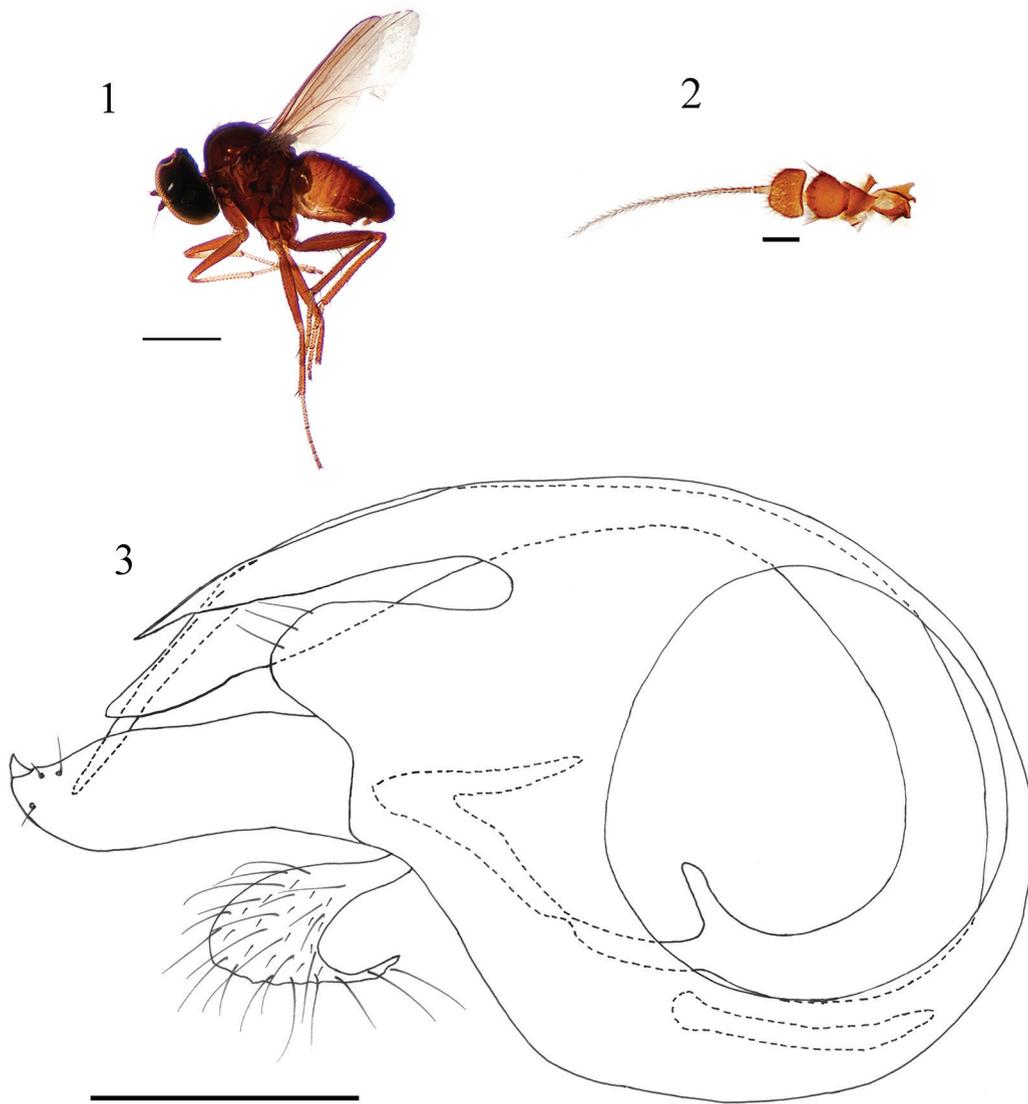
There is a species, *Dubius flavipedus* Liu et Yang, 2015 in Guangxi, with eyes approach on frons and separate on face (Liu et al. 2015b). As originally proposed by Wei, *Dubius* seems to assemble different lineages of *Chrysotus*. The genus *Dubius* is similar to *Chrysotus*. But besides fr/fa ratio, it is not easy to distinguish the two genera (Wei, 2012b). Some entomologists believe that the genus *Dubius* need to be better evaluated, as well as if it is worth applying to other species of *Chrysotus* (Capellari et Amorim, 2014).

## ACKNOWLEDGEMENTS

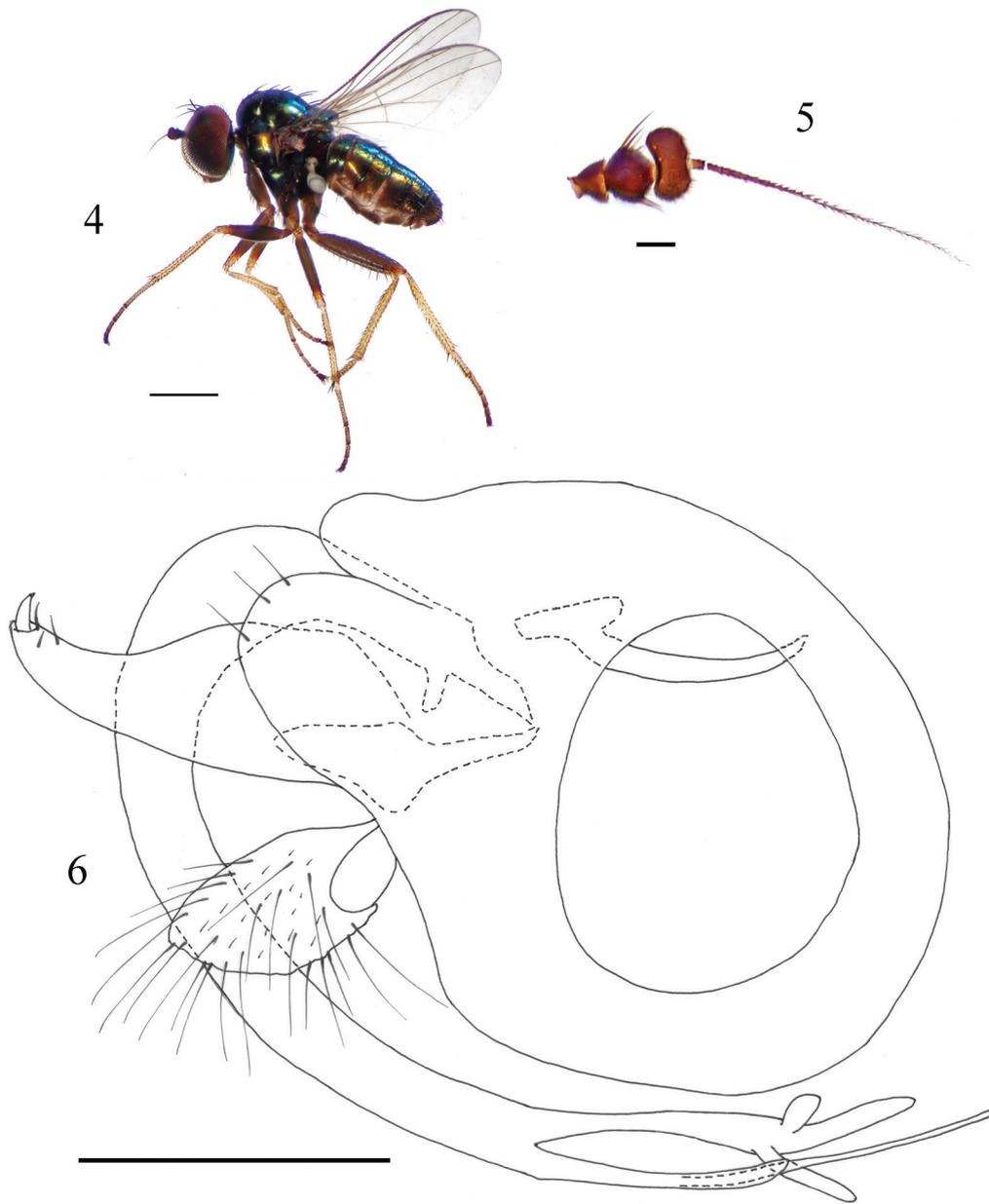
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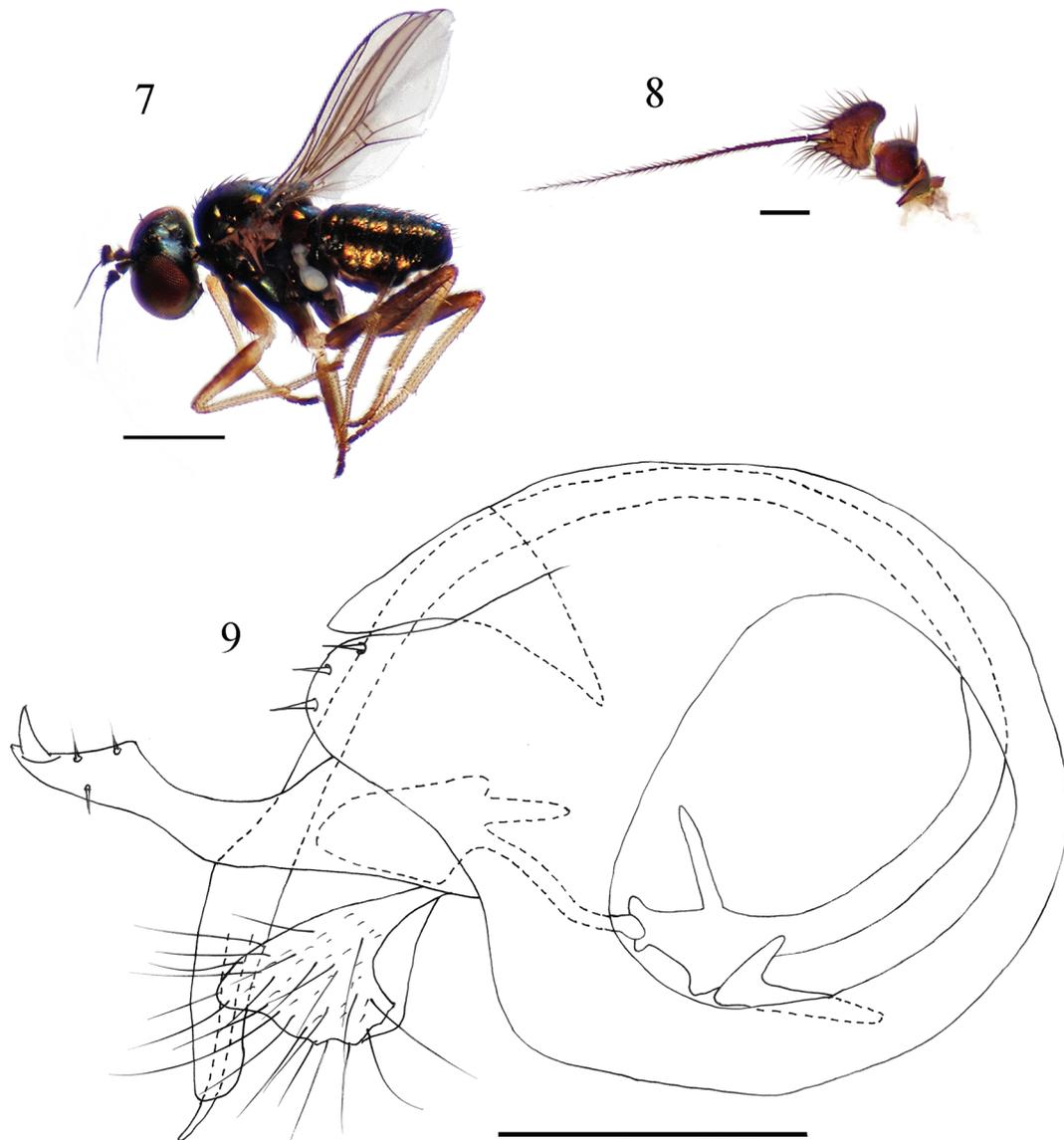
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Figures 1–3. *Chrysotus guangxiensis* sp. nov. (male): 1, body, lateral view, scale bars = 0.5 mm; 2, antenna, lateral view, scale bars = 0.1 mm; 3, genitalia, lateral view, scale bars = 0.1 mm.



Figures 4–6. *Chrysotus triprojiciens* sp. nov. (male): 4, body, lateral view, scale bars = 0.5 mm; 5, antenna, lateral view, scale bars = 0.1 mm; 6, genitalia, lateral view, scale bars = 0.1 mm.



Figures 7–9. *Chrysotus xiaominae* sp. nov. (male): 7, body, lateral view, scale bars = 0.5 mm; 8, antenna, lateral view, scale bars = 0.1 mm; 9, genitalia, lateral view, scale bars = 0.1 mm.