

Description of a new species of *Forcipomyia* (*Euprojoannisia*) Brèthes, 1914 (Diptera: Ceratopogonidae) and a key to Chinese species of the subgenus

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Forcipomyia (*Euprojoannisia*) *coronacella* Han et Hou **sp. n.** (Diptera: Ceratopogonidae) is described and illustrated based on male specimens from China. The new species is compared with the similar congeners, *F.* (*Euprojoannisia*) *palustris* (Meigen, 1804) and *F.* (*Euprojoannisia*) *mucronis* Liu et Yu, 2001. We provide separate keys for identification of the males and females of the species of the subgenus *F.* (*Euprojoannisia*) Brèthes in China.

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1. Introduction

Forcipomyia Meigen (Diptera: Ceratopogonidae), a genus with a worldwide distribution, is one of the species-richest in the biting midges, with many species being important pollinators of tropical and subtropical cultivated plants (Young 1986, Martínez *et al.* 2000). The genus comprises 1,186 species (1,154 extant and 32 fossil) (Borkent 2016). To date, in the subgenus *F.* (*Euprojoannisia*) Brèthes 27 species have been recorded in China (Liu & Yu 2005, Yu & Song 2008, this paper). Most species of the subgenus *F.* (*Euprojoannisia*) Brèthes have eyes bare (only a few species with numerous interommatidial spicules) and contiguous. Palpus of the 3rd segment is with a small sensory pit (a few species with a sacculate sensory pit or none). The aedeagus is triangular, mound-shaped or square, with finger-like, stout or teeth-shaped processes. Paramere is U-shaped or angular, with or without a process on the distal lateral arm and outside the lateral angle.

During the past three years, several entomological surveys of the Tianmushan National Nature Reserve and Qinling Mountains were undertaken, which resulted in a large series of midges deposited in the Insect Collection of Zunyi Medical University (China). We examined ceratopogonid specimens and found two male specimens of the genus *Forcipomyia*, belonging to an undescribed species of the subgenus *Euprojoannisia*. The purpose of this paper is to describe and illustrate this new species from China and compare it with morphologically similar species, as well as to provide separate identification keys to males and females of the species of the subgenus *Euprojoannisia* from China.

2. Materials and methods

The specimens of the new species described herein were collected by a Malaise trap in Tianmushan National Nature Reserve (30°20'N,

Table 1. Diagnostic features distinguishing *Forcipomyia* (*E.*) *coronacella* Han et Hou **sp. n.**, *Forcipomyia* (*E.*) *mucronis* Liu et Yu, 2001 and *Forcipomyia* (*E.*) *palustris* (Meigen, 1804).

Structure	<i>coronacella</i> sp. n.	<i>palustris</i>	<i>mucronis</i>
Aedeagus	Helmet-like, with a round and smooth process in middle (Fig. 2b)	Raft-like, with shallow excavation in middle, distinctly sclerotized at apex	Mound-like, with a columnar and truncate structure in middle, with many small teeth at apex (Fig. 3a)
Parameres	Angular, with 2 small processes on base and 2 teeth-like processes on lateral arm near middle (Fig. 2c)	Angular, with 2 large processes on base and 2 sting-like processes on lateral arm near apex	U-shaped and smooth, without any processes on lateral arm (Fig. 3b)

119°25'E), Zhejiang Province and by an insect net in Taibai, Qinling Mountains (34°7' N, 107°53' E), Shaanxi Province, China. The specimens were mounted in phenol-balsam and examined as described by Wirth and Marston (1968) and Liu and Yu (2005). The type specimens are deposited in the Insect Collection of Zunyi Medical University, Zunyi, Guizhou Province, China (ICZU).

The morphological terminology and identification methods used in the study follow McAlpine *et al.* (1981), Liu *et al.* (2001), Spinelli *et al.* (2005) and Liu & Yu (2005). Diagnostic characters were illustrated using a Leica MZ 12.5 stereomicroscope. The measurements of the wings, the flagellomeres 1–13, the segments of the palpus and the segments of the legs are in millimeters (mm). The following abbreviations are used:

- AR = Antennal ratio (the ratio of the lengths of the segments 11–15 and 3–10)
- PR = Palpus ratio (the ratio of the length and width of the 3rd segment)
- TR = Tarsus ratio (the ratio of the lengths of the 1st and 2nd segment)
- F–T = Femur-tibia-tarsus ratio (the ratios of the lengths of femur, tibia, and the 1st–5th segments of the tarsus)
- CR = The ratio of the lengths of costa and the wing

3. Taxonomy

3.1. Description of *Forcipomyia* (*Euprojoannisia*) *coronacella* Han et Hou **sp. n.** (Figs 1–2)

Material examined. Holotype: adult male, Taibaishan National Forest Park, Shaanxi Province, China, 16.VII.2012, Lv Bin leg. (ICZU)

Paratype: 1 adult male, Tianmushan National Nature Reserve, Zhejiang Province, China, 1.IX.2012, Han Xiaojing leg. (ICZU)

Diagnosis. The new species is most closely similar to *Forcipomyia* (*Euprojoannisia*) *mucronis* Liu et Yu, 2001 and *Forcipomyia* (*Euprojoannisia*) *palustris* (Meigen, 1804), which are distributed in Luding county, Sichuan province, China. The main differentiating characters of these three species are shown in Table 1.

Description. Male. Head brown, vertex with numerous brown hairs. Eyes (Fig. 1d) contiguous. Antennal flagellum (Fig. 1a) with lengths of flagellomeres 1–13 in proportion of 16:11:11:11:11:11:12:12:12:38:25:21:21, AR 1.23 (1.12–1.36, $n=2$), distal four segments elongated, segment 13 parallel-sided with terminal nipple. Palpus (Fig. 1b) with lengths of segments in proportion of 6:6:12:6:6; 3rd segment slender and swollen at the basal 1/2; sensory pit small, situated in front of swollen portion; 4th and 5th segment almost fused; PR 3.77 ($n=2$).

Thorax. Brown. Scutum dark brown, without pattern. All legs pale. Foreleg with lengths of F–T in proportion of 29:21:11:6:6:5:–, prothoracic TR

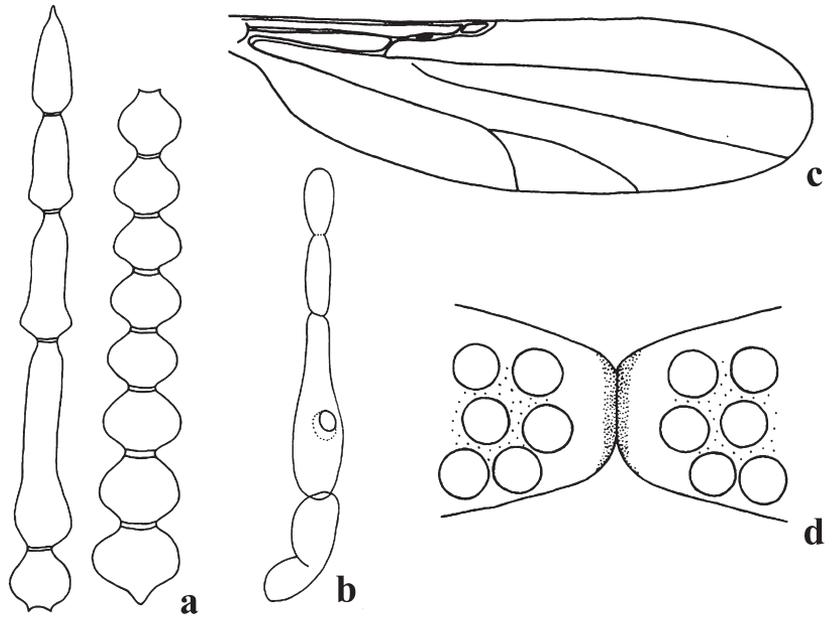


Fig. 1. *Forcipomyia (Euprojoannisia) coronacella* Han et Hou **sp. n.**, male. – a. Antenna. – b. Palpus. – c. Wing. – d. Eyes.

1.83 ($n=2$); midleg with lengths of F–T in proportion of 35:30:8:6:6:5:–, mesothoracic TR 1.23 ($n=2$); hindleg with lengths of F–T in proportion of 30:30:11:6:6:5:–, metathoracic TR 1.75 ($n=1$); claws slender, curved; empodia present; hind tibia with 6 terminal bristles, without ctenidial comb. Wing (Fig. 1c) pale, no spots, with dense macrotrichia; wing length 0.84 mm (0.8–0.88

mm, $n=2$), breadth 0.32 mm (0.3–0.33 mm, $n=2$); CR 0.43 (0.42–0.44, $n=2$). Halter pale.

Abdomen. Light brown, with short appressed hairs and long semierect hairs. Genitalia (Fig. 2a): tergite 9 short, not extending to apex of gonocoxite, posterior margin rounded; sternite 9 broad, posterior margin transverse. Gonocoxite moderately stout, about 2 times longer than the

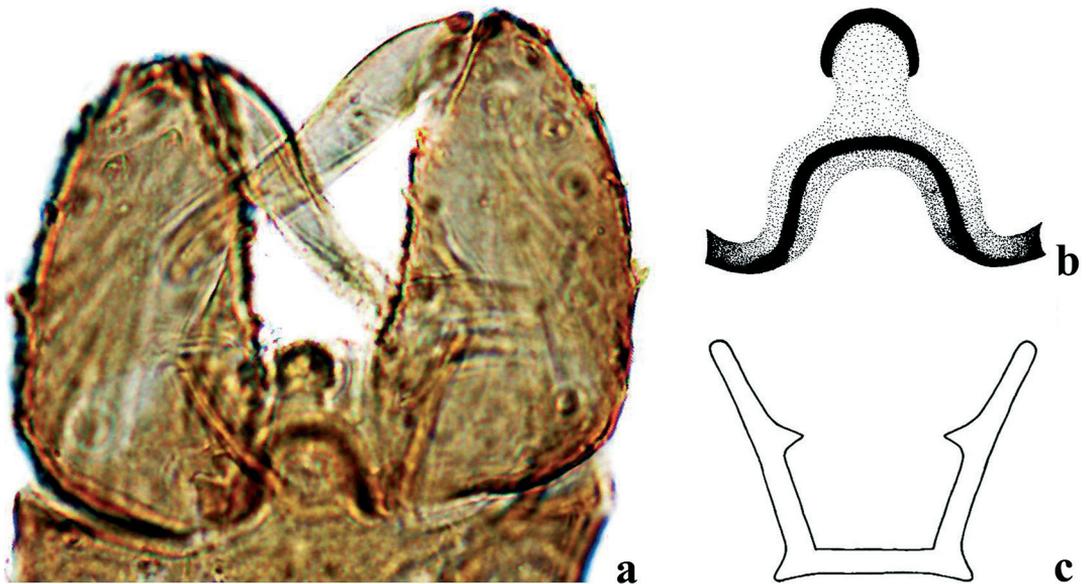


Fig. 2. *Forcipomyia (Euprojoannisia) coronacella* Han et Hou **sp. n.**, male. – a. Genitalia, ventral view. – b. Aedeagus. – c. Paramere.

greatest width; gonostylus pale, nearly straight, tip barely curved. Aedeagus (Fig. 2b) helmet-like, with bell-shaped on outline, one distal rounded and blunt process, 1/3 of height and 1/4 of width of whole aedeagus, sclerotized arch high; parameres (Fig. 2c) U-shaped, bottom flat, bottom angular between side arms and arch, with two processes on lateral arm near middle.

Female. Unknown.

Etymology. The species is named after the characteristic shape of its aedeagus, which is helmet-like.

Distribution. China (Zhejiang and Shaanxi Provinces).

3.2. Key to females of the species of the subgenus *F. (Euprojoannisia)* from China

1. With 1 spermatheca 2
- With 2 spermatheca 4
2. Spermatheca with a curved neck, neck length more than 1/2 of that whole spermatheca; tarsal ratio (T_1/T_2) of mesothoracic legs more than 1.80 *F. bahelea* Liu et Yu
- Spermatheca with straight neck, neck length less than 1/3 of that spermatheca; tarsal ratio (T_1/T_2) of mesothoracic legs less than 1.00 3
3. 3rd segment of palpus swollen significantly, with a deep and sacculate sensory pit *F. tonicus* Liu et Yu
- 3rd segment of palpus slender, with a shallow sensory pit *F. lingnanensis* Liu et Yu
4. Metathoracic TR>2.50; sizes of two spermatheca unequal *F. balteatus* Liu et Yu
- Metathoracic TR<1.80; two spermatheca equal-sized or unequal 5
5. Prothoracic TR>1.70; AR≥1.20 6
- Prothoracic TR<1.60; AR<1.10 7
6. 3rd segment of palpus with a large and deep sensory pit; subgenital plate arch-shaped, simple; sizes of two spermatheca unequal, with a short neck *F. centrosus* Liu et Yu
- 3rd segment of palpus with a small and shallow sensory pit; subgenital plate arch-shaped, with distinctly sclerotized band on outside of basal arms; spermatheca sizes equal, with long neck *F. ignobilis* Liu et Yu
7. 1st tarsal segment of hindleg with rows of feather-like bristles 8
- 1st tarsal segment of hindleg without rows of feather-like bristles 9
8. Spermatheca with long and swollen neck, width >60 μ m *F. psilonota* (Kieffer)
- Spermatheca with short neck, width <50 μ m *F. minor* Liu, Yan et Liu
9. Large species (wing length 1.20 mm); width of smaller spermatheca <30 μ m; PR>3.5 *F. largus* Liu et Yu
- Small species (wing length 0.77 mm); width of smaller spermatheca ≥40 μ m; PR<2.5 *F. pipiens* Liu, Yan et Liu

3.3. Key to males of the species of the subgenus *F. (Euprojoannisia)* from China

1. Aedeagus triangular, with cap-shaped, finger-like structure or nothing on distal end 2
- Aedeagus non-triangular 13
2. Aedeagus with triangular and sclerotized structure on distal end 3
- Aedeagus with finger-like structure on distal end 4
3. 9th sternite as long as wide; 9th tergite approximately triangular *F. appendicular* Liu, Yan et Liu
- 9th sternite two times as wide as long; shape of 9th tergite semicircle *F. psilonota* (Kieffer)
4. Aedeagus with teeth-like or pointed structure near end 5
- Aedeagus without above structure 7
5. Aedeagus with 2 finger shaped processes near end, directed to the base *F. pennielongata* Chan et LeRoux
- Aedeagus with 1 or 5 teeth-like processes on both sides of distal end 6
6. Aedeagus with 5 minor teeth-like processes on both sides of distal end; parameres without a process on distal end, parameres swollen on middle of side arms *F. calamistrata* Debenham et Wirth
- Aedeagus with a small and acute process on both sides of distal end; parameres with a process on distal end of side arms, swollen on middle of side arms *F. yoshimurai* Tokunaga
7. Parameres without process on base arm; 9th tergite approximately triangular, equal length with coxite 8

- Parameres with 2 processes on both ends of base arm; 9th tergite non-triangular, with length less than 1/2 of coxite 9
- 8. 3rd segment of palpus without a sensory pit
F. separatus Liu, Yan et Liu
- 3rd segment of palpus with a sensory pit
F. yapensis Tokunaga et Murachi
- 9. Parameres with U-shaped bottom flat, a pair of clear processes on outside lateral angle 10
- Parameres with U-shaped bottom flat or curved, without a process on outside lateral angle 11
- 10. 9th sternite with excavation postero-medially; coxite short and stout, 1.5 times as long as wide; aedeagus with blunt end
F. mesasiatica Remm
- 9th sternite with shallow depression postero-medially; coxite 2.0 times as long as wide; aedeagus with hook-shaped end
F. chongmingensis Liu et Yu
- 11. Aedeagus small and short, without sclerotized basal arch
F. astyla Tokunaga
- Aedeagus with well sclerotized basal arch 12
- 12. 9th sternite with a bump medially and sclerotized on both sides at posterior; aedeagus with basal arms arched
F. deformis Liu et Yu
- 9th sternite with excavation medially at posterior, not sclerotized; aedeagus with basal arms clearly curved
F. claudus Liu et Yu
- 13. Aedeagus with apex depressed and sclerotized 14
- Aedeagus with a globular, columnar and finger-shaped process at apex 15
- 14. Parameres with U-shaped bottom flat, 2 processes on distal lateral arm
F. palustris (Meigen)
- Parameres with U-shaped bottom curved, without a process on distal lateral arm
F. ratis Liu et Yu
- 15. Aedeagus with 1 or 2 slender and finger-like processes at apex 16
- Aedeagus bell-shaped on outline, with a stout structure in middle, obtuse or truncate at apex 17
- 16. 9th sternite with a shallow depression postero-medially; 9th tergite 1/3 times as long as coxite; aedeagus with a pair of long and fin-

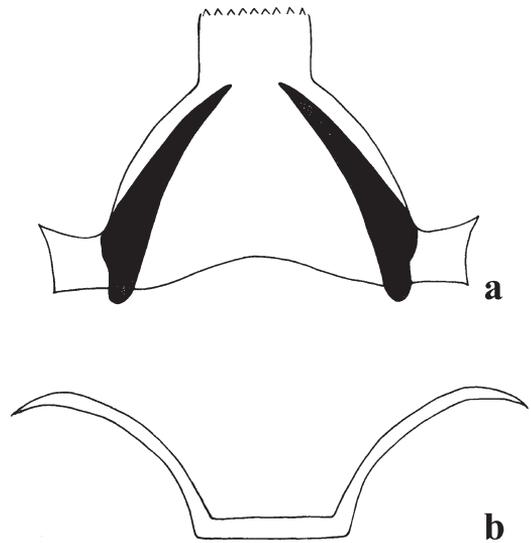


Fig. 3. *Forcipomyia (Euprojoannisia) mucronis* Liu et Yu, male. – a. Aedeagus. – b. Paramere. (After Liu et al. 2001)

- ger-like processes at apex; parameres U-shaped, without any processes
F. picturatus Liu et Yu
- 9th sternite curved posteriorly; 9th tergite 2/3 times as long as coxite; aedeagus with a small and finger-like process at apex medially; parameres angular, with 2 processes on lateral arm near apex
F. amiantos Yu et Song
- 17. Aedeagus mound-like, with a columnar and truncate process in middle, with many small teeth at apex; parameres U-shaped, without any processes on lateral arm
F. mucronis Liu et Yu
- Aedeagus helmet-like, with a round and smooth process in middle; parameres between side arms and arch bottom angular, with 2 processes on lateral arm near middle
F. coronacella Han et Hou **sp. n.**

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