Review of the genus *Malaxella* (Hemiptera: Fulgoroidea: Delphacidae) endemic in China, with a description of a new species

*Fengjuan Ren, Yixin Huang, Lifang Zheng and Daozheng Qin**

Abstract

The Chinese endemic delphacid genus *Malaxella* Ding & Hu (Hemiptera: Fulgoromorpha: Delphacidae) is reviewed in this paper. Three species are treated of which *M. flava* Ding & Hu and *M. tetracantha* Qin & Zhang are redescribed, one new species, *M. macracantha* Ren & Qin **sp. nov.**, is described. Habitus photos and illustrations of male genitalia of these 3 species are given. A key for identifying the species of *Malaxella* is also provided.

Key Words: Auchenorrhyncha; Fulgoromorpha; Tropidocephalini; taxonomy, distribution

Resumen

Se revisa el género delfácido endémico de China, *Malaxella* Ding y Hu (Hemiptera: Fulgoromorpha: Delphacidae). Se estudian tres especies de los cuales se redescriben *M. flava* Ding & Hu, *M. tetracantha* Qin & Zhang y se describe una nueva especie, *M. macracantha* Ren & Qin **sp. nov**. Se aportan fotos del hábitus e ilustraciones de la genitalia masculina de estas 3 especies. También se provee una clave para identificar las especies de *Malaxella*.

Palabras Clave: Auchenorrhyncha; Fulgoromorpha; Tropidocephalini; taxonomía; distribución

The delphacid genus *Malaxella* was established by Ding & Hu (Ding et al. 1986) based on the type species, *M. flava* Ding & Hu from Yunnan and Guangdong, China. It belongs to the tribe Tropidocephalini in the subfamily Delphacinae and is easily distinguished from other genera in this tribe by the orange body color without markings, by the vertex having percurrent submedian carinae uniting at the apex, and by the asymmetrical opening of the male pygofer (Qin & Zhang 2009). *Malaxella* is endemic to the Chinese fauna with 2 known species, *M. flava* Ding & Hu and *M. tetracantha* Qin & Zhang, both distributed in southern China.

In the present paper, the generic characteristics are redefined. *Malaxella macracantha* Ren & Qin collected from Yunnan Province is described as new to science. Habitus photos and illustrations of male genitalia of all the species in this genus are given and morphological features are either described or redescribed. A key to all *Malaxella* species is also provided.

Material and Methods

The specimens studied in this study are deposited in the Entomological Museum, Northwest A & F University, Yangling, Shaanxi, China (NWAFU). The genital segments of the examined specimens were macerated in 10% KOH and drawn from preparations in glycerin jelly with the aid of a light microscope. Illustrations of the specimens were made by a Leica MZ 12.5 stereomicroscope. Habitus photos were taken by a Scientific Digital micrography system equipped with an Auto-montage imaging system and a highly sensitive QIMAGING Retiga 4000R digital camera (CCD) and multiple photographs were compressed into final images. The body measurements of macropters are from the apex of vertex to the tip of the abdomen. All measurements are in millimeters (mm). The methods and morphological terminology in this paper follow those of Ding (2006).

Descriptive Taxonomy

Genus *Malaxella* Ding & Hu (Figs. 1-42)

Malaxella Ding & Hu in Ding et al. 1986: 419. Type species *Malaxella flava* Ding & Hu, in Ding et al. 1986, by original designation.

Malaxella Ding & Hu: Ding 2006: 154; Qin & Zhang 2009: 43.

DIAGNOSIS

The genus is readily separated from other genera in the tribe Tropidocephalini, subfamily Delphacinae by the orange body color without markings, by the submedian carinae of vertex percurrent and uniting at the apex, by the aedeagus laterobasally fused with the ventral armature of the anal segment, by the asymmetrical parameres and by the male anal segment having a cluster of hair-like setae at base of the left laterodistal process.

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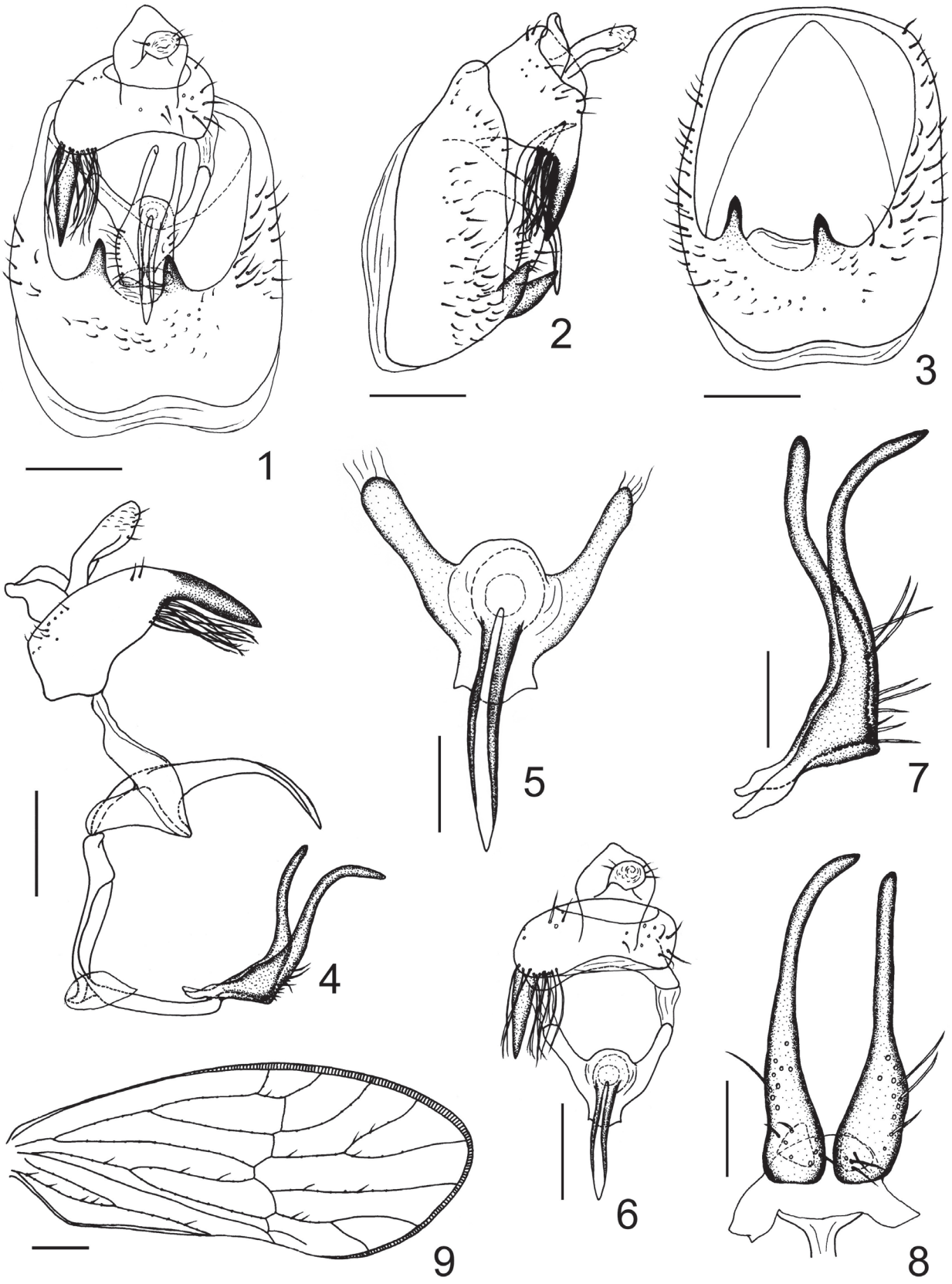
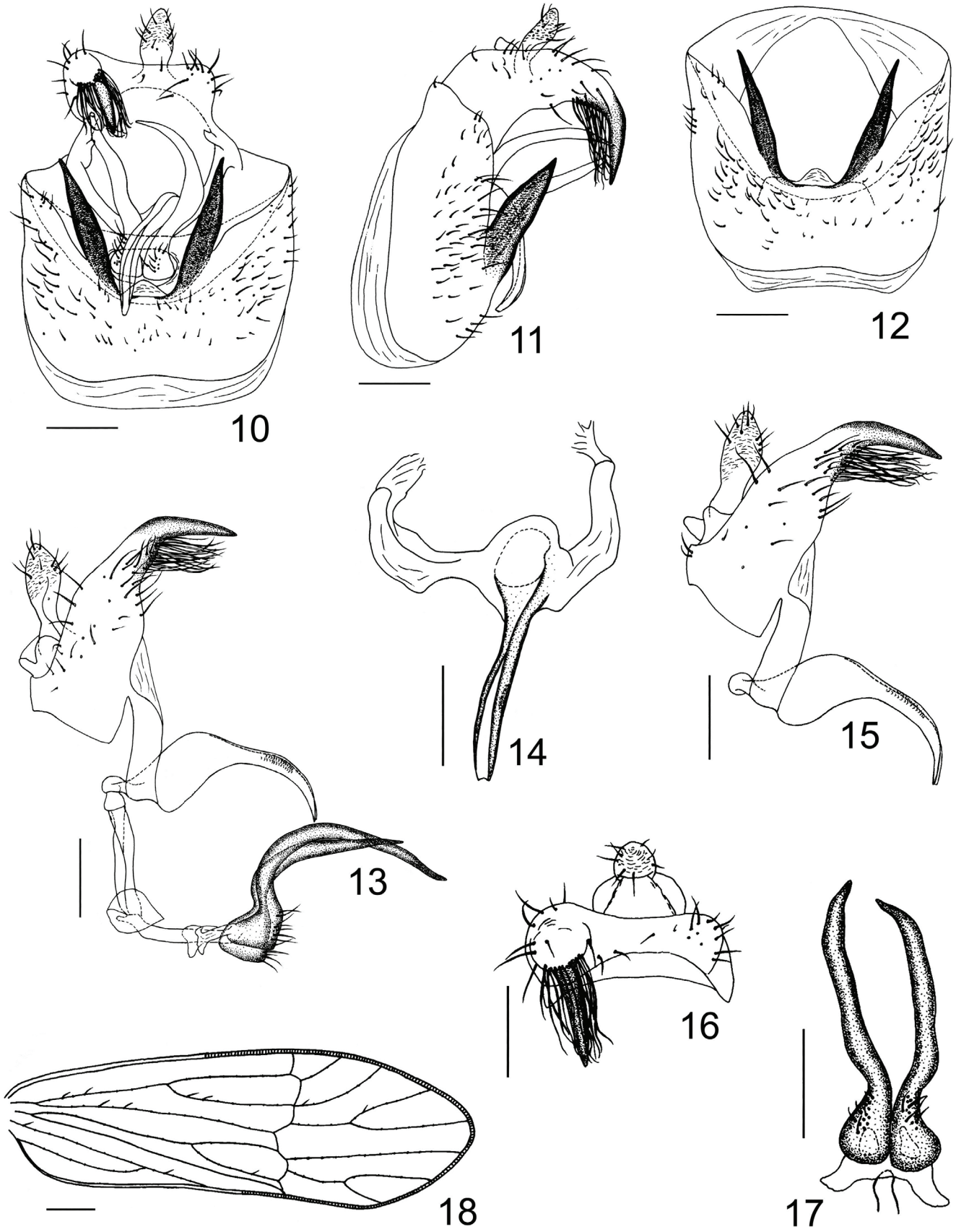
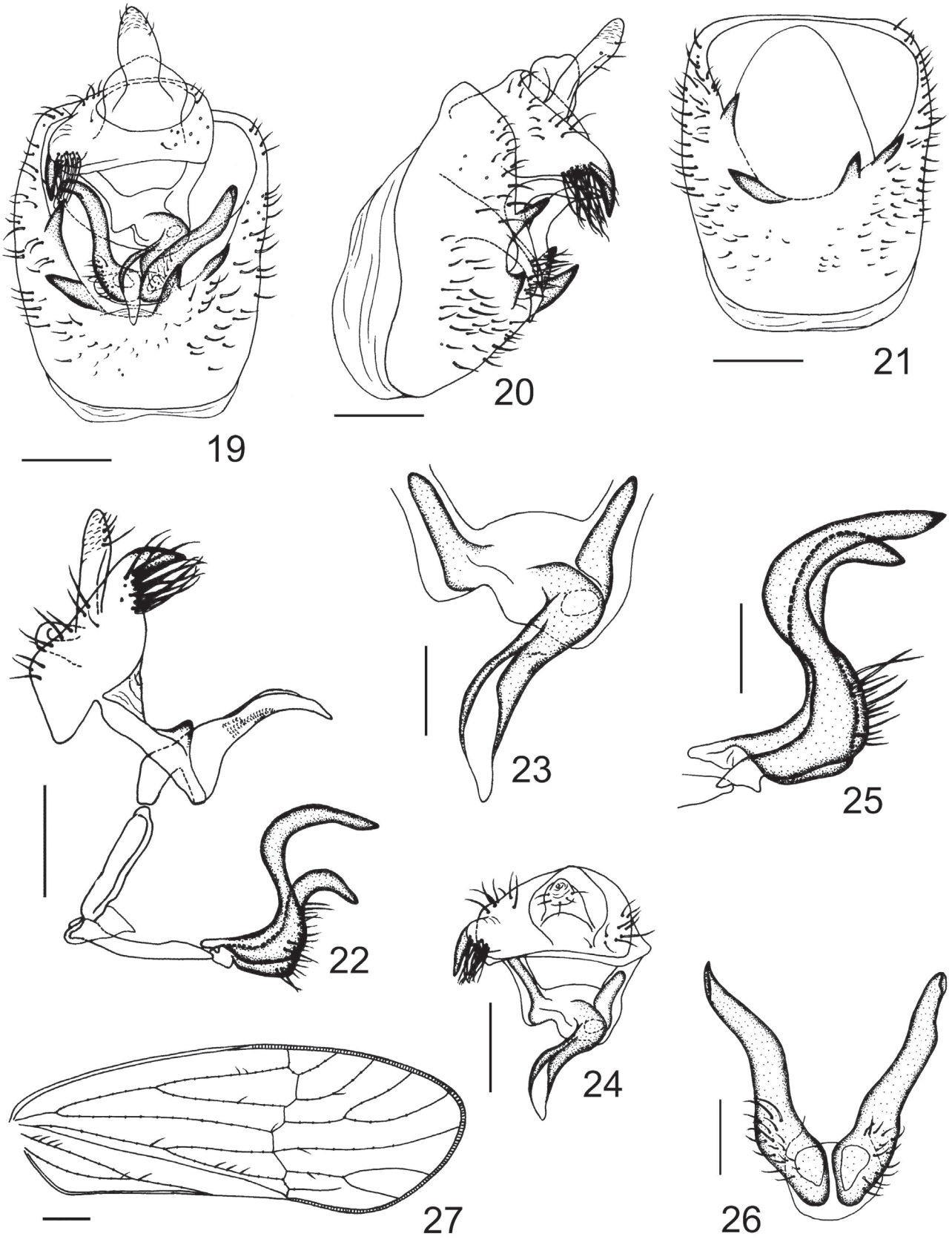


Figs. 1-9. *Malaxella flava* Ding & Hu. 1. Male genitalia, caudal view; 2. Male genitalia, left lateral view; 3. Pygofer, caudal view; 4. Anal segment, aedeagus-suspensorium complex, connective and parameres, left lateral view; 5. Aedeagus-suspensorium complex, caudal view; 6. Anal segment and aedeagus-suspensorium complex, caudal view; 7. Parameres, left lateral view; 8. Parameres, posterior view; 9. Forewing. Scale bars = 0.20 mm (Figs. 1-4, 6); 0.10 mm (Figs. 5, 7, 8); 0.5 mm (Fig. 9).



Figs. 10-18. *Malaxella macracantha* Ren & Qin **sp. nov.** 10. Male genitalia, caudal view; 11. Male genitalia, left lateral view; 12. Pygofer, caudal view; 13. Anal segment, aedeagus-suspensorium complex, connective and parameres, left lateral view; 14. Aedeagus-suspensorium complex, caudal view; 15. Anal segment and aedeagus-suspensorium complex, left lateral view; 16. Anal segment, caudal view; 17. Parameres, posterior view; 18. Forewing. Scale bars = 0.20 mm (Figs. 10-17); 0.50 mm (Fig. 18).



Figs. 19-27. *Malaxella tetracantha* Qin & Zhang. 19. Male genitalia, caudal view; 20. Male genitalia, left lateral view; 21. Pygofer, caudal view; 22. Anal segment, aedeagus-suspensorium complex, connective and parameres, left lateral view; 23. Aedeagus-suspensorium complex, caudal view; 24. Anal segment and aedeagus-suspensorium complex, caudal view; 25. Parameres, left lateral view; 26. Parameres, posterior view; 27. Forewing. Scale bars = 0.20 mm (Figs. 19-22, 24); 0.10 mm (Figs. 23, 25, 26); 0.50 mm (Fig. 27).`

Head. Including eyes distinctly narrower than pronotum (Figs. 28, 30, 32, 34, 36, 38). Vertex quadrate, slightly shorter in midline than broad at base, anterior margin sinuate, slightly projecting in front of eyes, submedian carinae originating near middle of lateral carinae, curved anteriorly to midline of apex, with curved transverse carina joining them at their midline; in dorsal view lateral carinae of vertex slightly concave medially, expanded anteriad and behind eyes (Figs. 28, 30, 32, 34, 36, 38). Frons long, slightly expanded just above the level of ocelli, longer in midline than wide at widest part (2.13-2.65:1), median carina conspicuous and branched at base (Figs. 35, 37, 39). Clypeus at base wider than frons at apex, tricarinate (Figs. 35, 37, 39). Rostrum almost reaching hind trochanters. Antennae cylindrical, very long, reaching or surpassing apex of anteclypeus; pedicle bearing a group of sensilla surrounded in distal half; scape slightly widening distad, longer than wide at apex (2.07-2.67:1), shorter than pedicle (0.29-0.35:1) (Figs. 35, 37, 39).

Thorax. Pronotum tricarinate, in midline nearly equal to median length of vertex, lateral carinae not reaching posterior margin (Figs. 28, 30, 32, 34, 36, 38). Mesonotum medially longer than vertex and pronotum together (1.53-1.85:1), median carina discontinuous medially (Figs. 28, 30, 32, 34, 36, 38). Forewings much longer than abdomen, rounded at apex, widest near apex, veins concolorous, ornamented with blackish brown granules and some brownish hairs on longitudinal veins, row of cross veins located in apical half to subapex of wing (Figs. 9, 18, 27-33). Spination of apex of hind leg 5 (3+2) (tibia), 6 (4+2) (basitarsus) and 4 (2nd tarsomere) (Figs. 40-42). Post-tibial spur large and thick, concave on inner surface, without teeth on interior margin but with a small apical tooth (Figs. 40-42).

Male Genitalia. Pygofer in profile much taller than wide, dorsocaudally not produced, with membranous band basally near dorsal side to basoventrally (Figs. 2, 11, 20), in caudal aspect opening of the male pygofer asymmetrical or not, bearing spine-like or blade-like processes on ventral margin (Figs. 1, 3, 10, 12, 19, 21). Diaphragm membranous (Figs. 1, 10, 19). Parameres long, asymmetrical, contiguous at bases (Figs. 1, 8, 10, 17, 19, 26). Aedeagus tubular at base, laterobasally fused with the ventral armature of the anal segment, phallobase absent, apical part of aedeagus curved, in caudal view the aedeagus arising from the middle of aedeagus-suspensorium complex, dorsally cleft to apex (Figs. 4-6, 13-15, 22-24). Male anal segment ring-like, left laterodistal angle strongly produced ventrad into a stout process, basally bearing a cluster of hair-like setae (Figs. 1, 2, 4, 6, 10, 11, 13, 15, 16, 19, 20, 22, 24).

REMARKS

Ding & Hu (1986) erected the genus *Malaxella* in Tropidocephalini and noted this genus was "closely allied to *Malaxa* Melichar". *Malaxella* is morphologically similar to *Malaxa* and they key out together in Ding (2006) and Qin & Zhang (2010). Chen et al. (2006) reviewed the genus *Malaxa* Melichar and compared it with *Malaxella* Ding & Hu. Hou et al. (2013) redescribed *Malaxa* and added *Malaxa bispinata* Muir to the Chinese fauna. These studies provide the basis for the comparison of traits between these 2 genera.

Malaxella is morphologically similar to *Malaxa* Melichar, 1914 in having quadrate vertex (Figs. 28, 30, 32, 34, 36, 38), long antennae (Figs. 35, 37, 39), pronotum with lateral carinae not attaining hind margin (Figs. 28, 30, 32, 34, 36, 38), male pygofer having medioventral processes, tubular aedeagus and the anal segment ring-like, which is produced at left laterodistal angle (Figs. 1, 10, 19). However, *Malaxella* differs from *Malaxa* in the following combination of characters: in *Malaxella* the general body color is yellow to orange and without markings (often with blackish brown markings in *Malaxa*); the submedian carinae of vertex percurrent and uniting at apex of vertex (uniting before apex of vertex in *Malaxa*), lateral carinae of vertex distinctly expanded anteriad (nearly parallel or slightly convergent anteriad in *Malaxa*); median carina of frons forked at base (median carina simple, not forked in *Malaxa*), lateral carinae widest just above the level of ocelli (lateral carinae nearly parallel, or gradually divergent below ocelli and widest at apex in *Malaxa*); male pygofer with membranous band basally (membranous band absent in *Malaxa*), aedeagus tubular basally and cleft dorsally (aedeagus wholly tubular in *Malaxa*), suspensorium fused with base of the aedeagus laterally (suspensorium absent in *Malaxa*), parameres asymmetrical, simple (parameres symmetrical and forked or with apical processes at apex in *Malaxa*); male anal segment bearing a cluster of hair-like setae at the base of left laterodistal processes (bare in *Malaxa*).

NOTE

According to the study of Ding et al. (1986) and Chen (2002), *Malaxella flava* Ding & Hu feeds exclusively on bamboo. Chen (2003) treated *Malaxa aurunca* Yang & Yang (1986) as a junior synonym of *Malaxella flava* Ding & Hu, and the former was found feeding on *Bambusa multiplex* (Lour.) Raeuschel (Bambusoideae) (Yang & Yang 1986). Unfortunately, the host plant of the other *Malaxella* species remains obscure for now, and information on the life history and biology of *Malaxella* species is also unavailable.

DISTRIBUTION

China (Yunnan, Guizhou, Hainan, Fujian, Taiwan, Guangdong and Guangxi).

Key to Species of Malaxella Ding & Hu (males)

1. Male pygofer with 2 medioventral processes (Figs. 1, 3, 10, 12) 2

—. Male pygofer with 4 medioventral processes (Figs. 19, 21). . . . . *M. tetracantha* Qin & Zhang

2. In caudal aspect, opening of pygofer asymmetrical, medioventral processes short, spine-like (Figs. 1-3); aedeagus cleft subbasally to acuminate apex on dorsal side (Fig. 5). . . . . *M. flava* Ding & Hu

—. In caudal aspect, opening of pygofer symmetrical, medioventral processes long, blade-like (Figs. 10-12); aedeagus cleft submedially to truncated apex on dorsal side (Fig. 14) . . . . . *M. macracantha* Ren & Qin, **sp. nov.**

Malaxella flava Ding & Hu, 1986 (Figs. 1-9, 28, 29, 34, 35, 40)

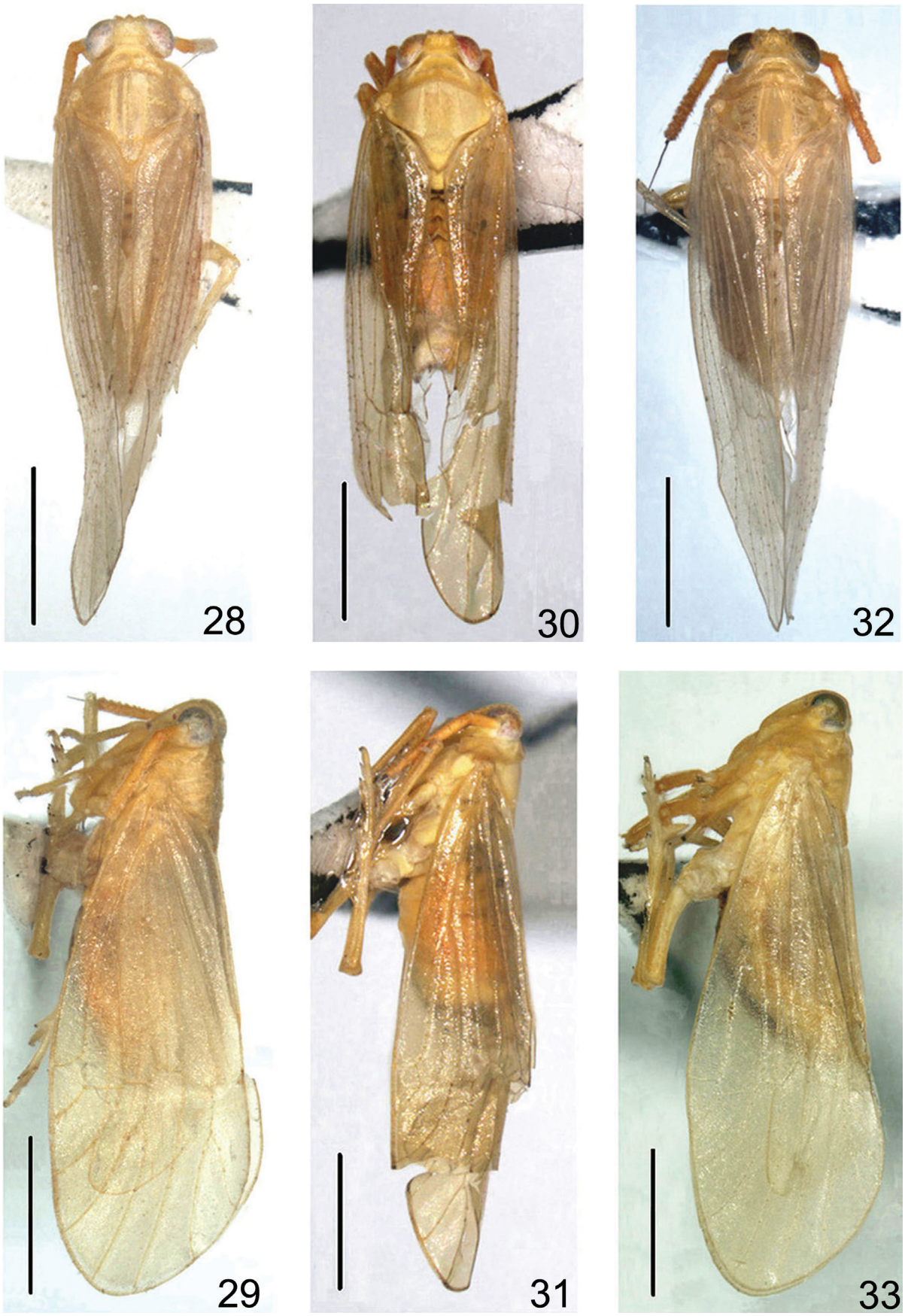
Malaxella flava Ding & Hu in Ding et al. 1986: 419; Qin & Zhang, 2009: 45.

Malaxa aurunca Yang & Yang, 1986: 59, synonymized by Chen, 2003: 820.

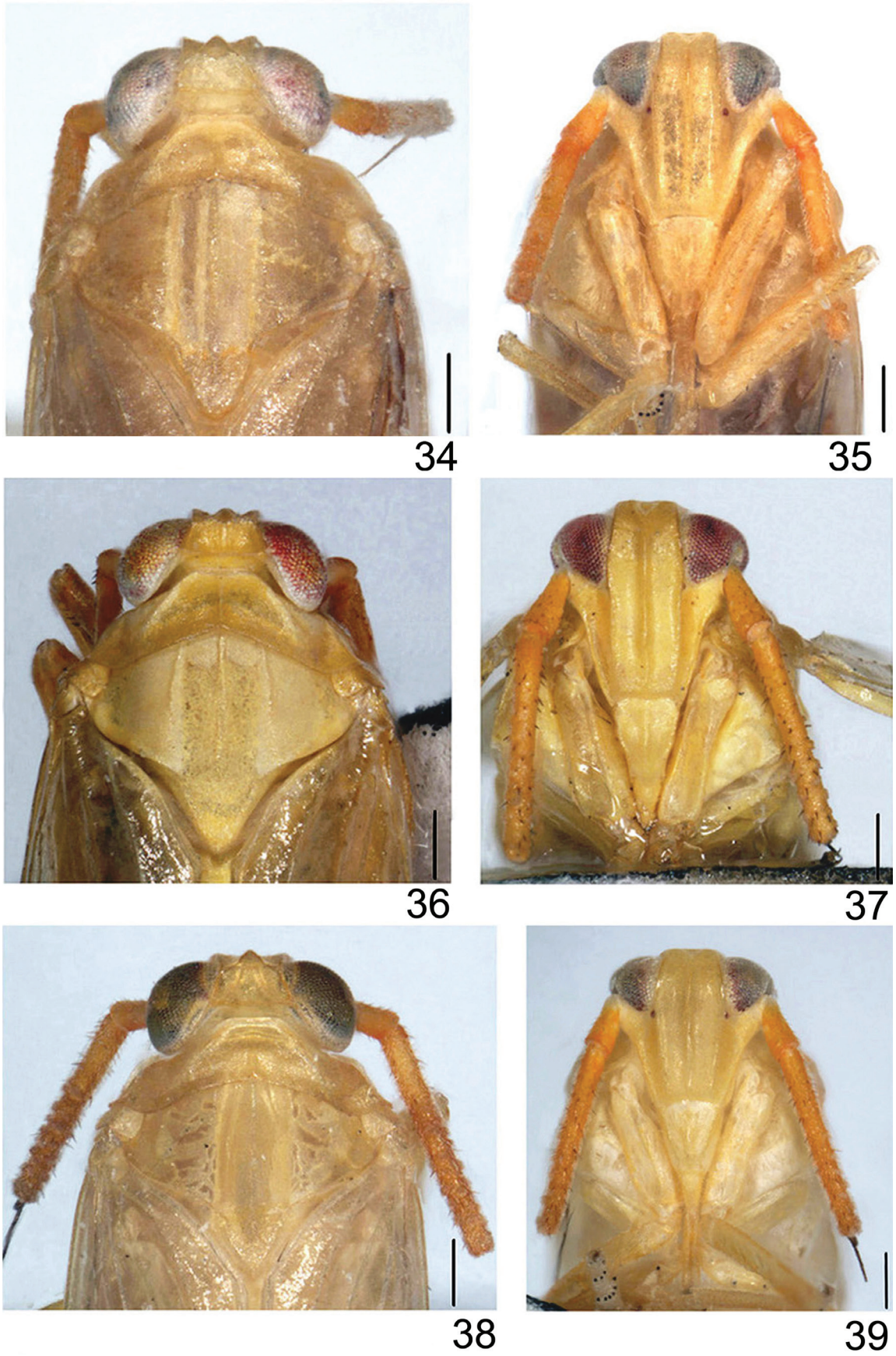
REDESCRIPTION

Body Length. (Macropterous) male 1.85-2.25 mm (*n* = 6); female 2.12-2.64 mm (*n* = 12); total length (from apex of vertex to the tip of forewing): male 3.53-3.75 mm (*n* = 6), female 3.75-4.15 mm (*n* = 12); forewing length: male 3.15-3.26 mm (*n* = 6), female 3.16-3.58 mm (*n* = 12).

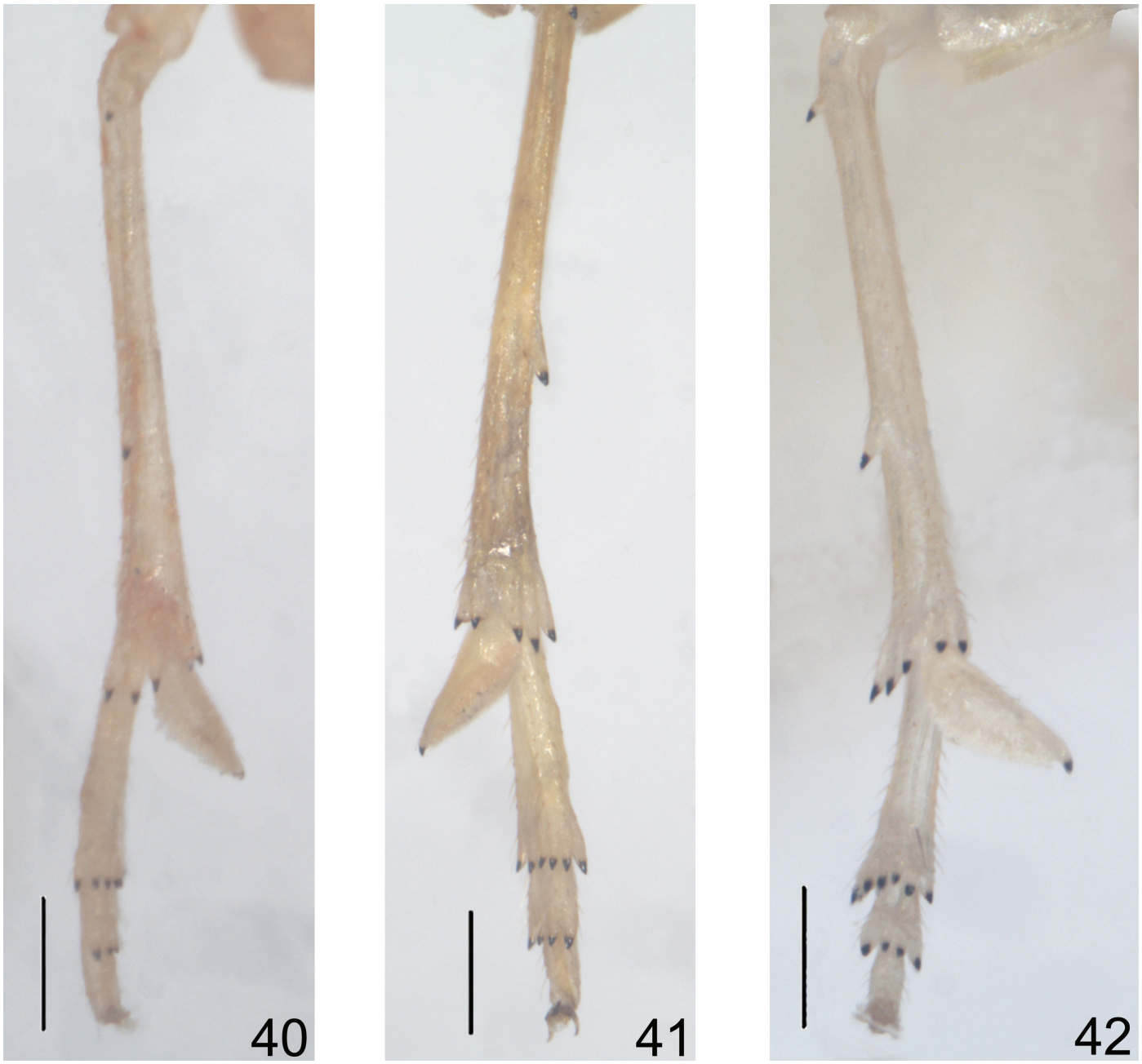
Color. General color yellow to orange. Eyes grayish black, in some specimens eyes with tinge of red (Figs. 28, 29, 34, 35). Ocelli red brown



Figs. 28-33. 28, 29. *Malaxella flava* Ding & Hu. Female; 30, 31: *Malaxella macracantha* Ren & Qin **sp. nov.** Male; 32, 33: *Malaxella tetracantha* Qin & Zhang. Female. 28, 30, 32. Habitus, dorsal view; 29, 31, 33. Habitus, left lateral view. Scale bars = 0.50 mm.



Figs. 34-39. 34, 35. *Malaxella flava* Ding & Hu. Female; 36, 37: *Malaxella macracantha* Ren & Qin **sp. nov.** Male; 38, 39: *Malaxella tetracantha* Qin & Zhang. Female. 34, 36, 38. Head and thorax, dorsal view; 35, 37, 39. Frons and clypeus. Scale bars = 0.20 mm.



Figs. 40-42. 40. *Malaxella flava* Ding & Hu; 41. *Malaxella macracantha* Ren & Qin **sp. nov.**; 42. *Malaxella tetracantha* Qin & Zhang. Hind leg. Scale bars = 0.20 mm.

(Figs. 29, 35). Antennae orange, apex of scape and base of pedicle reddish orange, in some specimens the antennae reddish orange except the apex of pedicle orange yellow (Fig. 35). Abdomen orange, in some specimens dorsum of abdomen yellowish brown except laterally orange. Male pygofer with medioventral processes, apex of parameres, aedeagus and left laterodistal processes of male anal segment blackish brown. Female ovipositor yellow to brownish orange.

Head and Thorax. Structures as in generic descriptions. Head including eyes narrower than pronotum (about 0.74:1) (Figs. 28, 34). Vertex wider at base than long submedially (about 1.16:1), slightly narrower at apex than at base (about 0.87:1) (Figs. 28, 34). Frons longer in midline than maximum width about 2.49:1 (Fig. 35). Post- and anteclypeus together approximately 0.85 × of the length of the frons (Fig. 35). Antennae reaching apex of clypeus, scape longer than apical width (about 2.33:1), shorter than pedicle (about 0.29:1) (Fig. 35). Pronotum slightly shorter than vertex in midline (about 0.91:1), pronotum width 0.73-0.80 mm, length 0.15-0.18 mm (Figs. 28, 34). Mesonotum medially ca. 1.53 times longer than vertex and pronotum together (Figs. 28, 34). Tegmina surpassing tip of abdomen by about two fifths of their total length (Figs. 28, 29), widest at apical third (Fig. 9). Legs with metatibiae 0.85-1.03 mm long, metabasitarsus 0.32-0.35 mm, tarsomere II 0.14-0.17 mm and III 0.19-0.22 mm, post-tibial spur (0.25-0.29 mm) nearly 0.82x as long as metabasitarsus (Fig. 40).

Male Genitalia. Male pygofer in posterior view with opening asymmetrical, bearing 2 spine-like processes on the midventral margin (Figs. 1, 3). Parameres fairly long, in caudal view apices attaining the level of anal segment, the left paramere acuminate at apex and longer than the right one (Figs. 1, 4, 7, 8). Aedeagus produced ventrally near the base, then curved and gradually narrowing distad (Fig. 4), in caudal aspect the aedeagus slightly curved to the left, cleft subbasally to acuminate apex on dorsal side (Figs. 1, 5, 6). Male anal segment large (Figs. 1, 2, 4, 6).

MATERIAL EXAMINED

CHINA: 4 males 7 females, Guangxi, Guilin, 28 Aug. 1974, coll. Yao Zhou & Zheng Lu; 1 female, Hainan, Nada, 23-24 Aug. 1974, coll. Yao Zhou & Zheng Lu; 1 female, Hainan, Jianfengling, 18 May 1983, coll. Yalin Zhang. 2 males, Fujian, Shanghang, Gutian County, 28 Aug. 2008, coll. Manqiang Wang; 3 females, Fujian, Jiangshi Nature Reserve, 29 July 2009, coll. Chaozhong Jiang.

HOST PLANT

Bambusa multiplex (Lour.) Raeuschel (Yang & Yang 1986; Chen 2003).

DISTRIBUTION

China (Fujian, Guizhou, Guangdong, Guangxi, Hainan, Taiwan, Yunnan).

Malaxella macracantha Ren & Qin **sp. nov.** (Figs. 10-18, 30, 31, 36, 37, 41)

DESCRIPTION

Body Length. (Macropterous) male 2.18-2.62 mm (*n* = 8); female 2.60 mm (*n* = 1); total length (from apex of vertex to the tip of forewing): male 4.20-4.25 mm (*n* = 8), female 4.53 mm (*n* = 1); forewing length: male 3.56-3.82 mm (*n* = 8), female 3.98 mm (*n* = 1).

Color. General color yellow to orange. Eyes reddish brown, in some specimens eyes greyish with tinge of red (Figs. 30, 31, 36, 37). Ocelli brownish red (Fig. 37). Antennae orange, in some specimens apex of scape and base of pedicle with tinge of red (Fig. 37). Abdomen orange. Male pygofer with ventral processes, parameres and left laterodistal process of male anal segment blackish brown. Female ovipositor yellowish orange.

Head and Thorax. Head including eyes narrower than pronotum (about 0.75: 1) (Figs. 30, 36). Vertex wider at base than long submedially (about 1.56:1), narrower at apex than at base (about 0.83:1) (Figs. 30, 36). Frons in midline longer than maximum width (about 2.52:1) (Fig. 37). Post- and anteclypeus together approximately 0.69 × of the length of frons (Fig. 37). Antennae surpassing apex of clypeus, scape longer than apical width (about 2.41:1), shorter than pedicle (about 0.35:1) (Fig. 37). Pronotum in midline slightly longer than length of vertex (about 1.08:1), pronotum width 0.80-0.88 mm, length 0.17-0.20 mm (Figs. 30, 36). Mesonotum medially ca. 1.72 times longer than vertex and pronotum together (Figs. 30, 36). Tegmina surpassing tip of abdomen by nearly half of total length (Figs. 30, 31), widest at apical 1/4 (Fig. 18). Legs with metatibiae 0.98-1.07 mm long, metabasitarsus 0.35-0.38 mm, tarsomere II 0.16-0.17 mm and III 0.22-0.23 mm, post-tibial spur (0.27-0.30 mm) nearly 0.79 x as long as metabasitarsus (Fig. 41).

Male Genitalia. Male pygofer in posterior view with opening symmetrical, bearing 2 fairly long, broad, blade-like processes on the ventral margin (Figs. 10, 11, 12). Parameres slender, in caudal view apices attaining the level of anal segment, the left paramere longer than the right one, both curved and pointed apically (Figs. 10, 13, 17). Aedeagus in lateral view broad subbasally, apical 2/3 curved and strongly narrowing distad (Figs. 13, 15), in caudal view the aedeagus curved to left, cleft submedially to truncated apex on dorsal side (Figs. 10, 14). Male anal segment with left laterodistal process moderate (Figs. 10, 11, 13, 15, 16).

TYPE MATERIAL

HOLOTYPE male (macropterous) CHINA: Yunnan, Menghai, Daluo County, 22 May 2011, 679 m, coll. Silong Xu (NWAFU). PARATYPES 7 males 1 female, same data as holotype (NWAFU).

ETYMOLOGY

The specific epithet refers to the large medioventral processes of the pygofer.

REMARKS

This new species differs from both *M. flava* and *M. tetracantha* in having 2 fairly long and blade-like medioventral processes (with either 2 or 4 short and spine-like processes in *M. flava* and *M. tetracantha,* respectively); in the aedeagus being humped dorsally in basal 2/5 (not humped dorsally in basal 2/5 in *M. flava* and *M. tetracantha*); the aedeagus being truncated at apex in caudal view (acuminate or rounded at apex in *M. flava* and *M. tetracantha*).

DISTRIBUTION

Known currently from the type locality in southwest China (Yunnan Province).

Malaxella tetracantha Qin & Zhang (Figs. 19-27, 32, 33, 38, 39, 42)

Malaxella tetracantha Qin & Zhang, 2009: 48.

DESCRIPTION

Body Length (macropterous) male 1.99-2.25 mm (*n* = 7); female 2.15-2.62 mm (*n* = 8); total length (from apex of vertex to the tip of forewing): male 3.93-4.26 mm (*n* = 7), female 3.90-4.45 mm (*n* = 8); forewing length male 3.47-3.65 mm (*n* = 7), female 3.43-3.95 mm (*n* = 8).

Color. General color yellow to orange. Eyes greyish black, in some specimens eyes with tinge of red (Figs. 32, 33, 38, 39). Ocelli red brown (Fig. 39). Antennae orange (Figs. 32, 38, 39). Male pygofer with medioventral processes, apex of parameres, and left laterodistal process of male anal segment blackish brown. Female ovipositor yellow to brownish orange. Abdomen reddish, in some specimens the dorsum of abdomen yellowish brown except laterally orange.

Head and Thorax. Structures as in generic descriptions. Head including eyes narrower than pronotum (about 0.77:1) (Figs. 32, 38). Vertex wider at base than long submedially (about 1.18:1), slightly narrower at apex than at base (about 0.88:1) (Figs. 32, 38). Frons longer in midline than maximum width (about 2.56:1) (Fig. 39). Post- and anteclypeus together approximately 0.79× the length of the frons (Fig. 39). Antennae surpassing apex of clypeus, scape longer than apical width (about 2.39:1), shorter than pedicle (about 0.33:1) (Fig. 39). Pronotum in midline slightly shorter than length of vertex (about 0.95:1), pronotum width 0.77-0.88 mm, length 0.16-0.20 mm (Figs. 32, 38). Mesonotum medially ca. 1.67 times longer than vertex and pronotum together (Figs. 32, 38). Tegmina surpassing tip of abdomen by 2/5 of their total length (Figs. 32, 33), widest in apical 1/4 (Fig. 27). Legs with metatibiae 0.90-1.02 mm long, metabasitarsus 0.33-0.36 mm long, tarsomere II 0.17-0.19 mm and III 0.21-0.23 mm, post-tibial spur (0.25-0.27 mm) about 0.76x as long as metabasitarsus (Fig. 42).

Male Genitalia. Male pygofer in posterior view with opening asymmetrical, bearing 4 spine-like processes along the mid to ventral margins (Figs. 19-21). Parameres broad, in caudal view apices reaching or not attaining the level of anal segment, contiguous at bases and detached distad (Figs. 19, 26), both S-shape in lateral view (Figs. 22, 25). Aedeagus produced ventrally near the base, nearly straight in middle portion, apically curved and strongly narrowed (Fig. 22), in caudal view the aedeagus strongly curved to right basally and then to left distally,

cleft submedially to rounded apex on dorsal side (Figs. 19, 23, 24). Male anal segment with left laterodistal process relatively short (Figs. 19, 20, 22, 24).

MATERIAL EXAMINED

CHINA: 1 male (HOLOTYPE), Fujian, Wuping County, 1 Sept. 2008, 320 m, coll. Lei Zhang; 4 males 6 females (PARATYPES), Fujian, Wuping County, 1 Sept. 2008, 320 m, coll. Lei Zhang; 1 female (PARATYPE), Fujian, Wuping County, 1 Sept. 2008, 320 m, coll. Bin Xiao; 1 male (Paratype), Hainan, Bawangling, 15 May 2008, 126 m, coll. Qiulei Men, light trap; 1 female (Paratype), Hainan, Bawangling, 17 May 2008, 176 m, coll. Qiulei Men, light trap; 1 male (Paratype), Hainan, Liangyuan, 31 May 1983, 173 m, coll. Yalin Zhang, light trap.

DISTRIBUTION

China (Fujian, Hainan).

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