



## Taxonomic study on the planthopper genus *Macrocixius* Matsumura (Hemiptera: Fulgoromorpha: Cixiidae) with descriptions of two new species from China

PEI ZHANG<sup>1,2,3</sup> & XIANG-SHENG CHEN<sup>1,2,4</sup>

<sup>1</sup>The Provincial Key Laboratory for Agricultural Pest Management of Mountainous Region, Guizhou University, Guiyang, Guizhou 550025, P. R. China

<sup>2</sup>Institute of Entomology, Guizhou University, Guiyang, Guizhou 550025, P. R. China

<sup>3</sup>Xingyi Normal University for Nationalities, Xingyi, Guizhou 562400, P. R. China

<sup>4</sup>Corresponding author. E-mail: chenxs3218@163.com

### Abstract

The cixiid planthopper genus *Macrocixius* Matsumura, 1914 (Hemiptera: Fulgoromorpha: Cixiidae: Cixiini) is known to from two species: *M. giganteus* Matsumura, 1914 and *M. grossus* Tsaur & Hsu, 1991 which are redescribed and illustrated. Two new species, *M. rarimaculatus* **sp. nov.** and *M. unispinus* **sp. nov.** from south China, are described and illustrated. The generic characteristics are redefined and a key to the species is provided.

**Key words:** cixiid, Fulgoroidea, Oriental region, planthopper, taxonomy

### Introduction

The cixiid planthopper genus *Macrocixius* was established by Matsumura (1914) for *M. giganteus* Matsumura, 1914, from Kyushu, Japan, and belongs to the tribe Cixiini in the family Cixiidae. *Macrocixius grossus* Tsaur & Hsu, 1991, from Taiwan, China was described in Tsaur *et al.* (1991). Since then, no reports on this genus have been published.

While sorting and identifying Cixiidae from material in the Institute of Entomology, Guizhou University (IEGU), we found two new species of *Macrocixius*, which are herein described and illustrated. Furthermore, the two known species of this genus, *M. giganteus* Matsumura and *M. grossus* Tsaur & Hsu are redescribed and reillustrated. The purpose of this paper is to describe these two new species and to provide an identification key to the species of this genus.

### Material and methods

The morphological terminology follows Tsaur *et al.* (1988) and Löcker *et al.* (2006). Dry specimens were used for the description and illustration. External morphology was observed under a stereoscopic microscope and characters were measured with an ocular micrometer. The genital segments of the examined specimens were macerated in 10% KOH and drawn from preparations in glycerin jelly with the aid of a Leica MZ 12.5 stereomicroscope. Illustrations were scanned with CanoScan LiDE 200 and imported into Adobe Photoshop CS3 for labeling and plate composition. Specimens examined are deposited in the Institute of Entomology, Guizhou University, Guiyang, Guizhou Province, China (IEGU).

## Taxonomy

### Genus *Macrocixius* Matsumura, 1914

*Macrocixius* Matsumura, 1914: 394; Tsaour and Hsu, 1991: 3.

Type species: *Macrocixius giganteus* Matsumura, 1914 (original designation).

**Diagnostic characters.** The distinctive characters used by Matsumura (1914) and Tsaour *et al.* (1991) are modified as follows.

*Body size.* Large-sized species. Total length varying from 8.8–12.5 mm.

*Head.* Head distinctly narrower than pronotum, transverse at base. Vertex concave posteriorly, generally fuscous, widening from subapical carina to both ends, base wider than apex, and with prominent median carina which is divided into two parts by subapical carina, the anterior part of the prominent median carina not touching subapical carina or vanishing, the posterior part of the prominent median carina not touching subapical carina; apical transverse carina nearly straight; subapical carina curving dorsally; area between apical transverse carina and subapical carina concave, sub-trapezoid; lateral margins behind subapical carina with two large subtriangular yellowish brown areas. Face narrowing basally, gradually widening to the level of the antennae then narrowing to frontoclypeal suture, apex wider than base, disc flattened; median carina distinct, percurrent on frons and clypeus, lateral carinae strongly elevated except on anteclypeus, frontoclypeal suture arched dorsally. Rostrum reaching hind femur, generally yellowish brown, apex black or dark brown.

*Pronotum and mesonotum.* Pronotum chevron shaped, each side with a prominent intermediate carina. Mesonotum tricarinate, convex anteromedially, smooth between lateral carinae; lateral carinae reaching anterior and posterior margins; bearing transverse striations on posteromedian area.

*Wings.* Forewing much longer than the abdomen, tectiform, slightly broader medially, covered with setae or not, with 7 subapical cells and 12 apical cells; indistinct tubercles along both sides of veins; first veinlet r+m basad of fork MA+MP; Rp 4-branched, MA 3-branched, Mp 2-branched; fork MA basad of fork MP; cross veins not in rows; some species with a narrow strip between bases of CuP and PCu; yellow alternating with fuscous on total length or apical half of veins, which with concolorous tubercles. Wing with MP and CuA1 partly fused.

*Legs.* Hind tibia yellowish brown, with about 3-4 lateral and 6 apical spines, apices of lateral and apical spines dark brown. Chaetotaxy of hind tarsi 8-9/7-9, 2<sup>nd</sup> hind tarsus with platellae.

*Abdomen.* Abdomen dorsoventrally compressed. Pygofer symmetrical, elongated, lateral lobes symmetrical; in ventral view, dorsal margin U-shaped. Medioventral process subtriangular, generally wider than long; in lateral view, basal half covered by lateral lobes of pygofer. Anal segment tubular with apical part reflexed and symmetrical in caudad view, relatively long; anal style finger-like, beyond anal segment. Genital styles symmetrical in ventral view, apex inflated and with setae. Aedeagus wide and large, in ventral view each side produced anteriorly; in right view, with four spines originating from apex of aedeagal shaft, near base of flagellum. Flagellum of aedeagus wide and large, with spines, some parts strongly sclerotized, not distinctly curving to one side; in dorsal view, dorsal margin with a wide and large S-shaped textures.

**Distribution.** Oriental and Palaearctic regions.

**Remarks.** This genus may be easily distinguished from other genera of Cixiini by the presence of 7 subapical cells and 12 apical cells on the forewing, by the wings with MP and CuA1 partly fused, by the shape of the median carina of vertex, by the apical margin of pygofer U-shaped in ventral view, by the aedeagus with an anteriorly directed triangular process on each side, and by the dorsal margin of flagellum with a wide and large S-shaped textures in dorsal view.

### Key to species of the genus *Macrocixius* Matsumura

1. Flagellum of aedeagus with one spine (Fig. 50) . . . . . *M. unispinus* **sp. nov.**
- Flagellum of aedeagus with more than one spine . . . . . 2
2. Flagellum of aedeagus with three spines (Fig. 24) . . . . . *M. grossus*
- Flagellum of aedeagus with two spines (Figs 11, 37) . . . . . 3
3. Forewing with numerous dark markings (Figs 3, 53, 57); the shortest spine on right side of aedeagus awl-shaped (Fig. 10) . . . . . *M. giganteus*
- Forewing with fewer dark markings (Figs 29, 55, 59); the shortest spine on right side of aedeagus generally straight, with base inflated and the rest distally tapering (Fig. 36) . . . . . *M. rarimaculatus* **sp. nov.**

## ***Macrocixius giganteus* Matsumura, 1914**

(Figs 1–13)

*Macrocixius giganteus* Matsumura, 1914: 394; Tsaour and Hsu, 1991: 3.

**Diagnostic characters.** Body length (from apex of vertex to tip of forewings): male 10.3 mm (n = 1).

**Coloration.** General color blackish brown (Figs 53, 57, 61). Eyes blackish brown. Ocelli pale yellow. Face yellowish to blackish brown; lateral and posterior margin of frons and discal area of postclypeus with light color. Pronotum with periphery yellowish brown, discal area blackish brown. Mesonotum black. Forewing milk white, semihyaline, spreading with small dark brown splashes on the surface; stigma blackish brown; strip between bases of CuP and PCu pale brown; yellow alternating with black brown on total length of veins. Hind tarsi with platellae crineous. Abdomen blackish brown ventrally.

**Head.** Median ocellus (Figs 2, 61) above the peak of frontoclypeal suture. Vertex (Figs 1, 53) 1.3 X wider than long; subapical carina joins lateral carinae at apical 1/5; anterior margin with middle slightly convex, posterior margin nearly trapezoidally concave; areolets before subapical carina slightly concave, area behind subapical carina deeply concave; both two portions of median carina existing. Frons (Figs 2, 61) 1.4 X longer than wide; anterior margin archedly concave; both sides of median carina with many fine scores. Rostrum with subapical segment 1.1 X longer than apical segment.

**Pronotum and mesonotum.** Pronotum (Figs 1, 53) 1.3 X longer than vertex; intermediate carinae curving parallel to posterior margin of eyes, vanishing near anterior margin of pronotum; both sides of median carina deeply concave; posterior margin concave, forming an obtuse angle. Mesonotum (Figs 1, 53) 2.2 X longer than pronotum and vertex combined; lateral carinae slightly sinuous, inner sides with fine striations, median carina indistinct on posteromedian area.

**Wings.** Forewing (Figs 3, 53, 57) 3.3 X longer than wide; fork Sc+RP basad of fork CuA1+CuA2, fork PCu+A1 distad of center of clavus.

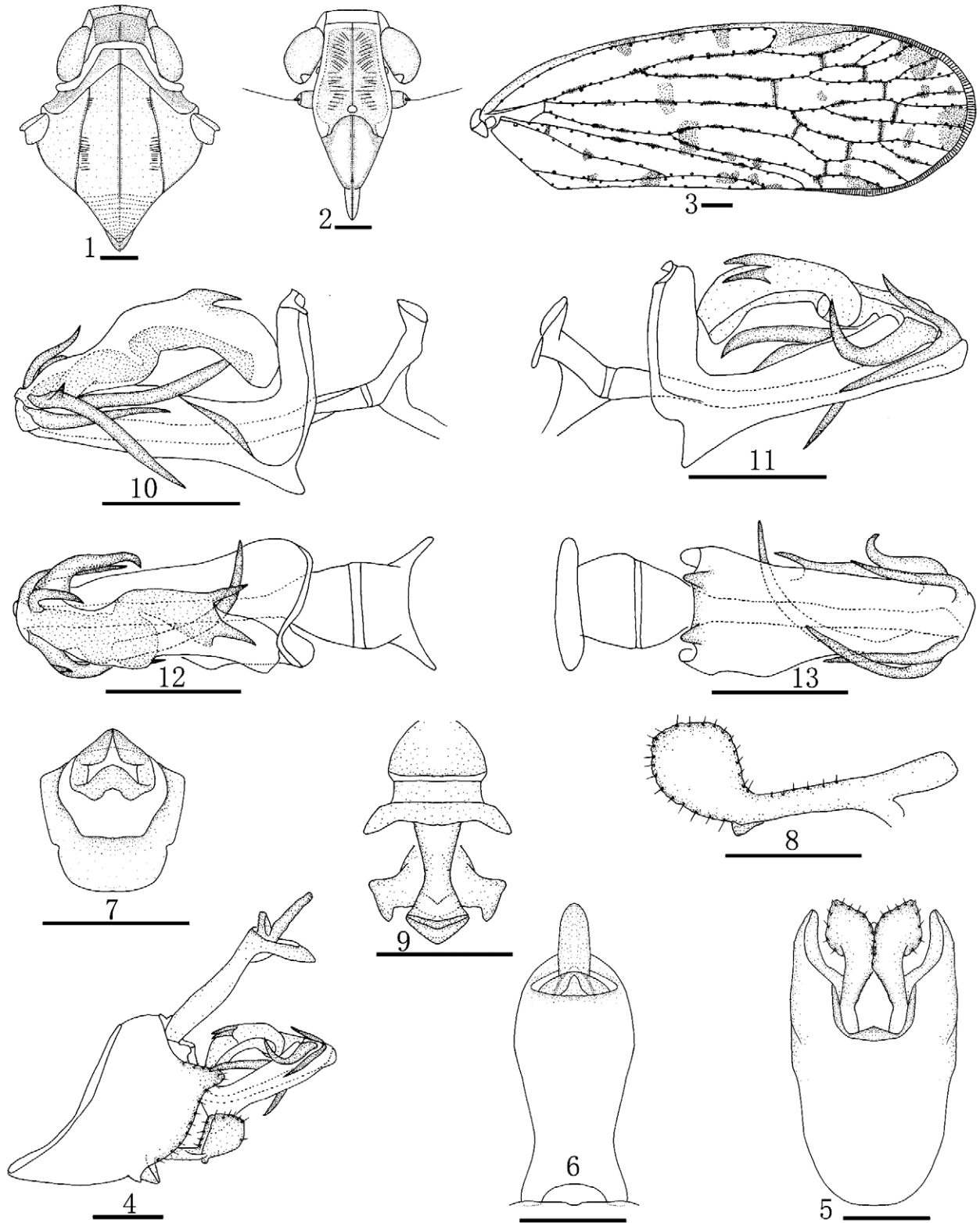
**Legs.** Hind tibia with 4 lateral spines; chaetotaxy of hind tarsi: 8/8, 2<sup>nd</sup> hind tarsus with 4 platellae.

**Abdomen.** Pygofer (Figs 4, 5) with outer margin slightly sinuous in ventral view, widening from base to middle, almost equal in width from middle to apex; in lateral view, lateral lobes caudally convex, mastoid-shaped, outer margin with setae. Medioventral process (Figs 4, 5) 4.7 X wider than long in ventral view, reaching to 1/10 of length of lateral lobes; thumb-like in lateral view. Anal segment (Figs 4, 6, 7), in lateral view, dorsal margin slightly concave, ventral margin sinuous; in caudal view, dorsal margin archedly convex, ventral margin convex into hemicycle; 2.2 X longer than wide in dorsal view; closely connected with pygofer, unmovable. Anal style (Figs 4, 6) relatively long; abdominal segment XI relatively small, covering base of anal style. Genital styles (Figs 4, 5, 8), in ventral view, with apical portion of inner margin nearly trapezoidally inflated, touching each other, outer margin with apical portion inflated and middle portion concave; in lateral view, dorsal and ventral margins with basal half nearly straight and apical portion inflated into balloon-shape; loosely connected with connective, movable. Aedeagus (Figs 10–13) with total of nine spines; four spines on right side: the shortest one awl-shaped, directed dorsocephalad, the longest one crossing dorsal margin of aedeagus to left side, the upper one of the remaining two spines curving downward, directed ventrocephalad, the lower one of the remaining two spines moderately long, slightly sinuous, directed cephalad; three spines on left side: the anterior one with basal half broad and large, apical half strongly curving upward, directed dorsocephalad, the posterior two spines joined at base, the upper one slightly curved, directed dorsocephalad, the lower one nearly straight, directed ventrocephalad. Flagellum with two nearly subparallel short spines on apical 1/3, both slightly curving and directed cephalad. Connective (Fig. 9) broad and large; aedeagal shaft 1.5 X wider than width of connective plus ventral arm.

**Material examined.** 1 ♂, Wuyishan (900m), Jiangxi Province, China, 1 August 2007, Z.-H. Meng.

**Distribution.** South China (Jiangxi, Taiwan) (new record from Mainland); Japan (Kyushu).

**Remarks.** *M. giganteus* was described as new species in Matsumura (1914). Tsaour *et al.* (1991) designated the lectotype and paralectotypes and provided a detailed description and illustrations of the male genitalia of this species. This species was also illustrated by Yang & Chang (2000) (as *Microcixius (sic) gigantus (sic)*). Our illustrations (based on one specimen) are somewhat different from those of Tsaour *et al.* (1991), the main differences are as follows: (1) the forewing of our specimen without large dark markings (the forewing with large dark markings on clavus and area below stigma in Tsaour *et al.* (1991)); (2) the spines of the aedeagus of our specimen



**FIGURES 1–13.** *Macrocoxius giganteus* Matsumura. (1) Head and thorax, dorsal view; (2) Face, ventral view; (3) Forewing; (4) Male genitalia, lateral view; (5) Pygofer and genital styles, ventral view; (6) Anal segment, dorsal view; (7) Anal segment, caudal view; (8) Right genital styles, ventral view; (9) Connective, dorsocephalic view; (10) Aedeagus, right side; (11) Aedeagus, left side; (12) Aedeagus, dorsal view; (13) Aedeagus, ventral view. Scale bars = 0.5 mm

differ from those of Tsaaur *et al.* (1991) in size and position. Because not having examined the type specimen, we have sent the illustrations and habitus figure of our specimen to Prof. Dr. S.-C. Tsaaur for comparison with the lectotype and paralectotypes. According to his advice and our identification, we regard our specimen as *M. giganteus*.

### ***Macrocixius grossus* Tsaaur & Hsu, 1991**

(Figs 14–26)

*Macrocixius grossus* Tsaaur & Hsu, 1991: 6.

**Diagnostic characters.** Body length (from apex of vertex to tip of forewings): male 9–9.9 mm (n = 7), female 10.7–11.7 mm (n = 6).

**Coloration.** General color blackish brown (Figs 54, 58, 62). Eyes generally yellowish brown alternating with black. Ocelli pale yellow, semihyaline. Face black brown, postclypeus paler in color. Pronotum generally blackish brown, with anterior and posterior margin yellowish brown. Mesonotum black brown, posteromedian area slightly paler in color. Forewing hoar, hyaline; stigma brown; strip between bases of CuP and PCu yellowish brown; yellow alternating with black brown on total length of veins; discal area of clavus with a small yellowish brown marking. Hind tarsi with platellae fuscous. Abdomen blackish brown ventrally.

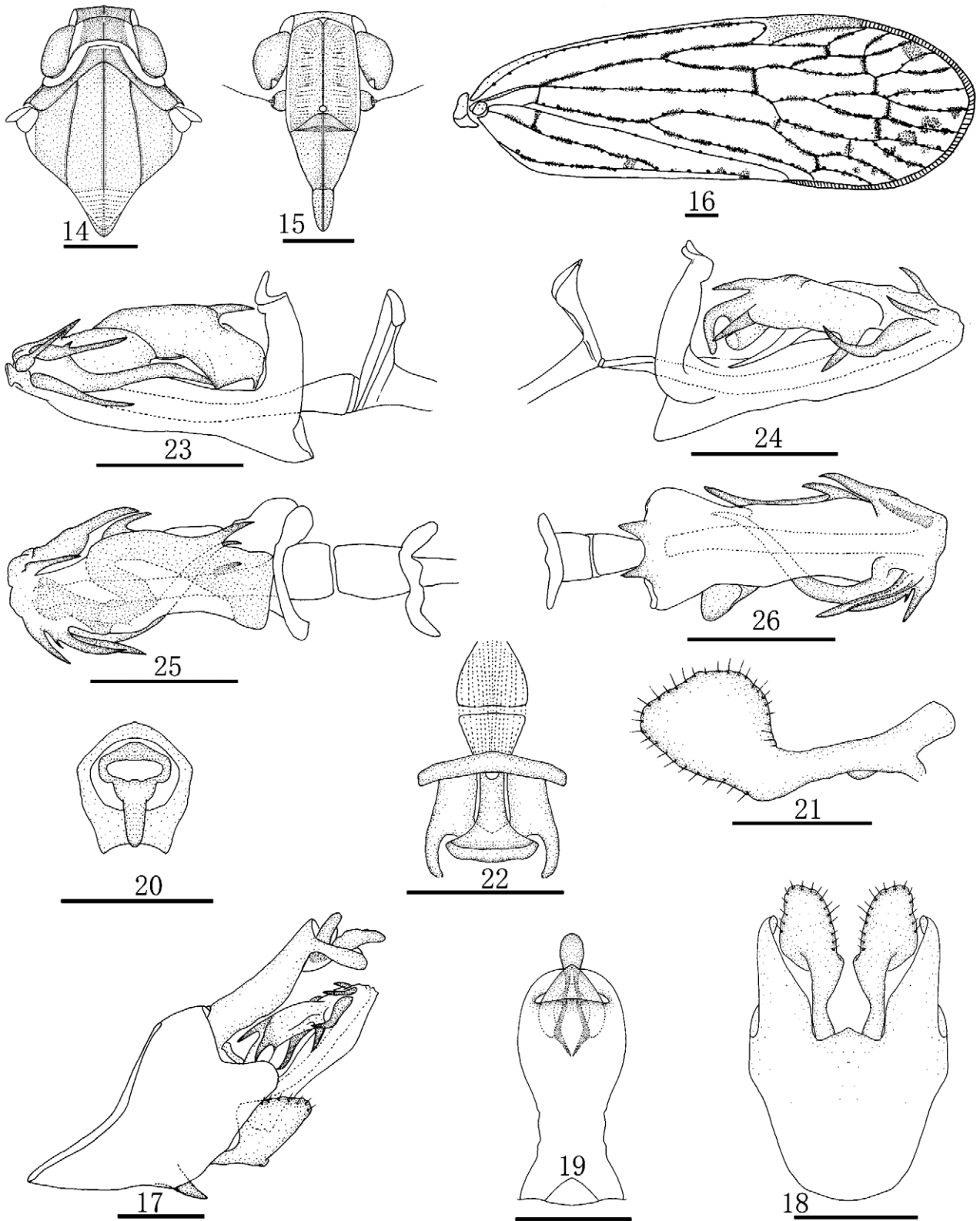
**Head.** Median ocellus (Figs 15, 62) on the peak of frontoclypeal suture. Vertex (Figs 14, 54) 1.4 X wider than long; subapical carina joins lateral carinae at apical 1/3; anterior margin slightly convex into an angle, posterior margin archedly concave; areolets before subapical carina concave, area behind subapical carina archedly concave; both two portions of median carina existing. Frons (Figs 15, 62) 1.5 X longer than wide; anterior margin concave into an obtuse angle; median carina forked basally; both sides of median carina with many fine scores. Rostrum with subapical segment 1.4 X longer than apical segment.

**Pronotum and mesonotum.** Pronotum (Figs 14, 54) 1.2 X longer than vertex; intermediate carinae curving forward, vanishing near anterior margin of pronotum; median carina distinct, posterior margin concave, forming an obtuse angle. Mesonotum (Figs 14, 54) 2 X longer than pronotum and vertex combined; lateral carinae slightly curving laterally, median carina indistinct on posteromedian area.

**Wings.** Forewing (Figs 16, 54, 58) 2.9 X longer than wide; fork Sc+RP distad of fork CuA1+CuA2, fork PCu+A1 slightly distad of center of clavus.

**Legs.** Hind tibia with 3 or 4 lateral spines; chaetotaxy of hind tarsi 8/9 or 9/7, 2<sup>nd</sup> hind tarsus with 3 platellae.

**Abdomen.** Pygofer (Figs 17, 18) with middle part of outer margin sub-triangularly convex in ventral view, narrowing to both ends; in lateral view, lateral lobes with portion slightly above middle caudally convex, tongue-shaped. Medioventral process (Figs 17, 18) 4.5 X wider than long in ventral view, reaching to 1/10 of length of lateral lobes; sub-triangular in lateral view, apex pointed. Anal segment (Figs 17, 19, 20), in lateral view, dorsal margin slightly concave into arch-shape, ventral margin archedly convex; in caudal view, dorsal margin archedly convex, ventral margin archedly concave; 2.2 X longer than wide in dorsal view; loosely connected with pygofer, movable. Anal style (Figs 17, 19) relatively broad and large; abdominal segment XI slightly small, covering base of anal style. Genital styles (Figs 17, 18, 21), in ventral view, with apical portion inflated, hammer-shaped, not touching each other; in lateral view, dorsal margin with basal half nearly straight, ventral margin with basal half slightly convex, apical portion subtriangularly inflated; loosely connected with connective, movable. Aedeagus (Figs 23–26) with total of nine spines; four spines on right side: the shortest one generally straight, with base inflated and the remainder slender, directed dorsocephalad, the longest one with base broad and large, crossing dorsal margin of aedeagus to left side, the upper one of the remaining two spines generally straight, directed ventrocephalad, with base inflated and the remainder slender, with or without a small triangular spines on dorsal margin, the lower one of the remaining two spines slightly sinuate, directed cephalad; two spines on left side: the anterior one with basal half broad and large, apical half strongly curving upward, directed dorsocephalad, the posterior one nearly straight with base inflated and the remainder slender, directed dorsocephalad. Flagellum with three short spines, one originating from dorsal margin, slightly curving, directed dorsocephalad, the remaining two spines on the left side of ventral margin, the former one nearly straight, directed ventrocephalad, the latter one inclining downward, directed ventrocephalad; apex of flagellum extended into a sheet process. Connective (Fig. 22) moderately long; aedeagal shaft 1.5 X wider than width of connective plus ventral arm.



**FIGURES 14–26.** *Macrocoxius grossus* Tsaour & Hsu. (14) Head and thorax, dorsal view; (15) Face, ventral view; (16) Forewing; (17) Male genitalia, lateral view; (18) Pygofer and genital styles, ventral view; (19) Anal segment, dorsal view; (20) Anal segment, caudal view; (21) Right genital styles, ventral view; (22) Connective, dorsocephalad view; (23) Aedeagus, right side; (24) Aedeagus, left side; (25) Aedeagus, dorsal view; (26) Aedeagus, ventral view. Scale bars = 0.5 mm.

**Material examined.** 2 ♂♂, 3 ♀♀, Zhuhai, Changning County, Sichuan Province, China, 5 June 2008, Y.-B. Zhang and H.-R. Li; 1 ♂, Baihualing, Baoshan County, Yunnan Province, China, 15 June 2011, J.-K. Long; 1 ♂, 1 ♀, Chishui City, Guizhou Province, China, 3 May 2008, Z.-G. Zhang; 1 ♂, 1 ♀, Jinshagou, Chishui City, Guizhou Province, China, 31 May 2000, Z.-Z. Li; 1 ♂, 1 ♀, Fengyang Mountain, Zhejiang Province, China, 28-29 July, 2009, Y. Chen; 1 ♂, Sansong Lake, Changning County, Sichuan Province, China, 29 September, 2009, H.-R. Li.

**Distribution.** South China (Sichuan, Zhejiang, Yunnan, Guizhou, Taiwan) (new record from Mainland China).

***Macrocixius rarimaculatus* sp. nov.**

(Figs 27–39)

**Description.** Body length (from apex of vertex to tip of forewings): male 10.5–11.2 mm (n = 9), female 11.4–12.5 mm (n = 5)

**Coloration.** General color black brown (Figs 55, 59, 63). Eyes deeply brown. Ocelli yellow. Face black brown, areas near two ends of frontoclypeal suture with yellow color. Pronotum generally yellow brown, with discal area darker in color. Mesonotum black brown, discal area paler in color. Forewing colorless, hyaline, spreading with small dark brown markings on costal cell, clavus and apical area; stigma black brown; strip between bases of CuP and PCu black brown; yellow alternating with black brown on total length of veins. Hind tarsi with platellae pale brown. Abdomen blackish brown ventrally.

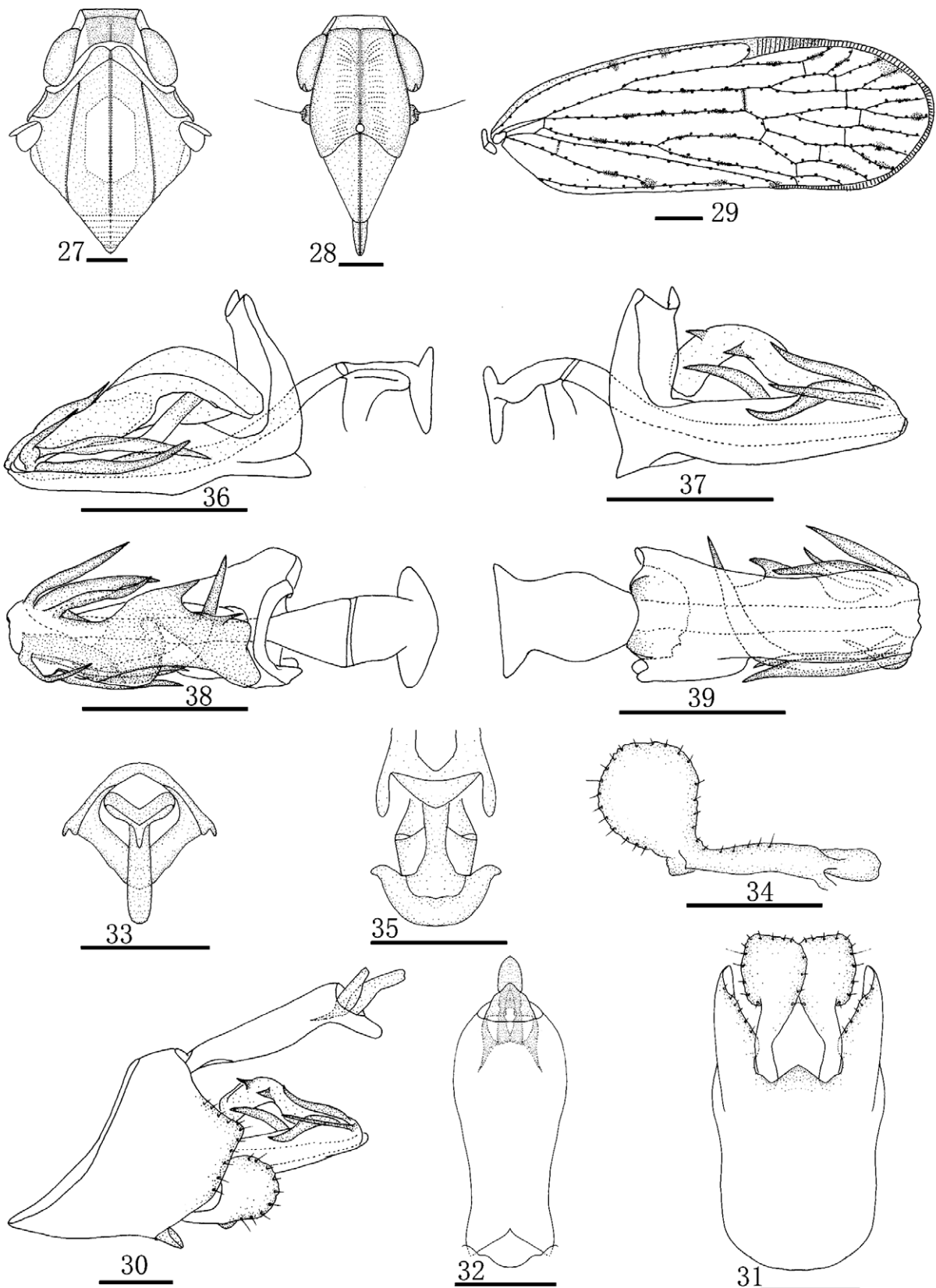
**Head.** Median ocellus (Figs 28, 63) slightly above the peak of frontoclypeal suture. Vertex (Figs 27, 55) 1.6 X wider than long; subapical carina joins lateral carinae at apical 1/4; anterior margin slightly concave into an angle, posterior margin archedly concave; areolets before subapical carina concave, area behind subapical carina deeply and curvedly concave; median carina only existing behind subapical carina. Frons (Figs 28, 63) 1.3 X longer than wide; anterior margin archedly concave; both sides of median carina with transverse scores. Rostrum with subapical segment 1.3 X longer than apical segment.

**Pronotum and mesonotum.** Pronotum (Figs 27, 55) 1.6 X longer than vertex; intermediate carinae curving parallel to posterior margin of eyes, vanishing near anterior margin of pronotum; both sides of median carina deeply concave; posterior margin concave, forming an obtuse angle. Mesonotum (Figs 27, 55) 1.9 X longer than pronotum and vertex combined; lateral carinae slightly curving laterally, median carina indistinct on posteromedian area.

**Wings.** Forewing (Figs 29, 55, 59) 2.9 X longer than wide; fork Sc+RP basad of fork CuA1+CuA2, fork PCu+A1 basad of center of clavus.

**Legs.** Hind tibia with 3 lateral spines; chaetotaxy of hind tarsi: 8/9, 2<sup>nd</sup> hind tarsus with 4 platellae.

**Abdomen.** Pygofer (Figs 30, 31) with outer margin slightly sinuous in ventral view, almost equal in width from base to apex; in lateral view, lateral lobes subtriangularly extending caudally, outer margin with setae. Medioventral process (Figs 30, 31) 2.7 X wider than long in ventral view, reaching to 1/6 of length of lateral lobes; thumb-like in lateral view. Anal segment (Figs 30, 32, 33), in lateral view, dorsal margin nearly straight, ventral margin sinuous; in caudad view, dorsal margin archedly convex, ventral margin subtriangularly convex; 2.3 X longer than wide in dorsal view; loosely connected with pygofer, movable. Anal style (Figs 30, 32) relatively broad and large; abdominal segment XI relatively broad and large, covering basal half of anal style. Genital styles (Figs 30, 31, 34), in ventral view, apical portion inflated, nearly hammer-shaped, touching each other; in lateral view, dorsal and ventral margins with basal half sinuous and apical portion inflated into balloon-shape; closely connected with connective, unmovable. Aedeagus (Figs 36–39) with total of nine spines; four spines on right side: the shortest one generally straight, with base inflated and the remainder slender, directed dorsocephalad, the longest one crossing dorsal margin of aedeagus to left side, the remaining two spines nearly as long as each other, the upper one slightly sinuous, generally curving downward, directed ventrocephalad, the lower with basal half nearly straight and apical half curving upward, directed dorsocephalad; three spines on left side: the anterior one with basal half broad and large, apical half finely curving upward, directed dorsocephalad, the upper one of the posterior two spines slightly sinuous, directed dorsocephalad, the lower one of the posterior two spines nearly straight, directed dorsocephalad. Flagellum with two subtriangular short spine on apical half, the former one directed dorsocephalad, the latter one directed cephalad. Connective (Fig. 35) broad and large; aedeagal shaft 1.5 X as wide as connective plus ventral arm.



**FIGURES 27–39.** *Macrocoxius rarimaculatus* sp. nov. (27) Head and thorax, dorsal view; (28) Face, ventral view; (29) Forewing; (30) Male genitalia, lateral view; (31) Pygofer and genital styles, ventral view; (32) Anal segment, dorsal view; (33) Anal segment, caudal view; (34) Right genital styles, ventral view; (35) Connective, dorsocephalad view; (36) Aedeagus, right side; (37) Aedeagus, left side; (38) Aedeagus, dorsal view; (39) Aedeagus, ventral view. Scale bars = 0.5 mm.



**Type material.** Holotype: ♂, **CHINA:** Linjiang, Xishui County, Guizhou Province, 1 June 2006, X.-S. Chen. Paratypes: 3 ♂♂, 2 ♀♀, same data as holotype; 5 ♂♂, 1 ♀, Xiangshuwan, Kuankuoshui National Natural Reserve, Suiyang County, Guizhou Province, 8–12 June 2010, P. Zhang, Y.-L. Zheng and Q.-Z. Song; 1 ♀, Wangcao, Kuankuoshui National Natural Reserve, Suiyang County, Guizhou Province, China, 3–6 June 2010, Q.-Z. Song; 1 ♀, Baishao Town, Kuankuoshui National Natural Reserve, Suiyang County, Guizhou Province, China, 6–8 June 2010, Y.-J. Li.

**Distribution.** Southwest China (Guizhou).

**Remarks.** This new species is similar to *M. giganteus*, but differs in: (1) the forewing with fewer dark markings; (2) the spines on the left side of the aedeagus differ from the latter in size, direction and position; (3) aedeagus with the shortest spine on right side generally straight, with its base inflated and the remainder slender (the shortest spine on right side of aedeagus awl-shaped in *giganteus*); (4) two short spines on flagellum smaller, in tandem for some distance (in *giganteus*, two short spines of flagellum longer, one above another, near each other).

**Etymology.** The name is derived from the Latin words “*rarimaculatus*”, which refers to the forewing with fewer dark markings.

### ***Macrocixius unispinus* sp. nov.**

(Figs 40–52)

**Description.** Body length (from apex of vertex to tip of forewings): male 8.8 mm (n = 1).

**Coloration.** General color blackish brown (Figs 56, 60, 64). Eyes yellowish brown alternating with black brown. Ocelli dull yellow. Face black brown, base and lateral margin deeply brown, areas around both ends of frontoclypeal suture with glassily yellow markings. Pronotum generally yellowish brown, area beside median carina and posterior margin of eyes black brown. Mesonotum black brown. Forewing colorless, hyaline, spreading with small dark brown markings on apical area, costal area and clavus area; stigma blackish brown; strip between bases of CuP and PCu black brown; yellow alternating with black brown on basal half of veins, apical half of veins mostly black brown. Hind tarsi with platellae yellow. Abdomen blackish brown ventrally.

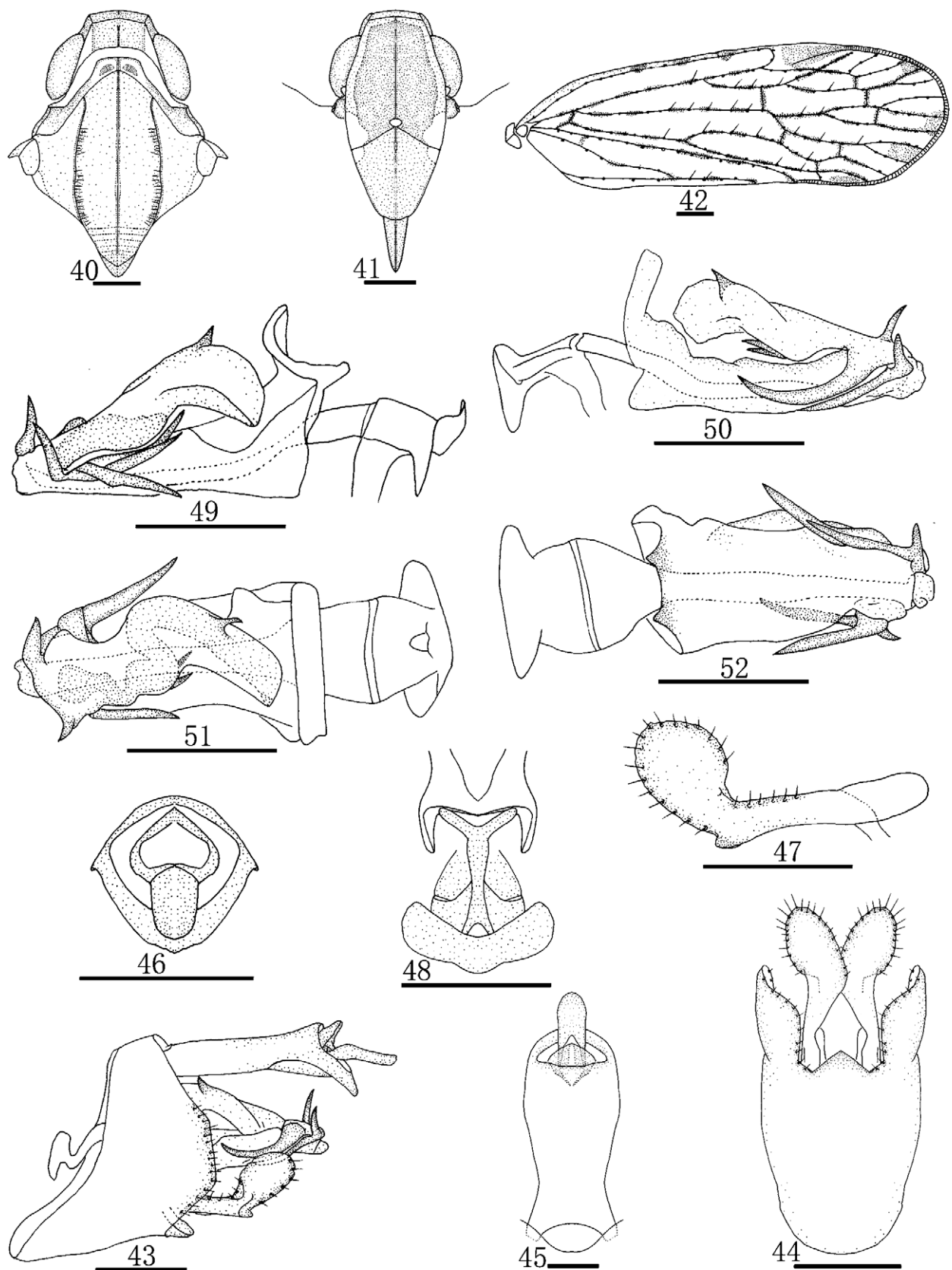
**Head.** Median ocellus (Figs 41, 64) on the peak of frontoclypeal suture. Vertex (Figs 40, 56) 1.3 X wider than long; subapical carina joins lateral carinae at apical 1/6; anterior margin slightly sinuous with middle archedly convex, posterior margin nearly trapezoidally concave; areolets before subapical carina concave, area behind subapical carina archedly concave; both two portions of median carina existing. Frons (Figs 41, 64) 1.2 X longer than wide; anterior margin concave into an obtuse angle. Rostrum relatively long, reaching apex of hind femur, subapical segment 1.3 X longer than apical segment.

**Pronotum and mesonotum.** Pronotum (Figs 40, 56) 1.3 X longer than vertex; intermediate carinae curving forward, vanishing near anterior margin of pronotum; both sides of median carina deeply concave; posterior margin concave, forming an obtuse angle. Mesonotum (Figs 40, 56) 1.7 X longer than pronotum and vertex combined; lateral carinae slightly sinuous, inner sides of them with fine short striations, median carina vanishing on posteromedian area.

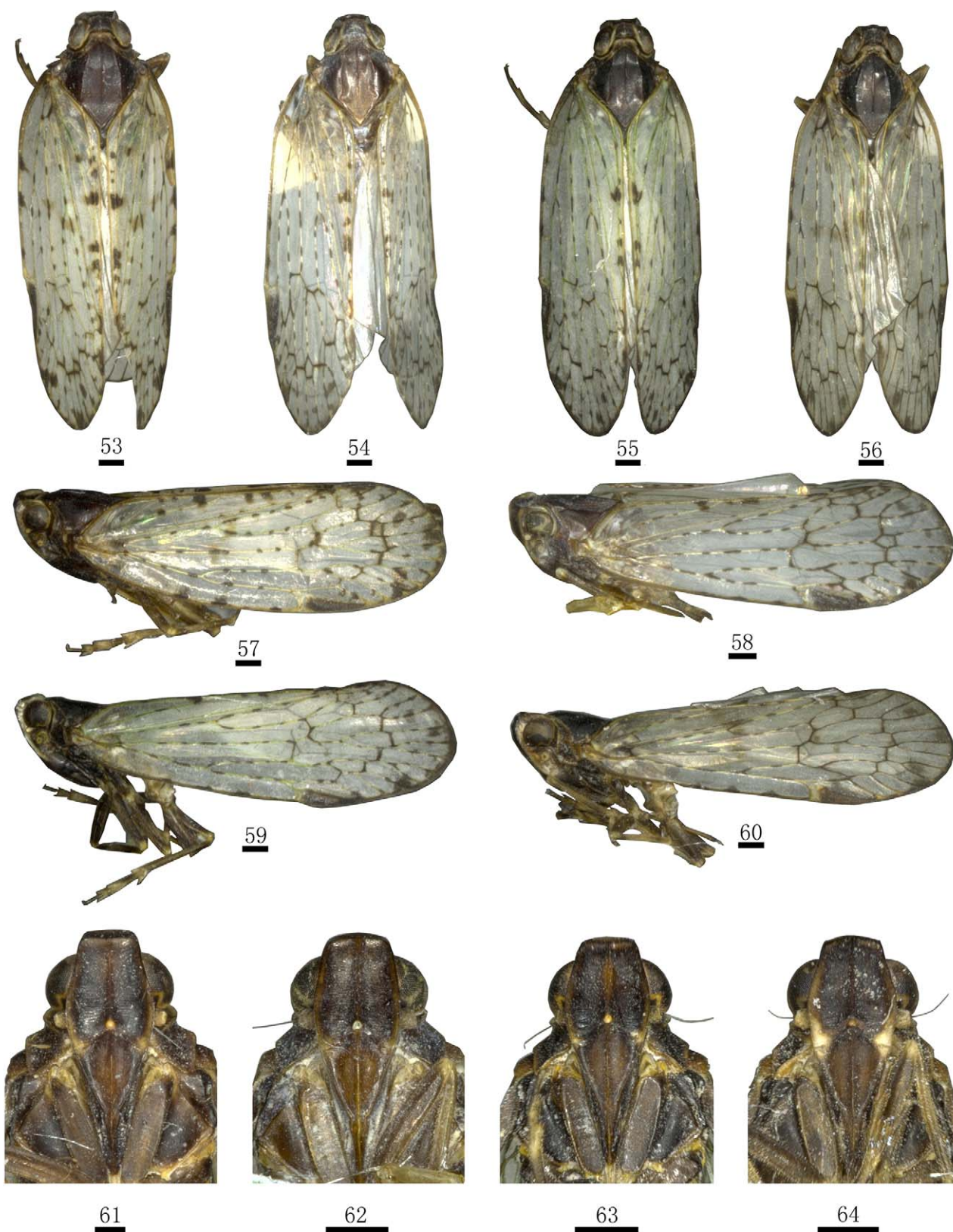
**Wings.** Forewing (Figs 42, 56, 60) 3 X longer than wide; fork Sc+RP distad of fork CuA1+CuA2, fork PCu+A1 distad of center of clavus.

**Legs.** Hind tibia with 4 lateral spines; chaetotaxy of hind tarsi: 8/9, 2<sup>nd</sup> hind tarsus with 4 platellae.

**Abdomen.** Pygofer (Figs 43, 44) with outer margin slightly sinuous in ventral view, widening from base to apex; in lateral view, lateral lobes trapezoidally convex caudally, outer margin with setae. Medioventral process (Figs 43, 44) 3 X wider than long in ventral view, reaching to 1/3 of length of lateral lobes; thumb-like in lateral view. Anal segment (Figs 43, 45, 46), in lateral view, both dorsal and ventral margins slightly sinuous; in caudad view, dorsal margin archedly convex, ventral margin subtriangularly convex; 2.2 X longer than wide in dorsal view; loosely connected with pygofer, movable. Anal style (Figs 43, 45) relatively long; abdominal segment XI relatively small, covering base of anal style. Genital styles (Figs 43, 44, 47), in ventral view, apical part of inner margin nearly triangularly inflated, touching each other, outer margin sinuous; in lateral view, base of dorsal margin slightly sinuous, base of ventral margin archedly concave, apical portion inflated into balloon-shape; closely connected with connective, unmovable. Aedeagus (Figs 49–52) with total of eight spines; four spines on right side: the latter one short and small, slightly curving caudally, directed dorsocaudad, the upper one of the



**FIGURES 40–52.** *Macrocoxius unispinus* sp. nov. (40) Head and thorax, dorsal view; (41) Face, ventral view; (42) Forewing; (43) Male genitalia, lateral view; (44) Pygofer and genital styles, ventral view; (45) Anal segment, dorsal view; (46) Anal segment, caudal view; (47) Right genital styles, ventral view; (48) Connective, dorsocephalad view; (49) Aedeagus, right side; (50) Aedeagus, left side; (51) Aedeagus, dorsal view; (52) Aedeagus, ventral view. Scale bars = 0.5 mm.



**FIGURES 53–64.** Adult of *Macrocixius* species. 53, 57, 61. *M. giganteus*. (53) Habitus, dorsal view; (57) Habitus, lateral view; (61) Face, ventral view. 54, 58, 62. *M. grossus*. (54) Habitus, dorsal view; (58) Habitus, lateral view; (62) Face, ventral view. 55, 59, 63. *M. rarimaculatus*. (55) Habitus, dorsal view; (59) Habitus, lateral view; (63) Face, ventral view. 56, 60, 64. *M. unispinus*. (56) Habitus, dorsal view; (60) Habitus, lateral view; (64) Face, ventral view. Scale bars = 0.5 mm.

former three spines curving upward, directed dorsocephalad, the middle one of the former three spines nearly straight, directed dorsocephalad, the lower one of the former three spines slightly curving downward, directed ventrocephalad; three spines on left side: the anterior one relatively broad and large, finely curving upward, apex pointed, directed dorsocephalad, the posterior two spines joined at base, the upper one awl-shaped, directed dorsad, the lower one moderately long, apical half slightly curving upward, directed cephalad. Flagellum with one short spine on dorsal margin, apex pointed, directed dorsocephalad. Connective (Fig. 48) broad and large; aedeagal shaft 1.1 X wider than width of connective plus ventral arm.

**Type material.** Holotype: ♂, **CHINA:** Tongbiguan, Yijiang County, Yunnan Province, 3 June 2011, J.-K. Long.

**Distribution.** Southwest China (Yunan).

**Remarks.** This new species is similar to *M. giganteus*, the main differences are as follows: (1) forewing of this new species with fewer dark markings; (2) the spines on the left side of the aedeagus differ from the latter in size, direction and position; (3) the longest spine on right side of aedeagus about 2 X longer than the shortest one, not crossing dorsal margin of aedeagus to left; (4) flagellum of this new species with one short spine on the dorsal margin.

**Etymology.** The name is derived from the Latin words “*unispinus*”, which refers to flagellum with one spine.

## Conclusion

All four species within *Macrocixius* are distributed in southern China (Tsaaur *et al*, 1991; this paper), with *M. giganteus* also occurring in Japan (Matsumura, 1914). It seems that the members of the genus *Macrocixius* are restricted to the Oriental region and somewhat extending into the southern area of the Palaearctic region.

## Acknowledgments

We are grateful to Prof. Z.-Z. Li, Ms. Q.-Z. Song, Dr. Z.-G. Zhang, Dr. Z.-H. Meng, Dr. Y.-J. Li, Master J.-K. Long, Master Y. Chen, Master H.-R. Li and Master Y.-B. Zhang (Institute of Entomology, Guizhou University, Guizhou, China) for collecting specimens. We also thank Prof. S.-C. Tsaaur (Research Center for Biodiversity, Academia Sinica, Taipei, Taiwan) for providing literature and identifying specimens. This work was supported by the National Natural Science Foundation of China (Grant no. 31060290, 31093430) and the International Science and Technology Cooperation Program of Guizhou (Grant no. 20107005).

## References

- Löcker, B., Fletcher, M.J., Larivière, M.C. & Gurr, G.M. (2006) The Australian Pentastirini (Hemiptera: Fulgoromorpha: Cixiidae). *Zootaxa*, 1290, 1–138.
- Matsumura, S. (1914) Die Cixiinen Japans. *Annotationes Zoologicae Japonenses*, 8, 393–434
- Tsaaur, S.-C., Hsu, T.-C. & Stalle, J.V. (1988) Cixiidae of Taiwan, Part (I) Pentastirini. *Journal of Taiwan Museum*, 41 (1), 35–74.
- Tsaaur, S.-C., Hsu, T.-C. & van Stalle, J. (1991) Cixiidae of Taiwan, Part V. Cixiini except *Cixius*. *Journal of Taiwan Museum*, 44, 1–78.
- Yang, C.-T. & Chang, T.-Y. (2000) *The External Male Genitalia of Hemiptera (Homoptera-Heteroptera)*. Shih Way Publishers, Taiwan, 746 pp.