

REVISION OF THE PLANTHOPPER GENUS *TAMBINIA*
(HEMIPTERA: FULGOROMORPHA: TROPIDUCHIDAE) FROM CHINA,
WITH DESCRIPTION OF A NEW SPECIES

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ABSTRACT

All 6 species of the genus *Tambinia* Stål, 1859 in China are reviewed, including 1 new species, *T. sinuata* **sp. nov.** from Yunnan Province. Morphological descriptions, illustrations, molecular characteristics of the mitochondrial COI gene and an identification key for Chinese *Tambinia* species are provided. Pairwise distances, calculated by the Kimura-2-parameter model among the *Tambinia* species examined, ranged from 0.0306 to 0.1072. Type specimens are deposited in the Entomological Museum, Northwest A & F University, Yangling, Shaanxi Province, China (NWFU).

Key Words: Fulgoroidea, *Tambinia sinuata*, mitochondrial COI gene, taxonomy

RESUMEN

Se revisan las 6 especies del género *Tambinia* Stål, 1859 en China, incluyendo una nueva especie, *T. sinuata* **sp. nov.** de la provincia de Yunnan. Se provee descripciones morfológicas, ilustraciones, características moleculares del gen mitocondrial COI y una clave de identificación para las especies de *Tambinia* en China. La distancia entre los pares, calculada por el modelo de 2-parámetros de Kimura entre las especies de *Tambinia* examinadas, varió desde 0.0306 hasta 0.1072. Los especímenes tipo están depositados en el Museo de Entomología, de la Universidad A & F del Noroeste en Yangling, Shaanxi Province, China (NWFU).

Palabras clave: Fulgoroidea, *Tambinia sinuata*, gen mitocondrial COI, taxonomía

The tropiduchid planthopper genus *Tambinia* was established by Stål (1859) based on specimens from Sri Lanka. Distant (1906) designated *T. languida* Stål, 1859 as the type species of the genus. *Tambinia* is currently treated as a member of the tribe Tambiniini Kirkaldy, 1907 (Metcalf 1954; Fennah 1982) and is easily separated from other genera in this tribe by the following combination of characters: head distinctly projecting in front of eyes and strongly depressed dorsoventrad, vertex unicarinate with straight posterior margin, frons unicarinate; hind tibiae with 2 spines laterally and 4-5 spines apically; forewings parallel-margined, rounded apically, nodal line obliquely straight, apical cell shorter than subapical; male genitalia with genital styles fused at base, with a process projected medially and a pair of lateral

processes arising from inner side near base, aedeagus elongate, tubular and wrapped by perianthrium subapically or medially (Liang & Jiang 2003; Wang & Liang 2011).

Before this study, 24 *Tambinia* species have been reported in the world, including 5 from China, which are restricted to the Oriental Region, i.e., *T. debilis* Stål 1859, *T. bizonata* Matsumura 1914, *T. rubrolineata* Liang 2003, *T. similis* Liang 2003 and *T. menglunensis* Men & Qin 2009. During a study of tropiduchid specimens collected from Yunnan Province, China, we found one undescribed species. The Chinese *Tambinia* species are reviewed here and the morphological descriptions, illustrations and molecular data on the mitochondrial COI gene (molecular data are unavailable for *T. bizonata*) for the known and new species are provided. A

key to all 6 Chinese species is also given. The type specimens and materials examined are deposited in the Entomological Museum, Northwest A & F University, Yangling, Shaanxi Province, China (NWFU).

MATERIALS AND METHODS

Taxonomic Analysis

Dry preserved specimens were examined from the Entomological Museum, Northwest A & F University (NWFU). Photographs of the habitus of adults were obtained using a Nikon SMZ 1500 (Nikon, Japan) stereomicroscope equipped with a QImaging QICAM FAST 1394 CCD (QImaging, Canada). The genital segment of each male was removed and macerated in 10% NaOH for 20 min at 100 °C or overnight at room temperature and observed in glycerin jelly and drawn using a Leica MZ 125 (Leica, Germany) stereomicroscope. The body length was measured from the apex of vertex to the tip of the forewing. All measurements were made in millimeters (mm). The terminology and methods of description and illustration follow that of Liang & Jiang (2003).

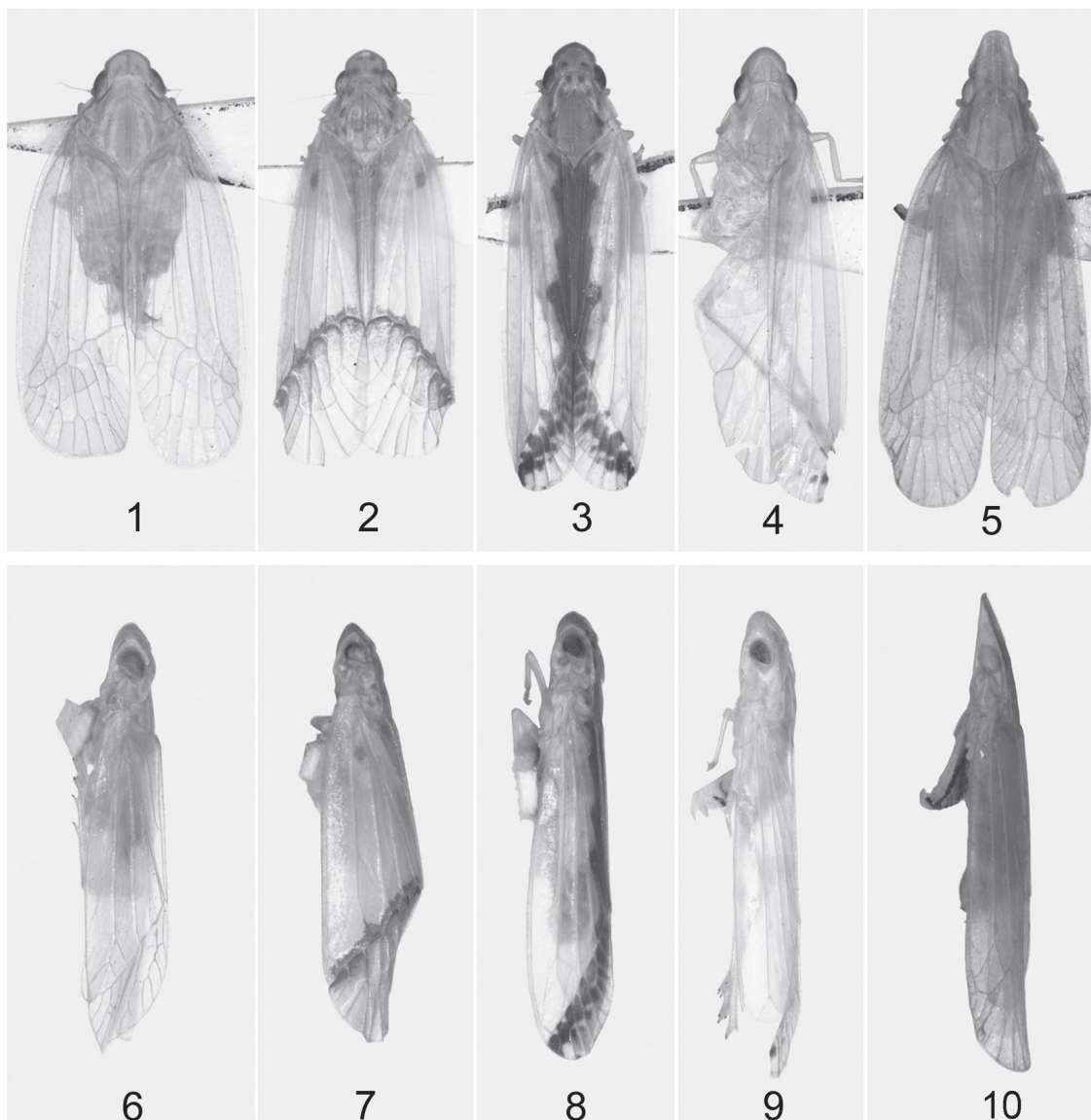
Molecular analysis

Genomic DNA was extracted from the abdomen (except genital segment) and leg of dry preserved specimens using Biomiga Insect gDNA Kit (Biomiga, USA). The partial sequence of

the mitochondrial COI gene was amplified with the universal primers for metazoan invertebrates, LCO1490 (5'-GGTCAACAAAT-CATAAAGATATTG-3') and HCO2198 (5'-TA-ACTTCAGGGTGACCAAAAAAT-3') (Folmer et al. 1994). PCR amplifications were employed using a final volume of 25 µL containing 3 µL 10 × PCR buffer (Mg²⁺ Minus), 2 µL MgCl₂ (25 mM), 2 µL each primer (10 µM), 2 µL dNTP mixture (each 2.5 mM), 2 µL DNA template and 0.2 µL Taq polymerase (5 U/µL) (Takara, Japan). Initial denaturation was for 5 min at 94 °C, followed by 35 cycles of 1 min at 94 °C for denaturation, 1 min at 47 °C for annealing and 1 min at 72 °C for extension, with a final extension at 72 °C for 10 min. All PCR sets included a negative control reaction tube in which all reagents were included but the template DNA. After electrophoresis, the target DNA was sent to Sunny Biotechnology Co., Ltd. (Shanghai) for sequencing. The partial COI gene sequences were aligned with CLUSTAL X (Thompson et al. 1997) and checked by eye. The aligned sequences were processed by MEGA 4.0 (Tamura et al. 2007) for analyzing the DNA sequence compositions and calculating pairwise distance based on the Kimura-2-parameter model (Kimura 1980). Five partial mitochondrial COI gene sequences obtained in this study were submitted to GenBank with the following accession numbers: *T. debilis* (JQ410447), *T. menglunensis* (JQ410448), *T. rubrolineata* (JQ410449), *T. similis* (JQ410450) and *T. sinuata* **sp. nov.** (JQ410451).

KEY TO CHINESE *TAMBINIA* SPECIES

- 1. Vertex shorter in midline than wide at base 2
- Vertex longer in midline than wide at base (Fig. 61). *T. sinuata* **sp. nov.**
- 2. Forewings without granules, with markings or patches 3
- Forewings transparent, with granules, without markings or patches (Figs. 1 and 6) . . . *T. debilis*
- 3. Forewings broad, less than 2.6 times longer than broad 4
- Forewings narrow, about 4.0 times longer than broad. 5
- 4. Frons with lateral carinae almost parallel (Fig. 31); forewings with red spots basally and red stripes along nodal line (Figs. 2 and 7); aedeagus expanded at apex (Fig. 35); periandrium short (Fig. 35). *T. menglunensis*
- Frons with lateral carinae unparallel (Fig. 12); forewings without red spots basally and red stripes along nodal line (Fig. 14); aedeagus not expanded at apex (Figs. 16 and 17); periandrium elongate (Figs. 16 and 17). *T. bizonata*
- 5. Vertex and pronotum without spots (Figs. 4 and 50); apex of aedeagus with two spinous processes (Figs. 55 and 59) *T. similis*
- Vertex and pronotum with red spots (Figs. 3 and 40); apex of aedeagus with three spinous processes (Figs. 45 and 49) *T. rubrolineata*



Figs. 1-10. Adults of *Tambinia* species. 1-5. Dorsal view. 6-10. Lateral view. 1, 6. *T. debilis*; 2, 7. *T. menglunensis*; 3, 8. *T. rubrolineata*; 4, 9. *T. similis*; 5, 10. *T. sinuata* **sp. nov.**

DESCRIPTIVE TAXONOMY

Genus *Tambinia* Stål, 1859

Tambinia Stål 1859: 316; Distant, 1906: 276; Kirkaldy, 1906: 474; Bierman, 1910: 26; Muir, 1913: 253; Melichar, 1914: 83; Metcalf, 1946: 118; Fennah, 1970: 76; Liang & Jiang, 2003: 509; Wang & Liang, 2011: 13. Type species: *Tambinia languida* Stål, by subsequent designation.

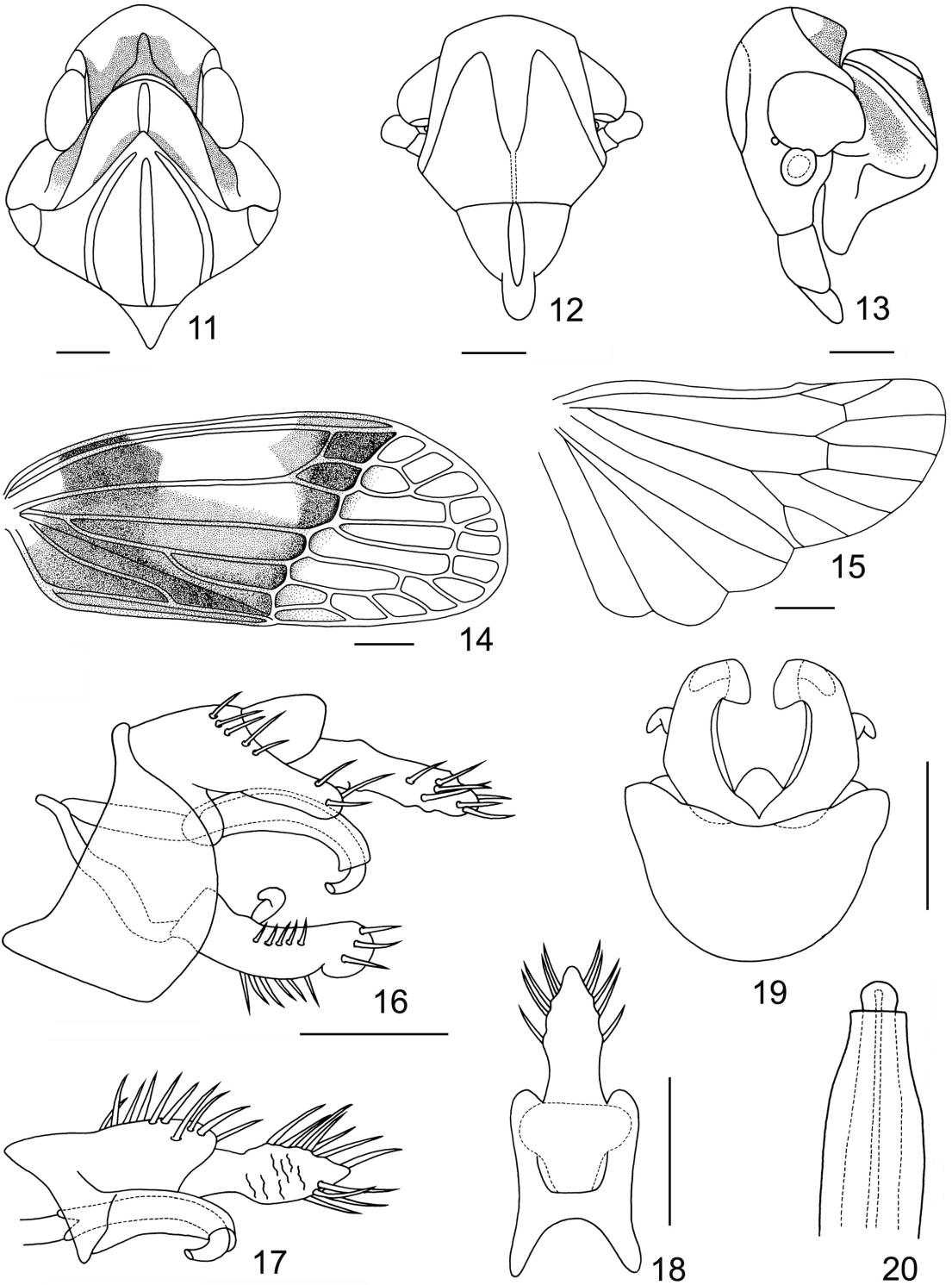
Ossa de Motschulsky, 1863: 106, synonymised by Melichar, 1914: 83. Type species: *Ossa dimidiata* de Motschulsky, by original designation.

Tambinia bizonata Matsumura, 1914 (Figs. 11-20)

Tambinia bizonata Matsumura, 1914: 265; Yang et al., 1989: 80; Liang & Suwa, 1998: 163.

Description (from Yang et al. 1989). Body length: male 5.7-6.0 mm, female 5.9-6.2 mm. General color yellow, yellowish green, greenish brown to reddish brown. Vertex with basal half yellow to reddish brown, eyes brown to black. Pronotum with lateral area behind eyes reddish brown, hind margin with reddish brown stripes (Figs. 11, 13). Forewing suffused with brown markings (Fig. 14).

Vertex shorter medially than width at base about 1.0: 1.8 (Fig. 11). Frons almost as long as



Figs. 11-20. *Tambinia bizonata* Matsumura. 11. Head and thorax, dorsal view; 12. Head, ventral view; 13. Head and pronotum, lateral view; 14. Right forewing; 15. Right hindwing; 16. Male genital capsule, left lateral view; 17. Aedeagus and anal segment, left lateral view; 18. Anal segment, dorsal view; 19. Genital styles and pygofer, ventral view; 20. Aedeagus, dorsal view. Scale bars = 0.25 mm. (Figs. 11-20 are from Yang et al. 1989).

maximum width (Fig. 12). Pronotum with ratio of width to length at middle 5.3: 1.0, pronotum and mesonotum together about 3.2 times as long as vertex in midline (Fig. 11). Forewings with 6 subapical cells and 12 apical cells, about 2.4 times as long as broad (Fig. 14). Hind tibiae with 2 lateral and 5 apical spines, basal metatarsal segment with 4-5 spines apically.

Male genitalia with pygofer semicircular in ventral view, extremely narrow dorsally in lateral view (Figs. 16 and 19). Anal segment moderately large, anal style very long (Figs. 16-18). Genital styles short, in ventral view fused at base with a rounded median process, afterwards the styles widely divergent and then strongly turned mesad in apical third, in lateral view the styles have a finger-like process arising from their dorsal margin in basal third (Figs. 16 and 19). Aedeagus tubular, long, curved basoventrad and truncated apically (Figs. 16, 17 and 20). Periandrium tubular, relatively elongate, surrounding aedeagal shaft for most part (Figs. 16, 17 and 20).

Material Examined

The male lectotype of this species was designated by Liang & Suwa (1998). No specimens of the species were examined in this study.

Distribution

China (Taiwan) (Fig. 71), Japan.

Tambinia debilis Stål, 1859 (Figs. 1, 6 and 21-29)

Tambinia debilis Stål, 1859: 317; Distant, 1906: 277; Melichar, 1914: 89.

Ossa dimidiata de Motschulsky, 1863: 106, synonymised by Melichar, 1914: 89.

Ossa dimiduata [sic] Shiraki, 1913: 162.

Osea [sic] *dimiduata* [sic] Maki, 1916: 90.

Osea [sic] *dimidiata* Wong & Tao, 1934: 452.

Description. Body length: male 6.5-7.0 mm, female 6.8-7.2 mm. General color yellowish green to green (Figs. 1 and 6). Eyes brown to black. Forewings green with veins dark green. Legs yellowish green with apices of spines on tibiae and tarsi black. Vertex broader at base than long in midline (1.6: 1.0) (Figs. 1 and 21). Frons nearly as long as broad in widest part (Fig. 22). Pronotum with ratio of width to median length 5.8: 1.0, pronotum and mesonotum together about 4.5 times as long as vertex in midline (Fig. 21). Forewings with 6 subapical cells and 14-15 apical cells, about 2.6 times longer than broad (Fig. 24). Hind tibiae with 2 spines laterally and 5 apically, basal metatarsal segment with 5-6 spines apically.

Male genitalia with pygofer quadrangular in profile, laterobasal margin prominently longer than laterocaudal margin (Fig. 26). Anal segment elongate, anal style fairly long and elliptical in

ventral view, extending well beyond end of anal tube (Figs. 26 and 27). Genital styles fused in basal third in ventral view, medially with a big spindle-like process, in lateral view the genital styles relatively short, apical half bent dorsocaudad and dorsally with a finger-like process submedially directed basolaterad (Figs. 26 and 29). Aedeagus tubular, slender, sinuate and truncated apically, its base slightly expanded and wrapped in tubular periandrium to mid-length (Figs. 26 and 27).

Specimens Examined

CHINA: 1 ♀, Fujian, Quanzhou, 27-VI-1963 (I. Chou); 1 ♀, Fujian, Shaowu, Dazhulan, 10-VII-1963 (I. Chou); 1 ♂ 1 ♀, Guangdong, Zhanjiang, 01-IX-1974 (I. Chou); 1 ♂, Guangdong, Dinghushan, 17-VII-1985 (Y.-L. Zhang); 2 ♂ ♂ 5 ♀ ♀, Hunan, Hengshan, 10-VIII-1985 (Y.-L. Zhang); 1 ♀, Jiangxi, Fanglou, 05-VIII-2002 (Q.-X. Sun); 5 ♀ ♀, Zhejiang, Gutianshan, 18-VIII-2003 (W. Dai); 3 ♂ ♂ 2 ♀ ♀, Hainan Is., Qixianling, 30-IV-2008 (Q.-L. Men).

Distribution

China (Guangdong, Guangxi, Fujian, Jiangxi, Hunan, Zhejiang, Hainan, Anhui, Taiwan, Hong Kong) (Fig. 71), Japan, Malaysia (Malacca), India (Madras), Singapore, Sri Lanka.

Remarks

The placement of *T. debilis* has been disputed because of the presence of the sublateral carinae on vertex (Figs. 1, 6, 21 and 23) and presence of granules on forewings and its very long anal style (Figs. 26 and 27). Wilson (1986) assumed that the genus *Kallitaxila* is closely related to *Tambinia*. Yang et al. (1989) transferred *T. debilis* to *Kallitaxila*, but this was not accepted by Wang and Liang (2006, 2011). Therefore, *debilis* is temporarily placed in *Tambinia* and we think the status of this species needs to be reconsidered in the future.

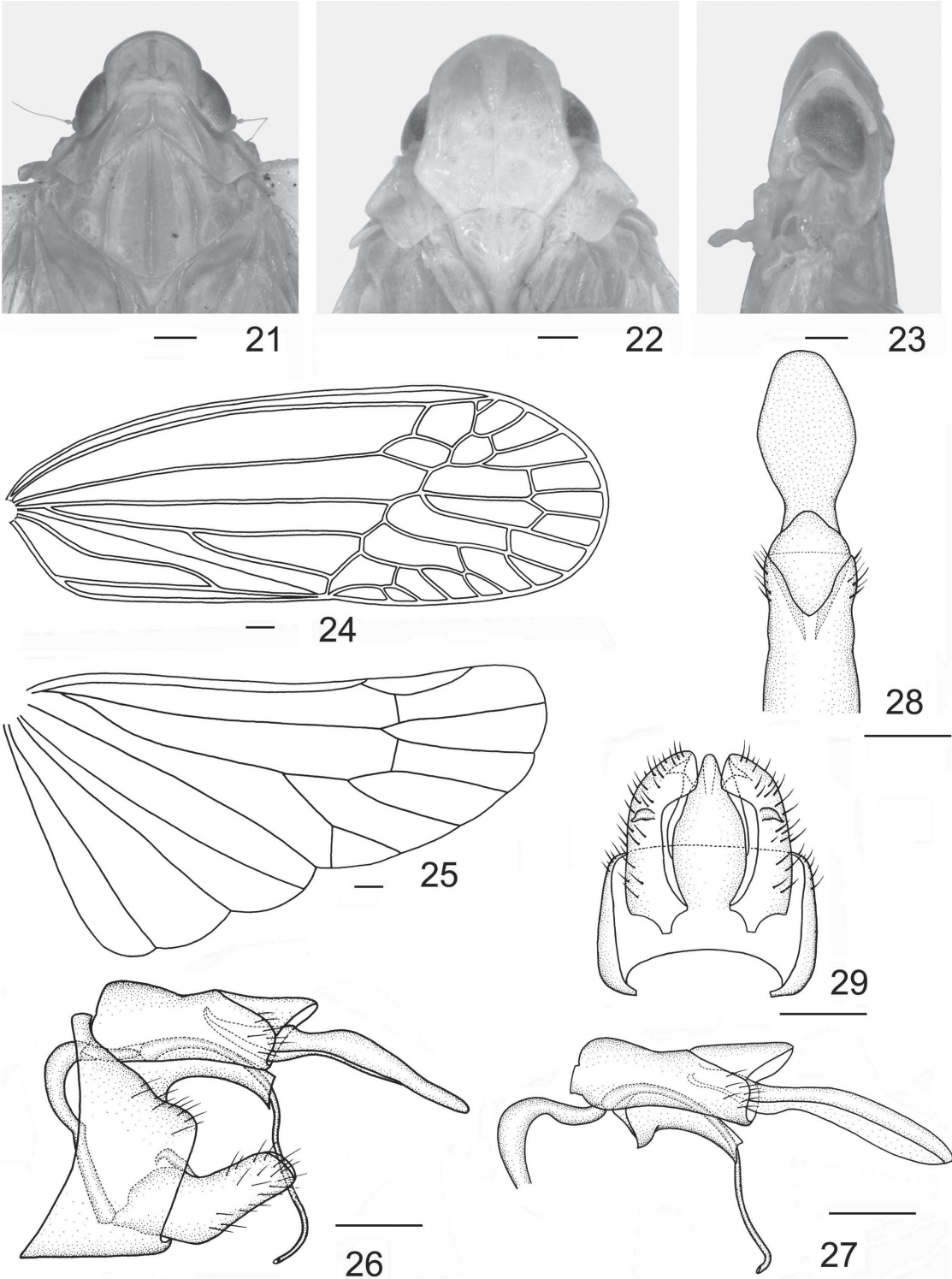
Molecular Characters

Partial mitochondrial COI gene sequence with GenBank accession number: JQ410447. Material: 1 ♂, Fujian, Longyan, 400m, 24-VIII-2008 (X. Gao).

Tambinia menglunensis Men & Qin, 2009 (Figs. 2, 7 and 30-39)

Tambinia menglunensis Men & Qin, 2009: 263.

Description. Body length: male 5.8-6.0 mm, female 6.0-6.2 mm. General color tawny yellow (Figs. 2 and 7). Eyes brown to black. Vertex, pro-



Figs. 21-29. *Tambinia debilis* Stål. 21. Head and thorax, dorsal view; 22. Head, ventral view; 23. Head and thorax, lateral view; 24. Right forewing; 25. Right hindwing; 26. Male genital capsule, left lateral view; 27. Aedeagus and anal segment, left lateral view; 28. Anal segment, dorsal view; 29. Genital styles and pygofer, dorsal view. Scale bars = 0.25 mm.

notum, mesonotum and forewings covered with red spots (Figs. 2, 7, 30, 32 and 33). Forewings with light red marking along hind margin, nodal line suffused with red markings and numerous small black spots nearby distad (Figs. 2, 7 and 33).

Vertex shorter in midline than width at base (1.0: 1.7) (Fig. 30). Frons with ratio of length in midline to maximum width 1.3: 1.0 (Fig. 31). Pronotum with ratio of width to median length 6.0: 1.0, pronotum and mesonotum together about 2.7 times as long as vertex in middle (Fig. 30). Forewings with 6 subapical cells and 11-12 apical cells, more than 2.6 times longer than broad (Fig. 33). Hind tibiae with 2 spines laterally and 5 apically, basal metatarsal segment with 5 spines apically.

Male genitalia with pygofer quadrangular, laterobasal margin almost 2 times as long as latero-caudal margin (Fig. 35). Anal segment relatively short, lateral margins concave inward in dorsal view, ventral margin slightly concave in dorsal view, anal style short (Figs. 35 and 36). Genital styles rounded apically, in lateral view narrowed submedially, basally with a pair of finger-like processes directed laterad and another paired opposite triangular processes on inner margin medially (Figs. 35 and 37-39). Aedeagus tubular, slender, elongate, apex slightly expanded and curved caudoventrally (Fig. 35). Periandrium relatively short, tubular, wrapping aedeagal shaft subapically (Fig. 35).

Specimens Examined

CHINA: 7♂♂8♀♀, Yunnan, Menglun, 12-V-2009 (L. Zhang).

Distribution

China (Yunnan) (Fig. 71).

Remarks

Tambinia menglunensis is similar to *T. rubrolineata*, but can be distinguished from the latter by the scattered patches and stripes on the vertex, pronotum, mesonotum and forewings (Figs. 2, 7, 30, 32 and 33) and by the relatively thick aedeagus without process at apex (Fig. 35) (aedeagus slender with three spinous processes at apex in *T. rubrolineata*).

Molecular Characters

Partial mitochondrial COI gene sequence with GenBank accession number: JQ410448. Material: 1♀, Yunnan, Menglun, 600m, 12-V-2009 (L. Zhang).

Tambinia rubrolineata Liang, 2003 (Figs. 3, 8 and 40-49)

Tambinia rubrolineata Liang, 2003: 509.

Description. Body length: male 6.8-7.0 mm, female 7.0-7.2 mm. General color pale yellow (Figs. 3 and 8). Vertex near basolateral angle with red spot on each side of median carina, eyes brown to black (Fig. 40). Pronotum with two pairs of red spots between median and lateral carinae and an additional pair outside lateral carinae near hind margin (Figs. 3 and 40). Mesonotum red to reddish brown (Figs. 3 and 40). Forewings with light brown to brown stripe between hind margin and claval fold, with numerous irregular brown to dark spots in apical or subapical cells (Figs. 3 and 43). Hindwings with light brown markings in middle or near apical angle (Fig. 44). Tips of spines on tibiae and tarsi black.

Vertex slightly shorter in midline than wide at base (0.9: 1.0) (Fig. 40). Frons longer than maximum width (1.2: 1.0) (Fig. 41). Pronotum with ratio of width to median length 4.0: 1.0, pronotum and mesonotum together about 2.4 times longer than vertex in midline. Forewings with 11 apical cells and 4-5 subapical cells, about 4.0 times longer than broad (Fig. 43). Hind tibiae with 2 lateral spines and 5 apical spines, basal metatarsal segment with 5 spines apically.

Male genitalia with pygofer quadrangular, laterobasal margin sinuate and distinctly longer than straight latero-caudal margin (Fig. 45). Anal segment elongate, anal style beyond end of anal tube (Figs. 45, 46 and 49). Genital styles elongate in ventral view, basal half broad and apical half apparently narrowed, median process small and cone-shaped, in the same level styles with a finger-like process arising from dorsal side, medially produced with an additional triangular process on inner margin (Figs. 45, 47 and 48). Aedeagal shaft tubular, slender, apex expanded with three spinous processes on right side (Figs. 45 and 49). Periandrium tubular, relatively short (Figs. 45 and 49).

Specimens Examined

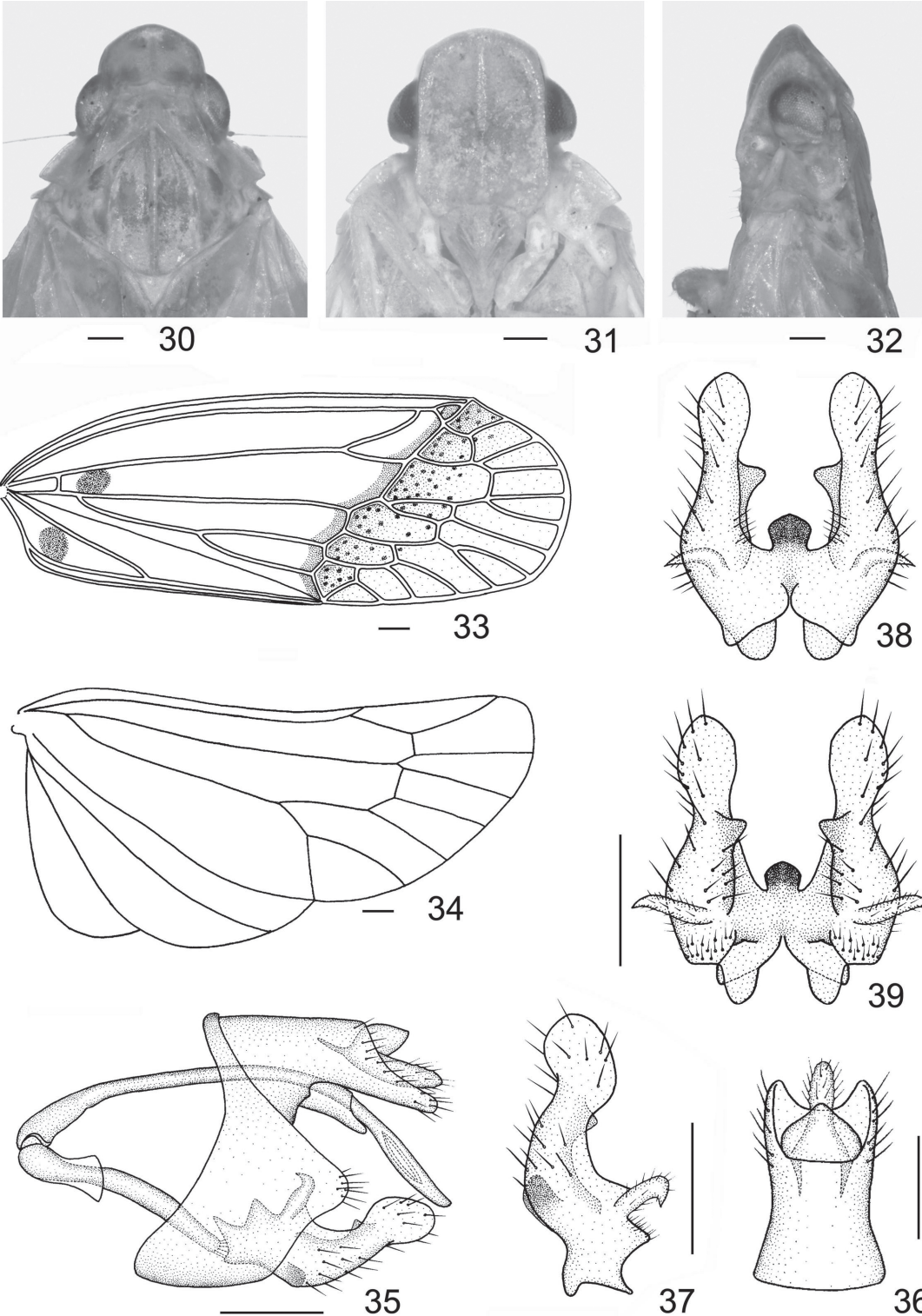
CHINA: 1♂, Yunnan, Menglun, 640m, 21-IV-1974 (I. Chou); 1♂1♀, Hainan Is., Jianfengling, 06-VI-2007 (L.-J. Cai); 1♂2♀♀, Hainan Is., Jianfengling, 980m, 08-V-2008 (Q.-L. Men); 2♀♀, Yunnan, Menglun, 600m, 12-V-2009 (L. Zhang).

Distribution

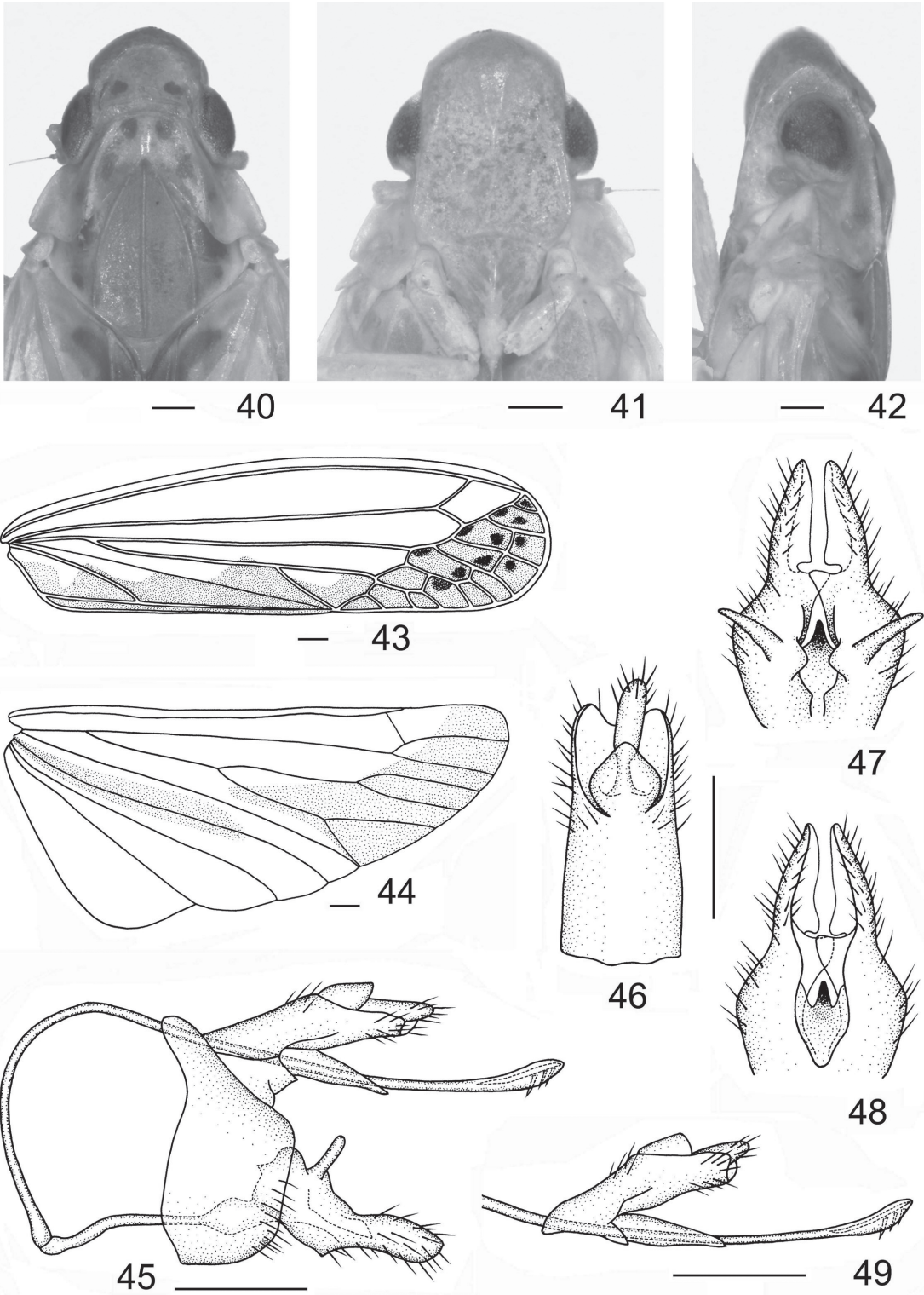
China (Yunnan, Hainan) (Fig. 71), Vietnam, Laos.

Remarks

Tambinia rubrolineata is similar to *T. theivora* Fennah, 1982 and *T. similis* Liang, 2003. It can be distinguished from *T. theivora* by the forewings



Figs. 30-39. *Tambinia menglunensis* Men & Qin. 30. Head and thorax, dorsal view; 31. Head, ventral view; 32. Head and thorax, lateral view; 33. Right forewing; 34. Right hindwing; 35. Male genital capsule, left lateral view; 36. Anal segment, dorsal view; 37. Genital styles, lateral view; 38. Genital styles, ventral view; 39. Genital styles, dorsal view. Scale bars = 0.25 mm.



Figs. 40-49. *Tambinia rubrolineata* Liang. 40. Head and thorax, dorsal view; 41. Head, ventral view; 42. Head and thorax, lateral view; 43. Right forewing; 44. Right hindwing. 45; Male genital capsule, left lateral view; 46. Anal segment, dorsal view; 47. Genital styles, dorsal view; 48. Genital styles, ventral view; 49. Anal segment and aedeagus, left lateral view. Scale bars = 0.25 mm.

with 11 apical cells (9 in *T. theivora*) and 4-5 subapical cells (3-4 in *T. theivora*), and from *T. similis* by the apex of aedeagal shaft with 3 spinous processes (2 in *T. similis*) and the presence of red spots on vertex and pronotum (without spots in *T. similis*).

Molecular Characters

Partial mitochondrial COI gene sequence with GenBank accession number: JQ410449. Material: 1♀, Yunnan, Menglun, 600m, 12-V-2009 (L. Zhang).

Tambinia similis Liang, 2003 (Figs. 4, 9, and 50-59)

Tambinia similis Liang, 2003: 509.

Description. Body length: male 6.5-6.8 mm, female 6.7-7.0 mm. General color yellow (Figs. 4, 9). Eyes brown to black. Forewings yellow with light brown stripes between hind margin and claval fold or absent, and with light brown spots in apical and subapical cells (Figs. 4 and 53). Tips of spines on tibiae and tarsi black. The proportions and veins of forewings are very similar to those of *T. rubrolineata* Liang, 2003.

Male genitalia with pygofer quadrangular (Fig. 55). Anal segment elongate, anal style beyond end of anal tube (Figs. 55 and 56). Genital styles closely resemble those of *T. rubrolineata* (Figs. 55, 57 and 58). Aedeagal shaft slender, tubular, expanded at end, apex with two spinous processes on right side (Figs. 55 and 59). Periandrium tubular, relatively short (Figs. 55 and 59).

Specimens Examined

CHINA: 1♂, Yunnan, Xishuangbanna, 21-V-1974 (I. Chou); 1♀, Guangxi, Guilin, 28-VIII-1974 (I. Chou & Z. Lu); 1♀, Hainan Is., Jianfengling, 06-VII-2007 (Y.-L. Wang); 1♂1♀, Hainan Is., Bawangling, 520m, 24-III-2008 (Q.-L. Men); 1♂, Yunnan, Menglun, 600m, 12-V-2009 (L. Zhang).

Distribution

China (Yunnan, Guangxi, Hainan) (Fig. 71), Vietnam.

Remarks

This species is very similar to *T. rubrolineata* Liang, but can be separated from the latter by the vertex and pronotum without spots (Fig. 50) (vertex and pronotum with spots *T. rubrolineata*), the stripes on forewings light in color or absent (Fig. 4) (black or dark brown in *T. rubrolineata*) and the aedeagal shaft with two spinous processes (Figs. 55 and 59) (with three spinous processes in *T. rubrolineata*).

Molecular Characters

Partial mitochondrial COI gene sequence with GenBank accession number: JQ410450. Material: 1♀ Hainan Is., Bawangling, 520m, 24-III-2008 (Q.-L. Men).

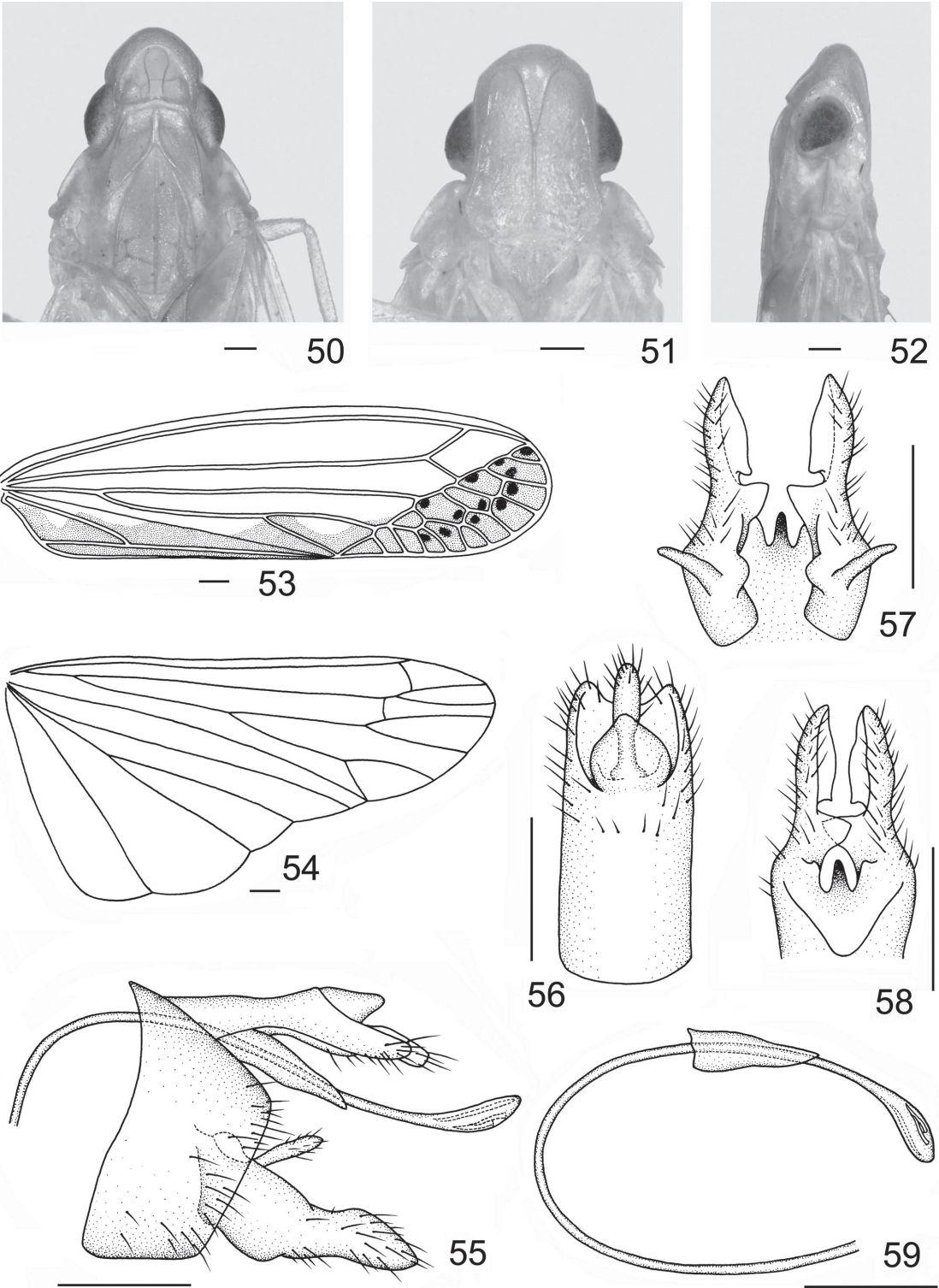
Tambinia sinuata sp. nov. (Figs. 5, 10, and 60-70)

Description. Body length: male 7.3 mm, female 7.5-7.7 mm. General color tawny yellow (Figs. 5 and 10). Eyes brown to black. Vertex with two longitudinal orange stripes extending to pronotum anteriorly (Fig. 60). Male genital segment light yellow. Legs with apices of spines on tibiae and tarsi black.

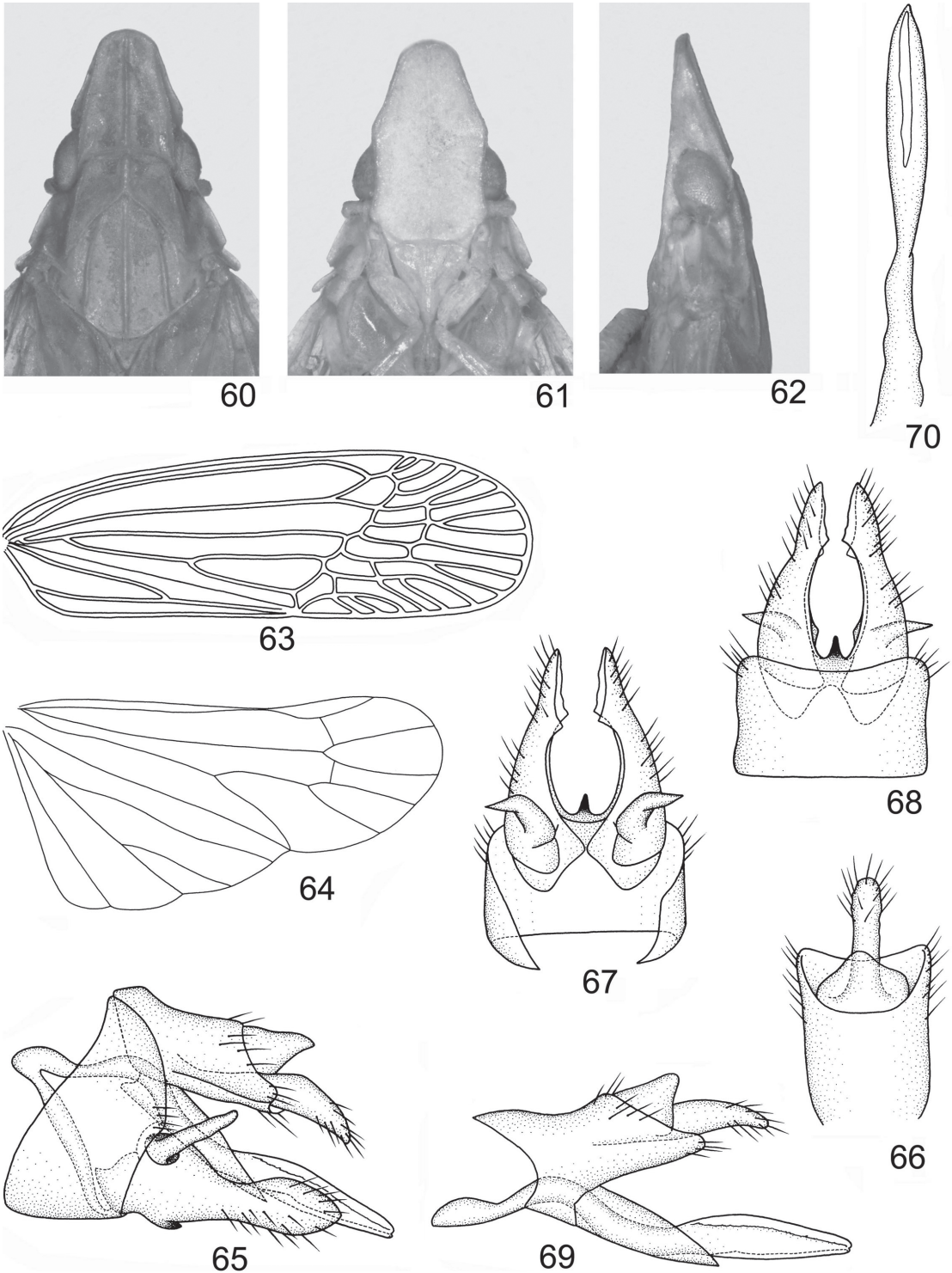
Head including eyes narrower than pronotum, significantly produced in front of eyes. Vertex longer in midline than broad at base (1.2: 1.0), anterior margin rounded, lateral margins parallel between eyes and gradually narrowed cephalad before eyes, posterior margin straight, median carina distinct and ridged (Figs. 60 and 62). Genae in front of eyes visible in dorsal view (Fig. 60). Frons flattened, longer in midline than maximum width (1.7: 1.0); basally rounded, apically constricted with anterior margin straight in middle; frons distinctly widened from upper level of eyes to lower of antennal sockets, lateral margins between them slightly concave; median carina thin and percurrent (Fig. 61). Eyes oval, ocelli small (Fig. 62). Clypeus distinctly ridged centrally (Fig. 61).

Pronotum with ratio of length to maximum width 1.0: 5.0, anterior margin straight, posterior margin obtusely excavated, dorsal disc almost parallel to vertex at base, median carina distinctly ridged and percurrent, with one lateral carina on each side between eye and tegula (Figs. 60 and 62). Mesonotum tricarinate, median carina straight, reaching the distinct transverse suture separating the dorsal angle; lateral carinae converging apically and posteriorly extending to hind margin; pronotum and mesonotum together about 1.6 times as long as vertex in midline (Fig. 60). Forewings rounded apically, widest near apex, more than 3.0 times as long as maximum breadth, Sc+R forking more than 3/5 basally, Cu₁ forking after level of junction of claval veins, claval apex beyond midpoint of forewings, claval veins converging in basal third, with 5 subapical cells and 17-18 apical cells (Fig. 63). Hindwings hyaline (Fig. 64). Hind tibiae with 2 lateral spines and 5 apical spines, basal metatarsal segment with 5 spines apically.

Male genitalia with pygofer quadrangular in profile, laterocaudal margin almost straight, laterobasal margin sinuate and more than twice as long as laterocaudal margin (Fig. 65). Anal segment relatively short, not surpassing end of aedeagus, lateral margins almost parallel in dorsal view, anal style elongate and beyond end of anal segment (Figs. 65, 66 and 69). Genital styles sym-



Figs. 50-59. *Tambinia similis* Liang. 50. Head and thorax, dorsal view; 51. Head, ventral view; 52. Head and thorax, lateral view; 53. Right forewing; 54. Right hindwing; 55. Male genital capsule, left lateral view; 56. Anal segment, dorsal view; 57. Genital styles, dorsal view; 58. Genital styles, ventral view; 59. Anal segment and aedeagus, left lateral view. Scale bars = 0.25 mm.



Figs. 60-70. *Tambinia sinuata* sp. nov. 60. Head and thorax, dorsal view; 61. Head, ventral view; 62. Head and thorax, lateral view; 63. Right forewing; 64. Right hindwing; 65. Male genital capsule, left lateral view; 66. Anal segment, dorsal view; 67. Genital styles and pygofer, dorsal view; 68. Genital styles and pygofer, ventral view; 69. Anal segment and aedeagus, left lateral view; 70. Aedeagus, ventral view. Scale bars = 0.25 mm.

TABLE 1. PAIRWISE GENETIC DISTANCES FOR COI GENE SEQUENCES OF FIVE *TAMBINIA* SPECIES.

Species	<i>T. debilis</i>	<i>T. menglunensis</i>	<i>T. rubrolineata</i>	<i>T. similis</i>	<i>T. sinuata</i> sp. nov.
<i>T. debilis</i>					
<i>T. menglunensis</i>	0.1072				
<i>T. rubrolineata</i>	0.0731	0.0977			
<i>T. similis</i>	0.0787	0.0740	0.0306		
<i>T. sinuata</i> sp. nov.	0.0957	0.0683	0.0797	0.0571	

metrical, in ventral view widest near base, median process small and cone-shaped, subbasally with another finger-like process on the dorsal side directed laterad, in lateral view styles narrowed in middle (Figs. 65, 67 and 68). Aedeagus tubular, elongate and beyond end of genital styles, distinctly sinuate, expanded in apical half, apical third fissured at ventral side (Figs. 65, 69 and 70). Periandrium fused with ventral base of anal segment, symmetrical, tubular, enveloping aedeagal shaft in middle (Figs. 65 and 69).

Material Examined

HOLOTYPE: ♂, CHINA: Yunnan, Lincang, Banhong, 1176m, 27-V-2011 (S.-L. Xu) (NWFU). **Paratypes:** CHINA: 1♀, same data as holotype; 1♀, Yunnan, Lincang, Nansan, 1010m, 07-VII-

2007 (L.-J. Cai) (NWFU); 1♀, Yunnan, Ruili, Ruili Arboretum, 21-VII-2007 (C. Wei) (NWFU).

Etymology.

The specific epithet is an adjective derived from the Latin '*sinuatus*' with the feminine termination '-a', referring to the sinuate aedeagal shaft of this species.

Distribution

China (Yunnan) (Fig. 71).

Remarks

The new species is very similar to *T. verticalis* Distant in external morphology, but differs from

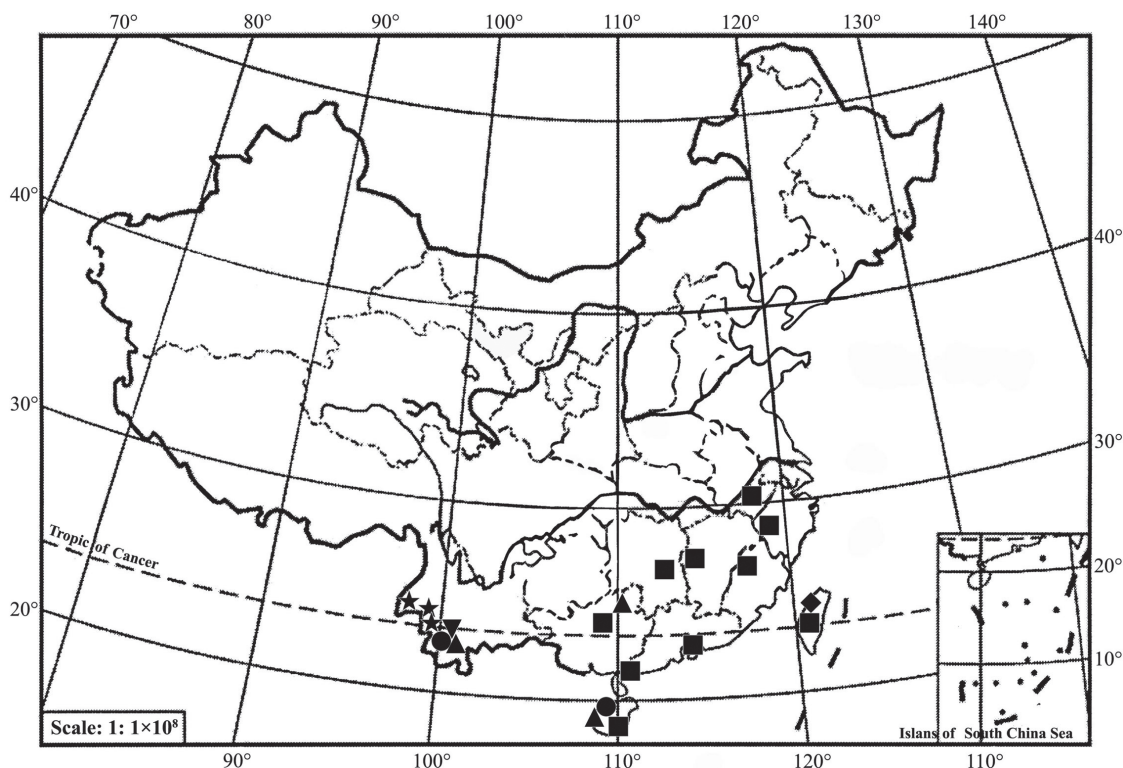


Fig. 71. Geographic distribution of Chinese *Tambinia* species: *T. bizonata* (◆); *T. debilis* (■); *T. menglunensis* (▼); *T. rubrolineata* (●); *T. similis* (▲); *T. sinuata* **sp. nov.** (★).

rina Wang & Liang 2011, *sinuata* **sp. nov.** 2012, China) from the Oriental Region. *T. verticalis* from India has been found breeding on coconut in Zanzibar, Africa. In the Chinese fauna, 5 species of the genus have been reported in southern China. Considering the close proximity of these regions to Indo-China and Southeast Asia where *Tambinia* species are highly distributed, it seems that there are gaps between field collecting and the higher diversity of Chinese tropiduchid fauna. Species like *T. verticalis* occurs in South India and *T. inconspicua* in Burma might possibly be found in China because of the close geographical location. Although every new carefully documented collection usually yields more and more new species from this genus, there is still a need for more sampling and taxonomic work to be done in the future.

Genetic distance among 5 *Tambinia* species ranged from 0.0306 to 0.1072, which indicates the mtDNA COI gene is effectively used as a means for identifying planthopper species. The genetic distance between *T. rubrolineata* and *T. similis* was 0.0306, the minimal value found when compared with the other 4 species; this suggests a closer relationship and is in agreement with distinct morphological similarities. The distances between the new species and the 4 known species ranged from 0.0571 to 0.0957, which provides molecular evidence for the distinctiveness of this new species (Table 1).

In Tropiduchidae, alpha taxonomy will be required to integrate data from morphology, behavior, ecology and geographic variation. This will be reinforced with complementary information from DNA sequences. Moreover, the characterization of molecular data in Tropiduchidae will contribute to our knowledge of the biodiversity and molecular evolution in the Hemiptera.

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