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Two new bamboo-feeding species of the genus *Neocarpia* Tsaur & Hsu (Hemiptera: Fulgoromorpha: Cixiidae: Eucarpiini) from Guizhou Province, China

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Abstract

Two new bamboo-feeding species of the cixiid planthopper genus *Neocarpia* Tsaur & Hsu, 2003 (Hemiptera: Fulgoromorpha: Cixiidae: Eucarpiini), *N. bidentata* **sp. nov.** (Guizhou: Xishui) and *N. hamata* **sp. nov.** (Guizhou, Yanhe), from southwest China, are described and illustrated. The generic characteristics are redefined. A key and a checklist to the known species of this genus in the world are provided.

Key words: bamboo pests, Fulgoroidea, Oriental region, planthopper, taxonomy

Introduction

The cixiid planthopper genus *Neocarpia* was established by Tsaur and Hsu (2003) for *N. maai* Tsaur & Hsu, 2003, and belongs to the tribe Eucarpiini in the family Cixiidae. Emeljanov and Hayashi (2007) described one new species and Löcker *et al.* (2010) described another new species. To date, three species, *N. maai* Tsaur & Hsu, 2003, *N. okinawana* Emeljanov & Hayashi, 2007 and *N. rhizophorae* Löcker, 2010, were recorded in this genus which occurs in the Oriental and Australian regions (China, Japan and Australia) (Tsaur and Hsu, 2003; Emeljanov and Hayashi, 2007; Löcker *et al.*, 2010).

While sorting and identifying Cixiidae from material in the Institute of Entomology, Guizhou University (IEGU), we found two new species of *Neocarpia*, which are herein described and illustrated. The purpose of this paper is to describe these two new species and to provide an identification key to the known species of this genus.

Material and methods

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 *Neocarpia* Tsaur & Hsu, 2003

Neocarpia Tsaur & Hsu, 2003: 440; Löcker *et al.*, 2010: 17.

Type species: *Necocarpia maai* Tsaur & Hsu, 2003.

Diagnostic characters. The distinctive characters were used by Tsaur and Hsu (2003) and Löcker *et al.* (2010) are modified as follows.

Body size. Pint-sized species. Body moderately compressed. Total length varying from 4.0–6.7mm.

Head. Head including eyes slightly narrower than pronotum. Median ocellus absent; lateral ocelli with or without red borders. Vertex widening towards basal emargination; disc compressed or hollowed; lateral and median carinae moderately elevated; subapical carina absent. Frons slightly wider at apex than at base, widest across level of antennae or more or less around the peak of frontoclypeal suture; median carina present; frontoclypeal suture generally angled. Clypeus with strongly elevated median carina, moderately elevated lateral carinae. Rostrum distinctly surpassing hind coxae.

Pronotum and mesonotum. Pronotum short chevron-shaped, with or without median carina, intermediate carinae curved following posterior margins of eyes. Mesonotum tricarinae.

Wings. Forewing steeply tectiform, widening towards apex, apical margin rounded, with 10 apical cells, and with speckles at ends of longitudinal veins; Sc+R fused, forming common stem Sc+R, M emerging separately from basal cell; Sc+R forking slightly basad or at same level as fork CuA1+CuA2; first veinlet MP-CuA1 about as long as or longer than vein MP from M fork to this veinlet, subapical cell MP with upper margin (vein MP) finely concave; no transverse vein between CuA1 and CuA2; position of first veinlet MP-CuA1 almost at same level as first veinlet r-m.

Legs. Hind tibia without lateral spine; chaetotaxy of hind tarsi 6–7/6–8.

Abdomen. Pygofer symmetrical, prolonged, lateral lobes symmetrical. Medioventral process thumb-like in lateral view. Anal segment tubular, short and stout. Genital styles symmetrical. Flagellum of aedeagus with spines.

Distribution. Oriental and Australian regions.

Remarks. This genus may be easily distinguished from other genera of Eucarpiini by the follow features: frontoclypeal suture generally angled; rostrum distinctly surpassing hind coxae; forewing with 10 apical cells, Sc+R forking slightly basad or at same level as fork CuA1+CuA2, first veinlet MP-CuA1 about as long as or longer than vein MP from M fork to this veinlet, subapical cell MP with upper margin (vein MP) fine concave, no transverse vein between CuA1 and CuA2, position of first veinlet MP-CuA1 almost at same level as first veinlet r-m. The two new species, *N. bidentata* **sp. nov.** and *N. hamata* **sp. nov.**, fit into the genus by the presence of features as above.

World checklist of species of *Neocarpia* Tsaur & Hsu, 2003

N. bidentata **sp. nov.**; Southwest China (Guizhou).

N. hamata **sp. nov.**; Southwest China (Guizhou).

N. maai Tsaur & Hsu, 2003; South China (Taiwan).

N. okinawana Emeljanov & Hayashi, 2007; Japan (Ryukyus).

N. rhizophorae Löcker in Löcker, Fletcher & Gurr, 2010; Australia (Queensland).

Key to species of the genus *Neocarpia* Tsaur & Hsu of the world

1. Dorsal margin of aedeagus without process 2
- Dorsal margin of aedeagus with process 3
2. Aedeagus with three spines distally, flagellum with a small awl-shaped spine protruding on left side near apex *N. maai*
- Aedeagus with one spines distally, flagellum with a large spine protruding on dorsal margin near middle *N. rhizophorae*
3. Spine on dorsal margin of aedeagus, directed dorsocephalad; flagellum with two spines near apex *N. okinawana*
- Spine on dorsal margin of aedeagus, not directed dorsocephalad; flagellum with one spine near apex 4

4. Spine on dorsal margin of aedeagus, hook-like, directed caudad, aedeagus with three spines near apex; base of spine near apex of flagellum smooth (Figs 23–26). *N. hamata* **sp. nov.**
 - Spine on dorsal margin of aedeagus, shovel-shaped, directed dorsad, aedeagus with two spines near apex; base of spine near apex of flagellum with two denticulations (Figs 10–13). *N. bidentata* **sp. nov.**

***Neocarpia bidentata* sp. nov.**

(Figs 1–13)

Description. Body length (from apex of vertex to tip of forewings): male 5.1–5.3mm (n = 2), female 5.7–5.9mm (n = 3)

Coloration. General color brown (Figs 27–29). Eyes blackish brown alternating with yellowish brown. Ocelli pale yellow, semitransparent, with surroundings reddish. Vertex generally dark brown, carinae bright yellow (except apical transverse carina crineous). Frons tawny to tan, color becoming deeper from base to end; lateral carinae black brown, median carina brightly yellow; areas near two ends of frontoclypeal suture with two glassily yellow splashes. Rostrum yellow, apex dark brown. Pronotum with discal area and carinae glassily yellow, the rest area tan. Mesonotum with area between lateral carinae glassily yellow, lateral area tan, carinae brightly yellow. Forewing pale brown, semihyaline; an oblique brown stripe arising from base of costal cell to middle of Y-vein, another V-shaped brown broad stripe on apical half of forewing; costal cell with two small spots; a short black brown elongate spot behind stigma. Hind tibiae yellow, apexes of apical spines dark brown. Abdomen blackish brown alternating with yellow ventrally.

Head. Vertex (Figs 1, 28) broad, 1.5 times wider than long; anterior margin truncated, posterior margin archedly recessed and middle with a small gap; median carina dividing vertex into two areolets which slightly hollowed. Frons (Figs 2, 29), widest more or less around the peak of frontoclypeal suture, 1.5 times longer than wide; anterior margin nearly concave into an obtuse angle; lateral carinae distinct and elevated, S-shaped. Rostrum reaching hind femur, subapical segment 1.3 times longer than apical segment.

Pronotum and mesonotum. Pronotum (Figs 1, 28), 1.2 times longer than vertex; median carina indistinct, reaching anterior and posterior margins; posterior margin concave, forming an obtuse angle. Mesonotum (Figs 1, 28) 1.7 times longer than pronotum and vertex combined.

Wings. Forewing (Figs 3, 27) 2.5 times longer than wide, with distinct tubercles which situated along veins, with 6 subapical cells; crossveins not in rows; fork Sc+RP slightly basad of fork CuA1+CuA2, first veinlet r+m basad of fork MA+MP; RP 2 branches, MA 3 branches, MP 2 branches; fork PCu+A1 basad of center of clavus; fork MA1+MA2 basad fork MP1+MP2.

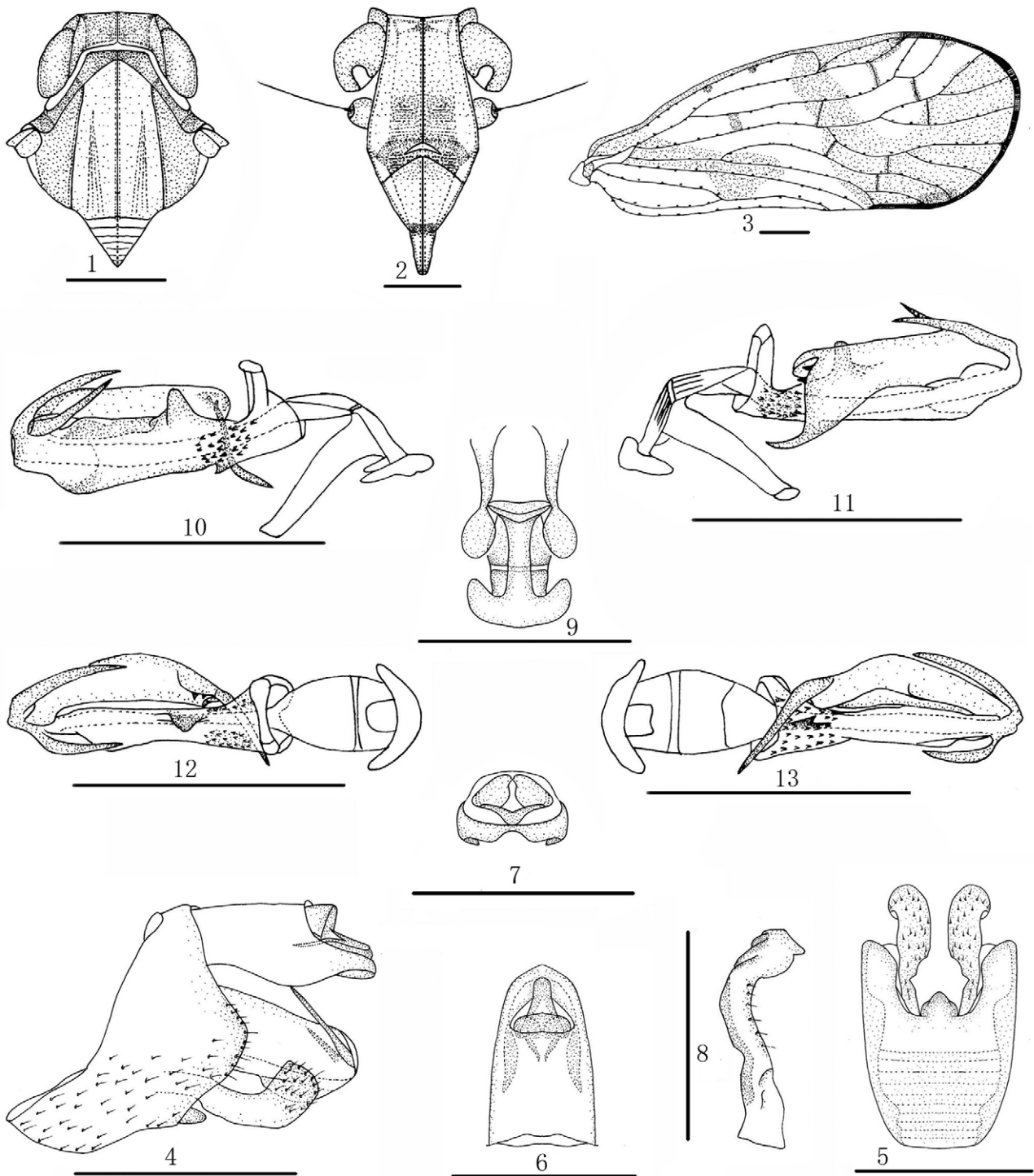
Legs. Hind tibia with 5 apical spines; chaetotaxy of hind tarsi: 7/8.

Abdomen. Pygofer (Figs 4, 5), dorsal margin shallowly concave and U-shaped in ventral view, widening from base to apex; in lateral view, lateral lobes archedly extended caudally, outer margin with setae. Medioventral process (Fig. 5) 1.4 times wider than long in ventral view, reaching to one third of length of lateral lobes. Anal segment (Figs 4, 6, 7), in lateral view, dorsal margin nearly straight, ventral margin waved; in caudal view, dorsal margin archedly convex, ventral margin waved; 1.7 times longer than wide in dorsal view; closely connected with pygofer, unmovable. Anal style finger-like, not beyond anal segment. Genital styles (Figs 4, 5, 8), apical part with setae; in ventral view, machete-like, widening to apex, not touching each other, both inner and outer margins waved; in lateral view, both dorsal and ventral margins bending up, with a small cornuted production; loosely connected with connective, movable freely. Aedeagus (Figs 10–13) with structure simple; ventral margin with a small triangular spine at basal one third, directed ventrocaudad; both right and left sides of aedeagus shaft with a long and broad spine, both spines directed dorsocephalad; dorsal margin of aedeagus with a shovel-shaped process, directed dorsad. Flagellum strongly sclerotized, generally curving left side, base broad, narrowing to apex, forming a longer spine, which with with two denticulations on base. Connective (Fig. 9) broad and large, aedeagal shaft as wide as connective plus ventral arm.

Type material. Holotype: 1 ♂, **CHINA:** Linjiang (28°19'N, 106°12'E), Xishui County, Guizhou Province, bamboo, 1 June 2006, X.-S. Chen; paratypes: 3 ♀♀, same data as holotype; 1 ♂, Dayi (25°10'N, 106°06'E), Wangmo County, Guizhou Province, bamboo, 24 Sep. 1997, X.-S. Chen.

Host plant. Bamboo.

Distribution. Southwest China (Guizhou Province).



FIGURES 1–13. *Neocarpia bidentata* **sp. nov.**. (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.

Remarks. This new species is similar to *N. hamata* **sp. nov.**, but differs in: (1) Forewing with an oblique brown stripe arising from base of costal cell to middle of Y-vein, a V-shaped brown broad stripe on apical half, and another short black brown microscler spot behind stigma, costal cell with two small spots (with only one small spot slightly basad of fork PCu+A1 in *hamata*); (2) Aedeagus with two spines near apex, ventral margin with a small triangular spine at basal one third, spine on dorsal margin shovel-shaped, directed dorsad (in *hamata*, aedeagus

with three spines near apex, base of ventral margin with two folioles whose margin saw-toothed, spine on dorsal margin hook-like, directed caudad); (3) The base of spine near apex of flagellum with two denticulation (lacking in *hamata*).

Etymology. The name is derived from the Latin words “*bidentata*”, which refers to base of spine near apex of flagellum with two denticulation.

***Neocarpia hamata* sp. nov.**

(Figs 14–26)

Description. Body length (from apex of vertex to tip of forewings): male 4.7 mm (n = 1), female 4.8–5.1 mm (n = 4)

Coloration. General color black brown (Figs 30–32). Eyes with discal area black and surroundings yellowish brown. Ocelli yellowish brown, semitransparent. Vertex generally yellowish brown, median carina yellow, lateral carinae black brown. Frons yellowish brown to black, discal area with deeper color, both sides with paler color, median carina yellowish brown, lateral carinae blackish brown. Rostrum generally brown, apex dark brown. Pronotum yellowish brown, color becoming deeper from discal area to lateral margin, carinae yellowish white. Mesonotum generally blackish brown, posterior half of area between lateral carinae rustedly yellow, median carina yellowish brown. Forewing blackish brown, semihyaline; veins blackish brown; tubercles black; stigma pale yellowish brown, indistinct; crossveins black; a deep color spot existing basad of fork PCu+A1. Hind tibiae yellowish brown, apical spines black. Abdomen blackish brown with yellow margin.

Head. Vertex (Figs 14, 31) nearly rectangle, disc hollowed; 1.5 times wider than long; anterior margin slightly concave, posterior margin archedly recessed and middle with a small gap. Frons (Figs 15, 32) widest slightly below the level of antennae, 1.4 times longer than wide; anterior margin nearly concave into a right angle; lateral carinae S-shaped, median carina disappeared basally. Rostrum reaching hind femur, subapical segment 1.4 times longer than apical segment.

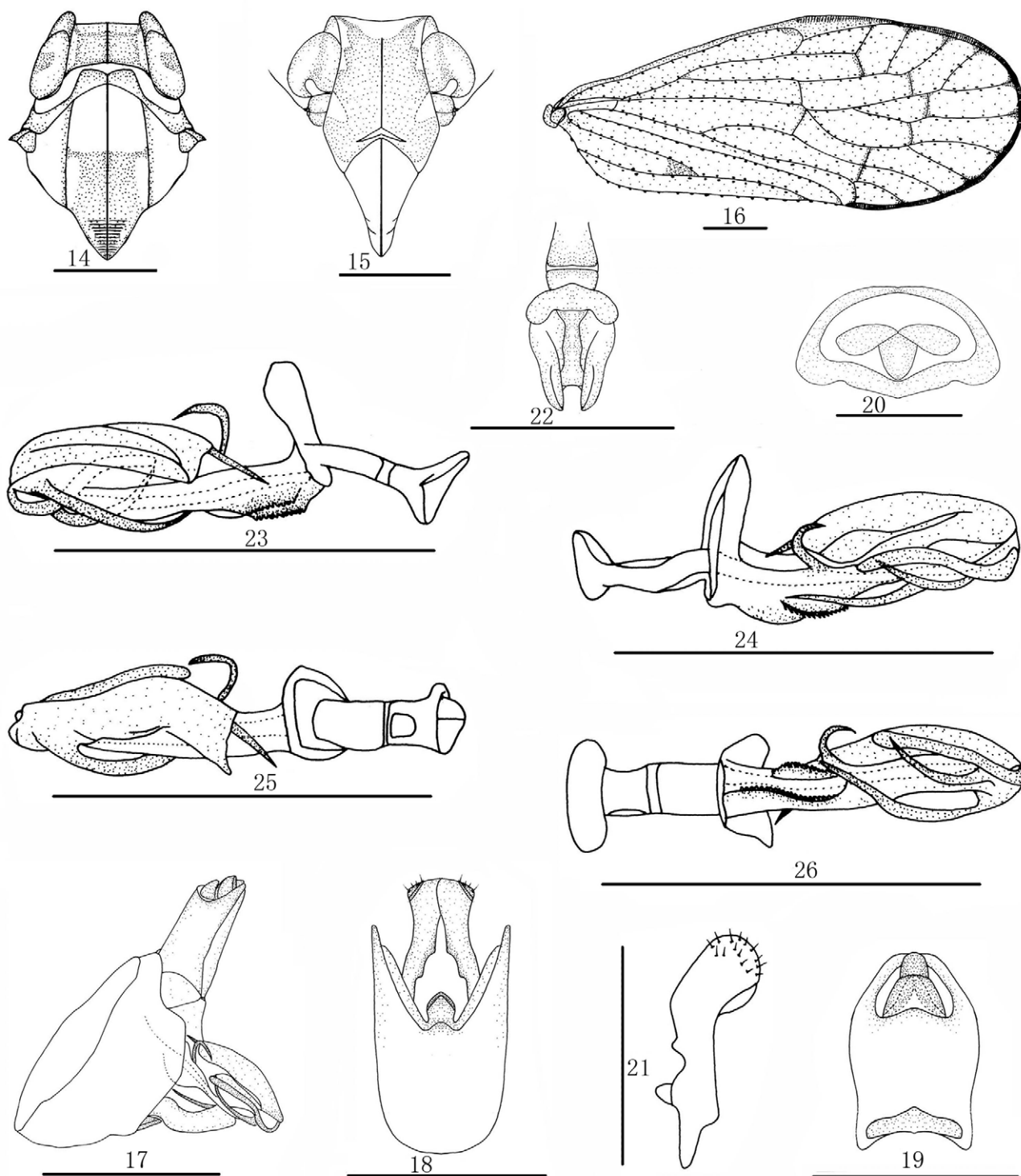
Pronotum and mesonotum. Pronotum (Figs 14, 31) 1.1 times longer than vertex; median carina distinct; posterior margin concave, forming an obtuse angle. Mesonotum (Figs 14, 31) 1.6 times longer than pronotum and vertex combined.

Wings. Forewing (Figs 16, 30) 2.5 times longer than wide, with 6 subapical cells; tubercles generally situated along veins, C and CuP only one side with tubercles, discal area of stigma with tubercles; crossveins not in rows; fork Sc+RP slightly basad of fork CuA1+CuA2, first veinlet r+m basad of fork MA+MP; RP 2 branches, MA 3 branches, MP 2 branches; fork PCu+A1 basad of center of clavus; fork MA1+MA2 basad fork MP1+MP2.

Legs. Hind tibia with 6 apical spines; chaetotaxy of hind tarsi: 7/8; 2nd hind tarsus with 2 platellae.

Abdomen. Pygofer (Figs 17, 18), dorsal margin concave and loudspeaker-shaped in ventral view, nearly equal width from base to apex; in lateral view, lateral lobes irregularly extended caudally, outer margin waved. Medioventral process (Fig. 18), broad and thick, length equal to width in ventral view, reaching to one third of length of lateral lobes. Anal segment (Figs 17, 19, 20), in lateral view, both dorsal and ventral margins tilted upward; in caudal view, dorsal margin archedly convex, ventral margin waved; 1.5 times longer than wide in dorsal view; loosely connected with pygofer, movable freely. Anal style with base broad and deplanate, apical part finger-like, not beyond anal segment. Genital styles (Figs 17, 18, 21), in ventral view, outer margin slightly archedly concave, inner margin waved, generally bush-knife-like, touching each other near apex; in lateral view, both dorsal and ventral margins waved; loosely connected with connective, movable freely. Aedeagus (Figs 23–26), base of ventral margin with two folioles whose margin saw-toothed; aedeagus shaft with three spines near apex, two on right side, both spines across ventral margin of aedeagus to the left, the former slender and pointed, directed dorsocephalad, the latter broad and pointless, directed dorsocephalad, another one arising from ventral margin, short and slender, directed dorsocephalad; dorsal margin of aedeagus with a hook-shaped spine at basal one third, apex directed caudad. Flagellum semi-sclerotized, broad and large, structure simple, generally curving right side, forming a moderately long spine on right side of apex, directed ventrocephalad. Connective anchor-shaped, broad and large (Fig. 22); aedeagal shaft 1.3 times as wide as connective plus ventral arm.

Type material. Holotype: 1 ♂, **CHINA:** Daheba (28°33'N, 108°30'E) (450–700 m), Yanhe County, Guizhou Province, 5–12 June 2007, P. Zhang; paratypes: 1 ♀, same data as holotype; 3 ♀♀, Lijiaba (700 m), Yanhe County, Guizhou Province, bamboo, 5–12 June 2007, X.-S. Chen.



FIGURES 14–26. *Neocarpia hamata* sp. nov.. (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, dorsocephalic view; (23) Aedeagus, right side; (24) Aedeagus, left side; (25) Aedeagus, dorsal view; (26) Aedeagus, ventral view. Scale bars = 0.5 mm.

Host plant. Bamboo.

Distribution. Southwest China (Guizhou Province).

Remarks. This new species is similar to *N. okinawana* Emeljanov & Hayashi, but differs in: (1) Spine on dorsal margin of aedeagus upright, strongly curving caudad, directed caudad (transverse, slightly curving upward, directed dorsocephalad in *okinawana*); (2) Flagellum with one spine near apex (with two spines near apex in

okinawana); (3) The spines near apex of the aedeagus is different in size, direction and position.

Etymology. The name is derived from the Latin words “*hamata*”, which refers to spine on dorsal margin of aedeagus upright and hook-like.



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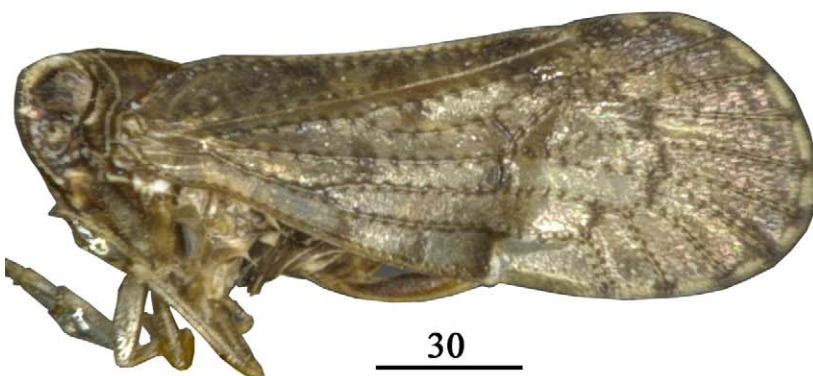
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FIGURES 27–32. *Neocarpia bidentata* sp. nov. and *N. hamata* sp. nov.. 27–29. *N. bidentata*. (27) Habitus, lateral view; (28) Head and thorax, dorsal view; (29) Face, ventral view; 30–32. *N. hamata*. (30) Habitus, lateral view; (31) Head and thorax, dorsal view; (32) Face, ventral view. Scale bars = 0.5 mm.

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