



Review of the Oriental genus *Neunkanodes* Yang (Hemiptera: Fulgoromorpha: Delphacidae) with descriptions of two new species

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Abstract

The Oriental planthopper genus *Neunkanodes* Yang, 1989 (Hemiptera: Fulgoromorpha: Delphacidae: Delphacinae: Delphacini) is reviewed to include three species: *N. bispinatus* **sp. nov.** (China: Yunnan), *N. formosana* Yang, 1989 (China: Taiwan, Guizhou, Yunnan) and *N. unispinatus* **sp. nov.** (China: Yunnan). The generic characteristics are redefined. The main morphological characters and male genitalia of three species are described or redescribed and illustrated. A key to the known species in the genus is provided.

Key words: Fulgoroidea, morphology, planthopper, taxonomy

Introduction

The Oriental delphacid genus *Neunkanodes* was erected by Yang (1989) with *N. formosana* Yang, 1989 (China: Taiwan) as type species. It belongs to the tribe Delphacini within the subfamily Delphacinae (Hemiptera: Fulgoroidea: Delphacidae) (Yang, 1989; Ding, 2006) and is easily separated from other members in Delphacini by the following characters: median line of frons, vertex, pro- and mesonotum white, frons between areas of carinae with narrow black stripe; frons longer in middle line than wide at widest part about 2.4–2.8:1, widest at apex or median; anal segment of male ring-like, lateroapical angles large and widely separated, each produced in a spinose process; phallus simple, tubular-shape, with processes. Currently, this genus is only known to occur in southern China. It has been a monobasic genus since 1989.

During on-going studies on the delphacid species in China, two new species of the genus *Neunkanodes* were found. The purpose of this paper is to review the genus, to describe two new species and to provide an identification key to the known species of the genus. The generic characteristics are redefined. The main morphological characters and male genitalia of three species are described or redescribed and illustrated.

Materials and methods

The methods and morphological terminology used in this study follows that of Yang & Yang (1986) and Ding (2006). The genital segments of the examined specimens were macerated in 10% KOH and drawn from preparations in glycerin jelly aid of a light microscope. Illustrations of the specimens were made with a Leica MZ 12.5 stereomicroscope. Spinal formula means the numbers of apical spines of the hind tibiae and 1st and 2nd hind tarsomeres. The specimens examined are deposited in the Insect Collection at the Institute of Entomology, Guizhou University, Guiyang, Guizhou Province, China (IEGU).

Taxonomy

Neunkanodes Yang, 1989

Neunkanodes Yang, 1989: 164; Ding, 2006: 575. Type species. *Neunkanodes formosana* Yang, 1989: 164, by original designation.

Description. The distinctive characters used by Yang (1989) and Ding (2006) are modified as follows.

Body size. Macropterous form, large size, body length (including forewing): male 4.15–5.00 mm, female 5.05–5.95 mm.

Coloration. General color yellowish brown to reddish brown. Vertex, frons, pro- and mesonotum with median carinae white to yellowish white (Figs 1, 13, 26; Yang, 1989: Fig. 68A; Ding, 2006: Fig. 314A). Frons bordered with dark brown to black stripe (Figs 2, 14, 27; Yang, 1989: Fig. 68B; Ding, 2006: Fig. 314B). Forewings hyaline, veins dark brown (Figs 3, 15, 28; Yang, 1989: Fig. 68C). Abdomen somewhat reddish brown.

Head and Thorax. Head including eyes narrower than pronotum. Vertex longer submedially than wide at base about 1.2:1, apical margin transverse or sinuate, submedian carinae uniting at apex, Y-shaped carina present. Frons longer in middle line than wide at widest part about 2.4–2.8:1, widest at apex or level of ocelli. Rostrum reaching to meta-coxae. Ocelli present. Antennae cylindrical, basal segment longer than wide, shorter than second about 1:2.2–3.5. Pronotum with lateral carinae not attaining hind margin. Spinal formula of hind leg 5–7–4. Post-tibial spur with about 23 teeth.

Male genitalia. Anal segment of male ring-like, lateroapical angles widely separated, each produced in a large spinose process. Pygofer in profile wider ventrally than dorsally, with a large lamellar process produced caudad medially at caudal margin, in posterior view opening longer than width, medioventral process present or absent. Phallus compressed, tubular-shape, with processes. Suspensorium ring-like ventrally. Diaphragm rather broad, dorsal margin roundly produced medially, ventral margin with thumb-like process. Genital styles widely divergent apically, long and fine, with laterobasal angle.

Host plant. Weed.

Distribution. China (Taiwan, Guizhou, Yunnan).

Remarks. This genus differs from *Unkanodes* Fennah in having pygofer with a large lamellar process medially at caudal margin, medioventral process present or absent; phallus compressed, with simple processes; diaphragm with a straight and thumb-like process at ventral margin; genital styles abruptly narrowing at basal 1/3, laterobasal angle with spine-like process.

Key to known species of *Neunkanodes*

1. Pygofer with one long, spinous medioventral process, apical margin slightly concave medially *N. unispinatus* sp. nov.
- Pygofer without spinous medioventral process. 2
2. Lobe of pygofer with two long, spine-like processes at apex; phallus with one process at middle, directed caudad
- *N. bispinatus* sp. nov.
- Lobe of pygofer without above process; phallus with two processes. *N. formosana* Yang

Neunkanodes bispinatus sp. nov.

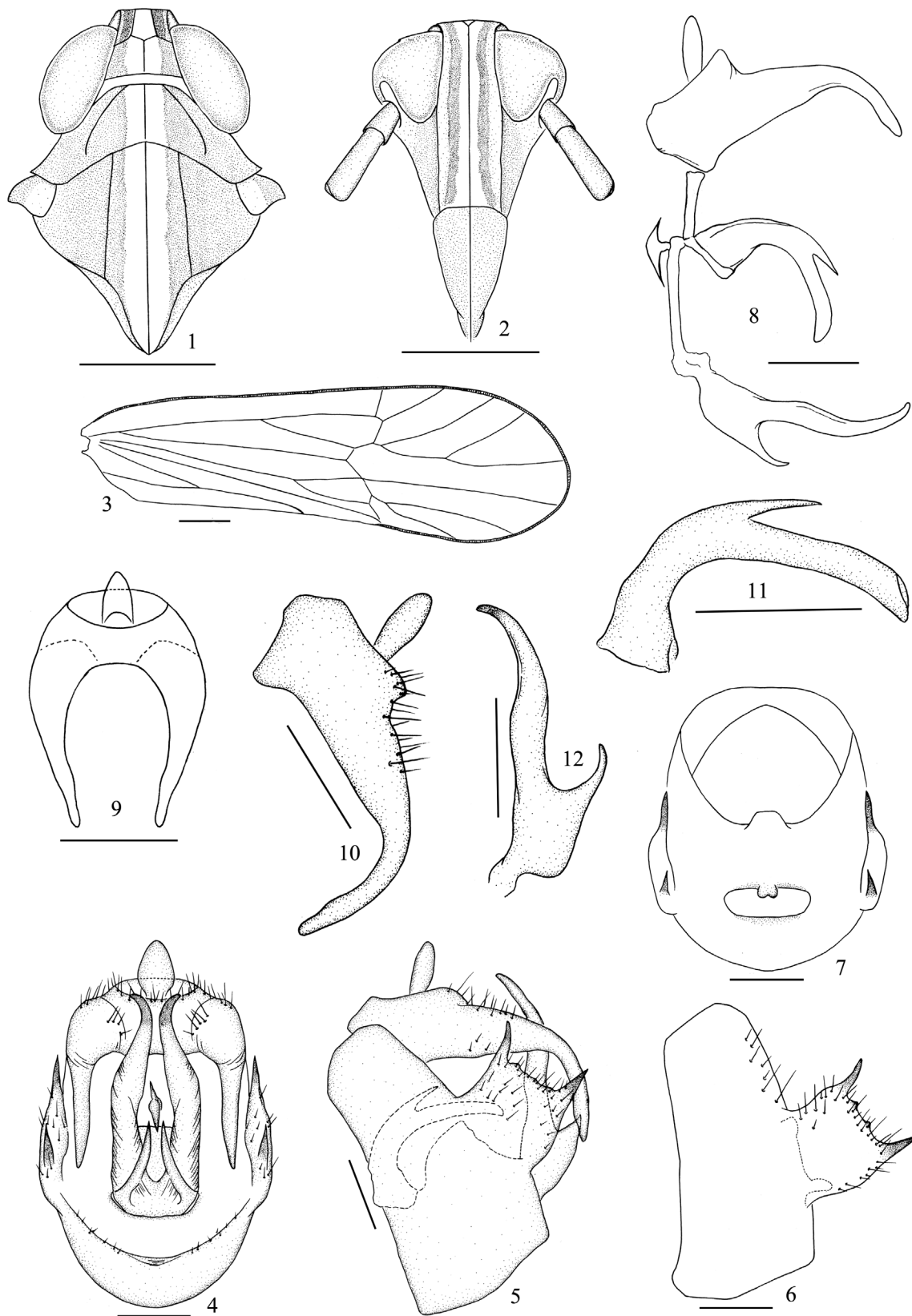
(Figs 1–12)

Measurement. Length of body 2.90–3.00 mm (male), 3.60 mm (female); including forewing 4.85–5.00 mm (male), 5.95 mm (female); forewing length 4.50 mm (male), 5.40 mm (female).

Coloration. General color yellowish brown. Median line of frons, vertex, pro- and mesonotum, commissural suture white. Areas between carinae of frons somewhat black. Abdomen somewhat yellowish white. Pygofer yellowish.

Head and Thorax. Vertex wider submedially than long at base about 1.2:1, apical margin transverse, lateral carinae nearly straight, submedian carinae not really uniting at apex, basal compartment wider at base than greatest length about 1.1:1. Frons longer in middle line than wide at widest part about 2.8:1, widest at middle, median carina simple. Post-clypeus wider at base than frons at apex, very long, longer than half of frons. Antennae

reaching frontoclypeal suture, basal segment longer than wide, shorter than second about 1:2.4. Post-tibial spur with 22–25 teeth. Tegmina longer than widest part about 3.2:1.



FIGURES 1–12. *Neunkanodes bispinatus* sp. nov. (1) Head and thorax, dorsal view; (2) Frons and clypeus; (3) Forewing; (4) Male genitalia, posterior view; (5) Same, left side view; (6) Pygofer, left side view; (7) Same, posterior view; (8) Anal segment, aedeagus and genital style, left lateral view; (9) Anal segment, posterior view; (10) Anal segment, left side view; (11) Aedeagus, left side view; (12) Genital style, left side view. Scale bars = 0.5 mm (Figs 1–3), 0.2 mm (Figs 4–7), 0.1 mm (Figs 8–12).

Male Genitalia. Anal segment of male with lateroapical angles widely separated, each produced in a long, stout process, gradually narrowing near middle, obtuse at apex. Pygofer in profile slightly wider ventrally than dorsally, at caudal margin strongly produced caudodorsad in a large plate-like process, with 2 spine-like processes at apex margin, in posterior view opening longer than wide, ventral margin planus, without medioventral process. Phallus somewhat compressed, long and tubular, C-shaped and strongly bent ventrad, broad at base, abruptly narrowing to apex, with one shorter, spinous process at middle directed caudad. Diaphragm broad, dorsal margin with a node protruding cephalad to supporting phallus, ventral margin with a thumb-like process directed caudad. Genital styles very long, slender, sinuate, divergent apically, quadrate at base, abruptly narrowing at basal 1/3, laterobasal angle with long, spine-like process, distinct at lateral view.

Type Material. Holotype ♂, CHINA: Yunnan Province, Pianma (26°03'N, 98°24'E), Lushui, Nujiang, 17–19 Jun. 2011, lamping, collected by J.-K. Long. Paratypes: 3 ♀♀, same data as holotype.

Host plant. Unknown.

Distribution. South China (Yunnan).

Remarks. This new species is similar to *N. unispinatus* sp. nov., but can be distinguished from the latter by the following features: anal segment each produced in a longer and stouter process; pygofer produced in a plate-like process, with 2 long spine-like processes at apex, without medioventral process; phallus with one shorter process at middle; genital styles at basal angle with slender process. The structural features of male genitalia are distinctly different from other known species of the genus.

Etymology. The specific name refers to the lobe of pygofer at caudal margin with two spine-like processes.

Neunkanodes formosana Yang, 1989

(Figs 13–25)

Neunkanodes formosana Yang, 1989: 164, fig. 68A–K; Ding, 2006: 575, fig. 314A–L.

Measurement. Length of body 2.90 mm (male), 3.50 mm (female); including forewing 4.60 mm (male), 5.80 mm (female); tegmen length 4.10 mm (male), 5.20 mm (female).

Coloration. General color reddish brown to yellowish brown. Median line of frons, vertex, pro- and mesonotum, commissural suture whitish yellow. Areas between carinae of frons somewhat dark brown. Abdomen somewhat whitish yellow to reddish yellow. Pygofer yellow.

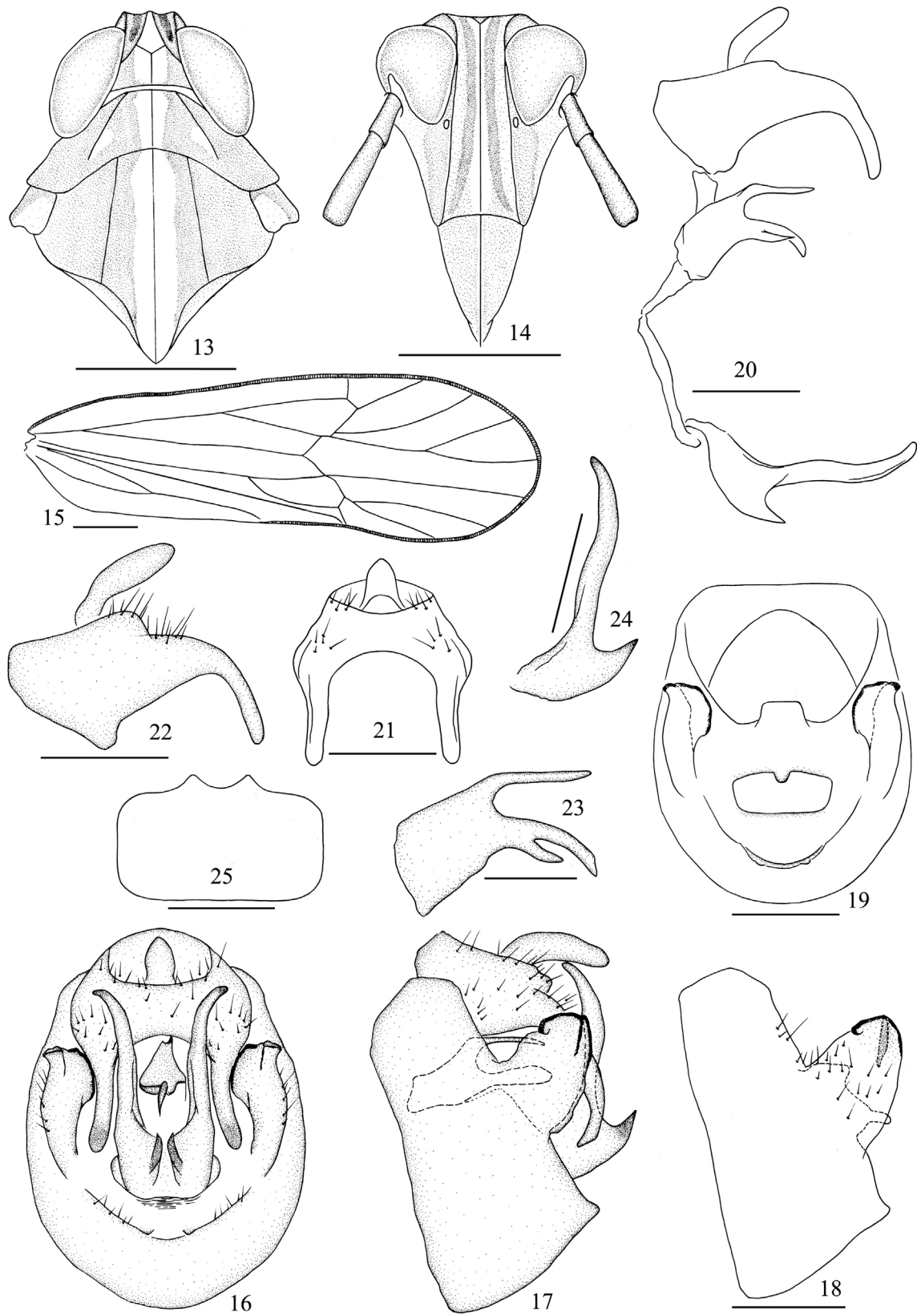
Head and Thorax. Vertex wider submedially than long at base about 1.1:1, apical margin transverse, lateral carinae nearly straight, submedian carinae not really uniting at apex, basal compartment width at base equal to greatest length. Frons longer in middle line than wide at widest part about 2.4:1, widest at apex, median carina simple. Post-clypeus wider at base than frons at apex, very long, longer than half of frons. Antennae reaching over frontoclypeal suture, basal segment longer than wide, shorter than second about 1:2.2. Post-tibial spur with 23–24 teeth. Tegmina longer than widest part about 3.1:1.

Male Genitalia. Anal segment of male with lateroapical angles widely separated, each produced in a stout spinose process, abruptly narrowing near middle, blunt at apex. Pygofer in profile distinctly wider ventrally than dorsally, at caudal margin strongly produced caudodorsad in a large lobe, slightly twisted near apex, sinuated at apical margin, in caudodorsal view opening longer than width, in ventral medioventral process obsolete, very wide, apical margin slightly concave medially. Phallus somewhat compressed, almost quadrate at base, forking at apex, upper one process slender, longer, directed caudad, lower one process Y-shaped, furcal, common petiole, directed caudodorsad. Diaphragm dorsal margin with a large node protruding cephalad to supporting phallus, ventral margin with a thumb-like process directed caudad. Genital styles very long, slender, sinuate, divergent apically, basal quadrate, abruptly narrowing at basal 1/3, laterobasal angle with moderate, spine-like process, distinct at lateral view.

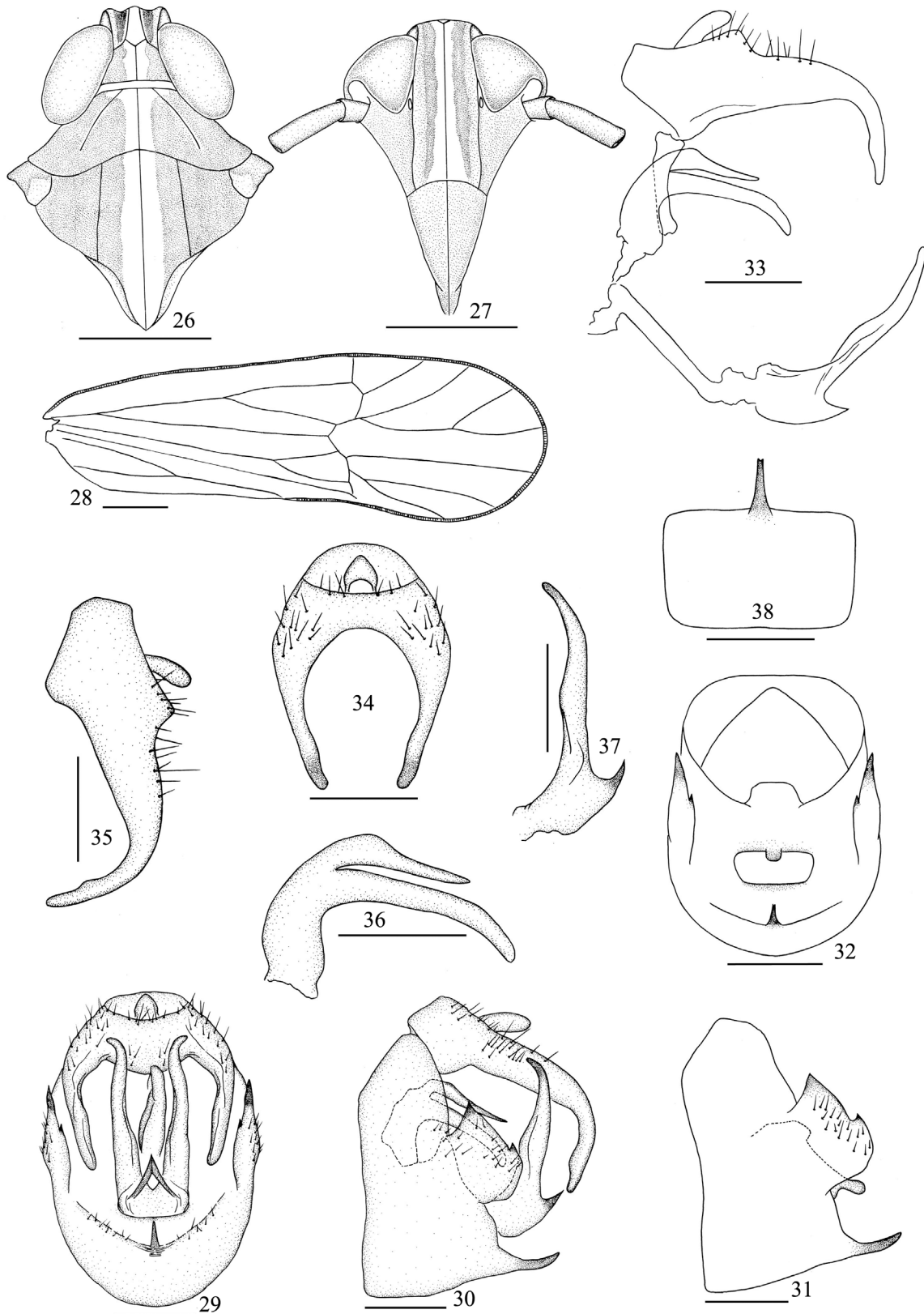
Material Examined. CHINA: Guizhou Province: 1 ♂, Dayi (25°17'N, 106°10'E), Wangmo, 24 Sep. 1997, collected by X.-S. Chen; 1 ♂, 1 ♀, Maolan (25°42'N, 107°88'E), Libo, 22 Oct. 1998, collected by X.-S. Chen; 2 ♂♂, Shitou village (24°98'N, 105°82'E), Ceheng, 4 Oct. 2012, collected by X.-H. Hou.

Host plant. Weed.

Distribution. South China (Taiwan, Yunnan, Guizhou).



FIGURES 13–25. *Neunkanodes formosana* Yang. (13) Head and thorax, dorsal view; (14) Frons and clypeus; (15) Forewing; (16) Male genitalia, posterior view; (17) Same, left side view; (18) Pygofer, left side view; (19) Same, posterior view; (20) Anal segment, aedeagus and genital style, left lateral view; (21) Anal segment, posterior view; (22) Anal segment, left side view; (23) Aedeagus, left side view; (24) Genital style, left side view; (25) Pygofer, ventral view. Scale bars = 0.5 mm (Figs 13–15), 0.2 mm (Figs 16–19), 0.1 mm (Figs 20–25).



FIGURES 26–38. *Neunkanodes unispinatus* sp. nov. (26) Head and thorax, dorsal view; (27) Frons and clypeus; (28) Forewing; (29) Male genitalia, posterior view; (30) Same, left side view; (31) Pygofer, left side view; (32) Same, posterior view; (33) Anal segment, aedeagus and genital style, left lateral view; (34) Anal segment, posterior view; (35) Anal segment, left side view; (36) Aedeagus, left side view; (37) Genital style, left side view; (38) Pygofer, ventral view. Scale bars = 0.5 mm (Figs 26–28), 0.2 mm (Figs 29–32), 0.1 mm (Figs 33–38).

***Neunkanodes unispinatus* sp. nov.**

(Figs 26–38)

Measurement. Length of body 2.35–2.60 mm (male), 2.80 mm (female); including forewing 4.15–4.50 mm (male), 5.05 mm (female); forewing length 3.95 mm (male), 4.20 mm (female).

Coloration. General color reddish brown. Median line of frons, vertex, pro- and mesonotum, commissural suture white. Areas between carinae of frons somewhat blackish brown. Abdomen somewhat dirty yellow to reddish brown. Pygofer brown.

Head and Thorax. Vertex longer submedially than wide at base about 1.1:1, apical margin distinctly emarginate at both sides of median point, lateral carinae concave, submedian carinae not really uniting at apex, basal compartment greatest longer than width at base about 0.9:1. Frons longer in middle line than wide at widest part about 2.5:1, widest at level of ocelli, median carina simple. Post-clypeus wider at base than frons at apex, moderately long, longer than half of frons. Antennae reaching over frontoclypeal suture, basal segment longer than wide, shorter than second about 1:3.5. Post-tibial spur with 23–25 teeth. Tegmina longer than widest part about 3.7:1.

Male genitalia. Anal segment of male with lateroapical angles widely separated, each produced in a huge, stout spinose process. Pygofer in profile distinctly wider ventrally than dorsally, at caudal margin strongly produced caudodorsad in a large plate-like process, with 2 small tooth at apex, in caudodorsal view opening longer than width, with a long, spinous process at medioventral, apical margin slightly concave medially. Phallus somewhat compressed, long and tubular, L-shaped and strongly bent ventrad, broad at base, abruptly narrowing to apex, with one slender, long process arising from dorsal margin at basal 1/3, directed ventral. Diaphragm broad, dorsal margin with a node protruding cephalad to supporting phallus, ventral margin with a thumb-like process directed caudad. Genital styles very long, slender, sinuate, divergent apically, quadrate at base, abruptly narrowing at basal 1/3, laterobasal angle with short, spine-like process, distinct at lateral view.

Type material. Holotype ♂, CHINA: Yunnan Province, Pianma (26°03'N, 98°24'E), Lushui, Nuijiang, 17–19 Jun. 2011, lamping, collected by J.-K. Long. Paratypes: 1♂, 3♀♀, same data as holotype.

Host plant. Unknown.

Distribution. South China (Yunnan).

Remarks. This new species is similar to *N. bispinatus* sp. nov., but can be distinguished from the latter by the following features: anal segment each produced in a shorter and slender process; pygofer at plate-like process of caudal margin with 2 small teeth-like processes at apex, with a spine-like medioventral process; phallus with one slender and longer process at basal 1/3; genital styles basal angle with shorter process. The structural features of male genitalia of this species are distinctly different from other known species in this genus.

Etymology. The specific name refers to the pygofer with a long, spinous process at medioventral margin.

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