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Two new species of the bamboo-feeding planthopper genus *Arcofacies* Muir (Hemiptera: Fulgoroidea: Delphacidae) from China

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Abstract

Two new species of the bamboo-feeding genus *Arcofacies* Muir, *A. longispinus* **sp. nov.** and *A. varius* **sp. nov.**, are described and illustrated from southwest China (Yunnan). A checklist to the species of *Arcofacies* is provided as well as a key for the Chinese species.

Key words: Fulgoromorpha, morphology, oriental region, taxonomy

Introduction

Muir (1915) established the genus *Arcofacies* with the type species *A. fullawayi* Muir, 1915 from Manila, Philippines. This genus falls within the tribe Tropidocephalini in the subfamily Delphacinae (Hemiptera: Fulgoromorpha: Delphacidae) and is easily recognized from other members in this tribe by the postclypeus at right angle to frons, by a white median longitudinal line extending from apex of frons to end of mesonotum, along the line bordered with black or brown stripe, and the forewings often with blackish brown markings, in dark portion veins with white spots (Chen *et al.* 2007). The Chinese species of *Arcofacies* were reviewed by Chen *et al.* (2007) and Hou and Chen (2010). Currently eight species of *Arcofacies* were described in the Oriental region, including China (5 species) (Ding 1987, 1990, 2006; Chen *et al.* 2007; Hou & Chen 2010), Philippines (2 species) (Muir 1915, 1919), Singapore (1 species) (Chen *et al.* 2007), Malaysia (2 species) (Muir 1919), Indonesia (1 species) (Chen *et al.* 2007), Sri Lanka (1 species) (Fennah 1975), Japan (1 species) (Hayashi & Fujinuma 2016).

Herein, two new species *Arcofacies longispinus* **sp. nov.** and *A. varius* **sp. nov.** are described and illustrated from Yunnan province, China. A checklist of the genus and a key to species of China are provided.

Materials and methods

The morphological terminology follows Chen *et al.* (2007). Body length was measured from apex of vertex to tip of forewing. Dry male specimens were used for the description and illustration. External morphology was observed under a stereoscopic microscope and characters were measured with an ocular micrometer. Color pictures for adult habitus were obtained by the KEYENCE VHX-1000 system. The genital segments of the examined specimens were macerated in 10% KOH and drawn from preparations in glycerin jelly using a Leica MZ 12.5 stereomicroscope. Illustrations were scanned with a Canon CanoScan LiDE 200 and imported into Adobe Photoshop 6.0 for labeling and plate composition.

The type specimens of the new species are deposited in the Institute of Entomology, Guizhou University, Guiyang, China (GUGC).

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Taxonomy

Genus *Arcofacies* Muir, 1915
(Figs 1–24)

Type species. *Arcofacies fullawayi* Muir, 1915

Arcofacies Muir, 1915: 319; Kuoh *et al.* 1983: 45; Yang & Yang 1986: 34; Ding 1990: 74; Ding *et al.* 1999: 442; Ding 2006: 115; Chen *et al.* 2007: 684; Hou & Chen 2010: 52.

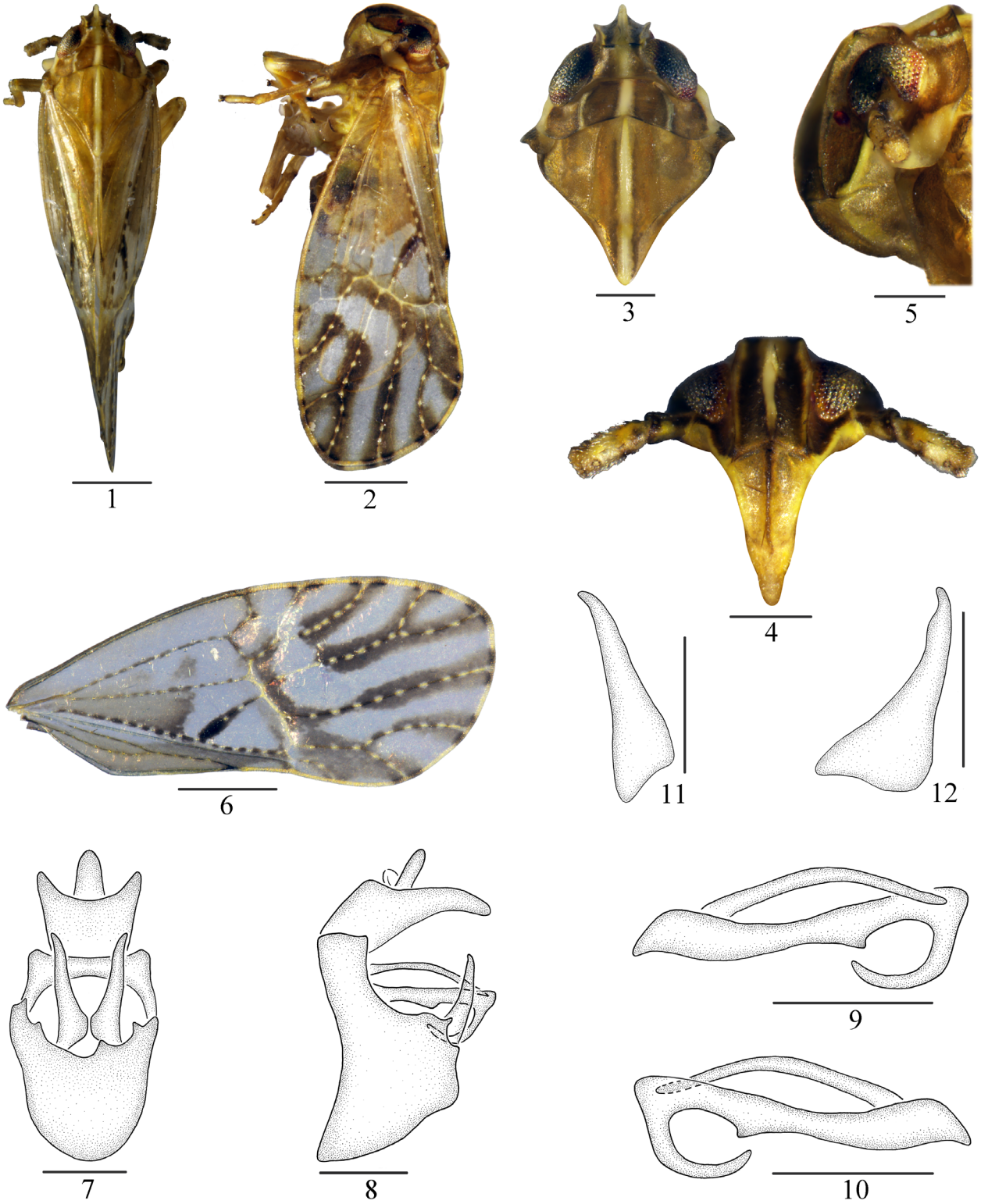
Diagnosis. General color yellowish green to yellowish brown. Frons, vertex, pronotum and mesonotum with median carina white bordered with dark brown or black. Lateral parts of pronotum each with oblique white band bordered with brown or dark brown. Forewings with light brown in basal third, apical portion hyaline, speckled with dark brown markings, in dark portion veins with white spots. Wings hyaline with brown veins. Head including eyes narrower than pronotum. Vertex trapeziform, with margins more or less well defined, wider at base than long submedially (1.70–1.88: 1), apical margin distinctly emarginate at both sides of median point, lateral carinae concave, submedian carinae transverse. Y-shaped carina without stalk, with very short arms, connecting submedian carinae which forms a small cell, in lateral view vertex and frons at right angle. Frons in middle line longer than wide at widest point (1.75–2.17: 1), widest at level of ocelli or at apex, lateral carinae convex at base, nearly straight below level of ocelli, median carina not well developed throughout, forked at extreme base. Postclypeus slightly wider at base than frons at apex, at right angle to frons, tricarinate. Rostrum almost extending to mesotrochanters. Eyes in dorsal view with lateral margin emarginated medially. Lateral ocelli present. Antennae cylindrical, scape distinctly longer than wide (1.60–2.00: 1), shorter than pedicel (0.52–0.59: 1). Pronotum with lateral carinae extending to hind margin, converging apically, median carina weak. Forewings tectiform at rest. M and Sc_1 of wing with a long common stalk, Cu_2 arising from tip of cross vein or basad. Spinal formula of hind leg 5-6-4. Anal segment of male collar-shaped, lateroapical angles produced into spinous processes or not. Pygofer in posterior view with opening longer than wide (1.29–1.6: 1), lateral margins strongly produced caudad medially or not, with a small medioventral process or not. Aedeagus tubular or flat, with spinous process or not, orifice subapical. Diaphragn armature sclerotized and pigmented, V-shaped. Diaphragm wide, membraneous. Genital styles long, simple, broad at base, narrowing apically, basal angle intumescent, apex twisting outward more or less (Hou & Chen 2010).

Remarks. This genus is similar to *Tropidocephala* Stål and *Arcofaciella* Fennah but differs from them in the shape of the frons, vertex and forewings and in the relative size of the antennae (Liang & Jiang 2005(2004)).

Distribution. China (Fujian, Taiwan, Chongqing, Hong Kong, Hainan, Guizhou, Yunnan), Ceylon, Indonesia, Japan (Ryukyu Islands), Malaysia (Penang), Philippines (Luzon), Singapore.

Checklist of species of *Arcofacies* Muir

A. ampelocalamus Chen, 2007; China (Guizhou).
A. fullawayi Muir, 1915; China (Fujian, Taiwan, Chongqing, Hong Kong, Hainan, Guizhou, Yunnan (new record)), Philippines, Malaysia, Indonesia, Singapore, Japan (Ryukyu Islands).
A. insignis Muir, 1919; Philippines (Luzon).
A. longispinus sp. nov.; China (Yunnan).
A. maculatipennis Ding, 1987; China (Guizhou).
A. moliensis Hou & Chen, 2010; China (Yunnan).
A. penangensis Muir, 1919; Malaysia (Penang).
A. strigatipennis Ding, 1990; China (Fujian, Hainan (new record)).
A. truncatipennis Fennah, 1975; Ceylon.
A. varius sp. nov.; China (Yunnan).



FIGURES 1–12. *Arcofacies longispinus* sp. nov. 1. Male habitus, dorsal view; 2. Same, lateral view; 3. Head and thorax, dorsal view; 4. Face; 5. Frons, lateral view; 6. Forewing; 7. Male genitalia, ventral view; 8. Same, lateral view; 9. Aedeagus, left lateral view; 10. Same, right lateral view; 11. Genital style, ventral view; 12. Same, left lateral view. Scale bars: 0.5 mm (1, 2, 6); 0.2 mm (3–5, 7–12).

Key to species (males) of *Arcofacies* from China (revised from Hou & Chen 2010)

1. Lateroapical angles of anal segment of male truncate, without spinous process (Chen *et al.* 2007: Fig. 6) . . . *A. fullawayi* Muir
– Lateroapical angles of anal segment produced into a stout spinous process respectively (Figs 7, 19) 2
2. Aedeagus simple, without elongate spinous process (Chen *et al.* 2007: Fig. 16) . . . . . *A. maculatipennis* Ding
– Aedeagus with long spinous process at middle or at base (Figs 9, 10, 22) 3
3. Aedeagus with 2 long spinous processes at middle (Ding 1990: Fig. 6) . . . . . *A. strigatipennis* Ding
– Aedeagus with long spinous process at base (Figs 9, 10, 22) 4
4. Pygofer in posterior view without medioventral process (Hou & Chen 2010: Fig. 11); apex of genital style forked (Hou & Chen 2010: Fig. 15) . . . . . *A. moliensis* Hou & Chen
– Pygofer in posterior view with medioventral process (Figs 7, 19); apex of genital style not forked (Figs 11, 23) 5
5. Pygofer in posterior view with small medioventral process, flake-shaped (Chen *et al.* 2007: Fig. 28); aedeagus with apex round and blunt (Chen *et al.* 2007: Fig. 31) . . . . . *A. ampelocalamus* Chen
– Pygofer in posterior view with 4 spinous medioventral processes (Figs 7, 19); aedeagus with apex acute, directed ventrad (Figs 9, 22). 6
6. Anal segment with lateroapical processes symmetrical (Fig. 7); middle ventral margin of aedeagus with small process (Figs 9, 10). . . . . *A. longispinus* sp. nov.
– Anal segment with lateroapical processes asymmetrical, left one distinctly longer than right one (Figs 19, 21); middle ventral margin of aedeagus without process (Fig. 22) . . . . . *A. varius* sp. nov

Arcofacies longispinus sp. nov.

(Figs 1–12)

Measurements. Body length including forewing: male 3.0–3.1 mm (*N* = 2), forewing length: male 2.4–2.5 mm (*N* = 2).

Diagnosis. The salient features of the new species include the following: anal segment of male with lateroapical processes symmetrical (Fig. 7); pygofer in posterior view with 4 spinous medioventral processes (Fig. 7); aedeagus with long spinous process at base, apex acute, directed ventrad, middle ventral margin of aedeagus with small process (Figs 9, 10); apex of genital style not forked (Figs 11, 12).

Coloration. General color yellowish brown with green. Frons, vertex, pronotum and mesonotum with median carina white bordered with blackish brown (Figs 3–5). Eyes yellowish to blackish brown; ocelli reddish brown. Antennae with apex of scape blackish brown, pedicel yellowish white (Fig. 4). Lateral margins of gena, vertex and pronotum each with oblique white band bordered with brown or dark brown (Figs 3, 4). Clypeus yellowish white (Fig. 4). Forewings with pale brown over basal third, rest area hyaline, along transverse vein and apical veins with brown stripes as figured (Fig. 6), in dark portion veins with white spots. Wings hyaline with brown veins. Legs yellowish brown.

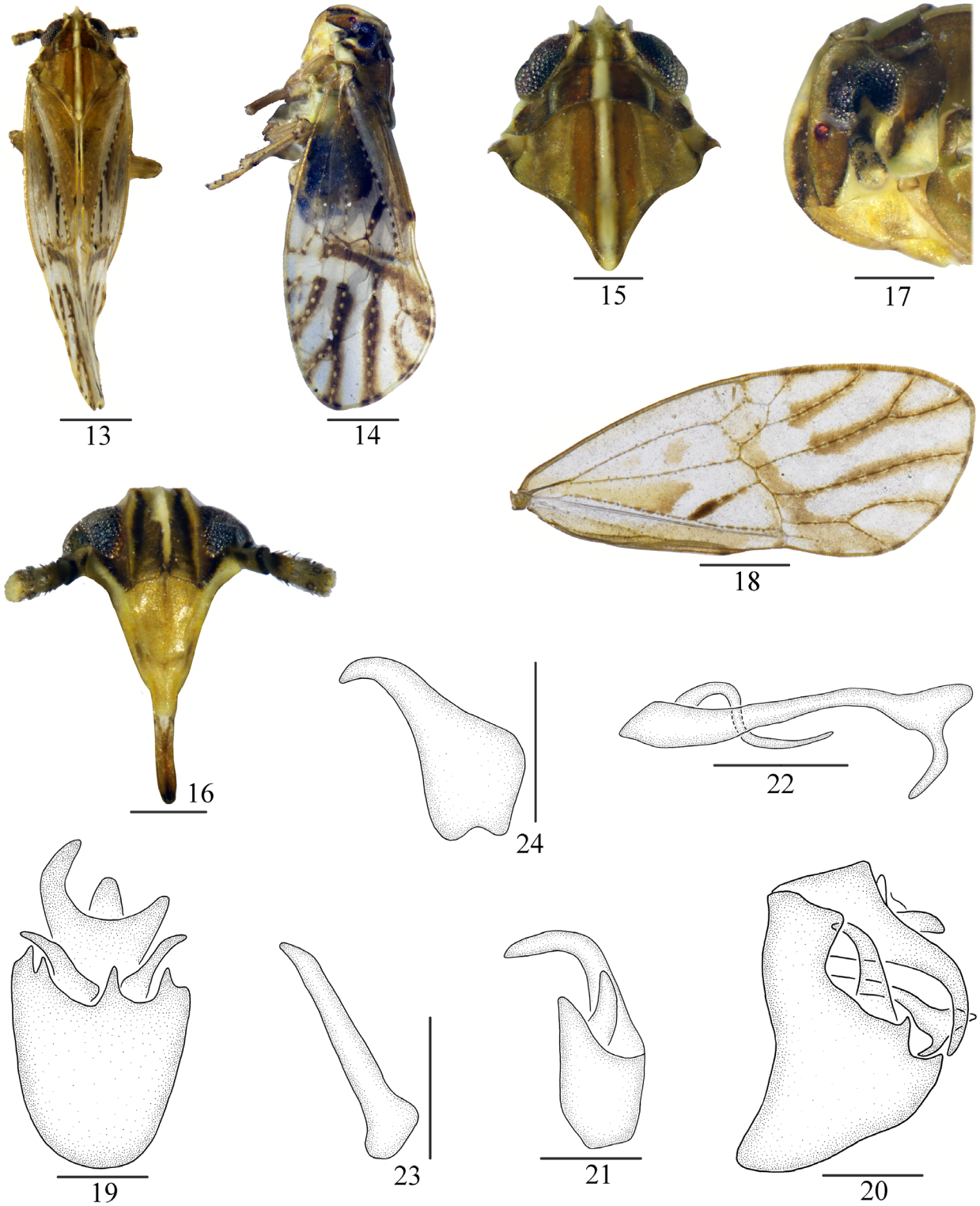
Head and thorax. Vertex (Fig. 3) wider at base than long submedially about 0.97: 1. Frons longer in middle line than wide at widest part about 1.25: 1, widest above ocelli. Antennae surpassing frontoclypeal suture, scape long equal to wide, shorter than pedicel about 0.38: 1 (Fig. 4). Pronotum shorter than vertex about 0.50: 1. Mesonotum longer in middle line than vertex and pronotum combined about 1.55: 1 (Fig. 3). Forewing longer in middle line than wide at widest part about 2.37: 1 (Fig. 6).

Male genitalia. Anal segment of male short, lateroapical angles produced into stout spinous process respectively (Fig. 7). Pygofer in posterior view ventral margin with four medioventral processes, finger-like (Fig. 7), in lateral view ventral angles distinctly produced (Fig. 8). Aedeagus with long spinous process at base, apex acute, directed ventrad, middle ventral margin of aedeagus with small process (Figs 9, 10). Genital styles long, reaching ventral margin of anal segment, broad at base, narrowing to apex (Figs 11, 12).

Type materials. Holotype ♂, **China:** Yunnan, Yingjiang County (24°´44N, 97°33´E), on bamboo, 18 Aug. 2015, Xiang-Sheng Chen; paratype, 1♂, same data as holotype, Lin Yang.

Remarks. This species is similar to *A. varius* sp. nov. but differs by: (1) anal segment of male with lateroapical processes symmetrical (Fig. 7) (anal segment with lateroapical processes asymmetrical, left one distinctly longer than right one in *A. varius* sp. nov.); (2) middle ventral margin of aedeagus with small process (Figs 9, 10) (middle ventral margin of aedeagus without process in *A. varius* sp. nov.); (3) genital styles in posterior view not distinct divergent (Fig. 7) (genital styles in posterior view distinct divergent in *A. varius* sp. nov.).

Etymology. The specific name is a combination of the Latin words "*longus*" and "*spinus*", referring to the aedeagus basally with a long spinous process.



FIGURES 13–24. *Arcofacies varius* sp. nov. 13. Male habitus, dorsal view; 14. Same, lateral view; 15. Head and thorax, dorsal view; 16. Face; 17. Frons, lateral view; 18. Forewing; 19. Male genitalia, ventral view; 20. Same, lateral view; 21. Anal segment, right lateral view; 22. Aedeagus, left lateral view; 23. Genital style, ventral view; 24. Same, left lateral view. Scale bars: 0.5 mm (13, 14, 18); 0.2 mm (15–17, 19–24).

Host plant. Bamboo.
Distribution. China (Yunnan).

***Arcofacies varius* sp. nov.**
(Figs 13–24)

Measurements. Body length including forewing: male 2.9–3.0 mm (*N* = 2), forewing length: male 2.3–2.4 mm (*N* = 2).

Diagnosis. The salient features of the new species include the following: anal segment of male with lateroapical processes asymmetrical, left one distinctly longer than right one (Fig. 21); pygofer in posterior view with 4 spinous medioventral processes (Fig. 19); aedeagus with long spinous process at base, apex acute, directed ventrad, middle ventral margin of aedeagus without process (Fig. 22); apex of genital style not forked (Figs 23, 24).

Coloration. General color yellowish brown with green. Frons, vertex, pronotum and mesonotum with median carina white bordered with blackish brown (Figs 15–17). Eyes dark brown to blackish brown; ocelli reddish brown. Antennae with dorsal and ventral margins and apex of scape, base and near apex of pedicel dark brown to blackish brown (Fig. 16). Lateral margins of frons, gena, vertex and pronotum each with oblique white band bordered with brown or dark brown (Figs 15, 16). Cypeus yellowish white (Fig. 16). Forewings with yellowish brown over basal third, rest area hyaline, along transverse vein and apical veins with brown stripes as figured (Fig. 18), in dark portion veins with white spots. Wings hyaline with brown veins. Legs yellowish brown. Abdomen with dorsum dark brown.

Head and thorax. Vertex (Fig. 15) wider at base than long submedially about 1.55: 1. Frons longer in middle line than wide at widest part about 1.26: 1, widest just above ocelli. Antennae surpassing frontoclypeal suture, scape long equal to wide, shorter than pedicel about 0.38: 1 (Fig. 16). Pronotum shorter than vertex about 0.70: 1. Mesonotum longer in middle line than vertex and pronotum combined about 1.84: 1 (Fig. 15). Forewing in middle line longer than wide at widest part about 2.34: 1 (Fig. 18).

Male genitalia. Anal segment of male short, lateroapical angles produced into stout spinous process respectively, asymmetric, left one distinctly longer than right one (Fig. 21). Pygofer in posterior view ventral margin with four medioventral processes, finger-like (Fig. 19), in lateral view ventral angles distinctly produced (Fig. 20). Aedeagus (Fig. 22) with long spinous process at base, S-shaped curved, apex acute, directed ventrad. Genital styles divergent, long, reaching ventral margin of anal segment, broad at base, narrowing to apex (Figs 23, 24).

Type materials. Holotype ♂, **China:** Yunnan, Mengla County (21°55´N, 101°15´E), on bamboo, 26 Apr. 2015, Zheng-Xiang Zhou; paratype, 1♂, same data as holotype, Qiang Luo.

Remarks. This species is similar to *A. strigatipennis* Ding, 1990 but differs by: (1) anal segment of male with lateroapical processes asymmetrical, left one distinctly longer than right one (Fig. 21) (anal segment with lateroapical processes symmetrical in *A. strigatipennis*); (2) pygofer in posterior view with 4 spinous medioventral processes (Fig. 19) (pygofer in posterior view without medioventral process in *A. strigatipennis*); (3) aedeagus with long spinous process at base, middle ventral margin without process (Fig. 22) (aedeagus broad at base, nearly quadrate, middle of dorsal margin and ventral margin each with process in *A. strigatipennis*).

Etymology. The specific name is derived from the Latin word "*varius*" (meaning different, changeable), referring to the anal segment with two asymmetrical processes.

Host plant. Bamboo.

Distribution. China (Yunnan).

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