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REVIEW OF THE BAMBOO DELPHACID GENUS *ARCOFACIES* (HEMIPTERA: FULGOROIDEA: DELPHACIDAE) FROM CHINA, WITH DESCRIPTION OF ONE NEW SPECIES

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ABSTRACT

Four species in the genus *Arcofacies* Muir, 1915 in China (Hemiptera: Fulgoroidea: Delphacidae: Delphacinae: Tropidocephalini) feeding exclusively on bamboo (Bambusoideae), are reviewed. The 4 species are *A. fullawayi* Muir, 1915 (Fujian: Wuyishan; Taiwan: Taibei, Gaoxiong, Nantou; Sichuan; Hainan; Guizhou: Luodan, Wangmo), *A. maculatipennis* Ding, 1987 (Guizhou: Luodian, Guiyang, Xishui, Chishui, Daozhen, Changshui, Fuqian), *A. strigatipennis* Ding, 1990 (Fujian: Wuyishan), and *A. ampelocalamus* Chen **sp. nov.** (Guizhou: Daozhen). The main morphological characters and male genitalia of the 4 species are described or redescribed and illustrated. A key for identifying the species of *Arcofacies* from China is provided. The importance of these as a pest on bamboo is discussed briefly, and biological notes of the new species are given.

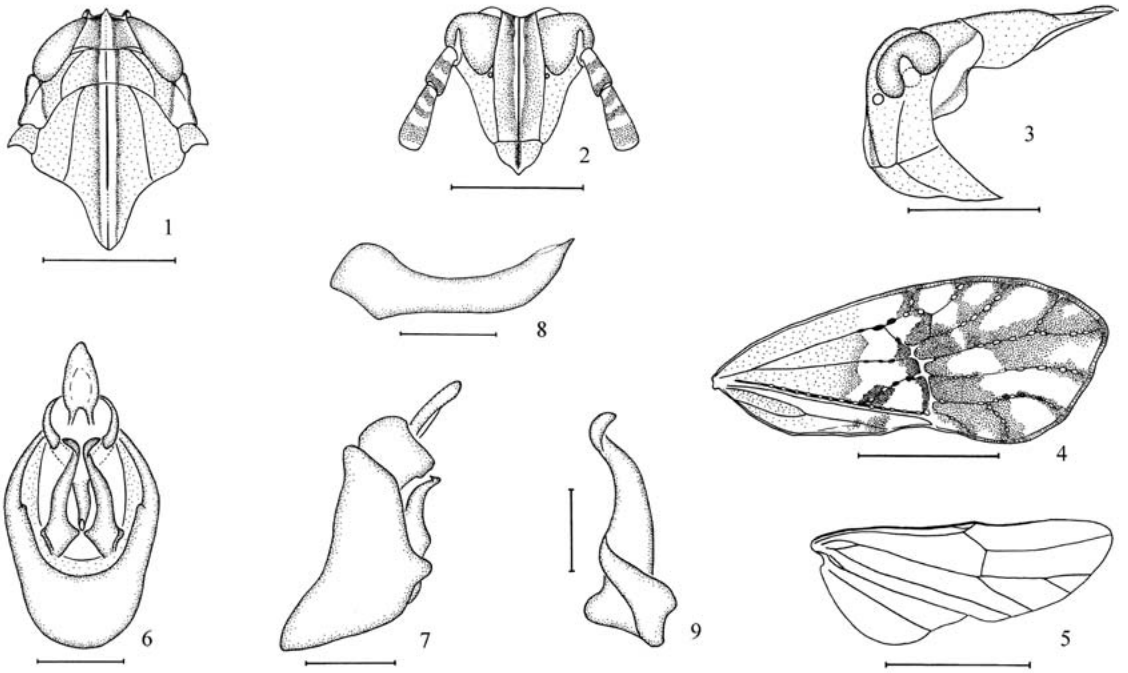
Key Words: *Arcofacies*, bamboo delphacids, Hemiptera, Fulgoroidea, new species, China

RESUMEN

Se revisa cuatro especies del genero *Arcofacies* Muir, 1915 de la China (Hemiptera: Fulgoroidea: Delphacidae: Delphacinae: Tropidocephalini) alimentandose exclusivamente sobre bambú (Bambusoideae). Las 4 especies son: *A. fullawayi* Muir, 1915 (Fujian: Wuyishan; Taiwan: Taizhong, Taibei, Gaoxiong, Nantou; Sichuan; Hainan; Guizhou: Luodan, Wangmo), *A. maculatipennis* Ding, 1987 (Guizhou: Luodian, Guiyang, Xishui, Chishui, Daozhen, Changshui, Fuqian), *A. strigatipennis* Ding, 1990 (Fujian: Wuyishan), y *A. ampelocalamus* Chen **sp. nov.** (Guizhou: Daozhen). Se describe o redecribe e ilustra las caracteristicas morfológicas principales de la genitalia de los machos de las 4 especies. Se incluye una clave para la identificación de las especies de *Arcofacies* de la China. Se discute brevemente la importancia de estas como plagas de bambú y se incluye notas biológicas sobre la nueva especie.

The delphacid genus *Arcofacies* was established by Muir (1915) based on specimens from Manila, the Philippines (type species: *Arcofacies fullawayi* Muir, 1915). It belongs to the tribe Tropidocephalini within subfamily Delphacinae (Hemiptera: Fulgoroidea: Delphacidae) and is easily separated from other members in this tribe by the postclypeus at right angle to frons (Fig. 3), by a white median longitudinal line extending from the apex of the frons to end of the mesonotum, along the line bordered with black or brown stripe (Figs. 1, 10, 18, 24), and by the forewings often with blackish brown markings, in dark portion veins bear white spots (Figs. 4, 12, 26). It is known to occur in the Oriental region. Six species have been recorded worldwide (Muir 1915, 1919; Fennah 1973-1975; Ding 1987, 1990), occurring in the Philippines (2 species: *A. fullawayi* Muir, 1915, *A. insignis* Muir, 1919), Singapore (1 species: *A. fullawayi*), Malaysia (2 species: *A. fullawayi*, *A. penangensis* Muir, 1919), Indonesia (1 species: *A. fullawayi*), Sri Lanka (1 species: *A. truncatipennis* Fennah, 1973-1975) and China (3 species: *A. fullawayi*, *A. maculatipennis* Ding, 1987, *A. strigatipennis* Ding, 1990).

Species of *Arcofacies* from China feed exclusively on bamboo (Bambusoideae) (Ding 1987, 1990; Yang & Yang 1986; Yang et al. 1999; Chen 2003). Specimens were collected on the leaves of several genera of bamboo, *Bambusa* (Yang & Yang 1986), *Neosinocalamus* and *Ampelocalamus* (this paper). *Arcofacies fullawayi* Muir, *A. maculatipennis* Ding and *A. ampelocalamus* **sp. nov.** are of economic significance due to large populations feeding on the bamboo in the fields.



Figs. 1-9. *Arcofacies fullawayi* Muir. 1. head and thorax, dorsal view; 2. frons and clypeus; 3. head and thorax, lateral view; 4. forewing; 5. hindwing; 6. male genitalia, posterior view; 7. male genitalia, lateral view; 8. aedeagus, lateral view; 9. right genital style, lateral view. Scale bars = 0.5 mm (Figs. 1-3); 1 mm (Figs. 4-5); 0.2 mm (Figs. 6-7); 0.1 mm (Figs. 8-9).

In this paper we review the Chinese species of the genus *Arcofacies*. *Arcofacies ampelocalamus* Chen, collected from Dashahe Nature Reserve, Daozhen, Guizhou Province, is described as new to science. The main morphological characters and male genitalia of 4 species are described and illustrated in detail. A key to all species found in China is provided.

Materials and Methods

Morphological techniques and terminology follow Yang & Yang (1986), and Ding (1990). Specimens examined are deposited in the Insect Collection at the Institute of Entomology, Guizhou University, Guiyang, Guizhou Province, China (IEGU).

Descriptive Taxonomy

Arcofacies Muir

Arcofacies Muir, 1915, Can. Ent., 47: 319. Type species: *Arcofacies fullawayi* Muir, 1915, by original designation.

Arcofacies Muir: Kuoh et al., 1983, Econ. Ins. Fauna China, 27: 45.

Arcofacies Muir: Yang & Yang, 1986, Mus. Spec. Publ. Seri., No. 6: 34.

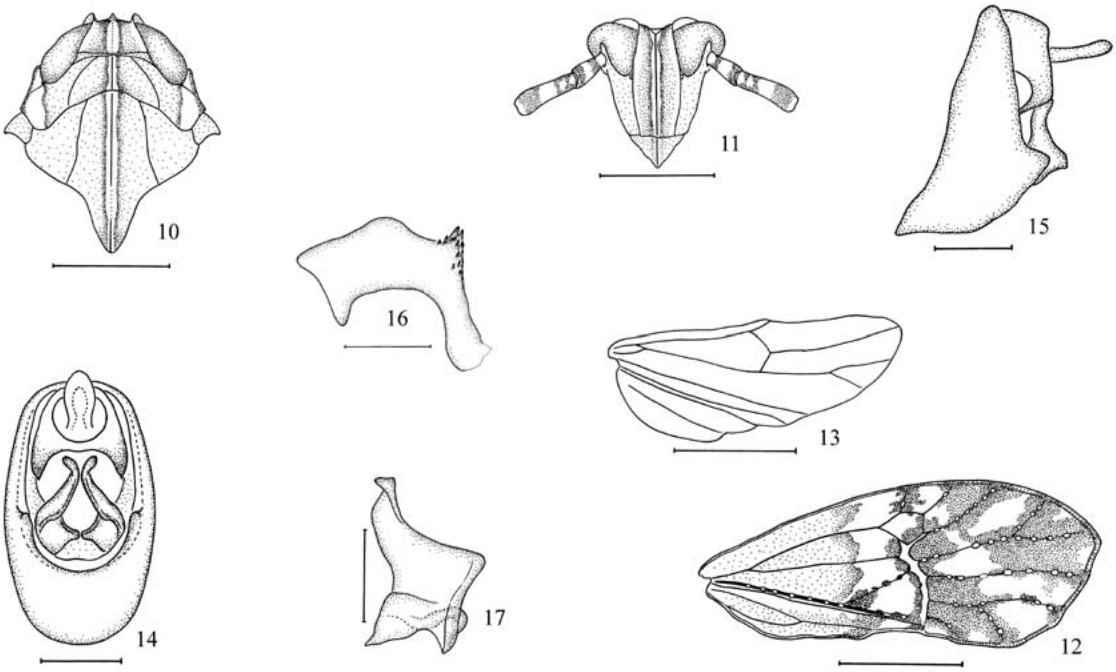
Arcofacies Muir: Ding, 1990, Journal of Bamboo Research, 9: 74.

Arcofacies Muir: Ding et al., 1999, Fauna of Insects in Fujian Province of China, **2**: 442.

The distinctive characters used by Muir (1915), Yang & Yang (1986), Ding (1990) and Ding et al. (1999) are modified as follows:

General color yellowish green to yellowish brown. A white median longitudinal line extends from the apex of the frons to the end of mesonotum, along the line 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 bear white spots. Hindwings hyaline with brown veins.

Head including eyes narrower than pronotum. Vertex (Figs. 1, 10, 18, 24) 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 (Fig. 3) vertex and frons at right angle. Frons (Figs. 2, 11, 19, 25) in middle line longer than wide at widest point (1.75-2.17:1), widest at level of ocelli or at apex,



Figs. 10-17. *Arcofacies maculatipennis* Ding. 10. head and thorax, dorsal view; 11. frons and clypeus; 12. forewing; 13. hindwing; 14. male genitalia, posterior view; 15. male genitalia, lateral view; 16. aedeagus, lateral view; 17. left genital style, lateral view. Scale bars = 0.5 mm (Figs. 10-11); 1 mm (Figs. 12-13); 0.2 mm (Figs. 14-15); 0.1 mm (Figs. 16-17).

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 (Fig. 3), 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 end of cross vein or basad. Spinal formula of hind leg 5-6-4.

Anal segment of male (Figs. 6, 14, 20, 28, 30) collar-shaped, lateroapical angles produced into spinous processes or not. Pygofer (Figs. 6, 14, 20, 28) in posterior view with opening longer than wide (1.29-1.6:1), lateral margins (Figs. 7, 15, 21, 29) 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 (Figs. 9, 17, 23, 32, 33) long, simple, broad at base, narrowing apically, basal angle intumescent, apex twisting outward more or less.

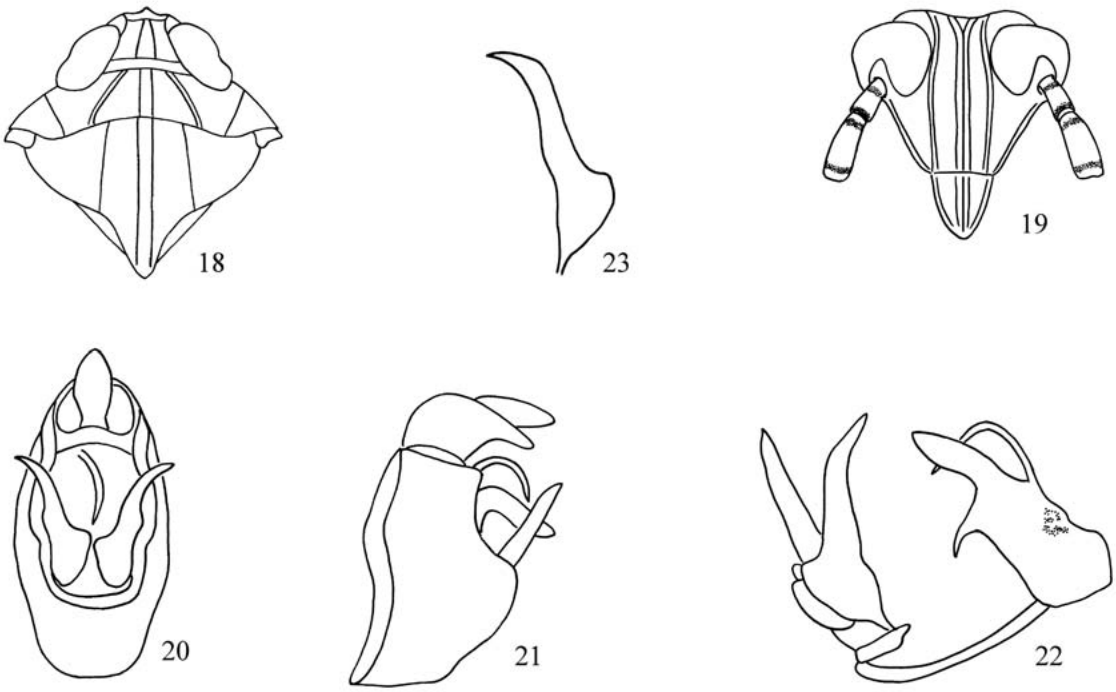
Host Plant. *Bambusa multiplex* (Lour.) Raeuschel, *B. oldhamii* Munro, *B. Multiplex* Raeuschel cv. "Fernleaf" Young (Yang & Yang, 1986), *Neosinocalamus affinis* (Rendle) Keng f.; *Ampelocalamus scandons* (Hsueh and Li) Chen, Wen and Sheng.

Distribution. Oriental Region (China, the Philippines, Malaysia, Indonesia, Singapore, Sri Lanka).

Key to species of *Arcofacies* Muir from China

1. Lateral carinae of frons, gena and pronotum yellowish brown, without white line (Figs. 1, 2, 10, 11); apical half of forewing with blackish brown markings (Figs. 4, 12); aedeagus simple, without elongate spinous process (Figs. 8, 16) 2

—Lateral carinae of frons, gena and pronotum bordered with white lines (Figs. 18, 19, 24, 25); apical veins of forewing bordered with brown stripes (Fig. 26); aedeagus with long spinous process at middle or at base (Figs. 22, 31) 3



Figs. 18-23. *Arcofacies strigatipennis* Ding. 18. head and thorax, dorsal view; 19. frons and clypeus; 20. male genitalia, posterior view; 21. male genitalia, lateral view; 22. aedeagus and genital styles, lateral view; 23. left genital style, posterior view. (All figures are reproduced from Ding, 1990.)

2. Median carina of postclypeus dark brown (Fig. 2); anal segment of male with lateroapical angles truncate, without spinous process (Figs. 6, 7); aedeagus tubular, acute at apex, dorsal margin concave (Fig. 8); genital styles in lateral view with base relatively narrow (Fig. 9). . . . . *A. fullawayi*

—Median carina of postclypeus white (Fig. 11); anal segment of male with lateroapical angles produced into stout spinous process (Figs. 14, 15); aedeagus tubular, blunt at apex, bent ventrad at middle, dorsocaudal margin with several teeth (Fig. 16); genital styles in lateral view with base relatively broad (Fig. 17) . . . . . *A. maculatipennis*

3. Pygofer without medioventral process (Fig. 20); in lateral view caudal margin concave, near ventrocaudal margin produced into a round protuberance (Fig. 21); aedeagus broad and flat at base, near quadrate, apex acute, thumb-shaped, two spinous processes arising from dorsal margin and ventral margin (Fig. 22). . . . . *A. strigatipennis*

—Pygofer with small medioventral process, flake-shaped (Fig. 28); in lateral view caudal margin nearly straight (Fig. 29); aedeagus with base coniform, apex round and blunt, a long spinous processes arising from left base (Fig. 31). . . . . *A. ampelocalamus*

Arcofacies fullawayi Muir
(Figs. 1-9)

Arcofacies fullawayi Muir, 1915, Can. Ent., 47: 320.

Arcofacies fullawayi: Muir, 1919, Philip. Jour. Sci., 15: 526.

Arcofacies fullawayi: Fennah, 1956, Proc. Calif. Acad. Sci., 28(4): 465.

Arcofacies fullawayi: Kuoh et al., 1983, Econ. Ins. Fauna China, 27: 45.

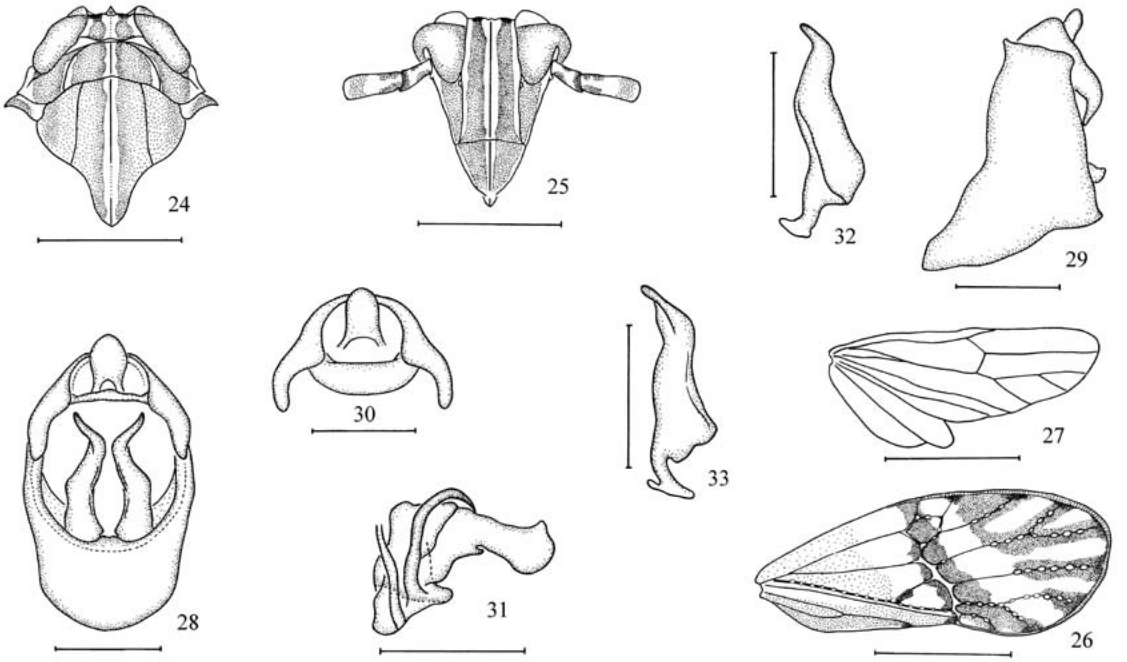
Arcofacies fullawayi: Ding, 1990, Journal of Bamboo Research, 9: 75.

Arcofacies fullawayi: Ding et al., 1999, Fauna of Insects in Fujian Province of China, 2: 442.

Arcofacies fullawayi: Chen, 2002, Insects from Maolan Landscape, 158.

Description. Body length (from apex of vertex to tip of forewing): male 3.40-3.45 mm, female 3.65-3.95 mm.

General color yellowish brown with green. A white median line from apex of frons to posterior aspect of mesonotum, bordered with blackish brown (Figs. 1-2); eyes dark brown to blackish brown; ocelli dark brown infused with red; antennae with middle and apex of scape, base and near



Figs. 24-33. *Arcofacies ampelocalamus* Chen, **sp. nov.** 24. head and thorax, dorsal view; 25. frons and clypeus; 26. forewing; 27. hindwing; 28. male genitalia, posterior view; 29. male genitalia, lateral view; 30. anal segment, posterior-ventral view; 31. aedeagus, lateral view; 32. left genital style, lateral view; 33. left genital style, posterior view. Scale bars = 0.5 mm (Figs. 24-25); 1 mm (Figs. 26-27); 0.2 mm (Figs. 28-33).

apex of pedicel ring with dark brown to blackish brown (Fig. 2); lateral parts of pronotum each with oblique white band bordered with blackish brown (Figs. 1, 3); forewings with yellowish brown over basal third, apical two-thirds hyaline, speckled with blackish brown markings as in Fig. 4, in dark portion veins bear white spots; wings hyaline with brown veins; legs with fore and median tibiae pale reddish orange; abdomen with dorsum of VII-IX segments dark brown, pygofer blackish brown; coloration of female same as male except lateral and ventral parts of thorax, abdomen pale green, ovipositor yellowish brown.

Vertex wider at base than long submedially about 1.70:1. Frons longer than wide at widest part (about 1.75:1), widest just above ocelli. Antennae surpassing frontoclypeal suture, scape longer than wide (about 2.00:1), shorter than pedicel (about 0.59:1).

Male Genitalia. Anal segment of male short, ring-like, with a big gap at ventral margin, lateroapical angles truncate. Pygofer in posterior view with opening larger in length than width (about 1.33:1) (Fig. 6), in lateral view posterior margin strongly produced caudad near ventral aspect (Fig. 7). Aedeagus simple, tubular, strongly concave on dorsal margin, acute at apex, directed dorsad (Fig. 8). Genital styles long, slender, rounded at base, abruptly narrowing and slightly twisted near apex (Fig. 9).

Host Plant. *Bambusa multiplex* (Lour.) Raeuschel; *B. oldhamii* Munro; *B. multiplex* Raeuschel cv. "Fernleaf" Young (Yang & Yang, 1986); *Neosinocalamus affinis* (Rendle) Keng f.

Distribution. China (Fujian, Taiwan, Chongqing, Hong Kong, Hainan, Guizhou), the Philippines, Malaysia, Indonesia, Singapore.

Specimens Examined. 2 males, 2 females, CHINA: Guizhou, Wangmo, Sanglang, 31-VII-1998 (X.-S. Chen); 1 male, 1 female, Guizhou, Luodian, Bamao, 2-VIII-1998 (X.-S. Chen), 1 male, 2 females, Taiwan, Nantou, Wushe, 850 m, 24-XI-2002 (X.-S. Chen) (IEGU).

Arcofacies maculatipennis Ding
(Figs. 10-17)

Arcofacies maculatipennis Ding, 1987, Acta Entomologica Sinica, 30(4): 439.

Arcofacies maculatipennis: Chen and Yang, 2005, Insects from Dashahe Nature Reserve of Guizhou, 122.

Arcofacies maculatipennis: Chen, 2005, Insects from Xishui Landscape, 153.

Arcofacies maculatipennis: Chen, 2006, Insects from Chishui Spinulose Tree Fern Landscape, 119.

Description. Body length (from apex of vertex to tip of forewing): male 3.75-4.00 mm, female 4.15-4.40 mm.

General color yellowish brown with green. A white median line from apex of frons to end of mesonotum bordered with blackish brown (Figs. 10-11); eyes dark brown to blackish brown; ocelli reddish brown; antennae with middle and apex of scape, base and near apex of pedicel ring with dark brown (Figs. 11); lateral parts of pronotum each with oblique white band bordered with blackish brown (Fig. 10); Forewings with yellowish brown over basal third, rest area hyaline, speckled with blackish brown markings as figured (Fig. 12), in dark portion veins bear white spots; wings hyaline with brown veins; legs with fore and median tibiae and tarsi, hind tarsi pale reddish orange; abdomen with dorsum of VII-IX segments dark brown to reddish brown, ventral areas pale reddish orange, pygofer blackish brown; coloration of female same as male except lateral and ventral parts of thorax, abdomen green, ovipositor yellowish brown.

Vertex wider at base than long submedially about 1.70:1. Frons longer in middle line than wide at widest part about 2.17:1, widest at level of ocelli. Antennae surpassing frontoclypeal suture, scape longer than wide about 1.80:1, shorter than pedicel about 0.53:1.

Male Genitalia. Anal segment of male short, ring-like, lateroapical angles each produced into stout process, acute at apex. Pygofer in posterior view with opening larger in length than width about 1.60:1 (Fig. 14), in lateral view ventral angles strongly produced (Fig. 15). Aedeagus simple, tubular, strongly bent ventrad, dorsal margin convex, with about 19-21 small teeth on dorsoposterior margin, obtuse at apex. Genital styles moderately long, approach ventral margin of anal segment (Figs. 14-15), broad at base, abruptly narrowing to apex, slightly twisted near apex (Fig. 17).

Host Plant. *Neosinocalamus affinis* (Rendle) Keng f.

Distribution. Southwest China (Guizhou).

Specimens Examined. 1 male, 4 females, Guizhou, Daozhen, 25-VII-1984 (Z.-Z. Li); 1 male, 3 females, CHINA: Guizhou, Xishui, Linjiang, 1-VI-2000 (X.-S. Chen); 6 males, 1 female, Guizhou, Guiyang, Huanxi Park, 25-VII-1998, 1050 m (X.-S. Chen); 3 males, 1 female, Guizhou, Guiyang, Huanxi, 28-VIII-1998, 1050 m (X.-S. Chen); 3 males, 6 females, Guizhou, Chishui, 20-IX-2000 (X.-S. Chen); 11 males, 21 females, Guizhou, Changshun, 24-VII-2006 (X.-S. Chen); 8 males, 13 females, Guizhou, Fuquan, 11-VIII-2006 (X.-S. Chen and L. Yang).

Arcofacies strigatipennis Ding
(Figs. 18-23)

Arcofacies strigatipennis Ding, 1990, Journal of Bamboo Research, 9(1): 75.

Arcofacies strigatipennis: Ding, Huang, and Zhuo, 1999, Fauna of Insects in Fujiang Province of China, 2: 443.

The description and illustration are reproduced from Ding (1990), Ding et al. (1999).

"Body length (from apex of vertex to tip of forewing): male 3.00 mm, female 3.50 mm."

"General color pale yellowish brown with somewhat green. A white median line from apex of frons to end of mesonotum, along lateral carinae of frons, gena, and pronotum with white line; forewings with pale brown over basal third, rest area hyaline, along apical veins bordered brown stripes, in dark portion veins bear white spots; male with abdomen most blackish brown, female with abdomen most yellowish brown, ovipositor brown."

"Anal segment of male in lateral view lateroapical angles each produced into process. Pygofer in posterior view with opening longer than wide (Fig. 20), in lateral view posterior margin concave, ventral angles strongly produced (Fig. 21). Aedeagus broad at base, nearly quadrate, apex finger-like, middle of dorsal margin and ventral margin each with a process, the dorsal one slender and curving. Genital styles divergent (Fig. 20), long, attaining ventral margin of anal segment, rounded at base, narrowing to apex, twisted near apex (Figs. 22-23)."

Host Plant. Bamboo (Ding 1990).

Distribution. South China (Fujian).

Specimen Examined. No specimen has been collected by the authors.

Arcofacies ampelocalamus Chen, **sp. nov.**
(Figs. 24-33)

Description. Body length (from apex of vertex to tip of forewing): male 2.90-4.00 mm, female 3.30-4.40 mm.

General color pale yellowish brown. Frons, clypeus, gena, vertex, pronotum and mesonotum brown to dark brown, a white median line from apex of frons to end of mesonotum, along lateral carinae of frons, postclypeus, gena, vertex and pronotum with white line (Figs. 24-25); 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. 25); lateral parts of pronotum each with oblique white band (Fig. 24); forewings with pale brown over basal third, rest area hyaline, along transverse vein and apical veins bordered brown stripes as figured (Fig. 26), in dark portion veins bear white spots; wings hyaline with pale brown veins; legs with fore and median tibiae pale reddish orange; abdomen pale yellowish green, pygofer blackish brown; coloration of female same as male except lateral and ventral parts of thorax, abdomen including ovipositor pale green.

Vertex wider at base than long submedially about 1.88:1. Frons longer in middle line than wide at widest part about 1.88:1, widest at apex.

Antennae surpassing frontoclypeal suture, scape longer than wide at apex about 1.60:1, shorter than pedicel about 0.52:1.

Male Genitalia. Anal segment of male short, ring-like, lateroapical angles each produced into stout process, relative obtuse at apex. Pygofer in posterior view with opening larger in length than width about 1.29:1, in ventral view with a small medioventral process (Fig. 28), in lateral view posterior margin nearly straight, ventral angles slightly produced (Fig. 29). Aedeagus tubular, with base coniform, apex round and blunt, middle ventral margin with a small process, a long spinous processes arising from left base, then strongly bent ventrad (Fig. 31). Genital styles moderately long, approach ventral margin of anal segment, moderately broad at base, narrowing to apex, slightly twisted near apex (Figs. 32-33).

Host Plant. *Ampelocalamus scandons* (Hsueh and Li) Chen, Wen and Sheng.

Etymology. This new species is named after the generic name of host plant, *Ampelocalamus scandons* (Poaceae: Bambusoideae).

Distribution. Southwest China (Guizhou).

Specimens Examined. Holotype male, CHINA: Guizhou, Daozhen, Dashahe, Xiannudong, 600 m, 26-V-2004 (X.-S. Chen). Paratype 16 males, 24 females, same data as holotype; 2 males, 8 females, Guizhou, Daozhen, Dashahe, Xiannudong, 660m, 25-VIII-2004 (X.-S. Chen).

Biology. This species maybe has two biological forms, the smaller form (body length including tegmen male 2.90 mm, female 3.30-3.50 mm), feeding on a native bamboo, *Ampelocalamus scandons* (Hsueh and Li) Chen, Wen and Sheng, with August as the probable peak periods; the larger form (body length including tegmen: male 3.75-4.00 mm, female 4.15-4.40 mm), feeding on a native bamboo, *Neosinocalamus affinis* (Rendle) Keng f., with May as the probable peak periods, so is its population peak.

Remarks. This species is similar to *A. strigatipennis* Ding, but differs as follows: frons widest at apex (widest at level of ocelli in the latter); pygofer in ventral view with short medioventral process (no medioventral process in the latter), in lateral view pygofer with posterior margin straight (posterior margin concave in the latter); two genital styles closer (two genital styles divergent in the latter); aedeagus coniform at base, round and blunt at apex (quadrate at base, acute at apex in the latter).

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