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A new genus *Microsarimodes* with one species from Hainan Province in China (Hemiptera: Fulgoromorpha: Issidae)

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Abstract

A new genus *Microsarimodes* Chang & Chen, **gen. nov.** with type species *Microsarimodes tumida* Chang & Chen**, sp. nov.** are described and illustrated. All type specimens are deposited in Guizhou University. A short discussion on the tribe Sarimini to which these taxa belongs is provided.

Key words: Sarimini, new taxa, female genitalia, planthopper

Introduction

The family Issidae Spinola, 1839 (Hemiptera: Fulgoromorpha) is one of the largest planthopper families, distributed worldwide (Bourgoin 2019). The family was originally divided into one subfamily Issinae Spinola, 1839 with three tribes: Issini Spinola, 1839, Hemisphaeriini Melichar, 1906 and Parahiraciini Cheng & Yang, 1991 (Gnezdilov 2013; 2016). But subsequently, according to molecular phylogeny analyses, Wang *et al.* (2016) divided into three subfamilies and seven tribes: Issinae (Issini sec. Wang *et al*., 2016 and Hysteropterini Melichar, 1906), Hemisphaeriinae Melichar, 1906 (Kodaianellini Wang, Zhang & Bourgoin, 2016, Sarimini Wang, Zhang & Bourgoin, 2016 (type genus *Sarima* Melichar, 1903), Parahiraciini and Hemisphaeriini) and Thioniinae Melichar, 1906 (Thioniini Melichar, 1906). Several previously classified in Issini Spinola 1839 (sec. Gnezdilov 2013) were transferred into Sarimini Wang, Zhang & Bourgoin, 2016. At present, Sarimini consist of 15 genera, seven of them present in China (Bourgoin 2019): *Eusarima* Yang, 1994, *Longieusarima* Wang, Bourgoin & Zhang, 2017, *Orbita* Meng & Wang, 2016, *Parasarima* Yang, 1994, *Sarima* Melichar, 1903, *Sarimodes* Matsumura, 1916, and *Tetrica* Stål, 1866. There more genera, currently classified Hemisphaeriinae *incertae sedis* by Wang *et al*. (2016) who not examined them in their study, are here formally added in Sarimini: *Neosarima* Yang, 1994, *Sinesarima* Yang, 1994 and *Yangissus* Chen, Zhang & Chang, 2014 (Chan & Yang 1994; Chen *et al.* 2014; Wang *et al.* 2017).

In the frame of a revision of Sarimini genera of China, we describe here one new genus, *Microsarimodes* Chang & Chen, **gen. nov.** with type species *Microsarimodes tumida* Chang & Chen**, sp. nov.** from China (Hainan Province). A checklist and key of identification to Sarimini genera are also provided.

Materials and methods

General morphological terminology follows Chan & Yang (1994) and Bourgoin *et al.* (2015) for the wing venation, and Bourgoin (1987, 1993) respectively for male and female genitalia, and Gnezdilov (2002, 2003). Dry specimens were used for descriptions and illustrations. The genital segments of the examined specimens were macerated in 10% NaOH, washed in water and transferred to glycerine. Illustrations of the specimens were made with a Leica M125 and Olympus CX41 stereomicroscope. Photographs were taken with a KEYENCE VHX-1000C.

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The type specimens are all deposited in the Institute of Entomology, Guizhou University, Guiyang, China (IEGU).

Checklist of genera of Sarimini Wang, Zhang & Bourgoin, 2016
(Completed from Bourgoin 2019**)**

Apsadaropteryx Kirkaldy, 1907; Australia.
Chlamydopteryx Kirkaldy, 1907; Australia, Indonesia.
Dactylissus Gnezdilov & Bourgoin, 2014; Vietnam.
Darwallia Gnezdilov, 2010; Indonesia, Malaysia, Philippines, Singapore, Vietnam.
Eusarima Yang, 1994 (Figs 1–3); China (Guangxi, Hubei, Taiwan), Iran, Japan, Nepal, Pakistan, Ryukyu Islands.
Longieusarima Wang, Bourgoin & Zhang, 2017 (Figs 4–6); China (Hainan).
Microsarimodes Chang & Chen, **gen. nov.** (Figs 7–8, 18–36); China (Hainan).
Neosarima Yang, 1994; China (Taiwan).
Nikomiklukha Gnezdilov, 2010; Indonesia, Malaysia.
Orbita Meng & Wang, 2016; China (Fujian).
Papunega Gnezdilov & Bourgoin, 2015; Papua New Guinea.
Parasarima Yang, 1994; China (Taiwan).
Sarima Melichar, 1903 (Figs 9–11); China (Fujian, Hong Kong, Yunnan), Australia, Fiji, India, Indonesia, Japan, Malaysia, Papua New Guinea, Philippines, Ryukyu Islands, Sri Lanka, Vietnam.
Sarimodes Matsumura, 1916 (Figs 12–14); China (Hainan, Taiwan).
Sinesarima Yang, 1994; China (Taiwan), Ryukyu Islands.
Syrgis Stål, 1870; Indonesia, Malaysia, Philippines.
Tempsa Stål, Stål, 1866; Indonesia, Malaysia, Singapore.
Tetrica Stål, 1866; China (Fujian, Zhejiang), Australia, India, Indonesia, Mongolia, Myanmar, Papua New, Philippines.
Yangissus Chen, Zhang & Chang, 2014 (Figs 15–17); China (Guizhou).

Notes: eight additional Sarimini genera are not found in China, so the key only based on genera in China.

Key to Sarimini genera of China

1. Forewing with ScP vein short, not reaching middle of forewing (Figs 5, 10) 2
- Forewing with ScP vein long, distinctly surpassing middle of forewing (Figs 2, 8) 7
2. Hindwing with A_1 branched (see Chan & Yang 1994: fig. 40D) . . . . . *Sinesarima*
- Hindwing with A_1 non branched 3
3. Aedeagus without obvious hooked projection (see Chen *et al.* 2014: fig. 2-82G) . . . . . *Yangissus*
- Aedeagus with obvious hooked projection 4
4. Hindwing with one transverse vein between Pcu and CuP (see Chan & Yang 1994: fig. 43D) . . . . . *Neosarima*
- Hindwing without transverse veins between Pcu and CuP 5
5. Forewing with Sc and R forming a loop (Fig. 10) . . . . . *Sarima*
- Forewing with Sc and R not forming a loop 6
6. Frons flat, without any protuberance (Fig. 6) . . . . . *Longieusarima*
- Frons with two large glossy orbs . . . . . *Orbita*
7. Hindwing with Pcu branched (see Chan & Yang 1994: fig. 39) 8
- Hindwing with Pcu simlpe, not branched 9
8. Frons and clypeus with median carina strong (see Gnezdilov *et al.* 2015: fig: 21–22) . . . . . *Tetrica*
- Frons with median carina slender, clypeus without median carina . . . . . *Parasarima*
9. Frons with median carina and lateral carina, reaching to frontoclypeal suture or surpassing middle level of frons . . . *Eusarima*
- Frons with median carina and lateral carina not reaching middle level of frons 10
10. Forewing with M vein forked behind the middle of forewing and behind the level of CuP vein forking (Figs 12–13) . . . . . *Sarimodes*
- Forewing with M vein forked before the middle of forewing and before the level of CuP vein forking (Fig. 21) . . . . . *Microsarimodes* **gen. nov.**

Taxonomy

Family Issidae Spinola, 1839

Subfamily Hemisphaeriinae Melichar, 1906

Tribe Sarimini Wang, Zhang & Bourgoin, 2016

Microsarimodes Chang & Chen, gen. nov.

(Figs 7–8, 18–37)

Type species: *Microsarimodes tumida* **Chang & Chen, sp. nov.**

Diagnosis. *Microsarimodes* **gen. nov.** can be easily distinguished from most genera of Sarimini by vertex quadrangular, distinctly wider than long in middle; frons relatively flat, median carina stout and lateral carina feeble, not reaching over middle; forewings relatively narrow, apical margin round, with ScP long, reaching over middle, RP forked before middle of forewing; hind wings with Pcu non branched, without transverse vein between CuP and Pcu; aedeagus with one process. The new genus is very similar to *Sarimodes*, but it differs by: 1) smaller body size 6.50–7.50 mm (Fig. 7); 2) forewings with MP dividing before middle of forewing (Fig. 21); 3) gonostyli with irregularly tumefied protuberance near base of capitulum (Fig. 25); 4) gonoplacs irregularly triangular (Fig. 36).

Description. Body small-medium size.

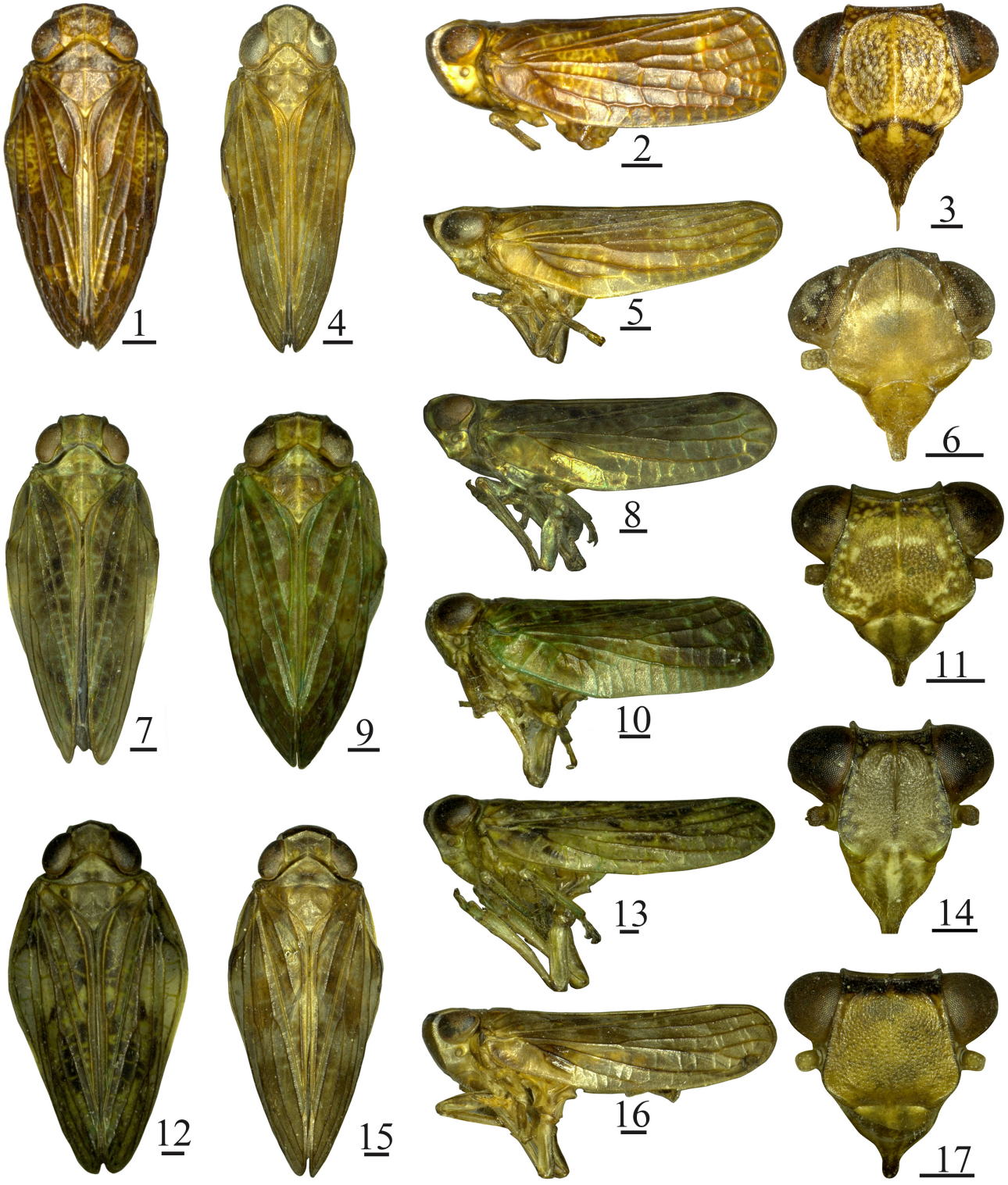
Head and Thorax. Width of head including eyes slightly narrower than pronotum (Fig. 18). Vertex hexagonal, anterior margin obtusely convex, posterior margin arched concave, lateral margin paralleled, disc of vertex depressed, with median carina obscure or linear in dorsal view (Fig. 18). Gena with one obvious ocellus between compound eye and antenna in lateral view (Fig. 19). Frons (Fig. 20) irregular hexagonal, basal margin arched concaved, apical margin nearly straight, lateral margin not paralleled, the base narrow, broader toward to apical margin, the maximum width below level of antenna, with median carina and lateral carina, not reaching to middle of frons, with verrucae along base margin and lateral margin. Clypeus (Fig. 20) triangular, with stout median carina. Rostrum reaching mesotrochanters. Pronotum (Fig. 18) triangular, anterior margin obtuse-angle concaved, posterior margin straight, with median carina obscure or slim, with lateral carina, and pit each other between median carina and lateral carina. Mesonotum (Fig. 18) triangular, with median carina obvious and lateral carina obscure. Forewings (Fig. 21) oblong, anterior margin slightly cambered convex, posterior margin straight, longitudinal veins obvious, with unobvious short transverse veins, ScP long, reaching or exceeding middle of forewing, ScP and RP convergent near base, RP not forked, MP forking before middle of forewing and before bifurcation of CuA, MP_1 forked near distal 1/4, CuA forked into two branches behind middle of forewing, CuP present, Pcu and A_1 uniting near middle of clavus. Hindwings (Fig. 22) well developed, trilobed, R and CuA forked near apical part , MP simple, not forked, CuA_2 and CuP fused near apical part, with one vein between R_2 and M, and M and CuA_1, Pcu non branched, without transverse vein between CuP and Pcu, A_1 simple. Hind tibia with 2 lateral spines and 6–7 apical spines, first metatarsomere with 6–7 apical spines, second metatarsomere with 2 spines.

Male genitalia. Anal tube (Fig. 24) irregularly oblong in dorsal view. Anal style (Fig. 24) located near middle, relatively long. Pygofer (Fig. 23) symmetrical, irregularly rectangular, posterior margin with obvious triangular process. Gonostyli (Figs 23, 25) symmetrical, irregularly triangular in lateral view, bearing small sheet prominence in tumefied protuberance near dorsal margin at the base of capitulum. Phallobase (Fig. 27) symmetrical, "U"-liked tubular, dorsal lobe without any processes near apex in lateral view. Aedeagus (Figs 27–28) with one hooked process in lateral view.

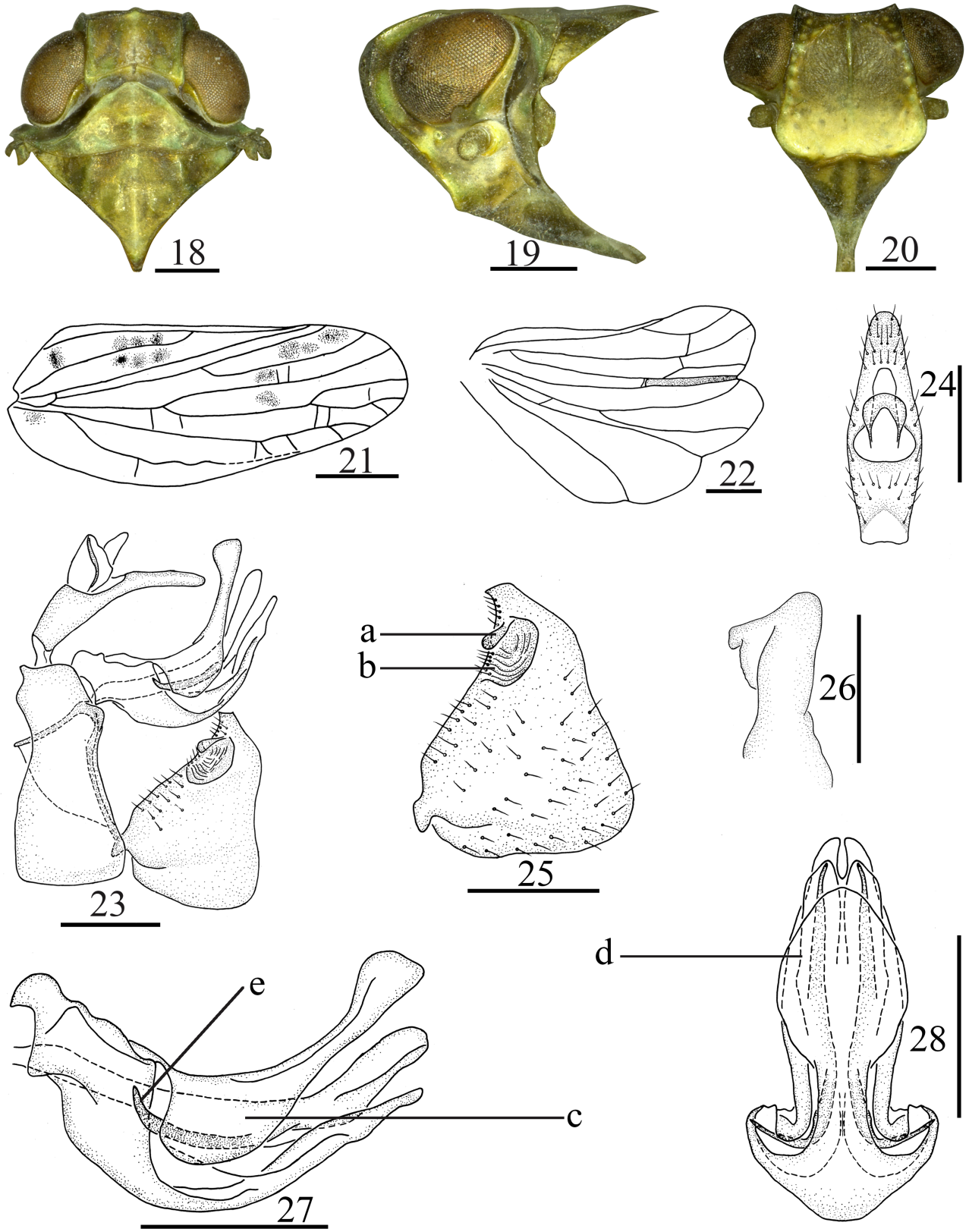
Female genitalia. Anal tube (Figs 29, 32) extremely narrow and obviously longer in middle line than the width. Anal style (Figs 29, 32) located in base of anal tube, short, not surpassing the end of anal pore. Hind margin of gonocoxa VIII with endogonocoxal lobe obscure, endogonocoxal process membranous developed (Figs 30–31). Anterior connective lamina of gonapophyses VIII irregularly rectangular, bearing 4–5 keels in lateral group and 2–3 small teeth in apical group, and with one small tooth in ventral margin (Fig. 33: vt). Posterior connective lamina of gonapophyses IX (Figs 34–35) triangular and narrow in dorsal view. Gonoplacs (Fig. 34) irregularly triangular, without keel. Hind margin of sternite VII with prominence in middle area in ventral view (Fig. 37).

Distribution. China (Hainan).

Etymology. The generic name is derived from a combination of "micro-" and "*Sarimodes*" (meaning that the new genus is similar to genus *Sarimodes* Matsumura, 1916 in appearance, but it is smaller than *Sarimodes* in size). The gender is feminine.



FIGURES 1–17. Dorsal and lateral habitus of Sarimini species and frons in ventral view. (Figs 1–3) *Eusarima yangi* Chen, Zheng & Chang, 2014; (Figs 4–6) *Longieusarima lunulia* Wang, Bourgoin & Zhang, 2017; (Figs 7–8) *Microsarimodes tumida* Chang & Chen, **sp. nov.**; (Figs 9–11) *Sarima bifurca* Meng & Wang, 2016; (Figs 12–14) *Sarimodes* sp.; (Figs 15–17) *Yangissus maolanensis* Chen, Zheng & Chang, 2014. Scale bars=0.5 mm.



FIGURES 18–28. *Microsarimodes tumida* Chang & Chen, **sp. nov.** 18. Head and thorax, dorsal view; 19. Same, lateral view; 20. Head, ventral view; 21. Forewing; 22. Hindwing; 23. Male genitalia, lateral view; 24. Male anal segment, dorsal view; 25. Gonostyli, lateral view; 26. Capitulum of gonostyli, posterior view; 27. Aedeagus and phallobase, lateral view; 28. Same, ventral view. a—sheet prominence, b—tumefied protuberance, c—lobe-liked, d—ventral lobe, e—hooked process. Scale bars = 0.5 mm.

Remarks. The new genus is similar to *Sarimodes* Matsumura, 1916, but it differs from the latter by: 1) the size ranges from 6.0–7.5 mm (8.0–10.0 mm in *Sarimodes*); 2) MP forking before middle of forewing (Fig. 8) (MP forking near distal of forewing in *Sarimodes* (Fig. 12)); 3) phallobase with dorsal lobe without any processes near apex (Fig. 27) (with dorsal lobe bearing pair of strong and long processes near apex in *Sarimodes* (Meng & Wang, 2016: fig. 24)); 4) gonostyli with tumefied protuberance at base of capitulum (Fig. 25) (without such a protuberance at base of capitulum in *Sarimodes* (Meng & Wang, 2016: fig. 22)); 5) gonoplacs of female genitalia triangular (Fig. 36) (quadrangular in *Sarimodes* (Meng & Wang, 2016: fig. 28)).

Microsarimodes tumida Chang & Chen, sp. nov.

(Figs 7–8, 18–37)

Measurement. Body length (from apex of vertex to tip of forewings): male 6.49–6.53 mm (N = 3), female 7.03 mm–7.41 mm (N = 7); forewings: male 5.29–5.49 mm, female 5.43–6.12 mm.

Type Material. Holotype: ♂, Diaoluoshan National Nature Reserve (18°50′N, 109°55′E), Hainan Province, China, 27 April 2014, H.-Y. Sun; paratypes: 1♂1♀, H.-Y. Sun and W.-C. Yang, data same as holotype; 1♂6♀♀, Jianfengling National Nature Reserve (18°44′N, 108°54′E), Ledong County, Hainan Province, China, 12 July 2007, Height 1300–1400 m, Z.-G. Zhang.

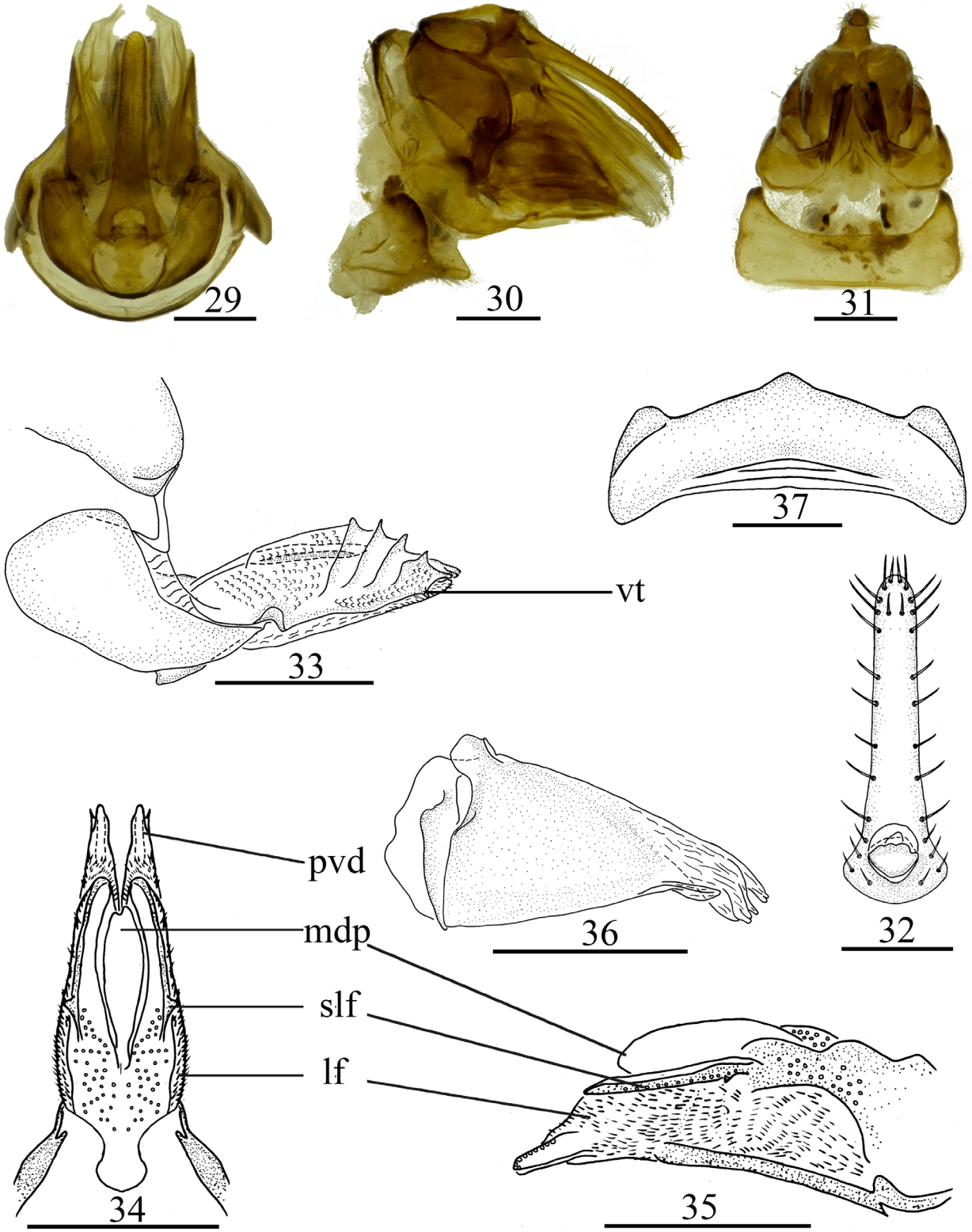
Coloration. General color yellow green to yellow brown (Fig. 7). Vertex and pronotum pale yellow green (Figs 18–19). Frons dark brown in basal 2/3, yellow in apical 1/3, with scores of pale verrucae along base and lateral margin (Fig. 20). Compound eyes ochreous, ocelli pale green (Fig. 19). Clypeus yellow brown (Fig. 20). Mesonotum yellow brown (Fig. 18). Forewings yellow green, with diffusely dark brownish (Figs 7–8). Hindwings brown. Legs pale green or yellow brown, tip of spines on hind tibiae and tarsi black.

Head and Thorax. Vertex shorter in middle than the width (0.54: 1.00) (Fig. 18). Frons (Fig. 20) slightly shorter in middle than the maximum breadth (0.93: 1.00), with median carina and lateral carina reaching to basal 1/3. Clypeus with stout median carina (Fig. 20). Pronotum (Fig. 18) with median carina slim. Mesonotum (Fig. 18) with median carina obvious. Forewings (Fig. 21) longer than width (2.42: 1.00), ScP and RP convergent near base, ScP long, exceeding middle of forewing, MP two branched in basal 1/3, MP_1 dividing three branches in distal 1/3, CuA forked into two branches behind middle of forewing, CuP present, Pcu and A_1 uniting in basal 2/3 of clavus, clavus almost 5/6 of forewing. Hindwings (Fig. 22) with one transverse vein between Pcu+A_1 and anal suture. Hind tibia with 2 lateral spines and 6–7 apical spines, first metatarsomere with 6–7 apical spines, second metatarsomere with 2 spines.

Male genitalia. Anal tube longer in middle than the widest breath (2.73: 1.00) in dorsal view, anterior margin slightly arched convex, lateral margin not parallel, the maximum width in middle of anal tube (Fig. 24). Anal style (Fig. 24) located in basal 2/5, relatively long and stout, surpassing the end of anal pore, not surpassing anal tube. Pygofer (Fig. 23) irregularly rectangular, anterior margin and posterior margin nearly paralleled in lateral view, posterior margin with obviously triangular process in dorsal part 1/3, dorsal margin narrow, ventral margin broad. Gonostyli (Fig. 25) irregularly triangular in lateral view, dorsal margin and ventral margin not parallel, dorsal margin straight, ventral margin slightly arched, with small sheet prominence (Fig. 25a) in tumefied protuberance (Fig. 25b) near dorsal margin at base of capitulum. Capitulum of gonostyli irregularly rectangular, with small angular, neck stout and unobvious (Fig. 26). Phallobase (Figs 27–28) with dorsal lobe slightly expanded in apical part, the middle part expanded to lobe-liked (Fig. 27c), lateral lobe splitting into two branches, ventral lobe shorter than lateral lobe in lateral view; ventral lobe with apical part leaf-liked (Fig. 28d), the base narrow and claviform in ventral view. Aedeagus (Figs 27–28) with one long hooked process (Fig. 27e) in lateral view, directing to cephalad.

Female genitalia. Anal tube (Fig. 32) longer in middle line than the width (3.30: 1.00), apical margin arched convex, lateral margin nearly paralleled, the base relatively broad, tapering to apex. Anal style (Fig. 32) located in basal 1/8 of anal tube, short, not surpassing the end of anal pore. Anterior connective lamina of gonapophyses VIII (Fig. 33) irregularly rectangular, bearing 4–5 keels in lateral group and 3 teeth in apical group, apical teeth small, and with one small tooth in ventral margin (Fig. 33: vt). Posterior connective lamina of gonapophyses IX (Figs 34–35) sub-triangular, relatively narrow, lateral field membraneous with microvilli (Fig. 34: lf); sub-lateral field with angular process near base (Fig. 34: slf); median field with asymmetric prominence (medial dorsal process) (Fig. 34: mdp); distal parts bent at acute angled in dorsal view (posterior ventral lobes) (Fig. 34: pvb). Gonoplacs (Fig. 36)

irregular triangular, without keels, apical part membraneous. Hind margin of sternite VII with obtusely convex near medial area in ventral view (Fig. 37).



FIGURES 28–37. *Microsarimodes tumida* Chang & Chen, **sp. nov.** 29. Female genitalia, dorsal view; 30. Same, lateral view; 31. Same, ventral view; 32. Female anal segment, dorsal view; 33. Anterior connective lamina of gonapophyses VIII, lateral view; 34. Posterior connective lamina of gonapophyses IX, dorsal view; 35. Posterior connective lamina of gonapophyses IX, lateral view; 36. Gonoplacs, lateral view; 37. Sternite VII, ventral view. vt—ventral tooth; lf—lateral field of posterior connective lamina of gonapophyses IX; slf—sublateral field of posterior connective lamina of gonapophyses IX; mdp—medial dorsal process; pvd—posterior ventral lobes. Scale bars = 0.5 mm.

Host plant. Unknown.

Distribution. China (Hainan).

Etymology. The specific name is derived from the Latin words "*tumida*" meaning that gonostyli bearing one tumefied protuberance near dorsal margin at base of capitulum.

Discussion

Based on a molecular phylogeny analysis, the classification of the family Issidae was recently reviewed by Wang *et al.* (2016) who recognized seven major monophyletic lineages they ranked at the level of tribes: Thioniini, Issini Hysteropterini, Kodaianellini, Sarimini, Parahiraciiini and Hemisphaeriini. All of them were strongly supported in the molecular anlysis, such as Sarimini which were morphologically characterized by: 1) a 3-lobed hind wing with Pcu-A_1 lobe more or less as wide as ScP-R-MP-Cu lobe; 2) a single or branched Pcu; 3) an anastomose between Pcu and A_1 on a short or longer distance; and 4) a non branched A_2.

Since the tribe Sarimini now groups 19 genera (including the three genera formally transferred in it in this paper), additional diagnosis characters of this tribe can be provided, particularly focussing on the hindwing conformation with: a forked CuA and a not forked MP, Pcu and A_1, and one transverse vein is respectively present between R_2 and MP and between MP and CuA_1 in *Chlamydopteryx*, *Dactylissus*, *Eusarima*, *Longieusarima*, *Orbita*, *Papunega*, *Sarima*, *Sarimodes*, *Microsarimodes* Chang & Chen, **gen. nov.**, *Neosarima*, *Yangissus* (Chan & Yang 1994; Chen *et al*. 2014; Gnezdilov & Fletcher 2010; Gnezdilov *et al*. 2014; Gnezdilov *et al*. 2015; Meng &Wang 2016; Meng *et al*. 2016; Wang *et al*. 2017). From this basal schema some variations are observed: 1) one or two transvers veins also occur between CuP and Pcu in *Papunega* and *Yangissus* (Chen *et al*. 2014; Gnezdilov *et al*. 2015); 2) a Pcu branched and a not forked A_1, such as in *Apsadaropteryx* Kirkaldy, 1907, *Darwallia* Gnezdilov, 2010 and *Parasarima* (see Chan & Yang 1994: fig. 39; Gnezdilov 2010: fig. 12; Gnezdilov & Fletcher 2010: fig. 20); 3) both Pcu and A_1 branched, such as *Nikomiklukha*, *Tetrica* (Gnezdilov 2010: fig. 13; Gnezdilov & Fletcher 2010: fig. 22; Gnezdilov *et al*. 2015: fig. 22;); 4) both Pcu and A_1 single such as in *Sinesarima* (Chan & Yang 1994: fig. 39).

However, with the double of new genera in the last 25 years several species previously described need now a new careful confirmation of their generic placement such as for *Tetrica zephyrus* Fennah, 1956 much probably misplaced. If more attention on hindwing may be useful in future works, this new set of characters put in light by Wang *et al*. (2016) still remain to be enriched with other morphological characters.

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