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A new genus of the tribe Parahiraciini (Hemiptera: Fulgoromorpha: Issidae) from Hainan Island

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Abstract

A new issid genus in the tribe Parahiraciini (Hemiptera: Fulgoromorpha: Issidae) is erected for *Fortunia jianfenglingensis* Chen, Zhang et Chang, 2014 (China: Hainan). Male of the species is described and illustrated for the first time. A key for the 15 genera of Parahiraciini is provided. Morphological peculiarity and phylogenetic position of the new genus and the distribution of the tribe Parahiraciini are briefly discussed.

Key words: Fulgoroidea, morphology, new genus, new combination, taxonomy

Introduction

The tribe Parahiraciini was erected as a subfamily Parahiraciinae within the family Issidae by Cheng & Yang (1991) for a single genus *Parahiracia* Ôuchi, 1940, which was transferred to Issidae from Tropicuchidae by Fennah (1982), on the basis of elongate ovate body and number of median sensory pits of meso- and metanotum (10 and 8 on each side respectively) in the fifth instar nymph (Cheng & Yang 1991a, 1991b), then it was downgraded to tribal level in the Issidae (Gnezdilov, 2003).

Soon afterwards, the study of the tribe Parahiraciini has undergone considerable progress. Firstly, genera *Fortunia* Distant, 1909, *Scantinius* Stål, 1866, *Pterygoma* Melichar, 1903, *Prosonoma* Melichar, 1906, *Bardunia* Stål, 1863 were transferred to tribe Parahiraciini basing on strongly protruding frons in shape of nasale and well developed, bi-or trilobed hind wings, and *Parahiracia* Ôuchi, 1940 was placed in synonymy under *Fortunia* (Gnezdilov *et al.*, 2004; Gnezdilov & Wilson, 2007). Later, two genera *Narinosus* Gnezdilov & Wilson, and *Pinocchias* Gnezdilov & Wilson were described, and *Clipeopsilus* Jacobi, 1944 was placed in synonymy under *Fortunia* Distant, 1909 (Gnezdilov & Wilson, 2005). The genus *Pterygoma* Melichar, 1903, was subsequently transferred to the family Caliscelidae according to examination of a male syntype (Gnezdilov & Wilson, 2006). After that, the genera *Flavina* Stål, 1861, *Mincopius* Distant, 1909, *Neodurium* Fennah, 1956, *Tetricodes* Fennah, 1956, and *Duriopsilla* Fennah, 1956 were transferred to the Parahiraciini (Gnezdilov & Wilson, 2007; Zhang & Chen, 2008, 2009; Gnezdilov, 2013). Meanwhile, *Dindinga* Distant, 1909 was placed in synonymy under *Scantinius*, *Prosonoma* was synonymized with *Bardunia*, and both *Nilalohita* Distant, 1906 and *Dolia* Kirkaldy, 1907 were placed in synonymy under *Flavina* (Gnezdilov & Wilson, 2007; Gnezdilov, 2009). Recently, several genera have been added to this tribe: *Fusiissus* Zhang & Chen, 2010, *Paratetricodes* Zhang & Chen, 2010, *Neotetricodes* Zhang & Chen, 2012 and *Folifemurum* Che, Zhang & Wang, 2013 (Zhang & Chen, 2010, 2012; Che, Zhang & Wang, 2013).

Currently, the tribe Parahiraciini comprises 14 genera with 46 species found in Eastern and Southeastern Asia, gravitating to subtropical and tropical regions (Che *et al.*, 2013; Gnezdilov, 2011, 2013; Gnezdilov & Wilson, 2005, 2006, 2007; Wang & Wang 2011; Zhang *et al.* 2010; Zhang & Chen, 2010, 2012; Chen *et al.*, 2014).

The tribe Parahiraciini could be diagnosed by the following characters: body elongate ovate; frons, pronotum, and mesonotum more or less with tubercles; frons with a well-developed nasale or not; pronotum large, anterior

margin strongly convex between eyes, length in middle line longer than vertex and slightly shorter than mesonotum, lateral lobes enlarged and nearly flabellate in front view, also with several tubercles; mesonotum triangular, anterior margin weakly concave; tegmina distinctly convex as beetle, moderately elongate and narrowing apically with a net of transverse veins, apex of “Y” veins reaching near the middle of tegmina; hind wings usually well developed two- or three-lobed (anal lobe more or less reduced, vannus rudimentary only in *Folifemurum*) with a deep notch between the remigium and vannus, and a net of transverse veins in the distal part; both fore and middle legs elongate; aedeagus relatively elongate, phallus with a pair of short hooks near middle or without; gonapophyses IX well-developed, strongly sclerotized.

Chen *et al.* (2014) described a new species *Fortunia jianfenglingensis* Chen, Zhang et Chang in genus *Fortunia* only based on one female specimen from Hainan Island in China. However, the species is not consistent with the genus *Fortunia* by the following characteristics: frons short and broad, enlarged to apex of nasale, with a small round swelling near apex of nasale, gonoplac forking at basal half and anterior connective lamina of gonapophysis VIII with apicodorsal angle bending angulately and teeth in lateral group bearing along dorsal margin. Moreover, according to the above characteristics, this species could not be included in any other genus of the tribe Parahiraciini. In this case, we propose to erect a new genus *Brevicopius* **gen. nov.** by *Fortunia jianfenglingensis* in the present paper. The detailed diagnosis between the new genus and *Fortunia* is provided below the description of new genus. Male of the species from Hainan Island is firstly described and illustrated. The veins of tegmen and hindwing and female genitalia are also detailedly redescribed. So far, 15 genera are included in the tribe Parahiraciini, an updated key to these genera is provided below.

Key to genera of Parahiraciini

1. Frons not extended to form a nasale (Gnezdilov & Wilson, 2007, Figs 5–6) 2
 - Frons strongly extended to form a nasale (Gnezdilov & Wilson, 2007, Figs 10–11) 9
2. Frons with a hemispherical protuberance 3
 - Frons without hemispherical protuberance 4
3. Vertex in dorsal view with anterior margin roundly convex. Frons with a hemispherical protuberance distally. Femora and tibiae of forelegs strongly flattened. Phallus with long lateral hooks (China: Guizhou, Guangxi) *Paratetricodes*
 - Vertex in dorsal view with anterior margin angularly convex medially. Frons with a hemispherical protuberance in basal half. Femora and tibiae of forelegs not flattened. Phallus without lateral hooks (China: Hubei, Guizhou, Yunnan) *Tetricodes*
4. Frons with median carina 5
 - Frons without median carina 8
5. Frons without sublateral carinae 6
 - Frons with sublateral carinae 7
6. Frons with disc finely granulose and distinctly elevated. Tegmen with CuP indistinct, M simple. Hind wing small, with vannus and anal lobe rudimentary. Phallus with ventral hooks (China: Sichuan, Yunnan) *Folifemurum*
 - Frons with disc only granulose near lateral margin and flat. Tegmen with CuP distinct, M three or four-branched. Hind wing with developed vannus. Phallus without ventral hooks (China: Guizhou) *Neotericodes*
7. Tegmen with CuP distinct. Hind wings with anal lobe developed. Hind tibia with 3–5 lateral teeth (India: Uttaranchal; Laos; Thailand; Vietnam; Myanmar; Malaysia: Borneo; Singapore; China: Guangxi, Yunnan, Hainan) *Flavina*
 - Tegmen with CuP indistinct. Hind wings with anal lobe rudimentary. Hind tibia with 2–3 lateral teeth (China: Hubei, Sichuan, Guizhou, Yunnan) *Neodurium*
8. Tegmen with CuP distinct, Sc vein reaching to the apex of costal margin. Basal metatarsal segment with 9 spines apically (China: Hubei) *Duriopsilla*
 - Tegmen with CuP indistinct, Sc vein reaching to the middle of costal margin. Basal metatarsal segment with 11 spines apically (China: Guizhou) *Fusiissus*
9. Tegmina with hypocostal plate 10
 - Tegmina without hypocostal plate 12
10. Tegmina with short and very narrow hypocostal plate presented only basally (Indonesia: Sumatra; Malaysia: Sarawak, Malay Peninsula) *Scantinius*
 - Tegmina with wide hypocostal plate 11
11. Frons relatively long and narrow, basal part almost as wide as apical part, upper margin straight in frontal view. Gonoplacs forking at its distal third (Fig. 20) (China: Zhejiang, Fujian, Taiwan, Hongkong; Thailand; Vietnam) *Fortunia*
 - Frons relatively short and broad, basal part distinctly narrower than apical part, upper margin deeply concave in frontal view. Gonoplacs forking at its basal half (Fig. 13) (China: Hainan) *Brevicopius* **gen. nov.**
12. Tegmina with CuP vein well marked throughout its length, frontal nasale relatively long 13
 - Tegmina with CuP vein well marked only proximally, frontal nasale relatively short (India: Andaman Islands) *Mincopius*
13. Frontal nasale cylindrical. Lateral margins of frons are not reaching apex of nasale. Phallus without ventral hooks (Bangla-

	desh)	<i>Pinocchias</i>
-	Frontal nasale more or less flattened dorso-ventrally and laterally. Lateral margins of frons are reaching apex of nasale. Phallus with a pair of ventral hooks.	14
14.	Frontal nasale with glossy swelling apically (Indonesia: Maluku, Java, Sulawesi, Sumatra, Sumba, Western New Guinea; Laos; Vietnam; China: Guizhou).	<i>Bardunia</i>
-	Frontal nasale without glossy swelling apically (China: Shaanxi, Shandong, Hubei)	<i>Narinosus</i>

Material and methods

External morphology was observed under a Leica MZ 125 microscope. All measurements were in millimeters (mm). Terminology used for the external morphology and the male genitalia mainly follows Chan and Yang (1994), forewing venation patterns follows Bourgoïn *et al.* (2014). The description of the female genitalia mainly follows Bourgoïn (1993) except for the gonoplac, which follows Gnezdilov (2002). The genital segments of the examined specimens were dissected and macerated in 10% NaOH solution at approximately 100°C for about 5 minutes, and subsequently transferred into glycerin. Photographs of the specimens were made using a Leica M205A microscope with a Leica DFC Camera. Images were produced using the software version LAS (Leica Application Suite) V3.7. All specimens studied are deposited in the Entomological Museum of Northwest Agriculture and Forestry University (NWFU), Yangling, China.

Taxonomy

Brevicopius gen. nov.

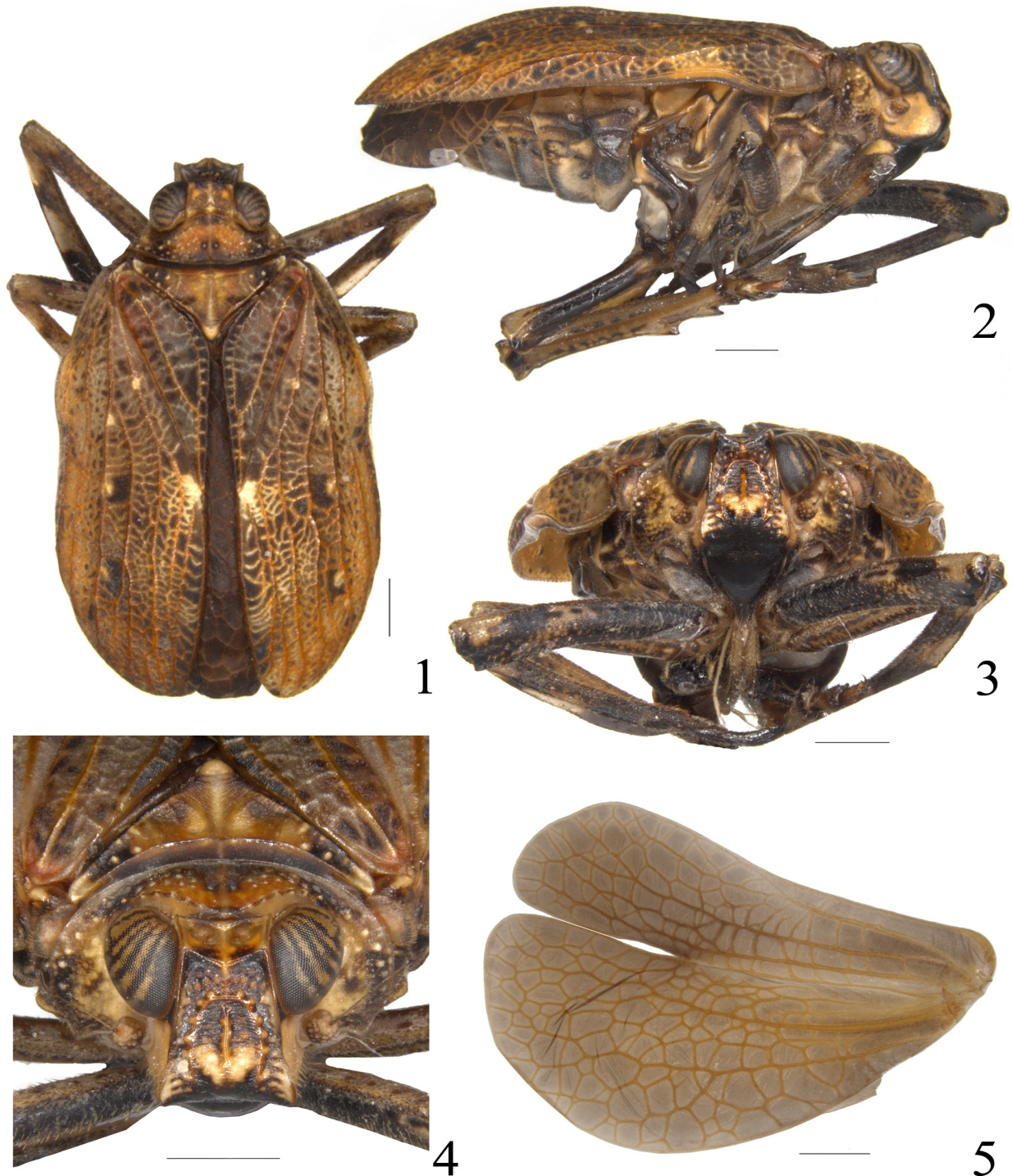
Type species. *Fortunia jianfenglingensis* Chen, Zhang et Chang, 2014

Description. Head with eyes slightly narrower than pronotum (Fig. 1). Vertex transverse, 1.6 times as wide as long medially, anterior margin almost straight, posterior margin emarginate, lateral margins distinctly elevated, with median carina (Figs. 1, 6). Frons longer than wide, slightly widening above the clypeus, lateral margin subparallel; upper margin angulately incised, lateral margins strongly elevated and slightly sinuate near to distal third; frons with three carinae, median carina present at upper and median area of frons, very strong at middle, sublateral carinae arcuate, united far away from upper margin of the frons, ending at frontal nasale and not reaching the clypeus, disc densely wrinkly between sublateral carinae, with a row of big tubercles along the outside of sublateral carinae, otherwise, with small tubercles at upper and lateral area; disc moderately depressed at upper part, small roundly swollen below apex of median carina, and protruded forward as short nasale near to clypeus in lateral view (Figs 2–4, 7). Rostrum reaching hind trochanters (Fig. 3). Eyes elliptical and well developed, with small excision just above antennae in lateral view (Figs 2–4). Antennae with scape short, ring-shaped, pedicel subglobose with numerous sensory organs (Figs 2–4).

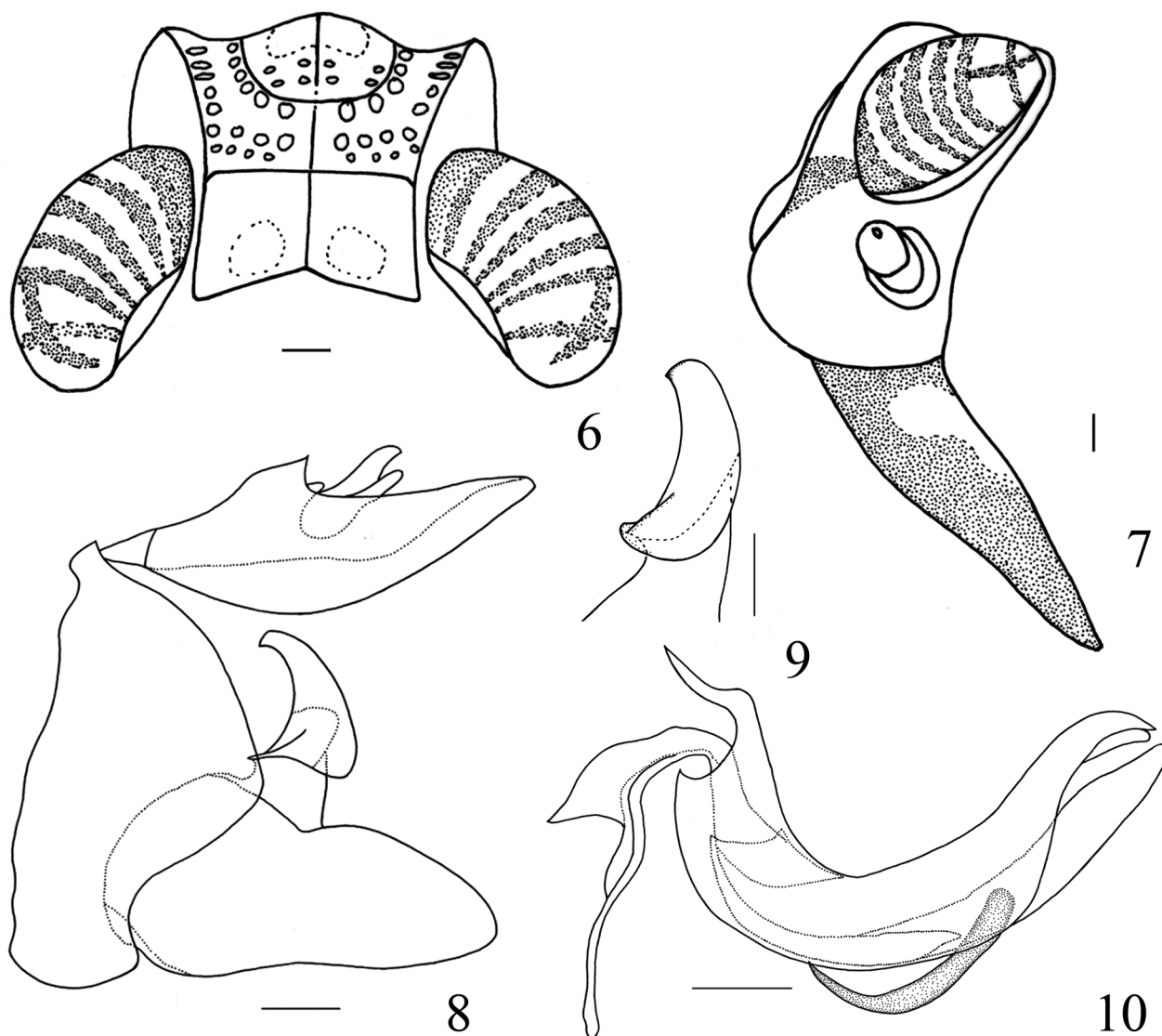
Pronotum large, covered with small tubercles, anterior margin convex between eyes medially, posterior margin arcuately convex at middle, with median carina and with two small rounded calli on both sides of median carina near its posterior margin; lateral lobes considerably enlarged and flabellate in frontal view, with small granules on the whole surface and tubercles on upper half along the inside of laterocaudal margin, apical margin slightly concave, apicolateral angles nearly right (Fig. 1). Mesonotum wide and relatively short, slightly narrower than pronotum; anterior and lateral margins distinctly elevated, disc flat, with three carinae, median carina anteriorly thin and distinctly thick posteriorly, sublateral carinae relatively thin and short, with several small tubercles on lateral area outside the sublateral carinae (Fig. 1).

Tegmina nearly oblongus, with narrow hypocoastal plate, weakly narrow to rounded apex, costal and claval margins subparallel, costal margin shallowly concave at basal third. Claval margin relatively straight, caudal angle bent down roundly; Sc+R forking near to basal cell, each branch simple, MP vein forking in its basal third, CuA vein independently emitting from the underneath of basal cell, forking at basal half, CuA₁ forked distally, CuA₂ forked just before the terminal tip of clavus; CuP distinct, clavus short, and reaching the middle of tegmina, Pcu + A1 running to CuP, but very close to the apex of clavus, Pcu and A1 united at distal third of clavus, with reticulated transverse veinlets between the Pcu and CuP, 12–14 transverse veinlets between A1 vein and A2; longitudinal veins distinctly prominent and transverse veins relatively weak, transverse veinlets comparatively dense and

reticulated at apical half (Fig. 1). Hind wings well-developed, trilobed, wider than tegmina, with deep cleft at apex of CuP vein, anal lobe rudimentary; longitudinal veins R, M, CuA, Pcu, A1 and A2 forking except CuP, among which, R forking at middle of the wing, M forking at distal half, CuA forking nearly before M, Pcu forking before wing middle, A1 and A2 forking distally; R, M, CuA, A1 and A2 veins distinct, CuP and Pcu relatively gracile; with one transverse vein at middle between C and R veins, about 4–5 transverse veins between R and M, 7–9 transverse veins between M and CuA, and 8–10 transverse veins between CuA and CuP from base to middle of wing; transverse veinlets obviously dense and reticulated after the middle of wing (Fig. 5). Anterior tibiae distinctly compressed and dilated, posterior tibiae with two lateral spines distally. Spinal formula of hind leg 7–8–2.



FIGURES 1–5. *Brevicopius jianfenglingensis* (Chen, Zhang et Chang, 2014), **comb. n.** 1. adult (male), dorsal view; 2. adult (male), lateral view; 3. frons and clypeus (male), in front view; 4. frons (male); 5. hind wing. Scale bars = 1 mm.

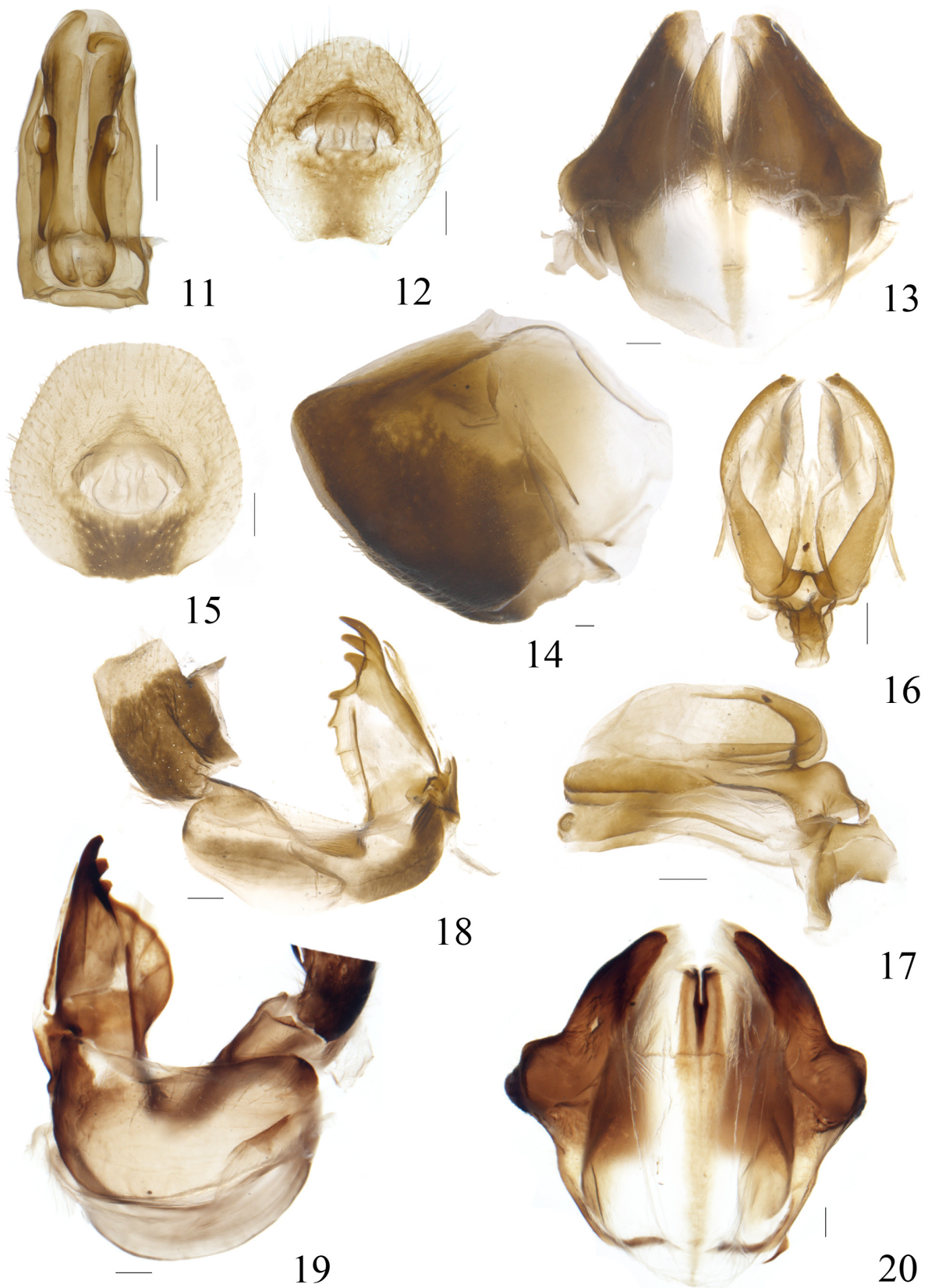


FIGURES 6–10. *Brevicopius jianfenglingensis* (Chen, Zhang et Chang, 2014), **comb. n.** 6. head, dorsal view; 7. head, lateral view; 8. male genitalia, lateral view; 9. capitulum, dorsal view; 10. aedeagus, left view. Scale bars = 0.2 mm.

Male genitalia: Anal tube nearly ovaliform in dorsal view (Fig. 12). Aedeagus shallowly U-shaped, phallus with a pair of slender and short hooks ventrally (Figs. 10, 11). Genital styles in profile view nearly triangular, caudo-ventral angle strongly convex, hind margin strongly angularly concave medially, and with transverse carina below the capitulum (Fig. 8). Capitulum of style long, tip pointed in lateral view, lateral tooth wide and large (Fig. 9). Pygofer with posterior margin strongly convex medially in lateral view (Fig. 8).

Female genitalia: Anal tube nearly quadrilateral in dorsal view (Fig. 15). Gonoplags wide and short in lateral view, apical margin membranous and oblique, with one blunt projection at base in dorsal view, third gonoplag lobes with fork wide, faintly sclerotized and pigmented (Figs 13, 14). Gonapophyses IX moderately large, elliptical in dorsal view, proximal part of posterior connective lamina convex, median field very large with two lobes, and extremely elevated wholly (Figs 16, 17). Gonospiculum bridge small, basal part relatively large, nearly quadrilateral and flat, apical part very short (Figs 16, 17). Anterior connective lamina of gonapophysis VIII with three strong teeth in apical group and four teeth in lateral group (Fig. 18). Gonocoxae VIII nearly rectangular, with hind margin concave (Fig. 18).

Etymology. The generic name is derived from combination of Latin root prefix “brevi-” and “-copius”, referring to the frons distinctly short. The name is masculine in gender.



FIGURES 11–20. *Brevicopius jianfenglingensis* (Chen, Zhang et Chang, 2014), **comb. n.** 11. aedeagus, ventral view; 12. male anal tube, dorsal view; 13. gonoplac, dorsal view; 14. gonoplac, right view; 15. female anal tube, dorsal view; 16. gonapophysis IX and gonaspiculum bridge, dorsal view; 17. gonapophysis IX and gonaspiculum bridge, right view; 18. gonocoxa VIII and gonapophysis VIII, left view. *Fortunia byrrhoides* (Walker, 1858). 19. gonocoxa VIII and gonapophysis VIII, right view; 20. gonoplac, dorsal view. Scale bars = 0.2 mm.

Diagnosis. This genus is similar to genus *Mincopius* Distant, 1909, but differs from the latter in the following characters: 1) frons short, slightly widening to clypeus, about 1.2 times longer than wider at widest in middle line, with median carina disappear near united lateral carina, in *Mincopius*, frons relatively long, about twice as long as wide in middle line, with median carina elongate, almost reaching to clypeus; 2) tegmina with narrow hypocostal plate, CuA vein forked appreciably at basal half of tegmina, bifurcate after M fork, CuP vein well marked throughout its length, in the *Mincopius*, without hypocostal plate, CuA vein forked extremely closed to basal cell, bifurcate in front of M fork, CuP vein well marked only proximally.

The new genus also resembles *Fortunia* Distant, 1909, but can be separated from the latter by the following characters: 1) frons relatively short and broad, enlarged to apex of nasale, apical margin slightly convex medially (in dorsal view), lateral margins of the frons not joining at apex of nasale (in ventral view), upper margin deeply concave (in frontal view), disc with a small round swelling below apex of median carina, in *Fortunia*, frons relatively long and narrow, basal part almost as wide as apical part, apical margin emarginate medially (in dorsal view), lateral margins of the frons curved inwards, almost joining at apex of nasale (in ventral view), upper margin straight (in frontal view), disc flat, without swelling (Ôuchi, 1940, Fig. 1: a–b; Chan & Yang, 1994, Fig. 35: A–C; Gnezdilov & Wilson, 2007, Figs. 10–11; Chen *et al.*, 2014, Fig. 2–45: A–E); 2) gonoplags forking at basal half (Fig. 13), in *Fortunia*, gonoplags forking at distal one third (Fig. 20); 3) anterior connective lamina of gonapophysis VIII with teeth in lateral group appearing from apical margin to dorsal margin, apicodorsal angle angulate (Fig. 18), in *Fortunia*, anterior connective lamina of gonapophysis VIII with teeth in lateral group appearing at apical margin, and apicodorsal angle widely rounded (Fig. 19).

Distribution. China (Hainan).

***Brevicopius jianfenglingensis* (Chen, Zhang et Chang, 2014), comb. n.**

Fortunia jianfenglingensis Chen, Zhang et Chang, 2014: 94.

Supplementary description. Male length (N=1) (including tegmen): 8.6 mm, length of tegmen: 6.9 mm; female length (N=1) (including tegmen): 9.1 mm, length of tegmen: 7.4 mm.

Colouration: Body fulvous, with flavous and atramentous speckles. Vertex flavescens, with two small black speckles near anterior margin, and two aurantiaceous freckles near antero-lateral corner. Eyes fuscous with dark yellow longitudinal stripes. Frons fusco-piceous, with brown carinae and tubercles. Clypeus piceous, with a light speckle in lateral view. Pronotum dark testaceous, median carina ochraceous, with two small yellow spots surrounding black; lateral lobe with a large triangulate flavous blotch and fusco-piceous maculations or speckles, lower granules pale taupe and upper granules most pallide-flavens, the tubercles lacteous. Mesonotum flavescens with three angles pale, and near lateroapical angle fuscous; three carinae and tubercles pallide-flavens. Tegmina luteotestaceous, costal margin with a pallide-flavens spot near middle, posterior margin with big pallide-flavens blotch closed to terminal of clavus, with four small pallide-flavens spots along the first branch of median vein and Cu vein in the middle of tegmina; longitudinal veins fusco-rufous, transverse veins fulvous except veins in clavus pale grayish white. Hind wings pale fuscous, veins dark testaceous (Figs 1–5).

Head and Thorax: Vertex about 1.6 times wide at base than long in middle line, disc deeply depressed (Fig. 1). Frons slightly trapezoidal, about 1.2 times longer than wide at widest part (Fig. 4). Pronotum relatively large, about 1.7 times longer than length of vertex in middle line (Fig. 1). Mesonotum nearly triangular, 2.1 times wider than long in middle line, 1.3 times longer than length of pronotum (Fig. 1).

Male genitalia: Anal tube as long in middle line as wide at widest part, widest near middle and then gradually narrowing to apex, apical margin arcuately convex, lateral margin bluntly convex in lateral view (Figs. 8, 12). Anal pore located at middle of anal tube. Epiproct large and quadrate, paraproct relatively short, not reaching the apical margin of epiproct (Figs. 8, 12). Aedeagus long and slender, laterodorsal lobe narrow at apex in lateral view, apical part membranous and weakly concave at apical margin in dorsal view; ventral lobe well-developed, as long as dorsolateral lobe, slightly sclerotized, apical margin round; phallus faintly sclerotized with obtuse apex weakly bent down, with a pair of short falcate processes near middle (Figs 10, 11).

Female genitalia: Anal tube widest near the middle, apical margin almost straight (Fig. 15). Anal pore located near middle of anal tube. Epiproct large and quadrate, paraproct short, not reaching the apical margin of epiproct

(Fig. 15). Endogonocoxal process little shorter than the length of anterior connective lamina, faintly pigmented along ventral margin, and bifurcate apically (Fig. 18). Anterior connective lamina of gonapophysis VIII with apical margin narrow, laterodorsal angles of anterior connective lamina roundly arcuate, three big teeth of apical group become successively smaller from top to bottom, with four teeth also become successively smaller from top to bottom along apical margin to dorsal margin (Fig. 18).

Material examined. 1 male, China, **Hainan Province**, Yinggeling Mountain, N 19° 03. 047', E109° 33. 782', 678 m, 21 August 2010, collected by canopy fogging, coll. Guo Zheng. 1 female, China, **Hainan Province**, Jianfengling Mountain, N 18° 44. 658', E 108° 52. 327', 975 m, 14 August 2010, coll. Guo Zheng.

Discussion

According to characteristics of frons strongly extended forward or frons flattened and not extended to form a nasale, the 15 genera of Parahiraciini known (described) were recognized in two groups: frons with nasale (*Fortunia*, *Mincopius*, *Narinomus*, *Pinocchias*, *Scantinius*, *Bardunia*, *Brevicopius* **gen. nov.**) and frons without nasale (*Flavina*, *Fusiissus*, *Paratetricodes*, *Neotetricodes*, *Folifemurum*, *Neodurium*, *Tetricodes*, *Duriopsilla*). Gnezdilov & Wilson (2007) assumed that “frons without nasale” is a primitive condition, while “frons with nasale” is an advanced condition of the character. With respect to *Brevicopius* **gen. nov.**, frons with distinct median carina and sublateral carinae, lateral margins strongly elevated, the new genus could be an relatively advanced group close with *Fortunia* and *Mincopius*, considering tegmina with wide hypocostal plate, CuP well marked on tegmen, *Brevicopius* **gen. nov.** may be more closer with *Fortunia*. Of course, this conclusion needs to be supported by much more studies on the intergeneric phylogenetic relationships of the tribe.

Up to the present, all 15 genera and 46 species within the Parahiraciini were found from Qinling Mountains of China in the north to Sumba of Indonesia in the south, from West Himalaya (Uttaranchal of India) in the west to Western New Guinea of Indonesia in the east (Bourgoin, 2015), this region is blessed with plentiful rainfall and a mild climate. There are 12 genera and 28 species known from China (including all 8 genera having frons without nasale). The new genus *Brevicopius* was from Yinggeling mountain Nature Reserve and Jianfengling mountain Nature Reserve in Hainan Province, the second species in the tribe Parahiraciini found in Hainan Island. With its unique tropical rainforest climate and abundant natural resources, as well as the distribution data, it has great potential species in Parahiraciini to be discovered.

Specimens of the species in this paper were collected by canopy fogging (Zheng & Li, 2013). There are almost no data published on the issids from canopy except *Oronoqua ibisca* Gnezdilov, Bonfils, Aberlenc & Basset, 2010 (Issini) collected in flight-interception traps at 7 and 14 m of mid-canopy in Panama (Gnezdilov *et al.* 2010) and *Rotundiforma nigrimaculata* Meng, Wang & Qin, 2013 (Hemisphaeriini) collected by canopy fogging from in plantation bamboo forest in Yunnan Province in China (Meng *et al.*, 2013). Thus, the record of *B. jianfenglingensis* (Chen, Zhang et Chang, 2014), **comb. n.** from the canopy is a first such information in the tribe Parahiraciini.

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