

ORIGINAL ARTICLE

Neotapirissus gen. nov. of the tribe Issini (Hemiptera: Fulgoromorpha: Issidae) from Hainan Island

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Neotapirissus gen. nov., in the tribe Issini (Hemiptera: Fulgoromorpha: Issidae), is described from China, and type species *Neotapirissus reticularis* sp. nov. (China: Hainan) is described and illustrated. The female internal reproductive organs of the new species are also described and illustrated. The new genus is compared to the superficially similar genus *Tapirissus* Gnezdilov. The morphological diversity of the issids distributed in Hainan Island is discussed briefly.

Key words: female internal reproductive system, Fulgoroidea, morphology, new species, taxonomy.

INTRODUCTION

The family Issidae Spinola, 1839 is a worldwide distributed group, with diverse fauna in the Oriental Region represented by three tribes: Issini Spinola 1839, Hemisphaeriini Melichar, 1906 and Parahiraciini Cheng & Yang, 1991 (Gnezdilov 2013a). The tribes Hemisphaeriini and Parahiraciini are mostly restricted to the Oriental Region. The largest tribe, Issini, includes 136 genera with 727 species distributed worldwide (Gnezdilov 2013a; Chen *et al.* 2014; Bourgoin 2016) and is highly diverse in the Oriental region with at least 66 genera and 336 species (Gnezdilov 2013a,b, 2014, 2015; Gnezdilov *et al.* 2014, 2015).

In Hainan Island, all three issid tribes are represented: Hemisphaeriini with five genera and thirteen species (Che *et al.* 2003, 2006, 2007; Zhang *et al.* 2006; Meng & Wang 2012; Sun *et al.* 2012; Chen *et al.* 2014), Parahiraciini with three genera and three species (Wang & Wang 1999; Zhang *et al.* 2010; Chen *et al.* 2014; Meng *et al.* 2015) and Issini

with three genera and four species (Ran & Liang 2006; Che *et al.* 2011; Chen *et al.* 2014; Gnezdilov *et al.* 2014; Meng & Wang 2016).

In the present paper, the new genus *Neotapirissus* is described from Hainan Island. It is placed in the tribe Issini.

MATERIALS AND METHODS

External morphology was observed under a light microscope (MZ125; Leica, Solms, Germany). All measurements are given in millimeters (mm). Terminology used for the external morphology and the male genitalia follows Gnezdilov (2014) and female genitalia follows Bourgoin (1993). The genital segments of the examined specimens were dissected and macerated in hot 10% NaOH solution for about 1–2 min and subsequently transferred into glycerin. Photographs of the specimens were made using a light microscope (M205A; Leica) with a camera (DFC425; Leica). Images were produced using the software LAS v3.7 (Leica Application Suite). All specimens studied are deposited in the Entomological Museum of Northwest Agriculture and Forestry University (NWAFU), Yangling, China.

TAXONOMY

Family Issidae Spinola, 1839
Subfamily Issinae Spinola, 1839
Tribe Issini Spinola, 1839

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***Neotapirissus* gen. nov.**

Type species. Neotapirissus reticularis sp. nov.

Diagnosis. Head including eyes distinctly narrower than pronotum (Fig. 1). Coryphe nearly quadrangle, disc distinctly depressed, anterior and posterior margins strongly carinate, lateral margin foliately expanded, anterior margin convex, posterior margin angularly concave (Fig. 1). Metope narrow and elongate, lateral margins parallel, strongly foliately expanded, laterobasal angle strongly sharply protrudent; disc rugose with weak median carina, which runs from its upper margin to frontoclypeal suture (Figs 2,3). Frontoclypeal suture slightly curved downwards (Fig. 2). Eyes elliptical. Ocelli present. Clypeus expanded into a short nasale, roundly convex in lateral view, with distinct median carina (Figs 2,3). Rostrum long, reaching to metatrochanter. Pronotum slightly longer than coryphe, with two central pits, anterior margin distinctly convex and foliately expanded (Fig. 1); lateral lobes wide, ventral margin moderately oblique, with several small tubercles along outer margin (Fig. 2). Mesonotum more or less triangular, anterior margin concave, with three weak carinae and two rounded depressions near lateral margins (Fig. 1). Tegmina nearly elliptical, claval suture present, costal margin slightly convex at basal third, narrowly rounded apically (Fig. 3). Legs relatively long, fore and median femora foliately dilated; lateral margin of hind tibia with two lateral spines (Fig. 4). Hindwings single-lobed, longer than one-half length of tegmen, veins distinct and netlike (Fig. 5).



Figures 1–3 *Neotapirissus reticularis*. 1 Habitus, dorsal view. 2 Face. 3 Habitus, lateral view. Scale bars, 1 mm.



Figure 4 *Neotapirissus reticularis*. Fore, mid and hind legs. (from left to right).

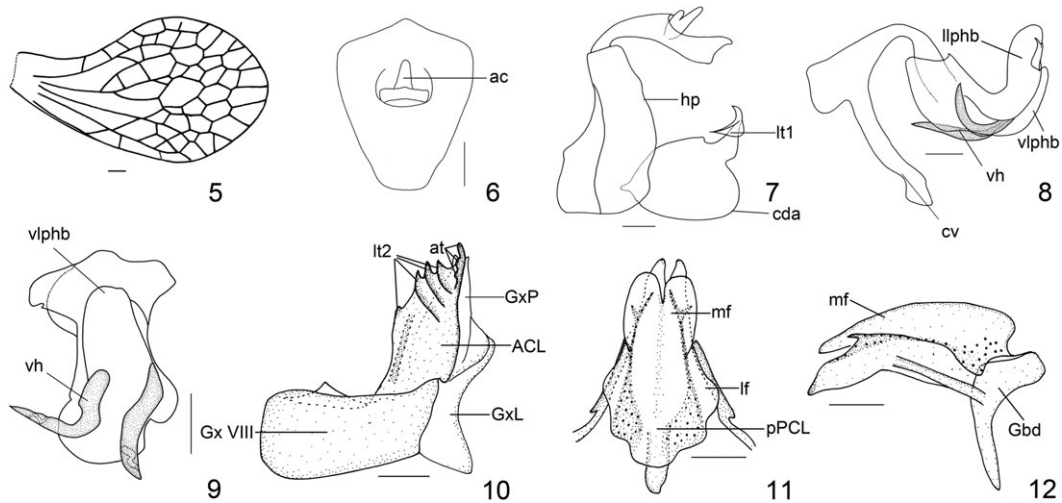
Male terminalia. Anal tube nearly triangular, widened to subapex. Anal column very short, 1/4 as long as anal tube, located beyond the middle of anal tube (Fig. 6). Pygofer with hind margin weakly convex after middle (Fig. 7). Suspensorium without processes. Dorsolateral phallobasal lobe widened near apex and twisted in lateral view. Aedeagus with a pair of ventral hooks at middle (Figs 8,9). Style with hind margin distinctly angularly excavated at middle, caudodorsal angle rounded (Fig. 7). Capitulum with pointed apex, and large lateral tooth (Fig. 7).

Female terminalia. Anal tube peach-shaped in dorsal view. Anal column very short, 1/3 as long as anal tube, located at basal half of anal tube (Fig. 13). Gonoplac nearly quadrangular, membranous near apex, apical margin roundly convex in lateral view, disc elevated near base in dorsal view, fork well pigmented in dorsal view (Figs 14,15). Gonapophyses IX with proximal part of posterior laminae distinctly convex (Fig. 12). Gonospiculum bridge moderately large, basal part almost as long as apical part (Fig. 12). Anterior connective laminae of gonapophysis VIII broad, in apical group with three teeth (Fig. 10). Gonocoxae VIII with hind margin concave (Fig. 10).

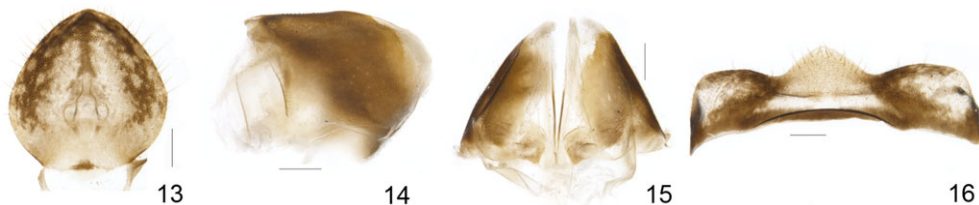
Remarks. This genus resembles *Tapirissus* Gnezdilov but differs from the latter in the following features: (i) lateral margins of coryphe and metope and apical margin of pronotum strongly foliately expanded (in *Tapirissus*, those margins are moderately keel-shaped); (ii) metope not enlarged above the clypeus, without small tubercles along the lateral margins and with weak median carina, which runs from its upper margin to frontoclypeal suture (in *Tapirissus*, the metope is enlarged above the clypeus, with rows of small tubercles along its lateral margins and with a weak median carina, which runs from its upper margin to its middle); (iii) ocelli present (in *Tapirissus*, ocelli are absent); (iv) fore and median femur foliately dilated and hind tibia with two lateral spines (in *Tapirissus*, fore and median femur are not dilated and the hind tibia has a single lateral spine); (v) suspensorium without processes, aedeagus with a pair of ventral hooks arising medially and directed to the base of phallobase (in *Tapirissus*, suspensorium with pair of narrow stick-shaped processes, aedeagus with pair of long and narrow ventral hooks, which arise basally and are directed to the apex of the phallobase).

Etymology. This generic name “*Neotapirissus*” refers to the strong resemblance to the genus *Tapirissus*. The genus is masculine in gender.

Distribution. China (Hainan).



Figures 5–12 *Neotapirissus reticularis*. 5 Hind wing. 6 Male anal tube, dorsal view. 7 Male genitalia, lateral view. 8 Penis, left view. 9 Penis, ventral view. 10 Gonocoxa VIII and gonapophysis VIII, dorsal view. 11 Gonapophyses IX and gonaspiculum bridge, right view. 12 Gonapophyses IX and gonaspiculum bridge, right view. *Abbreviations: ac, anal column; ACL, anterior connective lamina of gonapophysis VIII; at, apical tooth of * anterior connective lamina of gonapophysis VIII; cda, caudo-dorsal angle of style; cv, connective; Gbd, gonospiculum bridge; GxL, endogonocoxal lobe; GxP, endogonocoxal process; Gx VIII, gonocoxa VIII; hp, hind margin of pygofer; lf, lateral field; *lt1, lateral tooth of style; *lt2, lateral tooth of anterior connective lamina of gonapophysis VIII; llphb, lateral phallobase lobe; mf, median field; pPCL, proximal part of posterior connective lamina of gonapophyses IX; ps, plate of style; vh, ventral hooks of aedeagus; vlphb, ventral phallobase lobe. Scale bars, 0.2 mm. * [Correction added on 10 October, 2016, after first online publication: Figures 5–12 have been replaced and their figure legends have been corrected with the following changes: “Abbreviations” has been inserted, “style” has been changed to “anterior connective lamina of gonapophysis VIII”, “lt” has been changed to “lt1” and “lt2, lateral tooth of anterior connective lamina of gonapophysis VIII;” has been inserted.]



Figures 13–16 *Neotapirissus reticularis*. 13 Female anal tube, dorsal view. 14 Gonoplac, left view. 15 Gonoplac, dorsal view. 16 Sternum VII, ventral view. Scale bars, 0.2 mm.

***Neotapirissus reticularis*, sp. nov.**

Description

Male length ($n = 1$) (including tegmen): 5.8 mm, length of tegmen: 4.8 mm; female length ($n = 2$) (including tegmen): 6.1–6.2 mm, length of tegmen: 5.1–5.2 mm.

Coloration. General coloration fuscous with pale brown speckle. Coryphe brown with black margins. Metope fuscous with red in middle line, pale yellow near black lateral margin, disc with pale yellow speckle. Eyes brown. Clypeus black. Rostrum pale yellow. Pronotum brown to black, lateral lobes black. Mesonotum rufous, brown near black apex. Tegmen fuscous with pale brown spots, veins brownish. Hindwing dark brown. Leg dark brown, fore femora black brown, middle femora with black brown stripes and hind femora with dark brown ring. Abdomen

ventrally and dorsally dark brown, apex of each segment pale brown (Figs 1–3).

Head and thorax. Coryphe 1.9 times wider at apex than length in midline (Fig. 1). Metope 2.8 times longer than widest part (Fig. 2). Pronotum 1.4 times longer than coryphe (Fig. 1). Mesonotum 2.7 times wider than long in middle line (Fig. 1). Hind wing well developed, 0.8 times length of tegmen, Sc+R forked near apex, M highly branched, CuA bifurcate near apex, CuP and Pcu simple, Pcu short, reaching middle of wing (Fig. 5). Metatibiotarsal formula 2 + 7/9/2.

Male terminalia. Anal tube with apical margin strongly triangularly convex at middle (Fig. 6). Lateral phallobasal lobe forming a wide subapical process directed outside, left side larger than right side, ventral lobe with apical margin obtusely convex, aedeagus with a pair of thick

hooks, the left one curved outside, the right one directed cephalad (Figs 8,9).

Female terminalia. Proximal part of posterior connective lamina of gonapophyses IX rectangularly convex in lateral view, median field deeply concave at apex, lateral fields with a pair of short processes near apex in dorsal view (Figs 11,12). Endogonocoxal process foliate, bifurcated at apex (Fig. 10); endogonocoxal lobe moderately long and weakly concave inwardly (Fig. 10). Anterior connective laminae of gonapophysis VIII with three apical obtuse teeth gradually decreasing from top to bottom and with four keeled teeth in lateral group (Fig. 10). Sternum VII with apical margin distinctly strongly convex at middle (Fig. 16).

Female internal reproductive system: Distrysian. Bursa copulatrix well-developed with two pouches; first pouch smaller than second pouch, BC1 tubular; BC2 spheroidal. Vagina with posterior vagina and anterior vagina, posterior vagina relatively dumpy; anterior vagina thin and elongate, bearing anterior spermatheca and ventral common oviduct near apex. Common oviduct short and thin (not seen in figure). Spermatheca well developed, composed of five parts: orificium receptaculi weakly dilated; ductus receptaculi thin and elongate, distinctly orbicularly inflated at basal one-third; diverticulum ductus evidently saccate; pars intermedialis relatively thin with indistinct spiral fold; and glandula apicalis distinctly divided into two extremely thin ducts (mostly lost in dissection) (Fig. 17).

Type material. Holotype: male, China, Hainan, Jianfengling, 18°44.727'N, 108°59.632'E, 235 m a.s.l.,



Figure 17 *Neotapirissus reticularis*, general structure of the female reproductive organs, lateral view. BC, bursa copulatrix; BC1, first pouch; BC2, second pouch; Vp, posterior vagina; Va, anterior vagina; Sp, spermatheca; or, orificium receptaculi; dr, ductus receptaculi; dvd, diverticulum ductus; spp, pars intermedialis; ga, glandula apicalis.

17.viii.2010, coll. Guo Zheng. Paratypes: 1 female, same data as holotype; 1 female, China, Hainan, Wanning County, 18.iii.1964, coll. Liu Sikong.

Etymology. The specific epithet is derived from the Latin word “reticularis”, referring to the reticulate nature of the tegmen venation.

DISCUSSION

Neotapirissus **gen. nov.** is very close to the genus *Tapirissus* Gnezdilov, 2014 described from Laos. The morphological characteristic of the metope and coryphe meeting at an obtuse angle is indicative of the tribe Parahiraciini, which usually has a frontal nasale, while the single-lobed hindwing with reticulate veins is similar to the tribe Hemisphaeriini. In consideration of the distinct veins and well-developed claval suture on the tegmen, *Neotapirissus* and *Tapirissus* belong to the tribe Issini.

This genus is also similar to *Eusudasina* Yang, 1994 and *Euxaldar* Fennah, 1978 by tegmina with reticulate venation. However, in contrast to these two close genera, *Neotapirissus* **gen. nov.** has lateral margins of coryphe and metope and apical margin of pronotum strongly foliately expanded, fore and median femora foliately dilated, frons elongate.

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REFERENCES

- Bourgoin T (1993) Female genitalia in Hemiptera Fulgoromorpha, morphological and phylogenetic data. *Annales de la Société Entomologique de France* **29**, 225–244.
- Bourgoin T (2016) *FLOW (Fulgoromorpha Lists on The Web): a World Knowledge Base Dedicated to Fulgoromorpha. Version 8* [updated 1 May 2016; cited 11 May 2016]. Available from URL: <http://hemiptera-databases.org/flow/>
- Chan ML, Yang CT (1994) *Issidae of Taiwan (Homoptera: Fulgoroidea)*. Chen Chung Book Press, Taichung.
- Che YL, Wang YL, Chou I (2003) Taxonomic study of the genus *Gergithoides* Schumacher (Homoptera: Fulgoroidea: Issidae). *Entomotaxonomia* **25**, 102–108.

- Che YL, Zhang YL, Wang YL (2006) Two new species of the Oriental Planthopper genus *Hemisphaerius* Schaum (Hemiptera, Issidae). *Acta Zootaxonomica Sinica* 31, 160–164.
- Che YL, Zhang YL, Wang YL (2007) Seven new species and one new record of *Gergithus* Stål (Hemiptera: Fulgoroidea: Issidae) from China. *Proceedings of the Entomological Society of Washington* 109, 611–627.
- Che YL, Zhang YL, Wang YL (2011) A new genus of the tribe Issini Spinola (Hemiptera: Fulgoroidea: Issidae) from China. *Zootaxa* 3060, 62–66.
- Chen XS, Zhang ZG, Chang ZM (2014) *Issidae and Caliscelidae (Hemiptera: Fulgoroidea) from China*. Guizhou Science and Technology Publishing House, Guiyang.
- Cheng CL, Yang CT (1991) Nymphs of Issidae of Taiwan (IV) (Homoptera). *Plant Protection Bulletin* 33, 334–343.
- Fennah RG (1978) Fulgoroidea (Homoptera) from Vietnam. *Annales Zoologici Warszawa* 34, 207–279.
- Gnezdilov VM (2013a) Modern classification and distribution of the family Issidae Spinola (Homoptera, Auchenorrhyncha: Fulgoroidea). *Entomologicheskoe Obozrenie* 92, 724–738. (In Russian.) [English translation published in *Entomological Review* 94, 687–697].
- Gnezdilov VM (2013b) Notes on the genus *Sarima* (Hemiptera: Fulgoroidea: Issidae) with description of a new genus from Sri Lanka. *Acta Musei Moraviae, Scientiae Biologicae (Brno)* 98, 175–182.
- Gnezdilov VM (2014) Review of Indochinese Issini Spinola, 1839 (Hemiptera, Fulgoroidea, Issidae), with description of a new genus from Laos. *Zoosystema* 36, 761–770.
- Gnezdilov VM (2015) New genus and new species of the tribe Hemisphaeriini (Hemiptera: Fulgoroidea: Issidae) from Brunei. *Acta Entomologica Musei Nationalis Pragae* 55, 9–18.
- Gnezdilov VM, Soulier-Perkins A, Bourgoïn T (2014) Vietnamese Issidae (Hemiptera, Fulgoroidea): new taxa, new records and new distribution data. *Zootaxa* 3847, 80–96.
- Gnezdilov VM, Cesne ML, Soulier-Perkins A, Bourgoïn T (2015) New Guinean Issidae: description of new taxa in a poorly known island fauna (Hemiptera, Fulgoroidea). *Zootaxa* 3904, 82–94.
- Melichar DL (1906) Monographie der Issiden (Homoptera). *Abhandlungen der k. k. Zoologisch-botanischen Gesellschaft in Wien* 3, 1–327.
- Meng R, Wang YL (2012) Two new species of the genus *Gergithus* Stål (Hemiptera: Fulgoromorpha: Issidae) from China, with a redescription of *G. bimaculatus* Zhang and Che, and *G. tessellatus* Matsumura. *Zootaxa* 3247, 1–18.
- Meng R, Wang YL (2016) Descriptions of new species of the genera *Sarima* Melichar and *Sarimodes* Matsumura from southern China (Hemiptera, Fulgoromorpha, Issidae). *ZooKeys* 557, 93–109.
- Meng R, Qin DZ, Wang YL (2015) A new genus of the tribe Parahiraciini (Hemiptera: Fulgoromorpha: Issidae) from Hainan Island. *Zootaxa* 3956, 579–588.
- Ran HF, Liang AP (2006) Taxonomic study of the Issid genus *Flavina* Stål (Hemiptera, Fulgoroidea, Issidae). *Acta Zootaxonomica Sinica* 31, 388–391.
- Spinola M (1839) Sur les Fulgoelles, sous-tribu de la tribu des Cicadaïres, ordre des Rhyngotes (Suite). *Annales de la Societe Entomologique de France* 8, 339–454.
- Sun YC, Meng R, Wang YL (2012) *Neogergithoides*, a new genus with a new species from China (Hemiptera: Issidae). *Zootaxa* 3186, 42–53.
- Wang FX, Wang SZ (1999) A new species of Issidae in China (Homoptera: Fulgoroidea: Issidae). *Acta Agriculturae Boreali-Sinica* 14, 141–142.
- Zhang YL, Wang YL, Che YL (2006) A new genus of the subfamily Hemisphaeriinae (Hemiptera: Fulgoroidea: Issidae) from China. *Proceedings of the Entomological Society of Washington* 108, 165–168.
- Zhang YL, Che YL, Wang YL, Webb MD (2010) Three new species of the planthopper genus *Flavina* Stål from China (Hemiptera: Fulgoroidea: Issidae). *Zootaxa* 2641, 27–36.