

A new genus and a new species, representing a new tribe of the family Issidae (Hemiptera: Auchenorrhyncha: Fulgoroidea), from Costa Rica

Новый род и новый вид, представляющий собой новую трибу семейства Issidae (Hemiptera: Auchenorrhyncha: Fulgoroidea), из Коста Рики

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Abstract. New genus and species (*Cordela rubra* gen. et sp. n.) are described from Costa Rica. They represent a new tribe of the subfamily Thioniinae (Cordelini trib. nov.) which is based on the unique structure of the hind wing having weak clefts on the terminal margin, the cubitus anterior and cubitus posterior not fused with each other, and the second anal vein simple.

Резюме. Из Коста Рики описаны новый род и вид (*Cordela rubra* gen. et sp. n.). Они представляют собой новую трибу подсемейства Thioniinae (Cordelini trib. nov.), которая основана на уникальном строении заднего крыла, имеющего слабые выемки на терминальном крае, не слитые один с другим передний и задний кубитусы, а также простую вторую анальную жилку.

Key words: planthoppers, systematics, morphology, Neotropical Region, Hemiptera, Issidae, Thioniinae, new tribe, new genus, new species

Ключевые слова: фулгоровидные цикадовые, систематика, морфология, Неотропическая область, Hemiptera, Issidae, Thioniinae, новая триба, новый род, новый вид

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Introduction

The Neotropical fauna of the family Issidae remains almost undiscovered but is currently in the focus of taxonomist's interest (Gnezdilov, 2018a, 2018b; Gnezdilov & Bartlett, 2018). From Costa Rica just three issid species representing three genera were previously reported: *Dracela acuta* (Metcalf, 1938), *Picumna procidua* (Melichar, 1906), and *Thionia schmidti* Schmidt, 1910 (Melichar, 1906; Schmidt, 1910; Gnezdilov & O'Brien, 2008). The species described below is externally similar to the members of the genus *Thionia* Stål, 1859, but it is distinguished from *T. schmidti*, de-

scribed from three females (Schmidt, 1910), by the presence of three lateral spines of the hind tibia (*T. schmidti* has only two spines), the longer coryphe (*T. schmidti* has the coryphe twice as wide as long), and the presence of a red band on the metope (*T. schmidti* has the brown metope).

The higher classification of the family Issidae is under revision now (Gnezdilov, 2016a, 2017, 2018; Wang et al., 2016; Gnezdilov & Bartlett, 2018). After publishing the classification based on molecular analysis by Wang et al. (2016), many taxa, especially New World genera, became *incertae sedis*. A new species and genus described below are unique among all known Issidae by the

complex of primitive characters of the hind wing structure such as weak cubital and vannal clefts of the terminal wing margin, *CuA* and *CuP* not fused with each other (each with free branches), the remigio-vannal and anal lobes with the main veins not forked and without transverse veins, *Pcu* and $A_{1,1}$ not fused with each other, and A_2 simple. In the sense of described characters, the new genus can not be accommodated within any group of the tribal or subfamily rank in the classification by Wang et al. (2016), and a new tribe is erected here to be provisionally placed in the subfamily Thioniinae Melichar, 1906.

Material and methods

The morphological terminology follows Gnezdilov (2003) and Gnezdilov et al. (2014). For the fore wing venation, the following modifications of vein abbreviations in Issidae are used by Gnezdilov et al. (2014), Gnezdilov (2018b) and Gnezdilov & Bartlett (2018): *R*, *M*, *CuA*, *CuP*, *Pcu*, *A*. The radius (*R*) corresponds with “*ScP+R(+MA)* and *RA*, *RP*” of Bourgoïn et al. (2014), and the median (*M*) corresponds with “*MP*” of the same authors.

The drawings were made using a Leica MZ9.5 light microscope with a camera lucida attached. The photos were taken using the same microscope with a Leica DFC 290 camera. Images are edited with the Helicon Focus and Adobe Photoshop software.

The type series of the described species are shared between the Natural History Museum, London, United Kingdom (NHMUK) and Staatliche Naturhistorische Sammlungen, Dresden, Germany (SNSD).

Systematics

Family **Issidae** Spinola, 1839

Subfamily **Thioniinae** Melichar, 1906

Tribe **Cordelini trib. nov.**

Type genus: *Cordela* **gen. nov.** Gender feminine.

Diagnosis. Forewing elongate, surpassing abdomen apex, not narrowing apically; forewing apices not overlapping. Hind wing well developed, 3-lobed, nearly as long as fore wing, its remigial,

remigio-vannal and anal lobes almost equal in width; cubital and vannal clefts of terminal wing margin weak. Hind wing venation: *M* forked apically, posterior branch of *CuA* and *CuP* not fused with each other, apex of *Pcu* turned outwards, *Pcu* and $A_{1,1}$ not fused, A_2 simple. For comparison with other tribes see Discussion below.

Cordela gen. nov.

Type species *Cordela rubra* **sp. nov.**

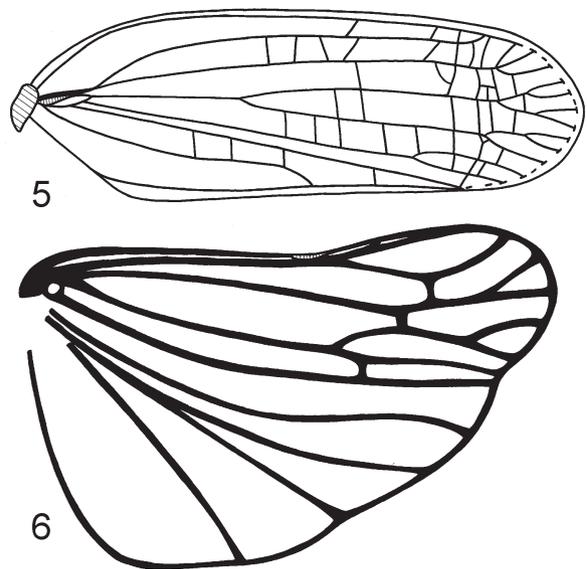
Diagnosis. Metope with only median carina distinct. Coryphe slightly transverse. Rostrum with second and third segments almost equal in length; third segment narrowing apically. Forewing with narrow precostal area and with short and narrow hypocostal plate; bulla absent. Forewing vein sequence: *R* 3, *M* 7, *CuA* 2. Clavus long, $\frac{3}{4}$ of wing length, opened. Hind tibia with three lateral spines. First metatarsomere ~1.5 times as long as second one, with two lateroapical and 7–10 intermediate spines. Each claw of pretarsus with three long setae. Each dorsolateral lobe of phallobase with horn-shaped apical process. Ventral phallobase lobe wide. Aedeagus with forked ventral hooks. Female sternum VII with concave hind margin. Gonoplares flat, slightly elongate.

Description. Metope slightly elongate, enlarged below eyes, with strong median carina running from its upper margin through post- and anteclypeus. Upper margin of metope weakly concave. Sublateral carinae of metope very weak, smooth, reaching metopoclypeal (frontoclypeal) suture. Median and sublateral carinae of metope joined just below its upper margin. Metopoclypeal suture strongly convex. Rostrum reaching only middle coxae, with second and third segments almost equal in length; third segment narrowing apically (Fig. 15). Ocelli present. Pedicel barrel-shaped. Coryphe slightly transverse, with lateral margins diverging posteriorly, without carinae; anterior margin obtusely convex; posterior margin rectangularly notched. Coryphe and metope joined at obtuse angle (in lateral view). Coryphe and pronotum nearly equal in length along midline. Pronotum with median carina; anterior margin sharply rectangularly convex; posterior margin almost straight. Paradiscal fields of pronotum narrow behind eyes. Mesonotum three times as long as pronotum, with lateral carinae connected in horse-

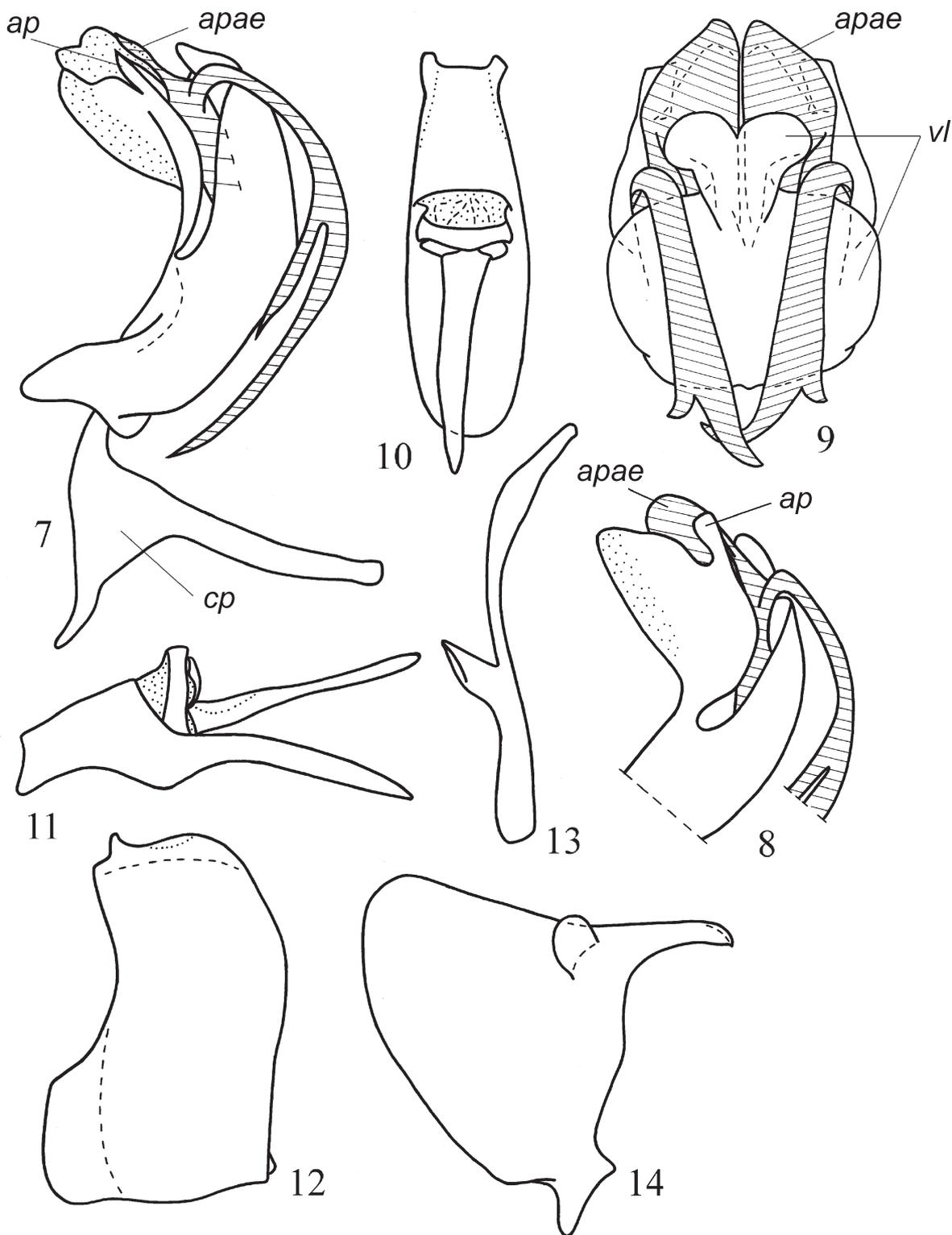


Figs 1–4. *Cordela rubra* gen. et sp. nov.: 1–3, male, holotype; 4, female, paratype (Tuis). Dorsal view (1); lateral view (2); frontal view (3, 4).

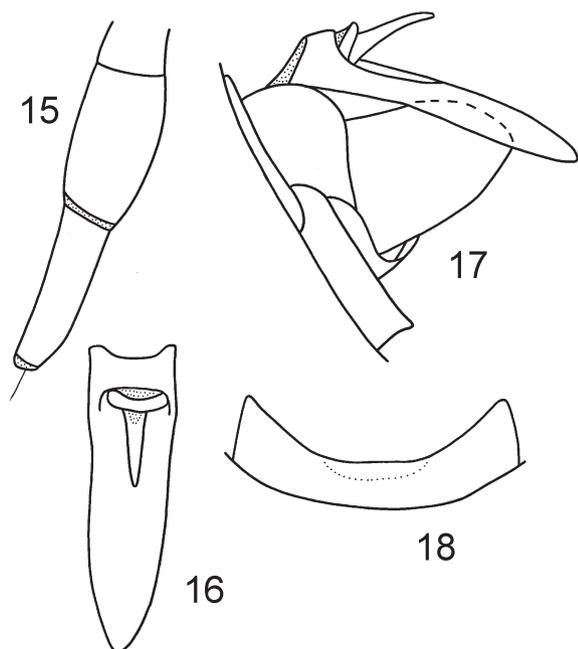
shoe and with median carina not reaching scutellum. Tegula large. Forewing long, not narrowing apically, with narrow precostal area and with short and narrow hypocostal plate in its basal third (Fig. 2). Basal cell elongately oval. Forewing vein sequence: *R* 3 (*R* firstly forked near to basal cell, and posterior branch of *R* also forked apically); *M* 7 (*M* firstly forked before wing middle, its anterior and posterior branches twice forked also apically); *CuA* 2 (*CuA* forked in apical quarter of wing). Clavus long, $\frac{3}{4}$ of wing length, opened; *Pcu* and *A*_{1,1} fused with each other at wing middle (Fig. 5). Transverse veins not numerous, present in apical two-third of remigium and in apical half of clavus. Hind wing well developed, almost as long as fore wing, three-lobed, with one coupling lobe (Fig. 6). Cubital and vannal clefts of terminal wing margin weak. Hind wing vein sequence: *R* 2 (*R* forked after coupling lobe); *r-m* 1; *M* 2 (*M* forked apically); *m-cua* 1; *CuA*



Figs 5–6. *Cordela rubra* gen. et sp. nov.: 5, fore wing; 6, hind wing.



Figs 7–14. *Cordela rubra* gen. et sp. nov., holotype, male genitalia: **7**, penis and connective, lateral view; **8**, penis, dorso-lateral view (but horn-shaped process visible from almost dorsal position); **9**, same, ventral view; **10**, anal tube, dorsal view; **11**, same, lateral view; **12**, pygofer, lateral view; **13**, style, dorsal view; **14**, same, lateral view. Abbreviations: *ap*, horn-shaped apical process of dorso-lateral phallobase lobe; *apae*, apical processes of aedeagus; *cp*, connective cup-shaped apodeme; *vl*, ventral phallobase lobe.



Figs 15–18. *Cordela rubra* gen. et sp. nov.: **15**, rostrum, male, holotype; **16**, female anal tube, dorsal view; **17**, ovipositor, lateral view; **18**, female sternum VII, ventral view.

3 (*CuA* firstly forked after wing middle, its anterior branch also forked apically); *cua-cup* 1; *CuP* 1; *Pcu* 1 (*Pcu* apex turned downwards); A_1 2; A_2 1. *Pcu* and $A_{1,1}$ not fused with each other. Hind tibia with three lateral spines on its middle and eight apical spines arranged in angular row (one spine situated below main part of this row). First metatarsomere nearly 1.5 times as long as second one, with two lateroapical and 7–10 intermediate spines arranged in two rows (variants of intermediate spines: 6+1; 6+2; 6+4; 7+2). Second metatarsomere with only two lateroapical spines. Arolium of pretarsus short; claws surpassing its hind margin by half of their length (in dorsal view); each claw of pretarsus with three long setae.

Etymology. Generic name is derived from the Greek word “κορδέλα” (ribbon), referring to the presence of red band on the face of the species.

***Cordela rubra* sp. nov.**
(Figs 1–19, 23)

Holotype. Male, **Costa Rica**, “Sector Cocori, 30 km N. de Cariari, Finca / E. Rojas, Prov. / Limón, Costa Rica. / 100 m. Mar 1994. E. Rojas, / LN



Fig. 19. *Cordela rubra* gen. et sp. nov., paratype (Tuis), ovipositor, lateral view.

286000_567500 # 2790” // “Costa Rica / INBIO / CRI001 / 740090” (NHMUK).

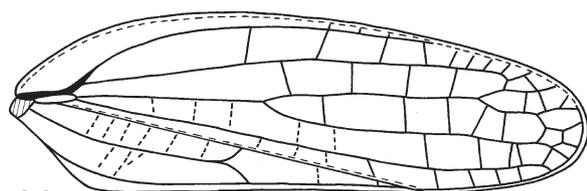
Paratypes. **Costa Rica:** 1 female, “Sector Cocori, 30 km al N. Cariari, / Prov. Limon, Costa Rica. 100 m. 4 / Feb 1995. E. Rojas, Malaise / L_N_286000_567500 # 5666” // “Costa Rica / INBIO / CRI002 / 310538” (NHMUK); 1 female, “Tuis, Cartago / 1000 m.” (green, hand written in ink) // “Costarica” (green, printed) // “1913 / 10” (green, printed and hand written in ink) // “coll. A. Jacobi” (white, printed) (SNSD).

Diagnosis. Metope with wide red or brownish red band in its upper half (Figs 3, 4).

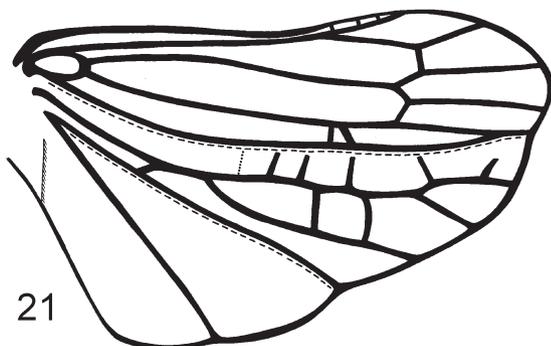
Description. Structure. As mentioned for this genus.

Coloration. General coloration light brownish green (Figs 1–4). Metope with dark brown lateral margins below eyes up to postclypeus, and with dark brown to black spots representing traces of larval sensory pits between lateral margins and sublateral carinae; upper half of metope with wide light brownish red band divided by green median carina and with a pair of small oval green spots besides carina. Coryphe light green. Apices of rostrum and leg spines black. Tegula, forewing, pro- and mesonotum light brown. Hind wing matte, with brown veins. Claws and dorsolateral plates of arolium of pretarsus dark brown to black. Abdominal tergites and sternites green to light green. Styles light brown. Female anal tube and gonoplas light brown; anal column dark brown. Gonocoxae VIII and sternum VII with black angles (Fig. 19).

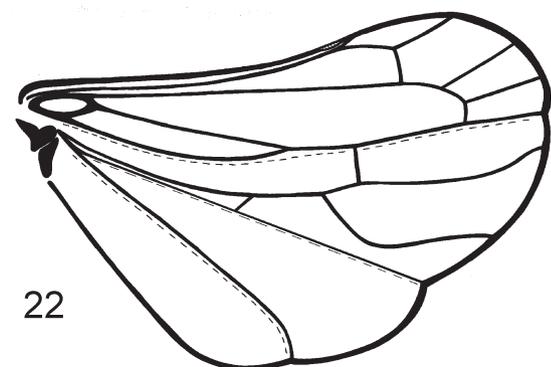
Male genitalia (Figs 7–14). Pygofer wide, with medially convex hind margins (Fig. 12). Anal tube



20



21



22

Figs 20–22. Issidae: **20, 21**, *Eupilis hyalinocosta* Melichar, 1914 (Philippines, Samar I.); **22**, *Syrgis* cf. *acutus* (Walker, 1851) (Philippines, Mindanao I.). Fore wing (20); hind wing (21, 22).

long and narrow, not narrowing apically (in dorsal view) (Fig. 10); lateral margins twice symmetrically concaved (in lateral view) (Fig. 11). Anal column long, half as long as anal tube. Phallobase relatively narrow (in lateral view), horseshoe-shaped, weakly sclerotized dorsoapically; each side with deep slit-like notch (Fig. 7). Each dorsolateral lobe with narrow, pointed horn-shaped apical process (Figs 7, 8, *ap*). Ventral phallobase lobe wide, rounded, with heart-shaped growth medioapical part (Fig. 9, *vl*). Aedeagus with wide apical processes visible above phallobase margin (Figs 7–9, *apae*) and with pair of long and wide two-branched ventral hooks directed downwards. Connective with relatively small cup-shaped apodeme (Fig. 7, *cp*). Style with straight hind margin; capitulum narrow, rounded apically, not narrowing to apex (in dorsal



Fig. 23. *Cordela rubra* gen. et sp. nov., female, paratype, hind wing.

view), without neck, and with lateral tooth wide (Figs 13, 14).

Female genitalia (Figs 16–19). Sternum VII with deeply and widely concave hind margin (Fig. 18). Anal tube long and narrow, narrowing apically (in dorsal view) (Fig. 16). Anal column narrow, $\frac{1}{4}$ as long as anal tube. Gonoplacs flat, slightly elongate (in lateral view) (Figs 17, 19).

Total length. Male – 7.0 mm. Females – 8.5 mm.

Etymology. The species name is derived from the Latin adjective “ruber” (red), referring to the red band of the metope.

Discussion

Cordelini trib. nov. is placed in the subfamily Thioniinae because of the similarity of *Cordela rubra* gen. et sp. nov. to the genus *Oronoqua* Fennah, 1947 (Thioniini Melichar, 1906: subtribe Oronoquina Gnezdilov, 2018) in the following characters of the hind wing: the cubital cleft is weak, *CuA* and *CuP* are not fused with each other, and *Pcu* and $A_{1,1}$ are without anastomosis (Gnezdilov et al., 2010, fig. 3C). On one hand, *Oronoqua* is characterized by A_2 of the hind wing forked and the fore wing apices are overlapping (Gnezdilov, 2018a). The last character of *Oronoqua* is unique within Issidae. On the other hand, *Cordela* gen. nov. is also close to Oriental genera *Eupilis* Walker, 1857 and *Syrgis* Stål, 1870 based on the long fore wings, surpassing abdomen apex, and the hind wings having a weak cubital cleft, the median vein forked, and A_2 simple (Figs 20–22). The

last genus is placed by Wang et al. (2016) in the tribe Sarimini Wang, Zhang et Bourgoin, 2016. Thus, *Eupilis hyalinocosta* Melichar, 1914 [taxonomic position of species within *Eupilis* is under revision now (Gnezdilov, in prep.)], known from the Philippines (Melichar, 1914), has *CuA* and *CuP* of the hind wing fused with each other for short distance only apically (Fig. 21). Additionally, based on the presence of the ventral aedeagal hooks arising in the distal quarter of the aedeagus, the new genus is also close to Oriental genera *Eupilis*, *Tempsa* Stål, 1866, and *Gabaloea* Walker, 1870 (Gnezdilov, 2016b: figs 17, 18). Forked median vein (M 2–4) of the hind wing mentioned above was discovered also in American genera *Proteinissus* Fowler, 1905, *Amphiscepa* Germar, 1830 and *Waorania* Gnezdilov et Bartlett, 2018. The taxonomic position of two first genera is under revision now (Gnezdilov, in prep.), and the last genus represents a monotypical subtribe (Waoraniina Gnezdilov et Bartlett, 2018) of the Thioniini. The species of the genus *Waorania* as well as of the American genera *Balduza* Gnezdilov et O'Brien, 2008, *Argepara* Gnezdilov et O'Brien, 2008, *Incasa* Gnezdilov et O'Brien, 2008 and *Cordela* **gen. nov.** are characterized by the forked ventral aedeagal hooks, the character apparently well presented within the New World Issidae and known also for several Oriental and Palaearctic genera representing different tribes (*Mycterodus* Spinola, 1839; *Sinesarima* Yang, 1994; *Yangissus* Chen, Zhang et Chang, 2014; *Rhombissus* Gnezdilov et Hayashi, 2016; *Bolbosphaerius* Gnezdilov, 2013; *Gergithoides* Schumacher, 1915).

In the conclusion, *Cordela rubra* **gen. et sp. nov.** is perhaps representing the condition close to ancestral issid taxa moved from Southeastern Asia to the New World via Beringian isthmus in Eocene confirming “Oriental roots” of American issid fauna (Gnezdilov, 2016a).

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References

- Bourgoin T., Wang R.R., Asche M., Hoch H., Soulier-Perkins A., Stroński A., Yap S. & Szwed J. 2014. From micropterism to hyperpterism: recognition strategy and standardized homology-driven terminology of the forewing venation patterns in planthoppers (Hemiptera: Fulgoroidea). *Zoomorphology*, **134**: 63–77.
- Gnezdilov V.M. 2003. Review of the family Issidae (Homoptera, Cicadina) of the European fauna, with notes on the structure of ovipositor in planthoppers. *Chteniya pamyati N.A. Kholodkovskogo* [Meetings in memory of N.A. Cholodkovsk], **56**(1): 1–145. St Petersburg: Zoological Institute RAS. (In Russian).
- Gnezdilov V.M. 2016a. *Planthoppers of the family Issidae (Hemiptera, Fulgoroidea) of Western Palaearctic. Thesis of Doctoral Dissertation (Dr. Sci. habilitation)*. St Petersburg. 44 p. (In Russian).
- Gnezdilov V.M. 2016b. A new species of the genus *Eusarima* Yang (Hemiptera: Fulgoroidea: Issidae) from Pakistan. *Entomologicheskoe Obozrenie*, **95**(1): 176–184. (In Russian). [English translation: *Entomological Review*, 2016, **96**(2): 218–224. <https://doi.org/10.1134/S0013873816020081>
- Gnezdilov V.M. 2017. To the knowledge of the African fauna of the family Issidae (Hemiptera, Auchenorrhyncha: Fulgoroidea) with descriptions of new genera and new species. *Entomological Review*, **96**(9): 1234–1260. <https://doi.org/10.1134/S0013873816090074>
- Gnezdilov V.M. 2018a. To the revision of the genus *Thionia* Stål (Hemiptera, Fulgoroidea, Issidae), with description of new genera and new subtribe. *Zootaxa*, **4434**(1): 158–170. <https://doi.org/10.11646/zootaxa.4434.1.10>
- Gnezdilov V.M. 2018b. A new genus representing a new tribe of the family Issidae (Hemiptera: Auchenorrhyncha: Fulgoroidea) from the forest canopy of French Guiana. *Zoosystematica Rossica*, **27**(1): 122–129.
- Gnezdilov V.M. & Bartlett C.R. 2018. A new genus and two new species of the family Issidae (Hemiptera, Auchenorrhyncha: Fulgoroidea) from Amazonian Ecuador. *Proceedings of the Entomological Society of Washington*, **120**(1): 62–75. <https://doi.org/10.4289/0013-8797.120.1.62>
- Gnezdilov V.M. & O'Brien L.B. 2008. New taxa and new combinations in Neotropical Issidae (Hemiptera: Fulgoroidea). *Insecta Mundi*, **31**: 1–26.

- Gnezdilov V.M., Bonfils J., Aberlenc H.-P. & Basset Y.** 2010. Review of the Neotropical genus *Oronoqua* Fennah, 1947 (Insecta, Hemiptera, Issidae). *Zoosystema*, **32**(2): 247–257.
- Gnezdilov V.M., Holzinger W.E. & Wilson M.R.** 2014. The Western Palaearctic Issidae (Hemiptera, Fulgoroidea): an illustrated checklist and key to genera and subgenera. *Proceedings of the Zoological Institute RAS*, **318**(Supplement 1): 1–124. http://www.zin.ru/journals/trudyzin/doc/vol_318_s1/TZ_318_1_Supplement_Gnezdilov.pdf
- Melichar L.** 1906. Monographie der Issiden (Homoptera). *Abhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien*, **3**(4): 1–327.
- Schmidt E.** 1910. Die Issinen des Stettiner Museums. (Hemiptera–Homoptera.). *Entomologische Zeitung*, **71**: 146–221.
- Wang M.-L., Zhang Y.-L. & Bourgoïn T.** 2016. Planthopper family Issidae (Insecta: Hemiptera: Fulgoromorpha): linking molecular phylogeny with classification. *Molecular Phylogenetics and Evolution*, **105**: 224–234. <https://doi.org/10.1016/j.ympev.2016.08.012>

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