

**A NEW GENUS AND TWO NEW SPECIES OF THE FAMILY ISSIDAE  
(HEMIPTERA, AUCHENORRHYNCHA: FULGOROIDEA) FROM  
AMAZONIAN ECUADOR**

urn:lsid:zoobank.org:pub:2E31A771-CC85-46B2-92F2-FB7052041917

---

VLADIMIR M. GNEZDILOV AND CHARLES R. BARTLETT

(VMG) Zoological Institute, Russian Academy of Sciences, Universitetskaya nab.1, 199034 Saint Petersburg, Russia (e-mails: vmgnezdilov@mail.ru, vgnezdilov@zin.ru); (CRB) University of Delaware, Department of Entomology and Wildlife Ecology, 250 Townsend Hall, 531 S. College Ave., Newark, Delaware, 19716-2160, USA (e-mail: Bartlett@udel.edu)

(VMG): urn:lsid:zoobank.org:author:85C736EC-1219-4F74-8848-3A168CF20152  
(CRB): urn:lsid:zoobank.org:author:47CE21C6-6289-4AD4-90EB-3F03DE1D9BF3

---

*Abstract.*—The **new genus *Waorania*** is described from terra firme forest canopy samples from Ecuador with two new species (***W. pantherina* sp. n.** and ***W. jaguarina* sp. n.**) representing a new subtribe, ***Waoranina* subtrib. n.**, of the tribe Thioniini (Issidae: Thioniinae).

*Key Words:* taxonomy, morphology, Issidae, Thioniinae, Thioniini, new subtribe, new genus, new species, Neotropics

DOI: 10.4289/0013-8797.120.1.62

---

The Ecuadorian fauna of the family Issidae is poorly known. Just five issid species have previously been recorded from Ecuador – *Incasa riobambae* (Schmidt, 1910) (originally described in *Hysteropterum* Amyot and Serville, 1843), *Thionia ecuadoriensis* Schmidt, 1910, and *T. ohausi* Schmidt, 1910. Recently, *I. riobambae* was redescribed with male genitalia illustrated, and *Dracela annulipes* Signoret, 1861 and *D. acuta* (Metcalf 1938) reported from Ecuador (Gnezdilov and O'Brien 2008). The two *Thionia* species listed above are still known only from original descriptions (Schmidt 1910).

Specimens of Issidae were among those collected during the field research of Terry Erwin (Smithsonian Institution, National Museum of Natural History) investigating canopy insects by fogging terra firme forest in the Orellana Province of Ecuador. Preliminary investigations of planthoppers found from these samples reported 17,951 planthopper specimens representing 638 morphospecies among 15 planthopper families, with 3,175 specimens reported as Issidae, representing 101 morphospecies (nearly all of these tentatively placed in *Thionia* Stål, 1859) from 952 canopy fogging event samples (Barringer 2011).

Formal investigation of the systematics of these specimens has only just begun (e.g., Gnezdilov et al. 2016). Among these were specimens that represent a new genus with two new species of the family Issidae described below. This new genus is placed in the tribe Thioniini Melichar, 1906 *sensu* Wang et al. (2016) based on a 3-branched  $A_2$  of the hindwing, but described placed into a new subtribe. Thus, the total number of genera and species in the family Issidae described from Ecuador, including those described here, rises to 4 and 7, respectively.

#### MATERIAL AND METHODS

The terminology of external morphological characters primarily follows Anufriev and Emeljanov (1988), Gnezdilov (2003, 2016), Gnezdilov and O'Brien (2006), and Gnezdilov et al. (2014), except for the female genitalia which follows Bourgoïn (1993) and Gnezdilov (2002). In the descriptions, the term 'genitalia' is understood to include the post-genital segments, 'styles' and 'anal tube' are equivalent to gonostyli ( $\approx$  parameres or harpagones) and segments X-XI (see Anufriev and Emeljanov 1988: 14, fig. 10) are anal tube and anal column as used in descriptive taxonomic literature. The term 'penis' is used in the sense of the combined aedeagus + phallosome (or phallobase) following Anufriev and Emeljanov (1988) and Gnezdilov et al. (2014). For the head, coryphe and metope (see Anufriev and Emeljanov 1988: 5, fig. 1) are approximately synonymous with vertex and frons, but more precisely defined (Emeljanov 1995). Forewing venation follows Bourgoïn et al. (2014) with these modifications for vein abbreviations as used for Issidae by Gnezdilov et al. (2014): R[ordinal number of vein from anterior wing margin], M [number of veins], CuA, CuP, Pcu, A where «R» corresponds with «ScP+R(+MA) and RA, RP» and «M»

corresponds with «MP» of Bourgoïn et al. (2014).

All available specimens are from canopy fogging of terra firme forests in Ecuador by Terry Erwin (Smithsonian Institution, National Museum of Natural History) and colleagues (e.g., Lucky et al. 2002). The specimens examined are deposited in the following collections:

USNM – Smithsonian Institution, National Museum of Natural History, Washington, D.C., USA;

UDCC – University of Delaware, Department of Entomology and Wildlife Ecology, Newark, Delaware, USA;

ZIN – Zoological Institute, Russian Academy of Sciences, Saint Petersburg, Russia.

Label information is quoted, with '/' indicating new line and '//' indicating next label.

#### RESULTS

##### TAXONOMY

Family Issidae Spinola, 1839

Subfamily Thioniinae Melichar, 1906

Tribe Thioniini Melichar, 1906

**Subtribe Waoranina Gnezdilov and Bartlett, subtrib. n.**

urn:lsid:zoobank.org:act:69D5B427-CEC4-494D-AF35-68341830A316

Type genus: *Waorania* gen. n.

Diagnosis.—Coryphe slightly to substantially projecting. Hindwing trilobed with *CuA* and *CuP* fused for a long distance, *Pcu* and  $A_{1.1}$  may have short anastomosis or none,  $A_2$  3. Phallobase complex with mobile dorsal portion bearing large weakly sclerotized "sac" on the top in active condition (Fig. 1) which collapses when dehydrated (Fig. 5). Ventral aedeagal hooks 3-branched, arising subapically on aedeagus.

Remarks.—*Waorania* gen. n. is very distinctive among other genera of the tribe

Thioniini by *CuA* and *CuP* of hindwing fused for a long distance, a feature rather typical of the Oriental tribe Sarimini Wang, Zhang and Bourgoin, 2016; and *Pcu* and  $A_{1,1}$  have short anastomosis in one species and none the other. The new genus is also characterized by a complex phallobase, with the dorsal portion bearing a large, weakly sclerotized “sac” at the apex (Fig. 1) which collapses in dry specimens (Fig. 5). It apparently plays some role during copulation as the sclerotized processes on the “sac” are fixed on the ventral surface of the anal tube when it expands. The phallobase “sac” expands when the genitalia are placed in boiling 10% KOH. *Incasa riobambae* also has a weakly sclerotized apical sac of the phallobase (Gnezdilov and O’Brien 2008, fig. 27), but the dorsal portion of the phallobase apparently is not mobile. Similar and apparently analogous phallobase sacs are found in Dictyopharidae and Fulgoridae which are phylogenetically basal to Issidae (Emeljanov 1991, Urban and Cryan 2007, but see Song and Liang 2013).

Typical Thioniini, subtribe Thioniina, is characterized by *CuA* and *CuP* of hindwing with separated apices or with apices connected, but usually not fused for a long distance or with a flattening; *Pcu* and  $A_{1,1}$  usually are not fused partly,  $A_2$  with 2 and more branches, apex of *Pcu* turned down from cubital cleft. Thus, we erect here a new subtribe of the tribe Thioniini to accommodate this new genus. The remaining Neotropical genera will be studied in the future in order to develop a complete subtribal system of Thioniini.

***Waorania* Gnezdilov and Bartlett,  
gen. n.**

urn:lsid:zoobank.org:act:7D6E8FCF-582B-446B-B035-552B642B12C8

Type species: *Waorania pantherina* sp. n.

Description.—Ocelli present. Metope without intermediate carinae, with straight keel above the metopoclypeal suture (Fig. 9). Coryphe projected, without carina (Figs. 10, 28), with hind margin concave. Clypeus strongly receding, flattened dorsoventrally, without carinae. Third segment of rostrum enlarged apically, equal in length to second (Fig. 22). Pedicel elongately cylindrical, with rows of rhinaria. Pronotum smooth, shorter than mesonotum medially, carinate at anterior margin, but without median carina. Paradiscal fields very narrow behind eyes (Figs. 10, 28). Paranotal lobes wide, with rounded angles, without carina. Tegulae large (Fig. 23). Forewings elongate (Fig. 24), narrowing apically, without hypocostal plate. Basal cell narrowly oval. Radius with 2 branches – furcates near basal cell, median vein with 2 branches – furcates before wing middle, cubitus anterior simple (*R* 2, *M* 2, *CuA* 1). Transverse veins few. Clavus long – 2/3 of wing length, open. Hindwing 3-lobed (Figs. 12, 25), with coupling lobe and deep cubital cleft and weaker anal cleft. Remigial, remigio-vannal, and anal lobes almost equal in width. Hindwing vein sequence *R* 2 (furcates after coupling lobe), *r-m* 1, *M* 2 (furcates apically), *m-cua* 1, *CuA* 1, *CuP* 1, *cup-pcu* 1, *Pcu* 2 (furcates apically), *pcu-a*<sub>1</sub> 1,  $A_1$  2,  $A_2$  3; *CuA* and *CuP* fused after wing middle. Hind tibia with 2 lateral spines in its distal half and with 9 spines apically (Fig. 35). First metatarsomere with 2 lateroapical and 6-8 intermediate spines arranged in arc. Ventral surface of tarsomeres with long setae. Claws longer than arolium (in dorsal view). Arolium with two narrow dorsolateral plates.

Male genitalia having phallobase with its dorsal part bearing spear-like sclerotization or tusk (Figs. 1, 3, 5) which is mobile with a “sac” at apex; in repose,

the weakly sclerotized portion of phallobase dorsum with bubble in the shape of a folded “sac” with 1-2 horn-shaped processes on each side. Ventral phallobase lobe short (Figs. 6, 13). Ventral aedeagal hooks arising subapically on aedeagus. Each hook with 3 narrow branches (Figs. 1, 14). Apical aedeagal processes fused except apically. Anal tube and phallobase basement connected by a strongly sclerotized plate (suspensorium). Connective with wide “cup” (Figs. 1, 15). Style massive, with convex hind margin and widely rounded caudo-dorsal angle (in lateral view) (Figs. 8, 18). Capitulum of style wide, not narrowing apically (in dorsal view), with long lateral tooth (Figs. 7, 17). Anal tube short and wide (1.5 times longer than wide) (Figs. 4, 16), without processes of lower margin (in lateral view). Anal column short and wide.

Hind margin of female sternum VII widely concave (Fig. 19). Female anal tube long and narrow. Gonoplasts smooth, triangular-shaped (in lateral view), without carina.

Etymology.—The genus name is derived from the name of the native Amerindians from the Amazonian Region of Ecuador, the Waorani, with the – a termination indicating a dedicative. Feminine in gender.

Remarks.—The new genus is similar in some respects to members of the genus *Thionia*; however, both Schmidt’s species known from Ecuador are characterized by coryphe twice as wide as long at midline and metope longer than wide (Schmidt 1910). Both new species described below have metope distinctly wider than long and one species has coryphe distinctly projecting. The coloration of the new species – multicolored with brown and yellows – is also very different from *T. ecuadoriensis* Schmidt, 1910 and *T. ohausi* Schmidt,

1910 which are brown with green (Schmidt 1910).

The new genus distinctly differs from *Incasa* Gnezdilov and O’Brien, 2008 by the well developed 3-lobed hindwings (rudimentary in *Incasa*) and from *Dracela* Signoret, 1861 by the wide metope and coryphe (long and narrow in *Dracela*) (Gnezdilov and O’Brien 2008).

KEY TO SPECIES OF *WAORANIA*

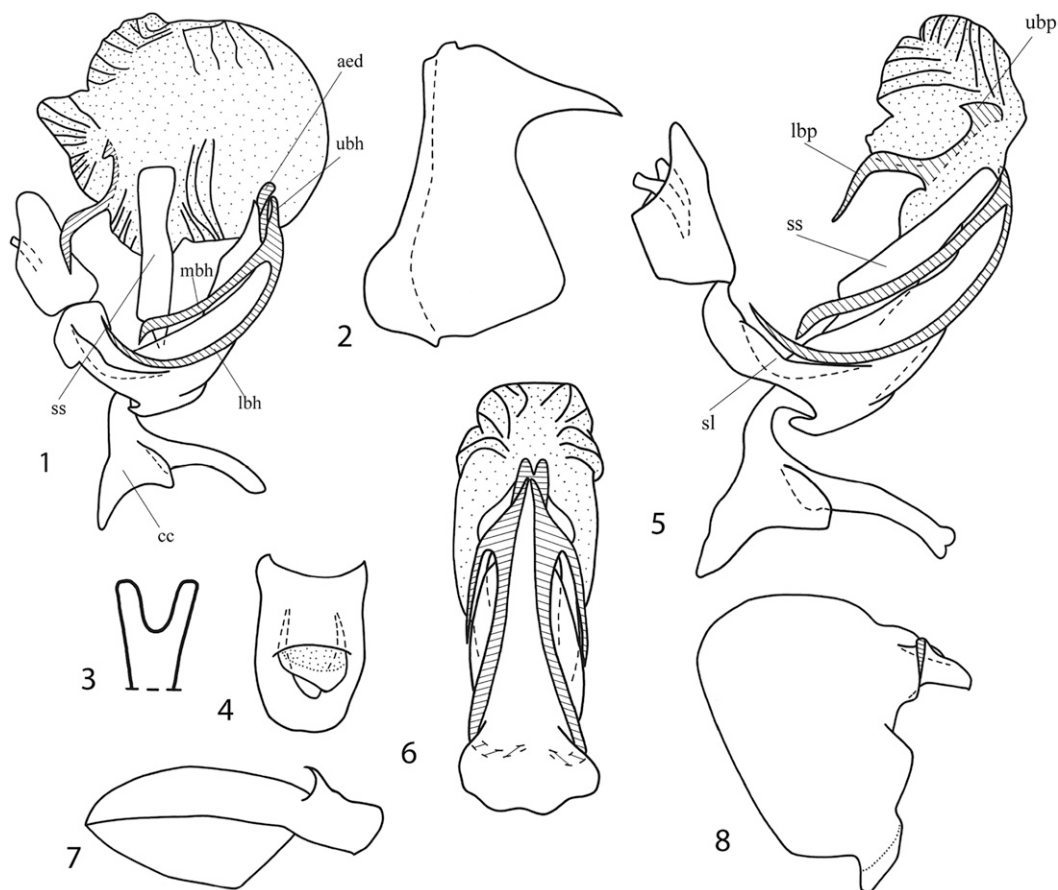
1. Coryphe transverse, weakly projected (Figs. 10, 11). Hindwings with *Pcu* and *A*<sub>1.1</sub> free (Fig. 12). Pygofer with a large horn-shaped process on its apical hind margin (Fig. 2). Upper branches of ventral aedeagal hooks directed apically, lower branches of the hooks directed to dorsal surface of the phallobase; phallobase “sac” with two horn-shaped processes on each side (Figs. 1, 5).....  
..... *W. pantherina* sp. n.
- . Coryphe projecting (Fig. 20, 21). Hindwings with *Pcu* and *A*<sub>1.1</sub> with short anastomosis (Fig. 25). Pygofer without process on its hind margin (Fig. 14). Upper branches of ventral aedeagal hooks directed to dorsal side of phallobase, lower branches of the hooks directed to ventral surface of the phallobase; phallobase “sac” with single horn-shaped process on each side (Fig. 14) .....  
..... *W. jaguarina* sp. n.

***Waorania pantherina* Gnezdilov and Bartlett, sp. n.**

urn:lsid:zoobank.org:act:F78C605A-4AA4-447D-9E0E-1F8B440E8C59

(Figs. 1–12, 26–29)

Description.—Body length: Male – 6.7 mm; female – 7.5 mm. Metope nearly rectangular – 1.5 times as wide as long at midline (Fig. 9), convex in its upper part, with short median carina



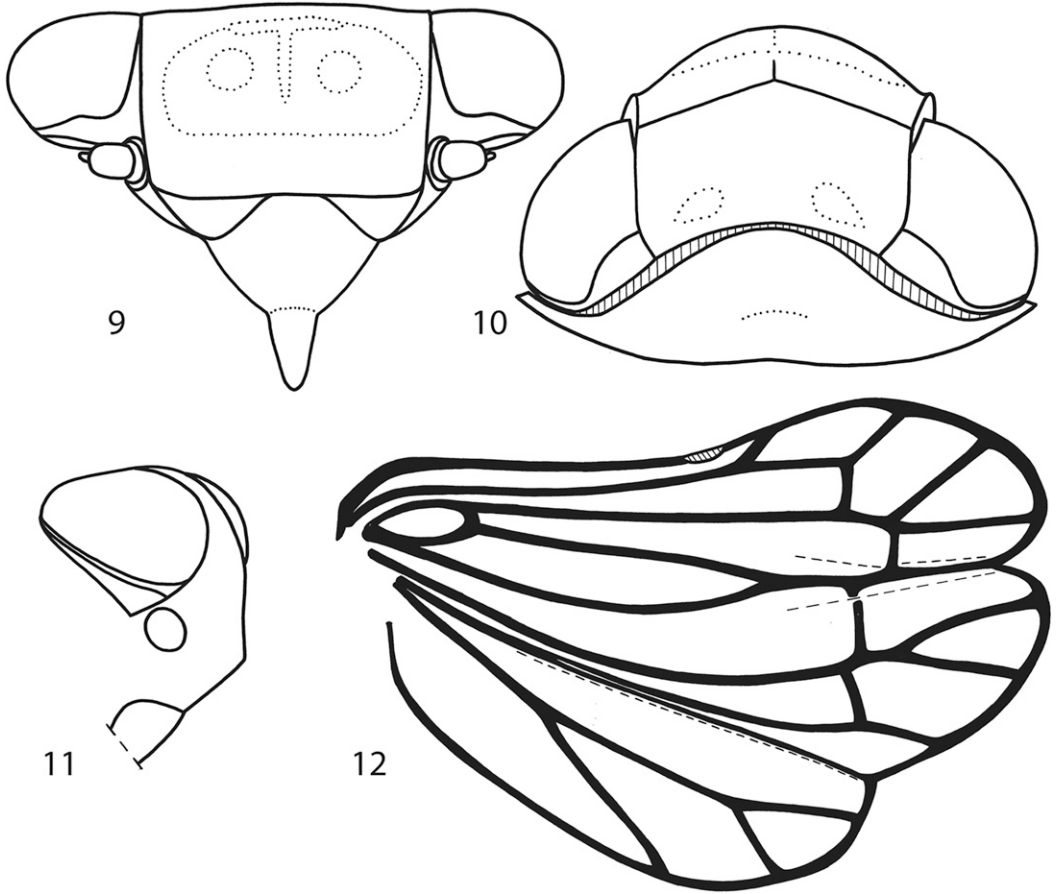
Figs. 1–8. *Waorania pantherina*, male genitalia. 1, Genital block, lateral view, 'sac' inflated. 2, Pygofer, lateral view. 3, Spear-like sclerotization, dorsal view. 4, Anal tube, dorsal view. 5, Genital block, lateral view, sac deflated. 6, Penis, ventral view. 7, Style, dorsal view. 8, Style, lateral view. Abbreviations: aed = aedeagus, ss = spear-like sclerotization, cc = connective 'cup', lbh = lower branch of ventral hook of aedeagus, lbp = lower horn-shaped process of phallobase, mbh = middle branch of ventral hook of aedeagus, sl = supporting lobe of phallobase, ubh = upper branch of ventral hook of aedeagus, ubp = upper horn-shaped process of phallobase.

apically. Lateral and dorsal margins of metope keeled. Metopoclypeal suture acutely angulately convex (Fig. 9). Coryphe transverse with anterior margin obtusely angulate. Mesonotum with weak lateral carinae. Hindwings with *Pcu* and  $A_{1,1}$  without anastomosis (Fig. 12). First metatarsomere with 2 lateroapical spines and 7–8 intermediate spines arranged in arc.

Coloration (Figs. 26–29): General body color shiny brown with yellow

markings. Metope shiny dark brown with wide light yellow band above metopoclypeal suture, extending laterally to genae; dorsal portion of metope with irregular yellow markings. Postclypeus dark brown to black. Anteclypeus light yellow. Scape and pedicel light yellow. Coryphe brown with broad midventral longitudinal vitta, extending caudally to pro- and mesonotum. Pronotum brown, darker caudally, with pale median vitta. Paranotal lobes light yellow, each with





Figs. 9–12. *Waorania pantherina*, head and wing. 9, Head, frontal view. 10, Head and pronotum, dorsal view. 11, Head, lateral view. 12, Hindwing.

black spot. Mesonotum brown, pale medially, at carinae and at lateral points. Fore and middle femora light yellow, with 3 wide longitudinal dark brown to black stripes on outer surface, reverse face pale with irregular brownish markings. Tegmina deep brown over clavus and portions of cubital and medial fields from base to about tip of clavus, brown portion marked with 2 large yellow spots in clavus and 2 spots between M and CuA veins; remainder of tegmina transparent except dark along veins at wing apex and on both R branches, shortly after fork. Abdomen dirty yellow, sternites IV–VI dark brown medially.

Male genitalia (Figs. 1–8): Pygofer with a large horn-shaped process on its hind margin apically and with projecting basal part (in lateral view) (Fig. 2). Anal tube not narrowing apically (in dorsal view) (Fig. 4). Phallobase slightly curved (in lateral view) (Fig. 1). Phallobase “sac” with two horn-shaped processes on each side – upper one short, but lower one long and narrow, curved. The lower horn-shaped process of the “sac” is fixed on ventral surface of anal tube in active position (Fig. 1). Apical aedeagal process or apical parts of aedeagus following Gnezdilov et al. (2014) (see Pl. 6, fig. 3, *apa* and Pl. 10, fig. 6, *apa*) visible

above the phallobase when penis everted. Each ventral aedeagal hook with one short upper branch directed apically and with two long branches turned to the dorsal side of the phallobase with middle ones crossed; lower branches laying on narrow lateral supporting lobes of the phallobase (Fig. 5). Capitulum of style on short and wide neck (in lateral view) (Fig. 8).

Etymology.—The specific name is derived from the genus *Panthera* with the added termination of *-ina* indicating having the quality of. The specific name is understood as feminine in gender.

Type material.—Holotype, ♂, **Ecuador**: “1224 Ecuador Orellana / Erwin Transect / Onkone Gare Camp / Reserva Etnica Waorani” // “0039' 25.7" S 076 27' 10.8" W / 6.X.95 T.L. Erwin et al. / Fogging terre firme forest” (USNM). Paratypes: **Ecuador**: 1♀, “1223 Ecuador Orellana / Erwin Transect / Onkone Gare Camp / Reserva Etnica Waorani” // “0039' 25.7" S 076 27' 10.8" W / 6.X.95 T.L. Erwin et al. / Fogging terre firme forest” (ZIN); 1♀ same, except 1032, 12.ii.[19]95 (USNM); 1♀ same except 1714, 2.x.[19]96 (UDCC).

***Waurania jaguarina* Gnezdilov and Bartlett, sp. n.**

urn:lsid:zoobank.org:act:98C07CC0-7476-4F95-B089-EBA1E040F437

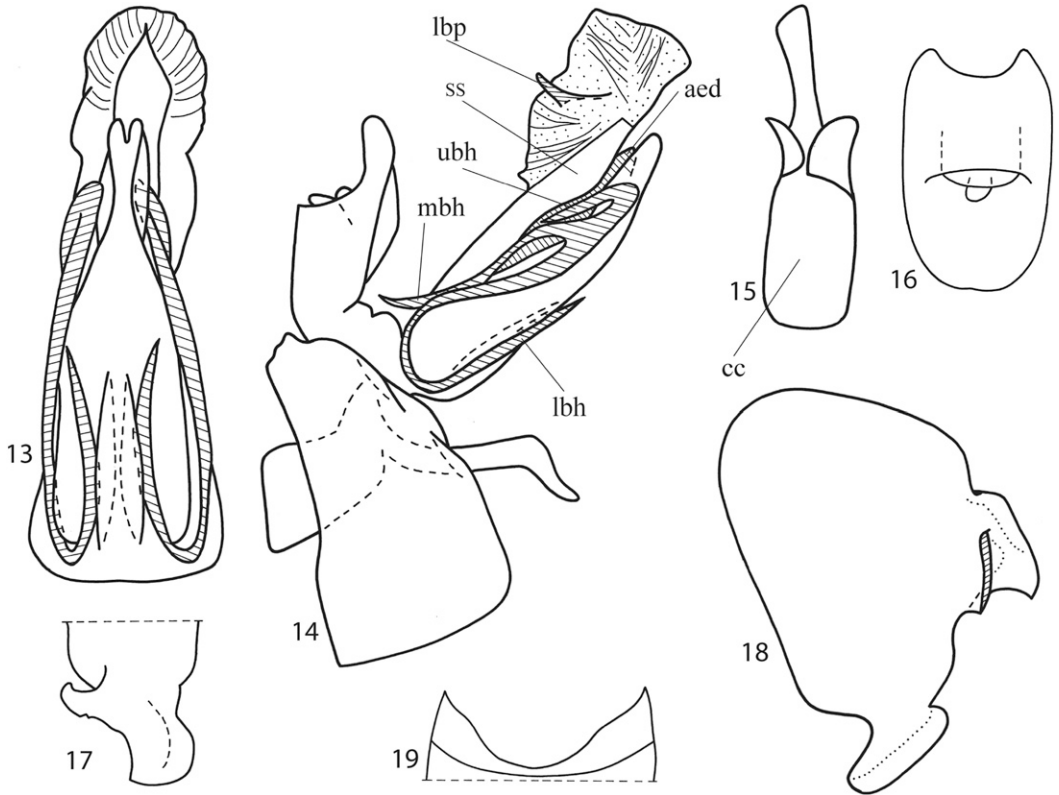
(Figs. 13–25, 30–35)

Description.—Body length: Male – 7.0–7.5 mm; female – 8.0 mm. Metope smooth, convex and elongate, with keel-shaped lateral margins that arc to the metopoclypeal suture that is acutely angulately convex (Fig. 34). Coryphe long, with lateral margins slightly diverging to the apex (Fig. 20). Mesonotum smooth, without carina. Hindwings with *Pcu* and  $A_{1.1}$  with short anastomosis before wing

middle and with one transverse vein between branches of first anal vein ( $a_{1.1}$ - $a_{1.2}$  1). First metatarsomere with 2 lateroapical spines and 4–6 + 2 intermediate spines arranged in arc.

Coloration (Figs. 30–34): General coloration light yellow. Metope pale yellow ventrally and dark brown below its upper margin, with an elongate yellow orange lateral patch on each side of midline. Pedicel light yellow. Metopocoryphe carina pale yellow orange, especially laterally. Coryphe brown with weak, sinuous pale line parallel to anterior margin and strong yellow median vitta, extending posteriorly to traverse the pro- and mesonotum. Pro- and mesonotum brown, with wide median yellow vitta and paler lateral margins. Paranotal lobes light yellow. Forewings light yellow with wide dark brown longitudinal stripe running via median, cubitus anterior, and clavus (which may be obscure). Anterior branch of radius proximally and apices of both branches of radius dark brown. Hindwings clear with brown veins. Legs yellow with darker carinae, spines with black apices. Abdomen yellow. Gonoplasts yellow, with brown margins.

Male genitalia (Figs. 13–18): Pygofer narrow in its upper part and with projecting basal part (in lateral view) (Fig. 14). Anal tube slightly narrowing to widely rounded apex (in dorsal view) (Fig. 16), with apical part turned up (in lateral view) (Fig. 14). Phallobase almost straight (in lateral view) (Fig. 14). Phallobase “sac” with narrow horn-shaped process (homologous to upper process of *W. pantherina* sp. n.) directed apically on each side. Each ventral aedeagal hook with one short upper branch directed to dorsal side of the phallobase and with two long branches – middle one turned to the dorsal side of the phallobase and crossed there and lower one



Figs. 13–19. *Waorania jaguarina*, genitalia. 13, Penis, ventral view. 14, Genital block, lateral view. 15, Connective ‘cup’, caudal view. 16, Anal tube, dorsal view. 17, Capitulum of style, dorsal view. 18, Style, lateral view. 19, Female VII sternite, ventral view. Abbreviations: aed = aedeagus, ss = spear-like sclerotization, cc = connective ‘cup’, lbh = lower branch of ventral hook of aedeagus, lbp = lower horn-shaped process of phallobase, mbh = middle branch of ventral hook of aedeagus, ubh = upper branch of ventral hook of aedeagus.

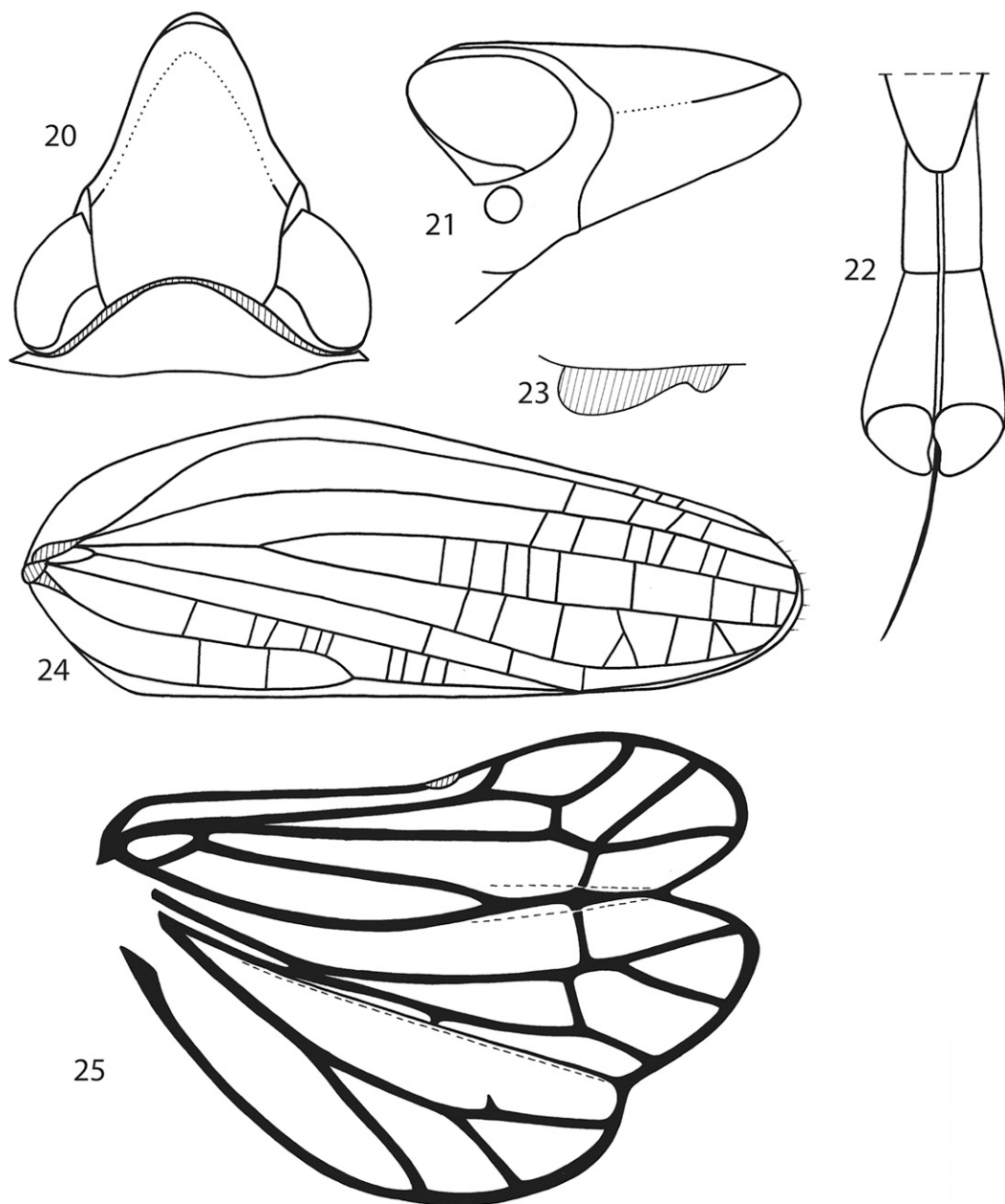
strongly curved and turned to ventral side of the phallobase where laying on supporting lobes of ventral phallobase lobe (Fig. 13). Capitulum of style without neck (in lateral view) (Fig. 18).

Etymology.—The specific name is derived from the English name *Jaguar* with the added termination of *-ina* indicating having the quality of. The specific name is understood as feminine in gender.

Type material.—Holotype, ♂, **Ecuador**: “1262 Ecuador, Orellana / Erwin Transect / Onkone Gare Camp / Reserva Ethnica Waorani” // “00 39’ 25.7” S 076 27’ 10.8” W / 8.X.95 T.L. Erwin et al. / Fogging terre firme forest”

(USNM). Paratypes: **Ecuador**: “1262 Ecuador, Orellana / Erwin Transect / Onkone Gare Camp / Reserva Ethnica Waorani” // “0039’ 25.7” S 076 27’ 10.8” W / 8.X.95 T.L. Erwin et al. / Fogging terre firme forest” (1♂, ZIN); “1587 Ecuador, Orellana / Erwin Transect / Onkone Gare Camp / Reserva Ethnica Waorani // 0039’ 25.7” S 076 27’ 10.8” W / 26.VI.96 T.L. Erwin et al. / Fogging terre firme forest” (1♂, UDCC); “698 Ecuador, Orellana / Transect Ent. 1 km 220 m/ S. Onkone Gare Camp / Reserva Ethnica Waorani” // “0039’ 10” S 076 26’ 00” W / 21.VI.94 T.L. Erwin et al. / Fogging terre firme forest” (1♀, ZIN);





Figs. 20–25. *Waorania jaguarina*, head, wing and rostrum. 20, Head and pronotum, dorsal view. 21, Head, lateral view. 22, Rostrum, dorsal view. 23, Tegula. 24, Forewing. 25, Hindwing.

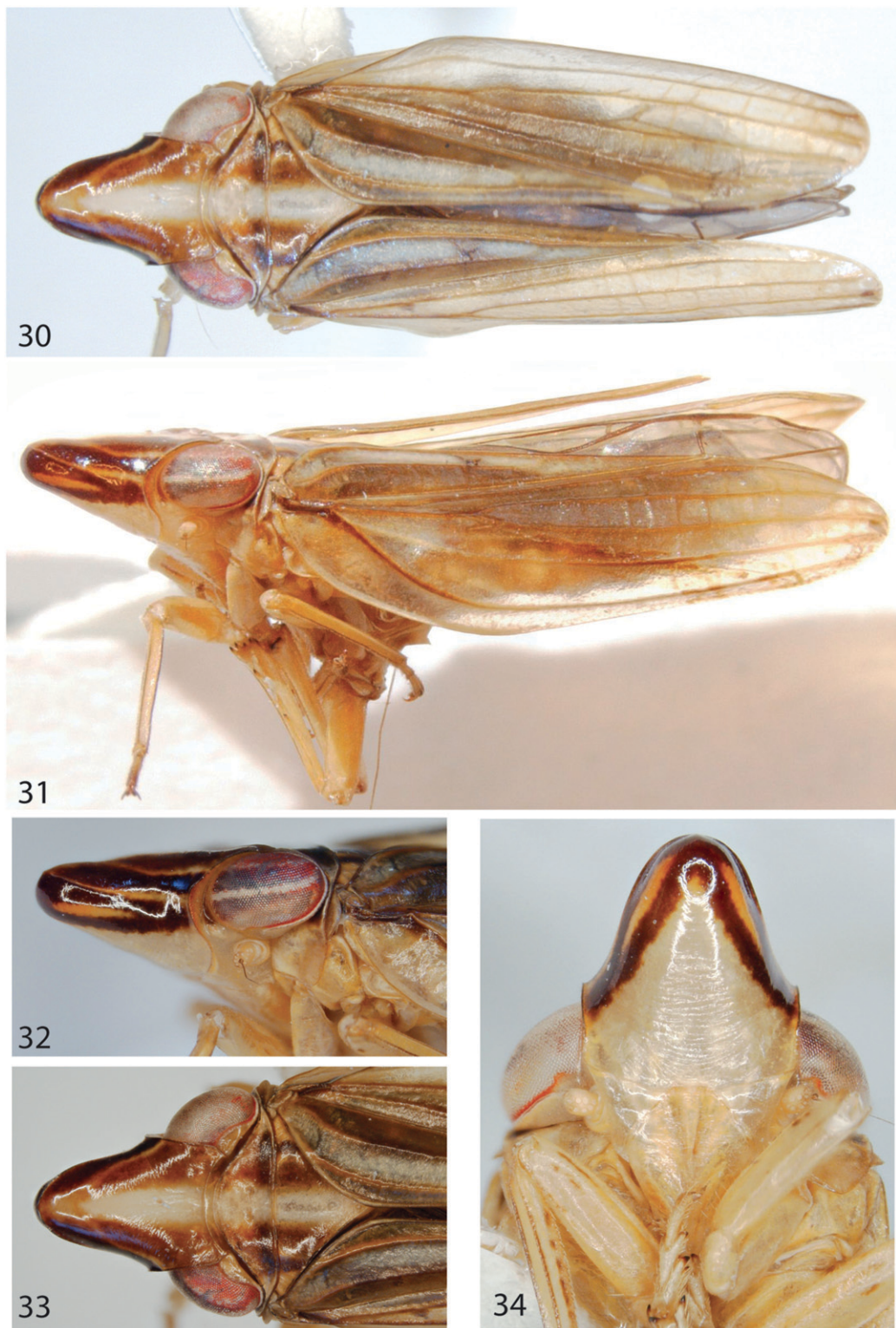
“1420 Ecuador, Orellana / Transect Ent.  
1 km S. / Onkone Gare Camp 220m /  
Reserva Ethnica Waorani // 5.II.1996,

T.L. Erwin et al. / “0039’ 10” S 076 26’  
00” W / T3 Fogging terre firme forest”  
(1♀, USNM).



Figs. 26–29. *Waorania pantherina*, habitus. 26, Dorsal view. 27, Lateral view. 28, Head and thorax, dorsal view. 29, Head, frontal view.





Figs. 30–34. *Waorania jaguarina*, habitus. 30, Dorsal view. 31, Lateral view. 32, Head and thorax, lateral view. 33, Same, dorsal view. 34, Head, frontal view.



Fig. 35. *Waorania jaguarina*, apex of hind tibia and hind tarsus, ventral view.

#### DISCUSSION

*Waorania* gen. n. differs most obviously from other South American Issidae in that the front of the head is roundly projected, either slightly (*W. pantherina* sp. n.) or substantially (*W. jaguarina* sp. n.), as opposed to not projected (e.g., *Thionia* Stål) or angulately projected (e.g., *Dracela* Signoret, see figs. 11–12 in Gnezdilov and O'Brien 2008).

The issid fauna of Ecuador is here reported to consist of 4 genera and 7 species. Given the limited attention fulgoroids have been afforded to date, and the volume of Issidae found in the terre firme forest canopy fogging samples from Ecuador (viz. 3,175 specimens, Barringer 2011), it is clear that the current knowledge greatly underestimates the true number of issid species for the country and region. A difficulty is that most of these specimens had been tentatively assigned to the genus *Thionia*, a New World genus (and one invasive species reported from Italy, Gnezdilov and Poggi 2014) consisting of 74 described species, with most members Neotropical but distributed throughout Mesoamerica, the Caribbean and the

Nearctic (Gnezdilov 2013; Bourgoïn 2017). The genus is in need of revision (as previously noted in Stroiński and Szwedo 2008), and formal treatment of the canopy *Thionia* implies consideration, re-description and revision of the described species as well, although possibly in a geographically iterative fashioned.

The South American Issidae may prove to be of special interest phylogenetically since recent molecular analyses have unexpectedly placed the Thionini (as Thioninae) as a basal lineage within the Issidae (Wang et al. 2016). In addition, the monophyly of Issidae (*sensu* Gnezdilov 2013) was not strongly supported, leading to questions concerning how Issidae might be redefined (more broadly or narrowly) and what the taxonomic and morphological limits of the family should be, a problem previously hinted at by Gnezdilov et al. (2015). Future investigation of this problem will undoubtedly require more consideration of the Neotropical Issidae and related families.

#### ACKNOWLEDGMENTS

We thank Terry Erwin (Smithsonian Institution, National Museum of Natural

History) for access to specimens from years of canopy fogging in Ecuador. We are particularly indebted to Kimberly Shropshire, for her extensive assistance in photography and artwork. Partial support for this research for CRB was provided by the US National Museum, Smithsonian Institution, and the University of Delaware Department of Entomology and Wildlife Ecology. The study was performed in the frames of the Russian state research project No. AAAA-A17-117030310210-3 and supported by the Russian Foundation for Basic Research grant No. 16-04-01143.

#### LITERATURE CITED

- Anufriev, G. A. and A. F. Emeljanov. 1988. Suborder Cicadinea (Auchenorrhyncha), pp. 12–495. *In* P. A. Ler, ed. *Opredelitel' nasekomykh Dal'nego Vostoka SSSR*, 2 [Keys to the Insects of the Far East of the USSR, In 6 Volumes. Volume II. Homoptera and Heteroptera]. Nauka, Leningrad, Russia.
- Barringer, L. E. 2011. Canopy assemblages and species richness of planthoppers (Hemiptera: Fulgoroidea) in the Ecuadorian Amazon. Master Thesis, University of Delaware, Newark. 94 pp.
- Bourgoin, T. 1993. Female genitalia in Hemiptera Fulgoromorpha, morphological and phylogenetic data. *Annales de la Société Entomologique de France (Nouvelle Serie)* 29: 225–244.
- Bourgoin, T. 2017. FLOW (Fulgoromorpha Lists on The Web): a world knowledge base dedicated to Fulgoromorpha. <http://hemiptera-databases.org/flow/>. Version 8, updated 26 Mar 2017; accessed 28 Mar 2017.
- Bourgoin, T., R. R. Wang, M. Asche, H. Hoch, A. Soulier-Perkins, A. Stroiński, S. Yap, and J. Szwedo. 2014. From micropterism to hyperpterism: recognition strategy and standardized homology-driven terminology of the forewing venation patterns in planthoppers (Hemiptera: Fulgoromorpha). *Zoomorphology* 134: 63–77.
- Emeljanov, A. F. 1991. An attempt to construct a phylogenetic tree for planthoppers (Homoptera, Cicadina). *Entomologicheskoe Obozrenie* 69(2): 353–356 [In Russian; English translation *Entomological Review* (1991) 70 (1): 24–28].
- Emeljanov, A. F. 1995. On the problem of classification and phylogeny of the family Delphacidae (Homoptera, Cicadina) taking into consideration larval characters. *Entomologicheskoe Obozrenie* 74(4): 780–794 [In Russian; English translation *Entomological Review* (1996) 75(9): 134–150].
- Gnezdilov, V. M. 2002. Morphology of the ovipositor in members of the subfamily Issinae (Homoptera, Cicadina, Issidae). *Entomologicheskoe Obozrenie* 81: 605–626. [In Russian; English translation *Entomological Review* (2004) 82(8): 957–974].
- 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. Cholodkovsky)*, St. Petersburg 56(1): 1–145. [In Russian].
- Gnezdilov, V. M. 2013. Modern classification and the distribution of the family Issidae Spinola (Homoptera, Auchenorrhyncha: Fulgoroidea). *Entomologicheskoe Obozrenie* 92: 724–738 [In Russian; English translation *Entomological Review* (2014) 94(5): 687–697].
- Gnezdilov, V. M. 2016. Planthoppers of the family Issidae (Hemiptera, Fulgoroidea) of western Palaearctic. Thesis of Doctoral Dissertation (Dr. Sci. habilitation). St.-Petersburg. 44 pp. [In Russian].
- Gnezdilov, V. M. and F. Poggi. 2014. First record of Nearctic issid planthopper *Thionia simplex* (Hemiptera: Fulgoroidea: Issidae) from Europe. *Zoosystematica Rossica* 23: 238–241.
- Gnezdilov, V. M. and L. B. O'Brien. 2006. Generic changes in United States Issini (Hemiptera, Fulgoroidea, Issidae). *Insecta Mundi* 20: 217–225.
- Gnezdilov, V. M. and L. B. O'Brien. 2008. New taxa and new combinations in Neotropical Issidae (Hemiptera: Fulgoroidea). *Insecta Mundi* 31: 1–26.
- Gnezdilov, V. M., W. E. Holzinger, and M. R. Wilson. 2014. The western Palaearctic Issidae (Hemiptera, Fulgoroidea): an illustrated checklist and key to genera and subgenera. *Proceedings of the Zoological Institute RAS* vol. 318 (Supplement 1): 124 pp.
- Gnezdilov, V. M., C. R. Bartlett and T. Bourgoin. 2016. A new tribe of Tropiduchidae (Hemiptera, Fulgoroidea) with revision of the genus *Buca* Walker and description of asymmetric



- hind leg spinulation. *Florida Entomologist* 99: 406–416.
- Gnezdilov, V. M., T. Bourgoïn, F. Mozaffarian, and S. Manzari. 2015. Difficulties in building a molecular phylogeny of the issidoid planthopper lineages (Insecta: Hemiptera: Fulgoroidea), pp. 218–227. In 1st Iranian International Congress of Entomology Teheran, 29–31 August 2015.
- Lucky, A., T. L. Erwin, and J. D. Witman. 2002. Temporal and spatial diversity and distribution of arboreal Carabidae (Coleoptera) in a western Amazonian rain forest. *Biotropica* 34: 376–386.
- Schmidt, E. 1910. Die Issinen des Stettiner Museums. (Hemiptera – Homoptera.). *Entomologische Zeitung* 71: 146–221.
- Song, N. and A. P. Liang. 2013. A preliminary molecular phylogeny of planthoppers (Hemiptera: Fulgoroidea) based on nuclear and mitochondrial DNA sequences. *PLOS One* 8(3): e58400.
- Stroiński, A. and J. Szewdo. 2008. *Thionia douglundbergi* sp. n. from the Miocene Dominican amber (Hemiptera: Fulgoromorpha: Issidae) with notes on extinct higher planthoppers. *Annales Zoologici (Warszawa)* 58(3): 529–536.
- Urban, J. M. and J. R. Cryan. 2007. Evolution of the planthoppers (Insecta: Hemiptera: Fulgoroidea). *Molecular Phylogenetics and Evolution* 42(2): 556–72.
- Wang, M.-L., Y.-L. Zhang, and T. Bourgoïn. 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>.