To the revision of the genus *Thionia* Stål (Hemiptera, Fulgoroidea, Issidae), with description of new genera and new subtribe

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**Abstract**

New subtribe, Oronoquina subtrib. n., is erected for the genus *Oronoqua* Fennah, 1947 in the tribe Thioniini Melichar. New genera, *Fowlerium* gen. n. (type species: *Thionia naso* Fowler, 1905) and *Aplos* gen. n. (type species: *Issus simplex* Germar, 1830) are erected in the subtribe Thioniina Melichar. *Thionia acuta* Doering, 1941 and *T. producta* Van Duzee, 1908 are transferred to *Fowlerium* gen. n. The photos of type specimen of *Issus cinctifrons* Stål, 1854 are examined and compared with original description of *Issus rubrocostatus* Spinola, 1839 (currently *Thionia rubrocostata* (Spinola, 1839)). *I. cinctifrons* is reinstated from synonymy with *I. rubrocostatus* Spinola, 1839 (currently *Thionia rubrocostata* (Spinola, 1839)). Diagnosis of *Thionia sensu stricto* is given basing on the characters of *T. cinctifrons*. Generic status of *Cheiloceps* Uhler, 1895 is discussed and confirmed. *Thionia argo* Fennah, 1949, *T. anguillana* Fennah, 1965, *T. borinqueta* Caldwell et Martorell, 1951, and *T. puertoricensis* Caldwell et Martorell, 1951 are transferred to the genus *Cheiloceps* Uhler. Hind wing venation characters of Issidae are discussed.

**Key words:** taxonomy, morphology, hind wing venation, new subtribe, new genus, new combination, Thioniinae, *Thionia*, *Cheiloceps*, *Oronoqua*, Neotropics

**Introduction**

*Issus cinctifrons* was described by C. Stål from Brazil more than 160 years ago (Stål, 1854). Soon after, Stål (1859) erected the genus *Thionia* and listed *I. cinctifrons* as well as *Issus longipennis* Spinola, 1839 as belonging to this new genus. Later on L. Melichar (1906) reviewing the genus *Thionia* Stål provisionally (marked by “?”) placed *I. cinctifrons* in synonymy under *Issus rubrocostatus* Spinola, 1839 (currently *Thionia rubrocostata* (Spinola, 1839)). *I. cinctifrons* is reinstated from synonymy with *I. rubrocostatus* as *Thionia cinctifrons* (Stål, 1854). Diagnosis of *Thionia sensu stricto* is given basing on the characters of *T. cinctifrons*. Generic status of *Cheiloceps* Uhler, 1895 is discussed and confirmed. *Thionia argo* Fennah, 1949, *T. anguillana* Fennah, 1965, *T. borinqueta* Caldwell et Martorell, 1951, and *T. puertoricensis* Caldwell et Martorell, 1951 are transferred to the genus *Cheiloceps* Uhler. Hind wing venation characters of Issidae are discussed.
are good enough to treat _Cheiloceps_ Uhler, 1895 as a separate genus of the family Issidae (Gnezdilov 2013). Currently this genus comprises 8 species from Puerto Rico and Lesser Antilles including the new combinations proposed below.

From other hand the morphological characters of _Thionia cinctifrons_ give the diagnosis of _Thionia sensu stricto_ as C. Stål (1859) treated this genus when he described it (for neotype designation for _Issus longipennis_ Spinola, 1839—type species of _Thionia_ see Gnezdilov & Dmitriev in press) and it is an opportunity to revise the genus _Thionia sensu lato_. Thus my examination of four species known from Canada, USA and Mexico and described or included in _Thionia_ after C. Stål showed that they do not belong to _Thionia sensu stricto_ and accordingly two new genera are erected here to accommodate them.

In newly proposed classification of the family Issidae Spinola (Wang et al. 2016) the last one is devided into three subfamilies with the subfamily Thioniinae Melichar treated as including “…_Thionia_ Stål and all Neotropical taxa (such as _Oronoqua_ Fennah, 1947) with their hind wing having a A2 vein branched and Pcu and A1 veins free, not partially fused” (Wang et al. 2016: 230). However _Thionia cinctifrons_ (Stål) redescribed here and been a member of _Thionia sensu stricto_, as well as _Cheiloceps_ Uhler and new genera described below are different from _Oronoqua_ Fennah in fore and hind wing venations (Figs 2–5, 9–16). These data give me the arguments to treat the tribe Thioniini comprising at least two subtribes—Thioniina Melichar with the genera _Thionia_ Stål, _Cheiloceps_ Uhler, _Fowlerium_ gen. n., and _Aplos_ gen. n. and a new subtribe with the genus _Oronoqua_ Fennah. Thus the diagnosis of the subfamily Thioniinae and the tribe Thioniini Melichar _sensu_ Wang et al. (2016) should be reduced up to one character—second anal vein (_A_2) with two and more branches which was discovered for most of American genera, except _Picumna_ Stål, 1864, _Proteinissus_ Fowler, 1905, and _Amphiscepa_ Germar, 1830 (Gnezdilov 2012 and original data). The taxonomic positions of other New World issid genera except mentioned above are in need of further determination.

### Material and methods

Morphological terminology follows Gnezdilov (2003) and Gnezdilov _et al._ (2014), classification of Issidae—Wang _et al._ (2016) with the corrections mentioned above. Wing venation according to Bourgoin _et al._ (2014) with following modifications for vein abbreviations used for Issidae by Gnezdilov _et al._ (2014) and Gnezdilov & Bartlett (2018): R[number of vein branches], M, CuA, CuP, Pcu, A[ordinal number of vein from anterior wing margin]. According to this scheme radius (R) corresponds with “ScP+R+(MA) and RA, RP” and median (M) corresponds with “MP” of Bourgoin _et al._ (2014) (Fig. 10).

The specimens examined are deposited in the Naturhistoriska Riksmuseet, Stockholm, Sweden (NHRS), Smithsonian Institution, National Museum of Natural History, Washington, D.C., USA (USNMNH), and Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia (ZIN).

### Taxonomy

**Family Issidae Spinola, 1839**

**Subfamily Thioniinae Melichar, 1906**

**Tribe Thioniini Melichar, 1906**

**Subtribe Thioniina Melichar, 1906**

Type genus: _Thionia_ Stål, 1859.

**Diagnosis.** Fore wings dull, coleopterous, with its apices never overlapping. Hind wings as long as fore wings, 3-lobed, with remigial, remigio-vannal, and anal lobes are almost equal in width; cubital cleft deep (Fig. 2, 4, 9–13). Hindwing vein sequence: apical parts of CuA1,2 and CuP are closely situated, with a transverse vein between them,
its apices free; Pcu and A\textsubscript{1.1} are closely situated (Figs 11–13) or fused medially (Figs 2, 4, 9, 10); A\textsubscript{2} with 2 and more branches. Distal parts of remigial and remigio-vannal lobes with few transverse veins.

**Composition.** Currently *Thionia* Stål, 1859, *Cheiloceps* Uhler, 1895, *Fowlerium* gen. n., and *Aplos* gen. n. Apparently still undescribed species from Miocene Mexican amber illustrated by Grimaldi & Engel (2005, figs 2.25, 2.26) with hind wing venation very close to *Aplos simplex* (Germar, 1830) (Fig. 11) also belongs to this subtribe.

**Comparison.** Presence of Pcu + A\textsubscript{1.1} anastomosis in *Thionia sensu stricto* and *Cheiloceps* species makes the subtribe Thioniina close to Oriental tribe Sarimini Wang, Zhang et Bourgoin, 2016, however, A\textsubscript{2} with two and more branches shows derived condition of American taxa in comparison with Sarimini having A\textsubscript{2} simple. From another side many Sarimini are characterized by fusion and flattening of apical parts of CuA and CuP which is kind of specialization connected with depression of cubital cleft used for tucking of hind wing below fore wing.

**Genus Thionia Stål, 1859**

*Thionia* Stål, 1859: 321. Type species: *Issus longipennis* Spinola, 1839.

**Diagnosis.** Metope wide, almost square, with distinct median and sublateral carinae joined at one point on its upper margin which is straight (Fig. 1). Metope and coryphe joined at obtuse angle (in lateral view) (Fig. 3). Coryphe transverse (Fig. 2). Fore wings long and narrow, rounded apically, far surpassing the apex of abdomen. Forewing vein sequence: R 2–3, with first furcation near to basal cell; M 2, furcating before wing middle; CuA 1. Clavus long, open –Pcu+A\textsubscript{1} runs into apex of clavus. Hind wings well developed, 3-lobed. Hindwing vein sequence: R 2, furcating after wing middle; M 1; CuA 2, furcating apically; CuP 1; Pcu 2, furcating apically and partly fused with A\textsubscript{1.1} at mid length; A\textsubscript{2}; A\textsubscript{2.1}, furcating at mid length (Fig. 2).

**Notes.** Thanks to kind help of Dr. Gunvi Lindberg the type specimen of *Issus cinctifrons* Stål, 1854 is located in the collection of Naturhistoriska Riksmuseet in Stockholm (Sweden). This single male perfectly matching with Stål’s original description of the species (Stål 1854: 247). In particular *I. cinctifrons* is characterized by wide almost square metope with median carina running from its upper margin to its middle and full sublateral carinae turned to median line above clypeus (Fig. 1). Metope with two rows of yellow spots—traces of larval sensory pits. Fore wings long and narrow, light brown yellowish with green spots besides of claval suture and with longitudinal veins yellow greenish (Figs 2, 3). From other side according to Spinola’s description of *Issus rubrocostatus* this species is characterized by metope much longer than wide, without carinae—“Front, plus long que large…sans traces de divisions en trois facettes…” and “Base du front…sans arête médiane.” (Spinola 1839: 357). In coloration *I. rubrocostatus* is distinguished by red longitudinal veins of fore wings—“Nervures principales, rouges…” (Spinola 1839). Thus it is clear that M. Spinola and C. Stål described two different species from Brazil.

*Thionia cinctifrons* (Stål, 1854)

Figures 1–3

*Issus cinctifrons* Stål, 1854: 247.


**Note.** For proposed synonymy of *Issus longipennis* Spinola, 1839 and *I. cinctifrons* Stål, 1854 in accordance with neotype designation see Gnezdilov & Dmitriev (in press).

**Genus Cheiloceps Uhler, 1895**

*Cheiloceps* Uhler, 1895: 68. Type species: *Cheiloceps musca* Uhler, 1895.

*Thionia* (*Cheiloceps*): Fennah 1955: 34 (as subgenus).
TO THE REVISION OF THE GENUS THIONIA STÅL

Diagnosis. Metope elongate, with distinct (sometimes not for the whole length) median carina and sublateral carinae (sometimes weak) (Fennah 1965, fig. 29) (Fig. 6). Median and sublateral carinae joined below upper margin of metope. Coryphea nearly square, often with incomplete median carina (Fennah 1965, fig. 30) (Fig. 4). Second and third segments of rostrum are almost equal in length; third segment narrowing apically (Fig. 17). Fore wings elongate, surpassing abdomen, without hypocostal plate. Forewing vein sequence: R 2–3, with first furcation near to basal cell; M 2, furcating before wing middle; CuA 1. Clavus long, open—Pcu+A, runs into apex of clavus (Fennah 1965, fig. 32). Hind wings well developed, 3-lobed, with distinct coupling lobe on its anterior margin (Figs 9, 10). Hindwing vein sequence: R 2, furcating after wing middle; M 1; CuA 2, furcating apically; CuP 1; Pcu 2, furcating apically and partly fused with A1, at mid length; A2; A2–3, firstly furcating at mid length (Figs 4, 5). Hind tibia with 2 lateral spines in distal half. First metatarsomere with a whole row of spines arranged in arc. Phallobase poorly sclerotized dorso-apically. Aedeagus with often poorly sclerotized ventral hooks, curved and directed ventrocephalad (Fennah 1965, fig. 33). Gonoplacs elongate and tapering distad (Figs 4, 7). Female anal tube long and narrow.

FIGURES 1–3. Thionia cinctifrons (Stål), holotype. 1—frontal view; 2—dorsal view; 3—lateral view.
*Cheiloceps musca* Uhler, 1895

Figs 4–8, 9, 17


**Other material examined.** 1♂, “St. Lucia / West Indies”, “on *Clusia* sp. / Soufriere / Feb. 1939”, “RGFennah / Collector 712”, “Lot № 40-18160” (USNMNH); 1♀, “Dominica / West Indies”, “Ridgefield / 1200 ft. / Jan. 1940”, “RGFennah / Collector 687” (USNMNH).

![Cheiloceps musca Uhler](image)

**FIGURES 4–8.** *Cheiloceps musca* Uhler, cotype. 4—dorsal view; 5—lateral view; 6—frontal view; 7—ovipositor, lateral view; 8—labels.
Cheiloceps argo (Fennah, 1949), comb. n.

Fig. 10

*Thionia argo* Fennah, 1949: 60, figs 20–23.

**Material examined.** 1 ♀, British Virgin Is., Guana Island, July 1985, Scott E. Miller leg. (ZIN).

Cheiloceps anguillana (Fennah, 1965), comb. n.


**Note.** Transferred to the genus according to original description and figures with peculiar ventral aedeagal hooks (Fennah, 1965).

Cheiloceps borinqueta (Caldwell et Martorell, 1951), comb. n.


**Note.** Transferred to the genus according to original description and figures including male genitalia with peculiar ventral aedeagal hooks (Caldwell & Martorell 1951).

Cheiloceps puertoricensis (Caldwell et Martorell, 1951), comb. n.


**Note.** Transferred to the genus according to original description and figures including male genitalia with peculiar ventral aedeagal hooks (Caldwell & Martorell 1951).

Fowlerium gen. n.

Type species: *Thionia naso* Fowler, 1905.

**Diagnosis.** Metope elongate, with distinct median and sublateral carinae joined in one point on its upper margin (Doering 1938, Pl. 52: 8, 10). Coryphe elongate, with distinct median carina running from its anterior margin to its middle; anterior margin acutely angulately convex (Doering 1938, Pl. 51: 2, 5). Second and third segments of rostrum are almost equal in length; third segment narrowing apically (Fig. 18). Fore wings elongate, surpassing abdomen, with narrow hypocostal plate. Forewing vein sequence: R 2, furcating near to basal cell; M 2, furcating before wing middle; CuA 1. Clavus long, open—Pcu + A 1 runs into apex of clavus. Pcu fusing A 1 after middle of clavus. CuA 2 and CuP not fused apically, but connected by several transverse veins (Figs 12, 13). Pcu and A 1 not fused medially, free. Hindwing sequence: R 2-m-1 M 1 m-cua 1 CuA 2 cua-cup 2-5 CuP 1 cup-pcu 1 Pcu 3 pcu-a, 1 A 1, 2 A 2–4. Hind tibia with 2 lateral spines. First metatarsomere with a whole row of spines arranged in arc. Ventral aedeagal hooks slightly furcating subapically (Doering, 1938, Pl. 55: 1, 7, 8). Ovipositor with rounded gonoplacs. Hind margin of VII sternum with large semicircular process.


**Composition.** In addition to type species *Thionia producta* Van Duzee, 1908 and *T. acuta* Doering, 1941 also belong to this genus.
FIGURES 9–11. Thioniína, hind wing. 9—Cheiloceps musca Uhler; 10—Cheiloceps argo (Fennah); 11—Aplos simplex (Germar). Abbreviations: rl—remigial lobe; rvl—remigio-vannal lobe; al—anal lobe.

**Fowlerium naso** (Fowler, 1905), comb. n.

Figs 12, 18

*Thonia naso* Fowler, 1905: 124, Tab. 12, figs 21, 21a.


**Fowlerium acutum** (Doering, 1941), comb. n.

*Thonia acuta* Doering, 1941: 214.


**Note.** Transferred to the genus according to original description (Doering 1938, 1941).
**Fowlerium productum** (Van Duzee, 1908), comb. n.

Fig. 13

**Thionia producta** Van Duzee, 1908: 494.


**FIGURES 12–13. Fowlerium spp., hind wing. 12—F. naso (Fowler); 13—F. productum (Van Duzee).**

**Aplos gen. n.**

Type species: *Issus simplex* Germar, 1830.

**Diagnosis.** Metope wide, with distinct median carina running from its upper margin to metopoclypeal suture and very weak sublateral carinae visible only in its upper part and joined median carina below upper margin of metope (Gnezdilov & Poggi 2014, fig. 3); lateral margins convex. Coryphe transverse, 1.5 times as wide as long at midline, with weak incomplete median carina (Gnezdilov & Poggi 2014, fig. 1). Second and third segments of rostrum are almost equal in length; third segment narrowing apically. Fore wings elongate, surpassing abdominal apex, with narrow hypocostal plate. Forewing vein sequence: R 2, furcating very close to basal cell; M 3, first furcation in basal third of the wing, second furcation in apical third; CuA 1 (Gnezdilov & Poggi 2014, fig. 2). Clavus long.
open—Pcu + A, runs into apex of clavus. Pcu fusing A, after middle of clavus (Gnezdilov & Poggi 2014, fig. 1). Hind wings 3-lobed, with deep cubital cleft and without coupling lobe on its anterior margin (Fig. 11). Hind wing vein sequence: R 2 r-m 1 M 1 m-cua 1 CuA 2 cua-cup 1 CuP 1 cup-pcu 1 Pcu 3 pcu-a, 1 A 1, 2 A 2. Hind tibia with 2 lateral spines in its apical half. First metatarsomere with a whole row of spines arranged in arc. Dorso-lateral phallobase lobes fused dorsally, poorly sclerotized apically. Each dorso-lateral phallobase lobe with a large hook-shaped apical process (Doering 1938, Pl. 55: 2).

**Etymology.** Generic name derived from Greek “Aplos” (simple). Masculine in gender.

**Composition.** Apparently *Thionia bullata* (Say, 1830) (originally *Flata bullata* Say, 1830) also belongs to this genus according to the structure of phallobase bearing hook-shaped apical process, however, this species differs from the type species by furcating subapically ventral aedeagal hooks (Doering 1938, Pl. 55: 10) and distinct sublateral carinae of metope (Bartlett et al. 2014, fig. 86D). The correct taxonomic position of this species needs to be confirmed.

**FIGURES 14–16.** *Oronoqua ibisca* Gnezdilov, Bonfils, Aberlenc et Basset. 14—fore wing; 15—hind wing; 16—total view (after Gnezdilov et al. 2010). Total length of the specimen—14 mm.

**Aplos simplex** (Germar, 1830), comb. n.

Fig. 11

*Issus simplex* Germar, 1830: 51.


**Material examined.** 1♂, Italy, Lombardia, 20 km N of Milan, Maresso, 6.IX.2014, F. Poggi leg. (ZIN).

**Supplementary description.** Male pygofer with almost straight hind margin, except slightly protruding medially. Ventral phallobase lobe long and wide, narrowing apically. Apical aedeagal processes not narrowing
apically, truncate, well visible above upper margin of phallobase. Ventral aedeagal hooks arising in apical third of aedeagus, long, simple apically, directed to aedeagal base. Style massive, with almost straight hind margin, caudo-
dorsal angle right. Capitulum of style long and narrow, narrowing apically (in dorsal view); lateral tooth wide;
apical tooth small. Anal tube long and narrow, narrowed medially and widely rounded apically (in dorsal view), flat
(in lateral view). Anal column short.

Subtribe Oronoquina subtrib. n.

Type genus: Oronoqua Fennah, 1947

Diagnosis. Fore wings elongate, opaque, with its apices overlapping and with many transverse veins between longitudinal veins (Figs 14, 16). Forewing vein sequence: R 2, furcating near to basal cell; M 2–3, furcating before wing middle; CuA 1. Clavus long, open –Pcu+A, runs into apex of clavus. Pcu fusing A 1 at middle of clavus. Hind wings as long as fore wings, 3-libed, with remigial, remigio-vannal, and anal lobes wide; cubital cleft weak (Fig.
15). Hindwing vein sequence: apical parts of CuA 1,2 and CuP are closely situated, with several transverse veins between them, not fused; Pcu and A 1,1 not fused, with several transverse veins between them; A 2,3. Distal parts of R, M, CuA, CuP, Pcu, and A 1,1 with many transverse veins between them.

Composition. The genus Oronoqua Fennah with two species known from Guyana, French Guiana, and Panama (Gnezdilov et al. 2010).

FIGURES 17–18. Thioniina, rostrum in lateral view. 17—Cheiloceps musca Uhler; 18—Fowlerium naso (Fowler).

Thioniini incertae sedis

All other species still currently placed in the genus Thionia are provisionaly placed in Thioniini incertae sedis awaiting for their new generic placement.
Discussion

The genera *Picumna* Stål, 1864, *Proteinissus* Fowler, 1905, and *Amphiscepa* Germar, 1830 differ from most of American genera examined up to now according to hind wing venation (Gnezdilov 2012; Gnezdilov & Bartlett 2018 and original data) by simple second anal vein (A2) which is a character of Old World Issidae. Molecular study of the family by Wang et al. (2016) showed isolated position of *Picumna* from Thioniinae and its placement near to Hemisphaeriinae. However if *Picumna* and *Proteinissus* have 3-lobed hind wings with anal lobe of vannus well developed, *Amphiscepa* has almost one-lobed hind wing with anal lobe of vannus rudimentary. Apparently the simplification of second anal vein in *Amphiscepa* is connected with reduction of anal lobe. Finally the genus *Ulixes* Stål, 1862 has one-lobed hind wing with anal lobe of vannus reduced. Thus the taxonomic position of these genera is still unclear and needs further morphological and molecular studies.

Hind wing anastomosis between Pcu and A1.1 known in Neotropical, Oriental, and Australian isid taxa is unstable character and apparently may appear and disappear independently in different taxa during the evolution of the group. This condition is very characteristic for Oriental and Australian taxa, however, already in the tribe Parahiracini *Nisoprincessa palawana* Gnezdilov, 2017 has long anastomosis (Gnezdilov 2017b, fig. 13), *Scantinius bruchoides* (Walker, 1858)—short anastomosis (Gnezdilov 2012, fig. 3), and the genera *Thabenula* Gnezdilov, Soulier-Perkins et Bourgoin, 2011 and *Flavina* Stål, 1862 have the veins Pcu and A1.1 free and just connected by several transverse veins (Gnezdilov et al. 2011, fig. 18C; Zhang et al. 2010, figs 23, 33). In this row of Parahiracini taxa the genera *Scantinius* Stål, 1866 and *Nisoprincessa* Gnezdilov, 2017 are characterized by primitive hind wing structure as their wing 3-lobed with well developed anal lobe already rudimentary in other taxa with bilobed wings like *Thabenula* and *Flavina* (Gnezdilov & Wilson 2007, fig. 5). Finally in Neotropical ditypical genus *Waorania* Gnezdilov et Bartlett, 2018 one species with short anastomosis (Pcu + A1.1) and another species— with Pcu and A1.1 free (Gnezdilov & Bartlett 2018, figs 12, 25). These examples demonstrating that fusion or separation of postcubital and first anal veins of hind wings are easy happened in different groups and probably in both directions in accordance to functional needs.

Two new genera described above are marking beginning of revision of *Thionia sensu lato* which have to be continued by reexamination of all species currently included in this genus which is important for study of New World Issidae biodiversity and taxonomy.

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