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## Research article

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# *Viuria* Grishin, 2019 (Lepidoptera: Hesperiiidae): taxonomy, description of two new species, and remarks on the morphology of secondary sexual organs of males

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**Abstract.** The taxonomy of the Neotropical Carcharodini genus *Viuria* Grishin, 2019 (Lepidoptera: Hesperiiidae: Pyrginae) is presented. Two new species are described: *Viuria inanna* sp. nov. from south-southeastern habitats Brazil and Paraguay, and *Viuria acadia* sp. nov. from Brazil and Ecuador. Illustrations of adults, including morphology of secondary sexual organs in males, male and female genitalia, diagnoses, remarks, and updated geographical distributions are also provided for all species.

**Keywords.** Androconia, butterflies, Pyrginae, skippers.

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## Introduction

*Viuria* Grishin, 2019 (Lepidoptera: Hesperiiidae: Pyrginae) was recently described based on molecular evidence to include three species previously placed in *Pachyneuria* Mabilie, 1888: *V. herophile* (Hayward, 1940), *V. licisca* (Plötz, 1882) and *V. lista* (Evans, 1953) (Cong *et al.* 2019). Molecular evidence shows that *Viuria* is a monophyletic genus closely related to *Viola* Evans, 1953, and not to *Pachyneuria* (Cong *et al.* 2019). Species of *Viuria* share with some species of *Viola* the presence of a fold in the hindwings containing long tufts of hair-like scales that cover a swollen portion of the vein

Rs+M1 (Evans 1953; Steinhauser 1989). This feature is also similar to that found in some *Nisoniades* Hübner, [1819] (Steinhauser 1989), *Mictris* Evans, 1955, *Pellicia* Herrich-Schäffer, 1870 and *Polycitor* Evans, 1953, and is considered a secondary sexual organ in males, although this structure was never studied in detail in the species of Carcharodini.

After conducting a detailed study of Neotropical Carcharodini, two unnamed species of *Viuria* were found deposited in some Brazilian institutions (see Material and methods). Thus, this study aims to describe two new species of *Viuria* from Brazil, Paraguay, and Ecuador, as well as provide an updated morphological characterization for all species of the genus. Detailed illustrations of the adults, including morphology of secondary sexual organs in males, male and female genitalia, diagnoses, and updated geographical distributions are also provided.

## Material and methods

For the study of the genitalia, the specimens had their abdomens detached and soaked in a heated 10% potassium hydroxide solution (KOH) for 5–10 minutes, and afterward dissected. All dissected genitalia were stored in vials with glycerin. The morphological terminology follows Carneiro *et al.* (2013). For the study of the secondary sexual organs, some specimens had their wings removed and then cleared in sodium hypochlorite (NaOCl). Dissected specimens are marked with an asterisk (\*) after the code number in the material examined section. The secondary sexual organs and the genitalia were photographed using the photo stacking process associated with a Leica® Application Suite ver. 4.12.0 stereo microscope.

Distributional maps were generated with SimpleMappr (Shorthouse 2010) from the collecting data of the specimens analyzed and literature records. In the latter case, records of reliable sources were considered only if they increased the distribution area based on the material examined.

## Institutional abbreviations

- DZUP = Coleção Entomológica Padre Jesus Santiago Moure, Universidade Federal do Paraná, Curitiba, Paraná, Brazil  
OM = Olaf Mielke collection, Universidade Federal do Paraná, Curitiba, Paraná, Brazil  
ZUEC = Coleção Zoológica do Museu de Diversidade Biológica da Universidade Estadual de Campinas, Campinas, São Paulo, Brazil

## Abbreviations for morphological terms

- DFW = dorsal side of the forewing  
DHW = dorsal side of the hindwing  
FW = forewing  
HW = hindwing  
VW = ventral side of the wing

## Results

### Taxonomy

Order Lepidoptera Linnaeus, 1758  
Superfamily Papilionoidea Latreille, [1802]  
Family HesperIIDae Latreille, 1809  
Subfamily Pyrginae Burmeister, 1878  
Tribe Carcharodini (Verity, 1940)

Genus *Viuria* Grishin, 2019

### Diagnosis

Adults are characterized by the following characters: wings ground color brown, DFW without apical hyaline spots (differing from *Nisoniades* and *Viola*); DFW with costal, cellular, discal, and submarginal spots dark brown; DHW with discal and submarginal spots dark brown; DHW of males with long tufts of hair-like scales near the base of the costal fold, and another patch of modified creamy scales near the base of the swollen veins Rs and M<sub>1</sub>; both males and females with a patch of modified greyish scales in the swollen vein Sc+R<sub>1</sub>; VW light brown; male and female genitalia asymmetrical; uncus bent downwards; tegumen with lateral asymmetric projections; sterigma with a spine-like process cover ventrally, ostium bursae opening ventrally at left side.

*Viuria herophile* (Hayward, 1940)

Figs 1A–D, 2–3, 12A–B

### Diagnosis

*Viuria herophile* resembles *V. licisca* in the genitalia pattern but is easily distinguished by the ventral left portion of the tegumen thin and rounded while in *V. licisca* curved inwards; left valva with ampulla rounded and well-developed, and harpe dorsally serrated, while in *V. licisca* the ampulla is truncated; right valva with harpe rounded dorsally, while in *V. licisca* the harpe has a spine-like process curved inwards; distal portion of aedeagus left curved, while in *V. licisca* curved upwards. Females with the right portion of the sterigma expanded ventrally, while in *V. licisca* the left portion of the sterigma has a developed process dorsally.

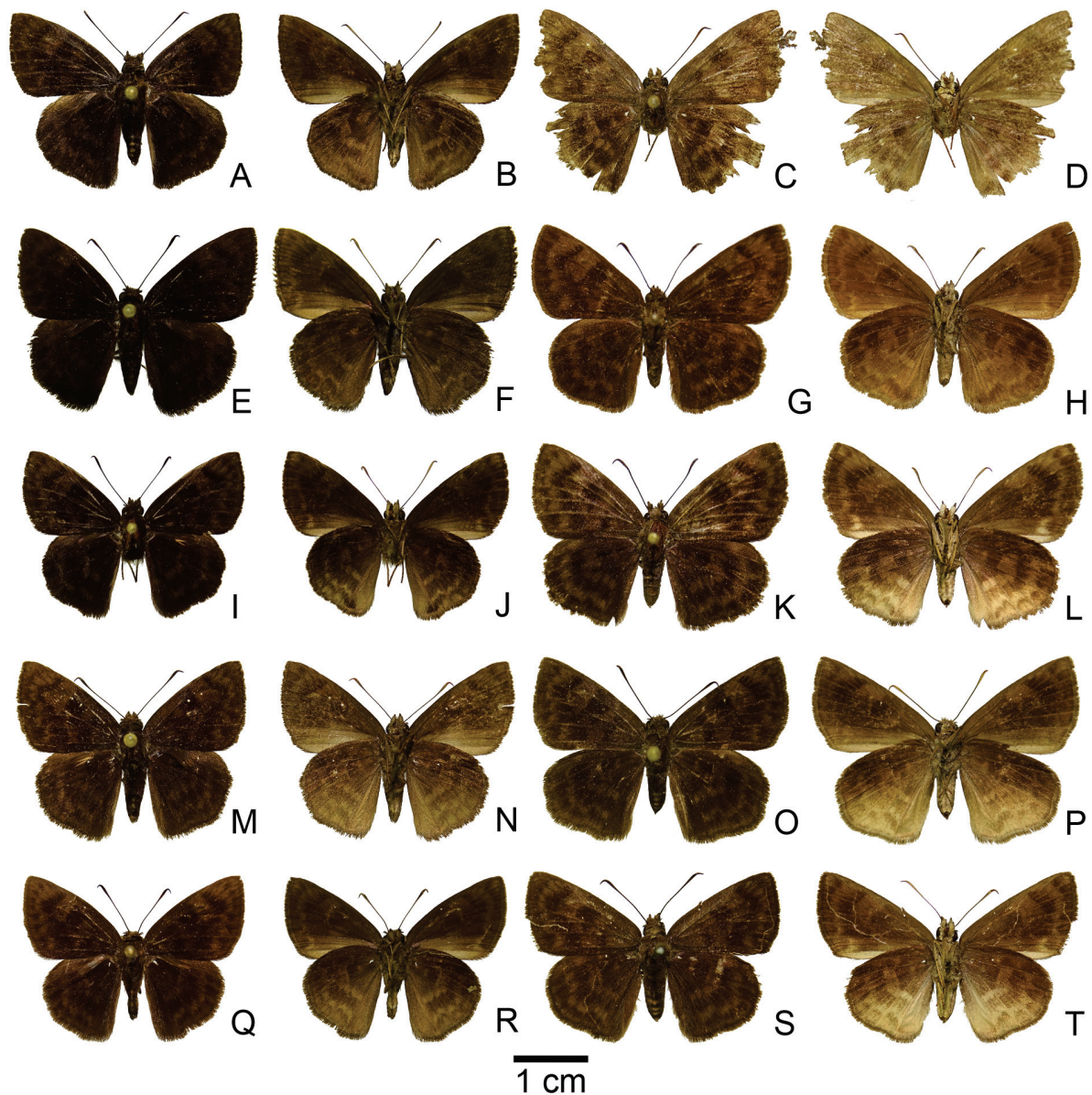
### Material examined

BRAZIL – Acre • 1 ♂; Senador Guiomard, Reserva Catuaba; 2–5 Sep. 2004; Mielke and Carneiro leg.; DZ 52.467; DZUP • 1 ♀; Bujari; 18–20 Sep. 2003; Mielke and Casagrande leg.; DZ 47.221; DZUP • 1 ♂; Santa Rosa do Purus; 3–5 Aug. 2008; Mielke and Carneiro leg.; DZ 15.617; DZUP.

PERU • 1 ♂; Huanuco, Tingo Maria; Oct. 1996; Büche leg.; OM 46.811; OM • 15 ♂♂; Madre de Dios, Parque Manu, Pakitza, [11°55'48" S, 71°15'18" W]; 10–29 Oct. 1991; Mielke leg.; DZ 9.681, DZ 9.676–9.677, DZ 47.161, DZ 47.282–47.283, DZ 47.291–47.293, DZ 47.301–47.303, DZ 52.464–52.466; DZUP.

### Taxonomic remarks

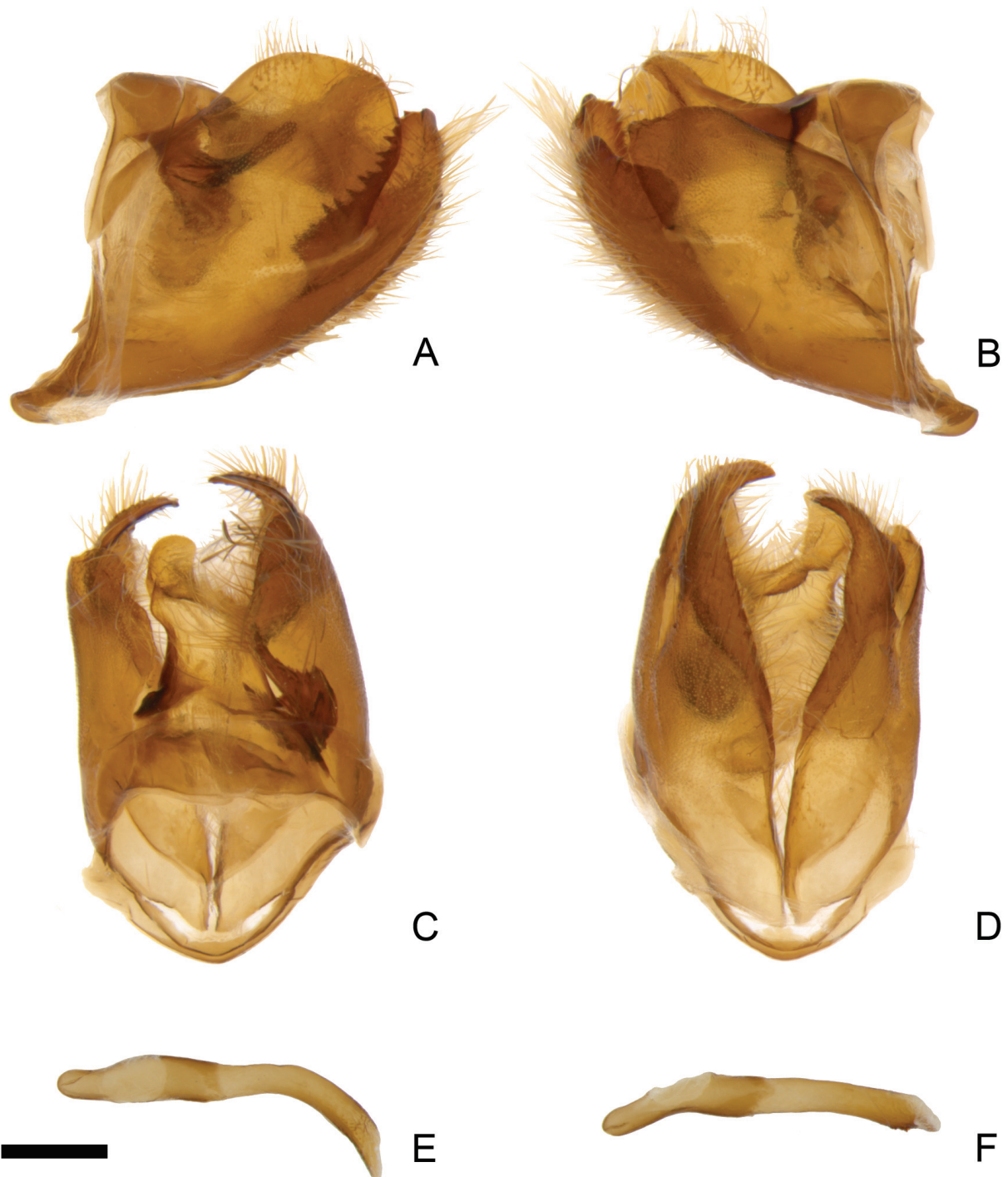
Evans (1953) considered *Pellicia herophile* Hayward, 1940 as a subspecies of *Pachyneuria licisca* Plötz, 1882. Later, Steinhauser (1989) elevated its status as a species of *Pachyneuria*, and this taxonomy has been followed until the description of the genus *Viuria* (Cong *et al.* 2019).



**Fig. 1.** Species of *Viuria* Grishin, 2019, dorsal and ventral views. **A–D.** *V. herophile* (Harward, 1914). **A–B.** ♂, Peru, Madre de Dios, Parque Manu, Pakitza (DZ 52.466). **C–D.** ♀, Brazil, Acre, 50 km NO of Bujari (DZ 47.221). **E–H.** *V. licisca* (Plötz, 1882). **E–F.** ♀, Costa Rica, San José, Ciudad Colón (OM 26.945). **G–H.** ♂, Mexico, Oaxaca, Candelaria Loxicha (DZ 47.162). **I–L.** *V. lista* (Evans, 1953). **I–J.** ♀, Brazil, Rondônia, 58 km W of Ariquemes (OM 14.507). **K–L.** ♀, Brazil, Rondônia, 58 km W of Ariquemes, (OM 14.504). **M–P.** *V. inanna* sp. nov. **M–N.** ♂, holotype (DZ 52.489), Brazil, Paraná, Fênix. **O–P.** ♀ (DZ 52.492), Brazil, Paraná, Fênix. **Q–T.** *V. acadia* sp. nov. **Q–R.** ♂, holotype (DZ 52.520), Brazil, Mato Grosso, 31 km NO of Barra do Bugres. **S–T.** ♀ (DZ 52.517), Brazil, Mato Grosso, 31–35 km NO of Barra do Bugres.

### Geographical distribution

*Viuria herophile* is distributed in the Amazon basin, with records from Ecuador, Peru, and Brazil (Fig. 14). Evans (1953) also cited the occurrence of *V. herophile* in the state of Minas Gerais, Brazil, and in Paraguay, but these specimens were not examined in the present study.



**Fig. 2.** Male genitalia of *Viuria herophile* (Harward, 1914) (DZ 9.681). **A.** Left lateral view. **B.** Right lateral view. **C.** Dorsal view. **D.** Ventral view. **E.** Aedeagus, dorsal view. **F.** Aedeagus lateral view. Scale bar: 500  $\mu$ m.

*Viuria licisca* (Plötz, 1882)

Figs 1E–H, 4–5, 12C

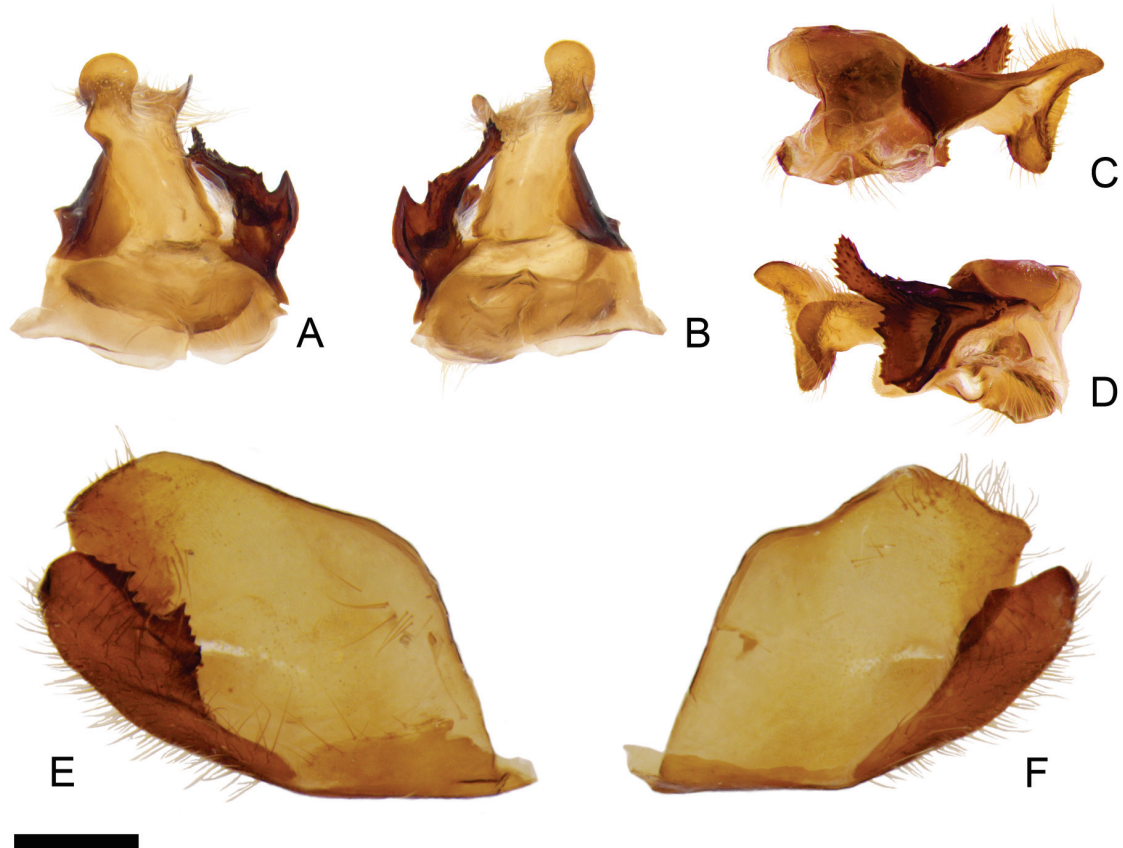
**Diagnosis**

*Viuria licisca* resembles *V. herophile* in the genitalia pattern but is easily distinguished by the ventral left portion of the tegumen rounded and curved inwards, while in *V. herophile* thin and rounded; left valva with ampulla truncated while in *V. herophile* rounded and well developed; right valva with ampulla rounded and well developed, and harpe with a spine-like process curved inwards while in *V. herophile* the ampulla is rounded dorsally and the spine-like process in the harpe is absent; distal portion of aedeagus curved upwards while in *V. herophile* left curved. Females with the left portion of the sterigma with a developed process dorsally; the spine-like process is less developed when compared with its congeners.

**Material examined**

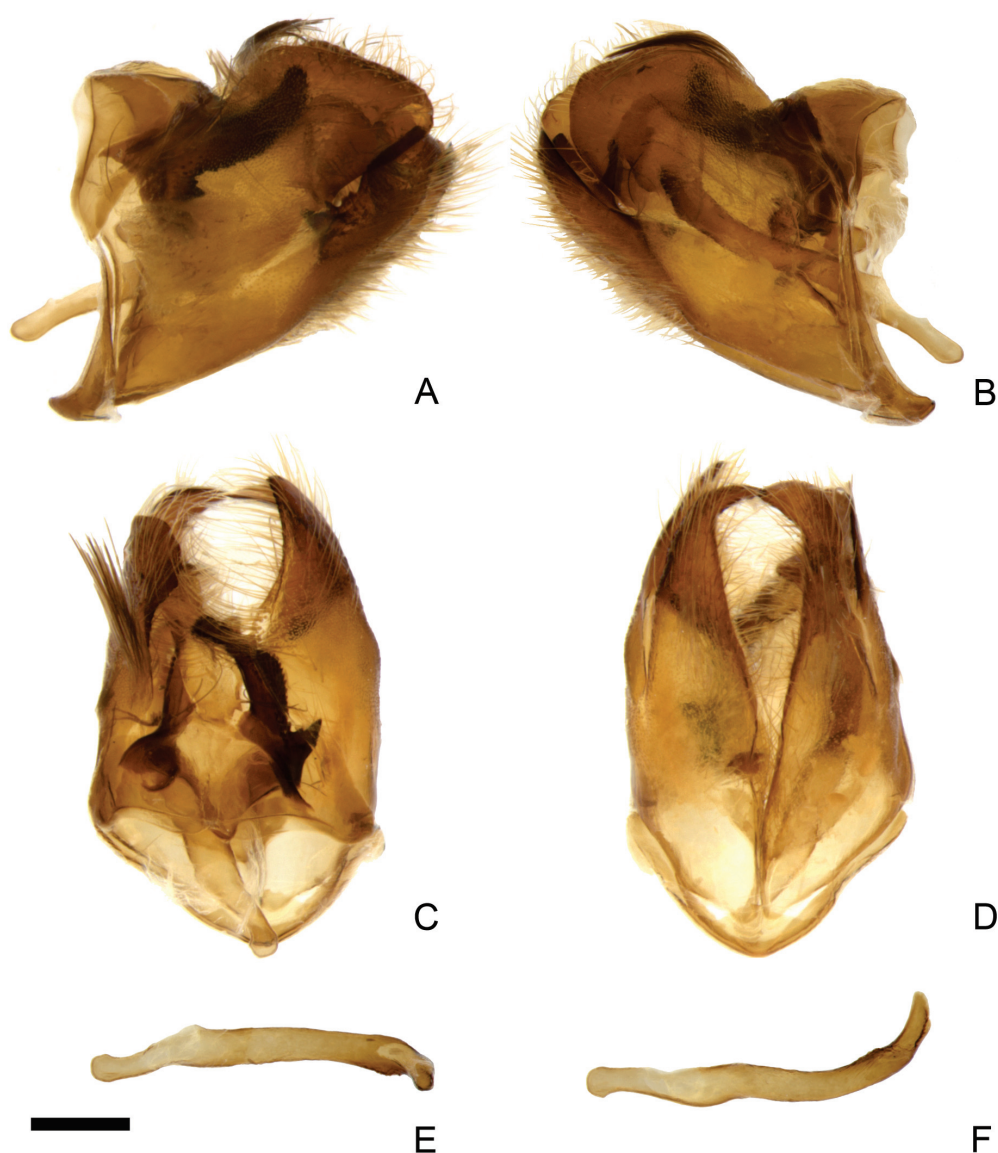
COSTA RICA • 1 ♂; Canal Zone, Cerro Galera; 22 Sep. 1978; Robbins leg.; DZ 47.241; DZUP • 1 ♂; Canal Zone, Summit; 27 Jun. 1977; Robbins leg.; DZ 47.242; DZUP • 1 ♂; Limón, Siquirres; alt. 200 m; 27 Jan. 1973; Becker leg.; DZ 47.231; DZUP • 1 ♂; same collection data as for preceding; DZ 47.243; DZUP • 1 ♂; San José; Ciudad Colón; 6 Sep. 1990; Pagels leg.; OM 26.945; OM • 1 ♂; same collection data as for preceding; OM 26.521; OM • 1 ♀; same collection data as for preceding; OM 28.758; OM.

GUATEMALA • 1 ♂; Zacapa, La Unión; alt. 850 m; 5 Nov. 1981; Welling leg.; OM 44.935; OM.



**Fig. 3.** Male genitalia of *Viuria herophile* (Harward, 1914) (DZ 9.677). **A–D.** Uncus and tegumen. **A.** Dorsal view. **B.** Ventral view. **C.** Left lateral view. **D.** Right lateral view. **E.** Valva, left lateral inner view. **F.** Valva, right lateral inner view. Scale bar: 500  $\mu$ m.

MEXICO • 1 ♂; Oaxaca, Candelaria Loxicha; alt. 500 m; 22. Aug. 1973; Welling leg.; DZ 47.253; DZUP; 1 ♂; same collection data as for preceding; DZ 47.263; DZUP • 1 ♂; same collection data as for preceding; 14. Aug. 1973; DZ 47.271; DZUP • 1 ♂; same collection data as for preceding; 15 Jul. 1972; DZ 47.272; DZUP • 1 ♂; same collection data as for preceding; 15. Sep. 1973; DZ 47.261; DZUP • 1 ♂; same collection data as for preceding; DZ 47.262; DZUP • 1 ♂; same collection data as for preceding; 14 Jun. 1972; DZ 47.232; DZUP • 1 ♂; same collection data as for preceding; 15 Jun. 1972; DZ 47.252; DZUP • 1 ♂; same collection data as for preceding; 4 Aug. 1972; DZ 47.163; DZUP • 1 ♂; same collection data as for preceding; 2 Aug. 1973; DZ 47.273; DZUP • 1 ♀; same collection data as for preceding; 4 Sep. 1973; DZ 47.162; DZUP • 1 ♂; Quintana Roo, Nuevo X-Can; 20. Aug. 1974; Welling leg.; DZ 47.233; DZUP • 1 ♂; Tabasco, Tenosique; 8 Aug. 1962; 31 Aug. 1962; Welling leg.; OM 43.776; OM • 1 ♂; same collection data as for preceding; 43.759; OM.



**Fig. 4.** Male genitalia of *Viuria licisca* (Plötz, 1882) (OM 43.776). **A.** Left lateral view. **B.** Right lateral view. **C.** Dorsal view. **D.** Ventral view. **E.** Aedeagus, lateral view. **F.** Aedeagus, dorsal view. Scale bar: 500  $\mu$ m.

PANAMA • 1 ♂; Colón, Achiote; 28 May 1977; Robbins leg.; DZ 47.281; DZUP.

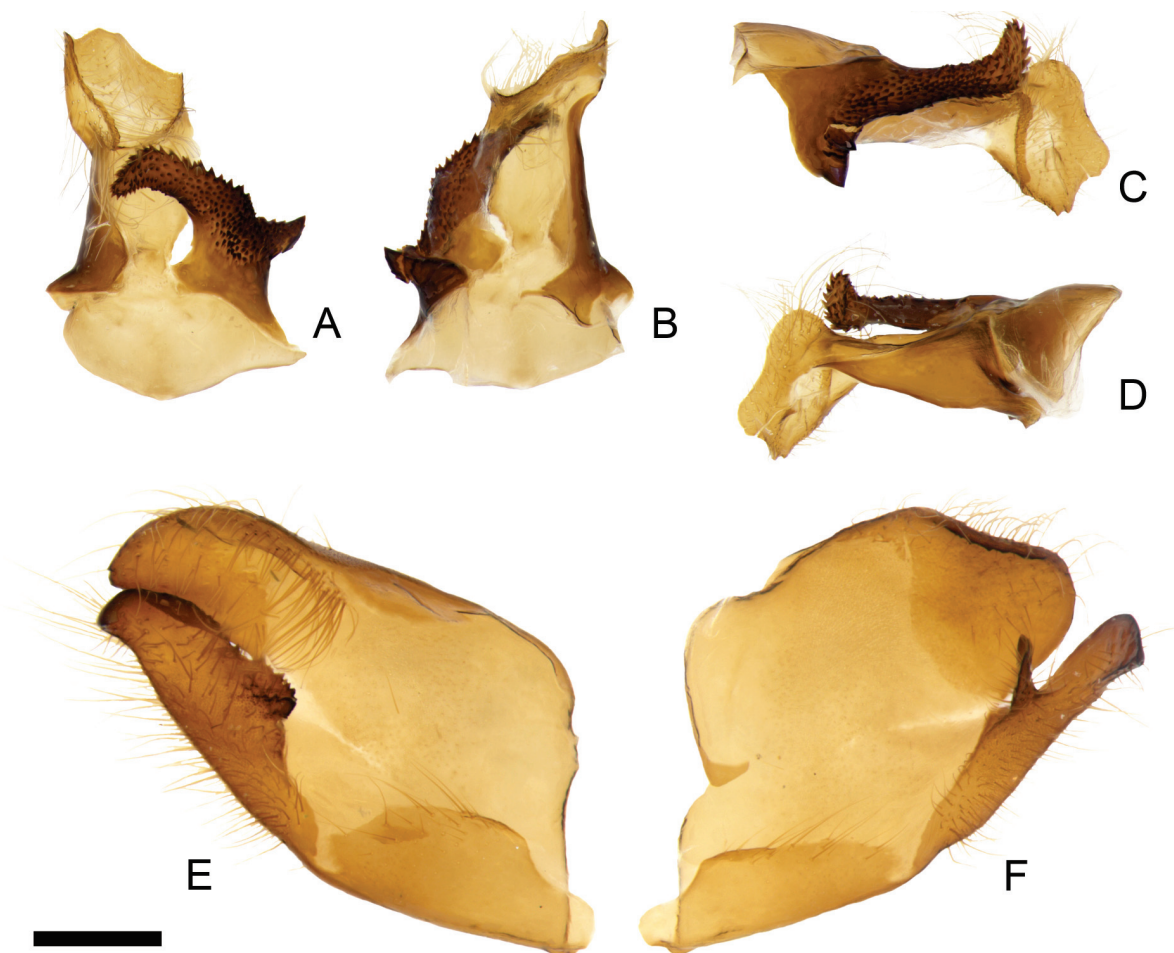
VENEZUELA • 1 ♀; Aragua, Ocumare; alt. 50 m; 4 Jul. 1982; Mielke and Casagrande leg.; DZ 47.201; DZUP • 1 ♂; El Cenizo; 14 Jun. 1957; Rosalia leg.; DZ 47.251; DZUP.

### Remarks

*Viuria licisca* (Plötz, 1882) is the only species of the genus occurring in Central America. Although Moss (1949) reported immatures of *V. licisca* on Sterculioideae (Malvaceae) in Pará, Brazil, no specimen of this species was found at this locality. Janzen & Hallwachs (2009) partially illustrated the immature stages of *V. licisca* feeding on species of *Bytneria* (Malvaceae) at the Area de Conservación de Guanacaste, Costa Rica.

### Geographical distribution

*Viuria licisca* is distributed in Central and northern South America, with records from Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, and Venezuela (Evans 1953) (Fig. 14).



**Fig. 5.** Male genitalia of *Viuria licisca* (Plötz, 1882) (OM 43.281). **A–D.** Uncus and tegumen. **A.** Dorsal view. **B.** Ventral view. **C.** Left lateral view. **D.** Right lateral view. **E.** Valva, left lateral inner view. **F.** Valva, right lateral inner view. Scale bar: 500  $\mu$ m.

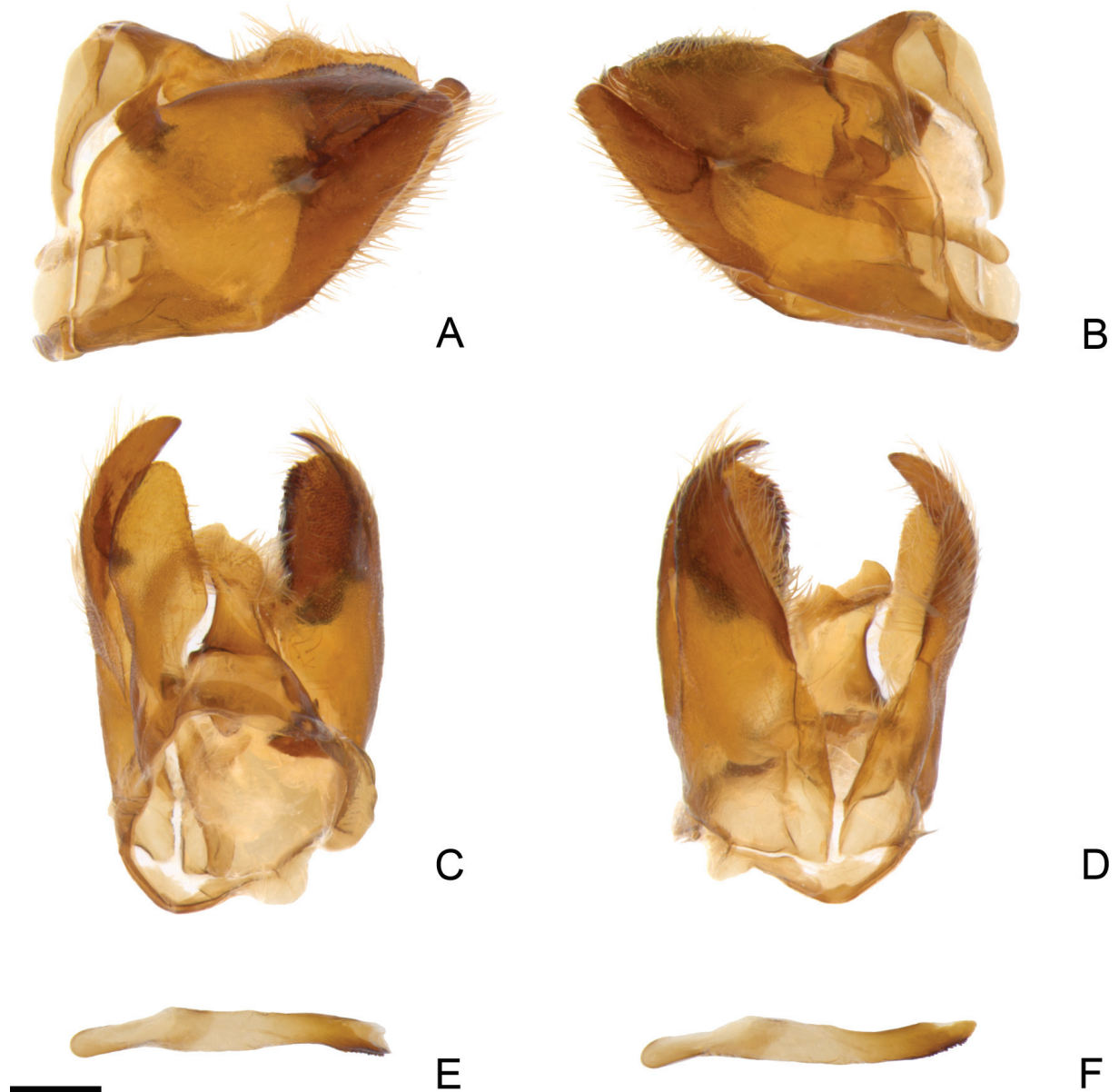


*Viuria lista* (Evans, 1953)

Figs 11–L, 6–7, 12D

**Diagnosis**

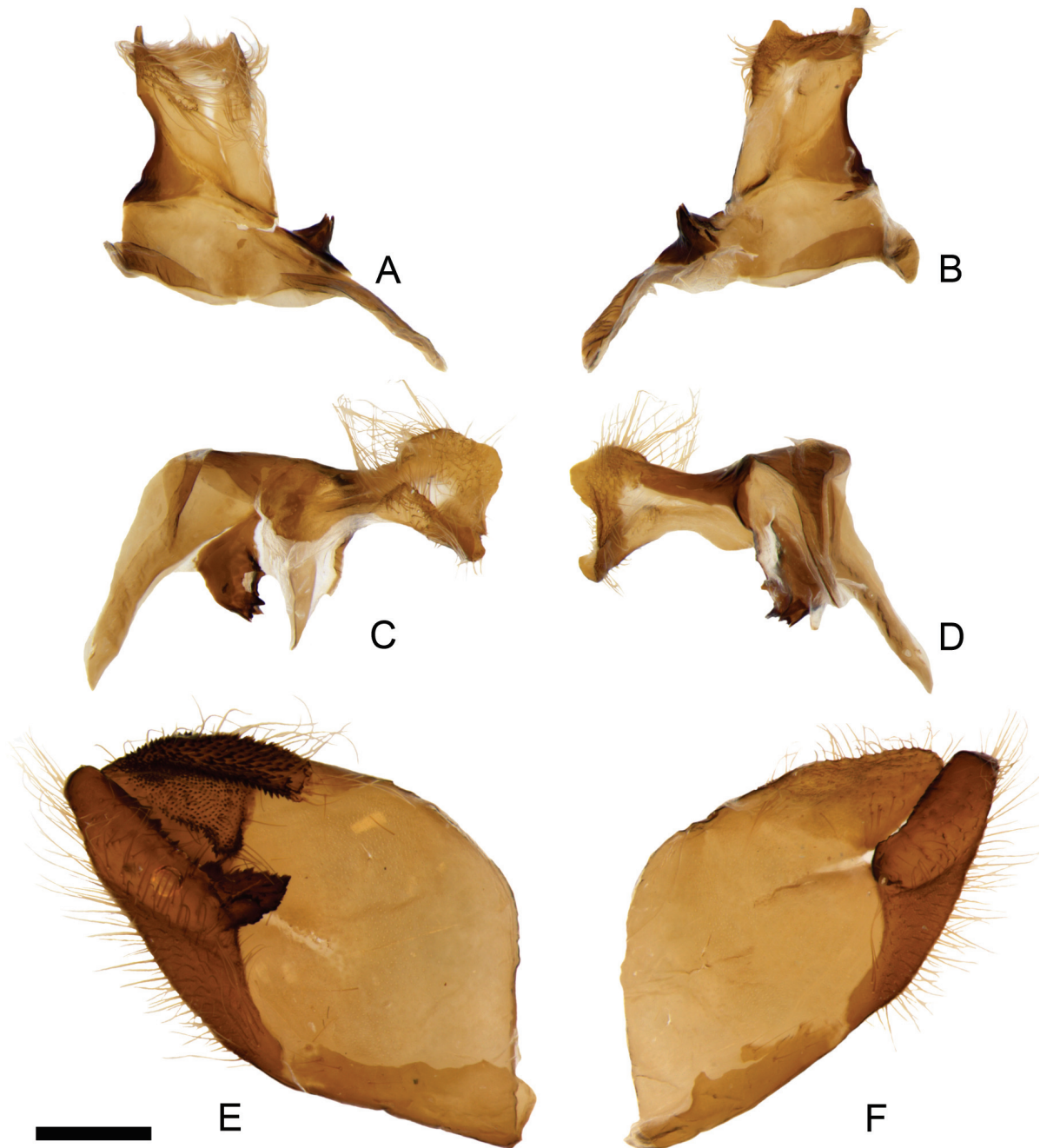
*Viuria lista* resembles *V. innana* sp. nov. in the genitalia pattern but is easily distinguished by the ventral left portion of the tegumen short while in *V. innana* sp. nov. it is bigger with a spine-like process; both valvae elongated; right ampulla with a dorsal projection and smooth margin while in *V. innana* sp. nov. the ampulla is smaller than the harpe. Females with the spine-like process of sterigma well developed and sparse when compared with its congeners.



**Fig. 6.** Male genitalia of *Viuria lista* (Evans, 1953) (OM 4.507). **A.** Left lateral view. **B.** Right lateral view. **C.** Dorsal view. **D.** Ventral view. **E.** Aedeagus, lateral view. **F.** Aedeagus, dorsal view. Scale bar: 500  $\mu$ m.

**Material examined**

BRAZIL • 1 ♂; Rondônia, Ariqueme, 19–20 Mar. 1987; Mielke leg.; OM 14.507; OM • 1 ♀; same collection data as for preceding; OM 14.504; OM • 1 ♂; Rondônia, Cacaupônia; 8–19 Nov. 1994; Mielke leg.; OM 39.078; OM.



**Fig. 7.** Male genitalia of *Viuria lista* (Evans, 1953) (OM 4.507). **A–D.** Uncus and tegumen. **A.** Dorsal view. **B.** Ventral view. **C.** Left lateral view. **D.** Right lateral view. **E.** Valva, left lateral inner view. **F.** Valva, right lateral inner view. Scale bar: 500  $\mu$ m.

**Remarks**

After its description, *Pachyneuria licisca lista* Evans, 1953 had its status elevated to species by Steinhauser (1989), with this interpretation followed until its inclusion in the genus *Viuria* (Cong *et al.* 2019).

**Geographical distribution**

*Viuria lista* is known only from French Guiana (Evans 1953) and in the state of Rondônia, Brazil (Fig. 14).

***Viuria inanna* sp. nov.**

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Figs 1M–P, 8–9, 12F

**Diagnosis**

*Viuria inanna* sp. nov. resembles *V. lista* in the genitalia pattern but is easily distinguished by the ventral left portion of the tegumen with a spine-like process while absent in *V. lista*; right valva with ampulla smaller than harpe while in *V. lista* the valva has a dorsal projection and smooth margin. Females with papilla analis moon-shaped; the spine-like process of sterigma is covered by small setae.

**Etymology**

The specific epithet refers to the ancient Mesopotamian goddess of love, war, and fertility, also known as the Queen of Heaven. Inanna was associated with the planet Venus, being related to beauty, sex, divine justice, and political power.

**Type material****Holotype**

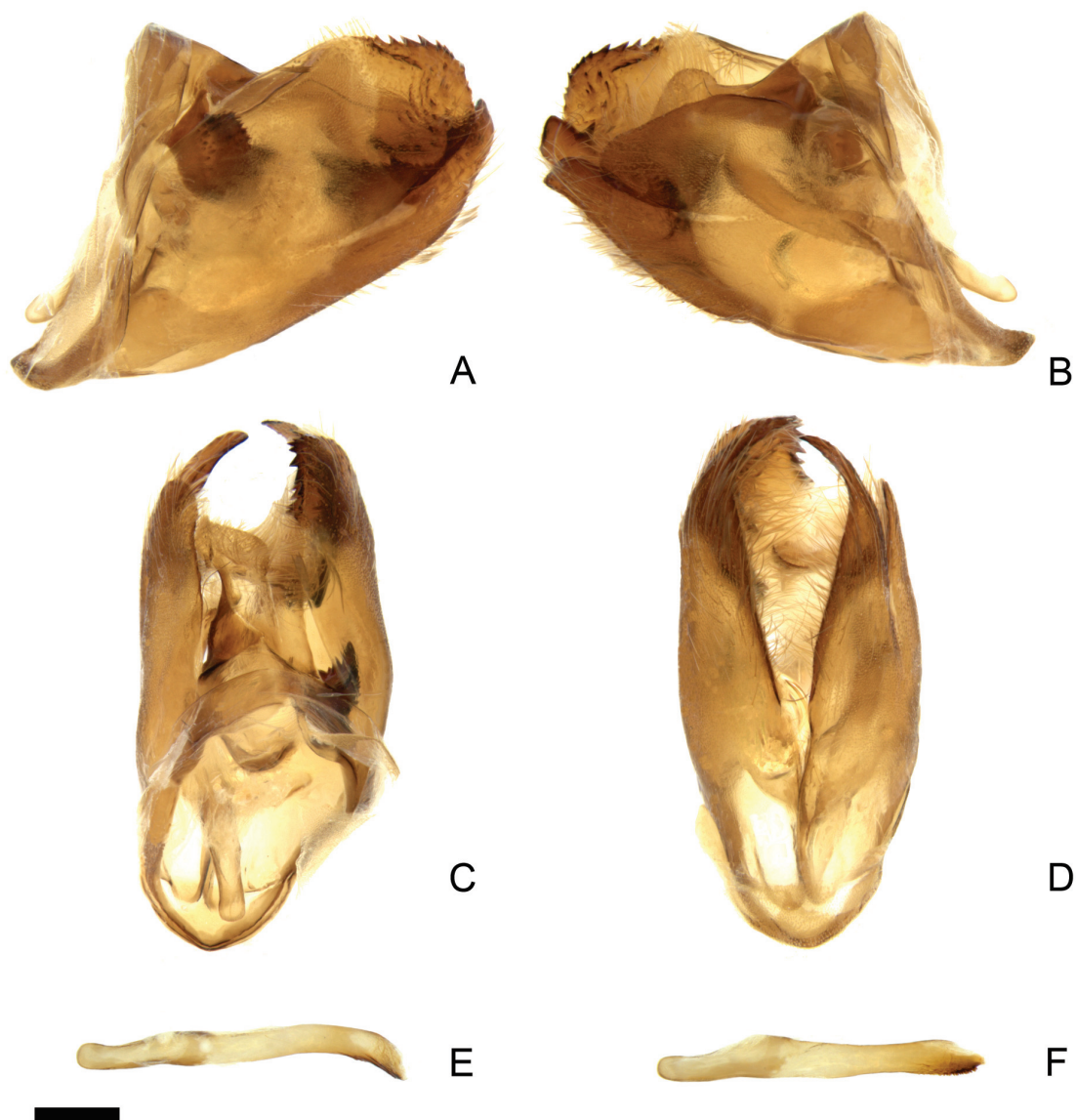
BRAZIL • ♂; “HOLOTYPUS/29.IV.1987 Fênix, P[a]R[aná] [Brazil] Mielke & Casagrande PROFAUPAR/*Viuria inanna* Siewert & Mielke det. 2022/DZ 52.489”; DZUP.

**Paratypes**

BRAZIL • 1 ♂; Espírito Santo, Linhares; 1722 Jun. 1974; C. Elias leg.; DZ 52.468; DZUP • 1 ♀; same collection data as for preceding; DZ 52.493; DZUP • 1 ♂; same collection data as for preceding; 15 Jun. 1973; DZ 52.472; DZUP • 1 ♂; same collection data as for preceding; DZ 52.485; DZUP • 1 ♂; same collection data as for preceding; DZ 52.487; DZUP • 1 ♂; same collection data as for preceding; DZ 47.172\*; DZUP • 1 ♀; same collection data as for preceding; DZ 52.471; DZUP • 1 ♂; same collection data as for preceding; 28 May 1973; DZ 52.473; DZUP • 1 ♂; same collection data as for preceding; DZ 52.500; DZUP • 1 ♂; same collection data as for preceding; 1116 Jun. 1973; DZ 52.474; DZUP • 1 ♀; same collection data as for preceding; Jan. 1978; DZ 52.476; DZUP • 1 ♀; same collection data as for preceding; 26 May 1974; DZ 52.483; DZUP • 1 ♀; same collection data as for preceding; May 1982; DZ 52.490; DZUP • 1 ♂; same collection data as for preceding; Feb. 1978; DZ 52.497; DZUP • 1 ♀; same collection data as for preceding; 18 Jun. 1974; DZ 52.498\*; DZUP • 1 ♀; same collection data as for preceding; 10–15 Apr. 1973; DZ 52.499; DZUP • 1 ♀; same collection data as for preceding; 20 Mar. 1970; DZ 52.501; DZUP • 1 ♀; same collection data as for preceding; 20 Mar. 1974; DZ 52.502; DZUP • 1 ♀; same collection data as for preceding; May 1978; DZ 52.503; DZUP • 1 ♀; same collection data as for preceding; 23–31 May 1973; DZ 52.504; DZUP • 1 ♂; same collection data as for preceding; 15 Mar. 1973; DZ 52.506; DZUP • 1 ♂; Minas Gerais, Parque Florestal Rio Doce; 13 May 1974; Ebert leg.; ex coll. Ebert; DZ 52.505; DZUP • 1 ♂; São Paulo, Assis; 11 Mar. 2001; Uehara-Prado leg.; ZUEC LEP 4486; ZUEC • 1 ♂; Campinas, Mata de Santa Genebra; 5 Apr. 2002; K. Brown and Freitas leg.; ZUEC

LEP 2234; ZUEC • 1 ♂; Cotia; 10 May 2002; Uehara-Prado leg.; ZUEC LEP 4230; ZUEC • 1 ♂; Rio Claro; alt 600 m; 10 Mar. 1963; Ebert leg.; ex coll. Ebert; DZ 52.484; DZUP • 1 ♂; Paraná, Fênix; alt 300 m; 29 Apr. 1987, 34 Oct. 1987; Mielke and Casagrande leg.; DZ 52.470; DZUP • 1 ♂; same collection data as for preceding; DZ 52.475; DZUP • 1 ♂; same collection data as for preceding; DZ 52.478; DZUP • 1 ♂; same collection data as for preceding; DZ 52.481; DZUP • 1 ♂; same collection data as for preceding; DZ 52.496; DZUP • 1 ♂; same collection data as for preceding; DZ 52.479; DZUP • 1 ♀; same collection data as for preceding; DZ 52.480; DZUP • 1 ♀; same collection data as for preceding; DZ 52.491; DZUP • 1 ♀; same collection data as for preceding; DZ 52.492; DZUP • 1 ♂; Londrina, Fazenda Santa Helena; alt. 650 m; 7 Dec. 1975; Mielke and Wedderhoff leg.; DZ 52.495; DZUP.

PARAGUAY • 1 ♂; Alto Paraná, General Dias, Itakyry; alt. 400 m; 1520 Jan. 1980; C. Mielke and Miers leg.; DZ 52.469; DZUP • 1 ♂; same collection data as for preceding; DZ 52.482; DZUP • 1 ♂;



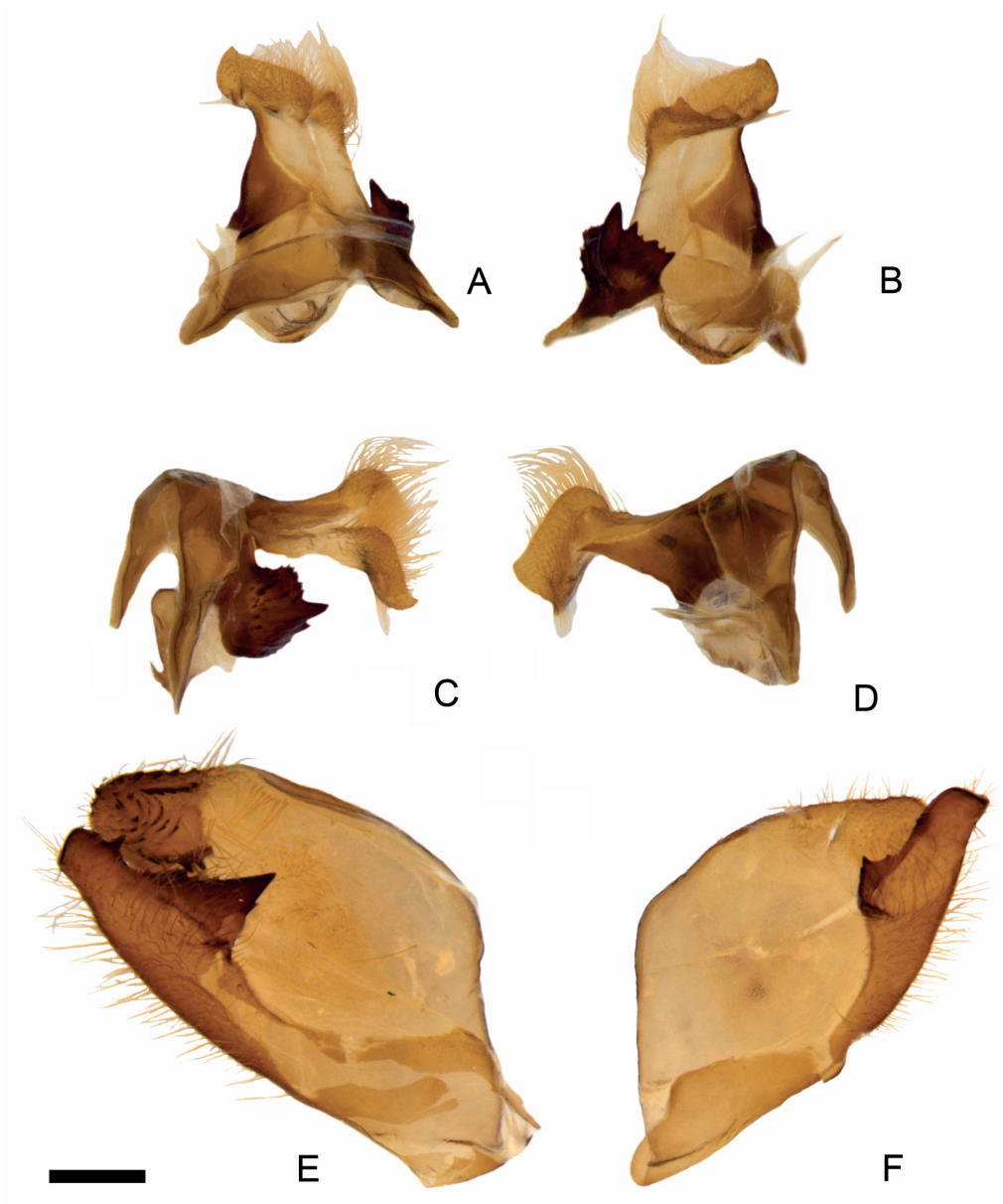
**Fig. 8.** Male genitalia of *Viuria innana* sp. nov., paratype (DZ 47.172) **A.** Left lateral view. **B.** Right lateral view. **C.** Dorsal view. **D.** Ventral view. **E.** Aedeagus, dorsal view. **F.** Aedeagus, lateral view. Scale bar: 500  $\mu$ m.

same collection data as for preceding; DZ 52.486; DZUP • sex unknown; same collection data as for preceding; DZ 52.488; DZUP • 1 ♂; same collection data as for preceding; DZ 52.494; DZUP • 1 ♀; same collection data as for preceding; DZ 52.477; DZUP.

### Description

HEAD. Dark brown, frons and vertex brown; eyelashes short and dark brown; labial palpus porrect; antennae dark brown, base of each segment cream, apical third ventrally cream; nudum with 19–20 segments.

THORAX. dorsally dark brown, ventrally dark brown and cream.



**Fig. 9.** Male genitalia of *Viuria innana* sp. nov., paratype (DZ 47.172). **A–D.** Uncus and tegumen. **A.** Dorsal view. **B.** Ventral view. **C.** Left lateral view. **E.** Valva, left lateral inner view. **F.** Valva, right lateral inner view. Scale bar: 500  $\mu$ m.

FOREWING. Male 13–15 mm (n = 12), mean length 14.5 mm; female 16–17 mm (n = 4), mean length 16.5 mm. Ground colour dark brown; VW lighter; basal, discal and postdiscal bands dark brown, from costa to anal margin. Female with ground colour light brown.

HINDWING. Similar to FW. VW lighter. Males with secondary sexual organs are described in the genus diagnosis.

ABDOMEN. Dark brown.

MALE GENITALIA. Tegumen quadrate, with latero-ventrally asymmetrical expansions; left expansion quadrate with margin serrated; uncus asymmetrical, apical portion slightly inclined downwards and rounded; gnathos as a transversal plate lightly sclerotized. Valvae asymmetrical; left valva with harpe 2× as long as wide, with median-dorsal spine expansion and curved inwards, ampulla rounded, with posterior margin covered with spine-like projections; right valva shorter than left valva, harpe with median-dorsal spine projection, ampulla rounded. Aedeagus cylindrical, vesica and aedeagus opening dorsally, distal portion left curved and serrated ventrally.

FEMALE GENITALIA. Papilla analis rectangular, moon-shaped, with a small apophysis; sterigma sclerotized and asymmetrical, right side wider and ventral margin with projections covered by spine-like setae; ostium bursae opening ventrally at the left side; ductus bursae and bursa copulatrix completely membranous, signa absent.

### Geographical distribution

*Viuria inanna* sp. nov. is known from Paraguay (Humid Chaco) and the Brazilian states of Espírito Santo, Minas Gerais, São Paulo, and Paraná (Fig. 14).

*Viuria acadia* sp. nov.

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Figs 1Q–T, 10–11, 12F

### Diagnosis

*Viuria acadia* sp. nov. is distinguished from other species of *Viuria* by the combination of the following genitalic characteristics: the ventral left portion of the tegumen is similar to that of *V. herophile* and *V. licisca* but shorter; the left and right valvae with ampulla triangled distally while in *V. herophile* the left valva is rounded and in *V. licisca* the right one is rounded. Females with papilla analis truncated ventrally; the spine-like process of the sterigma is smooth, differing from its congeners.

### Etymology

The specific epithet refers to the Akkadian Empire, the first ancient empire of Mesopotamia.

### Type material

#### Holotype

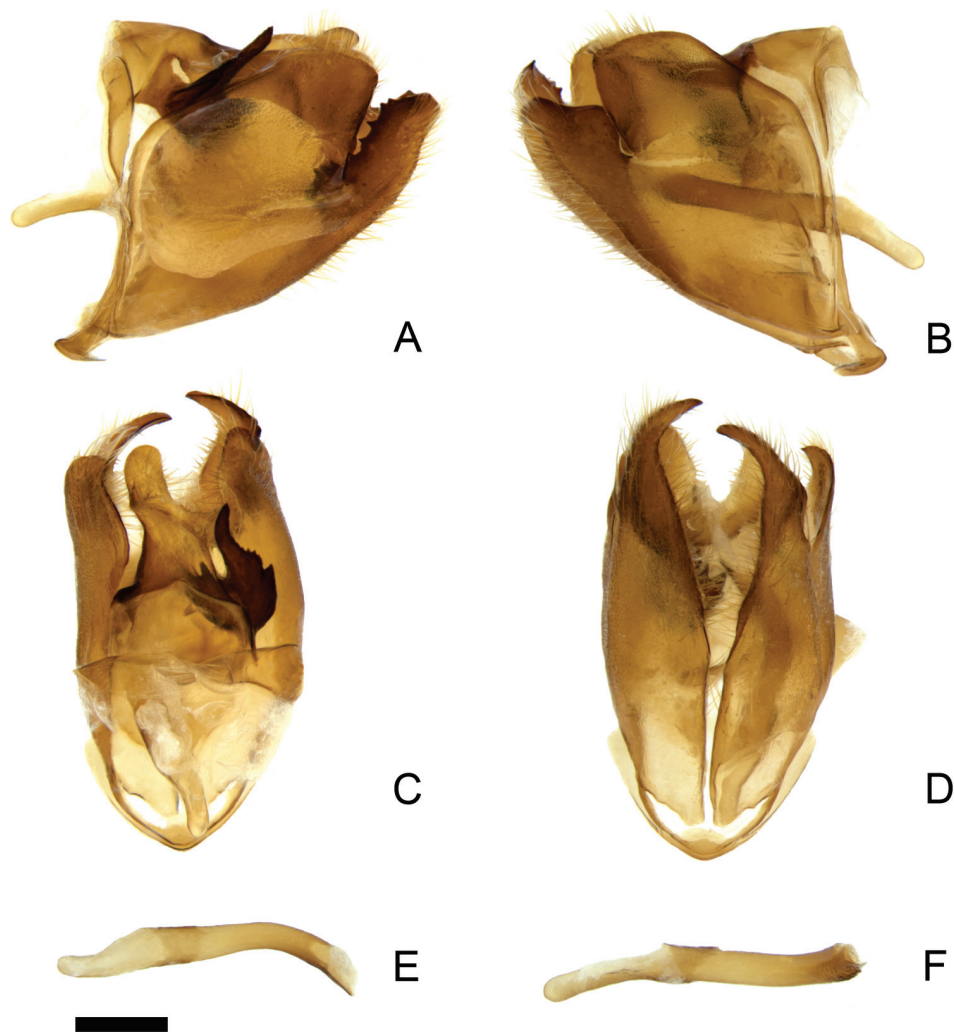
BRAZIL • ♂; “HOLOTYPUS/31 Km NO de Barra do Bugres, Barra do Bugres, MT [Mato Grosso, Brazil], 4-VIII-1972 200m, Mielke & Brown/*Viuria acadia* Siewert & Mielke det. 2022/DZ 52.520”; DZUP.

#### Paratypes

BRAZIL • 1 ♂; Rondônia, Ouro Preto d'Oeste; 23–30 Sep. 1987; Elias leg.; DZ 47.183\*; DZUP • 1 ♂; same collection data as for preceding; 6–23 Oct. 1987; DZ 52.508; DZUP • 1 ♀; same collection data as

for preceding; 17–31 Aug. 1987; DZ 52.522; DZUP • 1 ♂; Vilhena; 4 Nov. 1986; Elias leg., DZ 52.509; DZUP • 1 ♂; same collection data as for preceding; 17 Dec. 1986; DZ 52.510; DZUP • 1 ♂; Acre, Senador Guiomard, Reserva Catuaba (UFAC); 23 Sep. 2003; Mielke and Casagrande leg.; DZ 47.191\*; DZUP • 1 ♂; Mato Grosso, Barra do Bugres; alt. 200 m; 4 Jul. 1972, Mielke and Furtado leg.; DZ 52.511, DZUP • 1 ♂; same collection data as for preceding; DZ 52.520; DZUP • 1 ♂; same collection data as for preceding; 28 Apr. 1974; DZ 52.518 • 1 ♀; same collection data as for preceding; DZ 52.521; DZUP • 1 ♂; same collection data as for preceding; 29 Jun. 1972; DZ 52.513; DZUP • 1 ♂; same collection data as for preceding; DZ 47.173\*; DZUP • 1 ♂; same collection data as for preceding; DZ, 52.515; DZUP • 1 ♂; same collection data as for preceding; DZ 52.516; DZUP • 1 ♂; same collection data as for preceding; DZ 52.514; DZUP • 1 ♀; same collection data as for preceding; DZ 52.517; DZUP • 1 ♂; Diamantino, Fazenda São João, Rio Arinos; alt. 300–400 m; 9 Nov. 1975; Furtado leg.; ex coll. Ebert; DZ 52.512; DZUP.

ECUADOR • 1 ♂; Cotopaxi, Milimbanco; alt. 3900 m; Sep. 1971; Lafebre leg.; DZ 47.182\*; DZUP • 1 ♂; Yanaiaco; alt. 550 m; May. 1980; Lafebre leg.; DZ 52.523; DZUP.



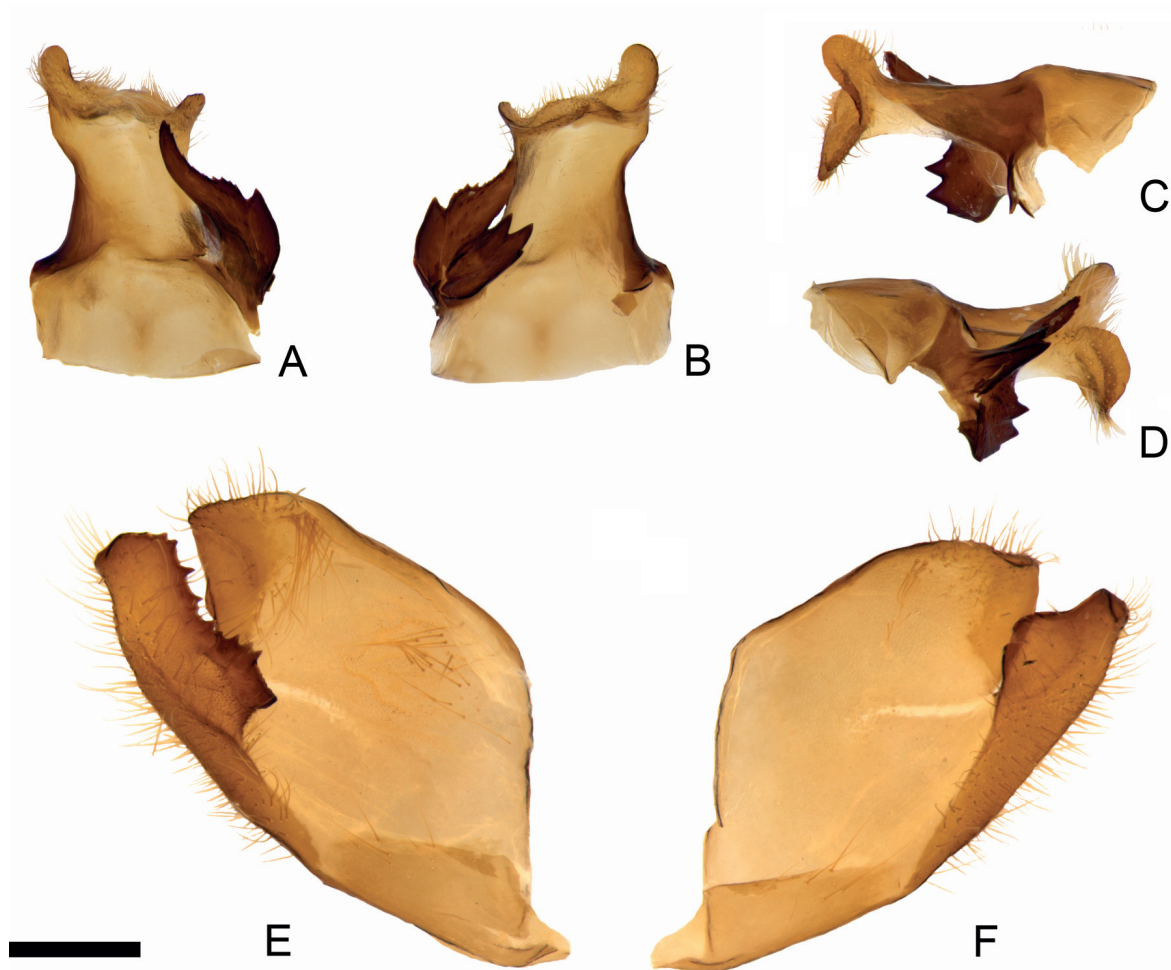
**Fig. 10.** Male genitalia of *Viuria acadia* sp. nov., paratype (DZ 47.183). **A.** Left lateral view. **B.** Right lateral view. **C.** Dorsal view. **D.** Ventral view. **E.** Aedeagus, dorsal view. **F.** Aedeagus, lateral view. Scale bar: 500  $\mu$ m.

## Description

Head, thorax, wings and abdomen as in other species of *Viuria*.

**MALE GENITALIA.** Tegumen squared, with latero-ventrally asymmetrical expansions; left expansion sinuous with margin serrated; uncus asymmetrical, apical portion slightly inclined downwards and rounded; gnathos as transversal plate lightly sclerotized. Valvae asymmetrical; left valva with harpe  $2\times$  as long as wide, with dorsal margin serrated and curved inwards, ampulla rounded, with posterior margin smooth; right valva shorter than left valva, harpe with median-dorsal rounded projection, ampulla rounded. Aedeagus cylindrical, vesica and aedeagus opening dorsally, distal portion left curved and serrated ventrally.

**FEMALE GENITALIA.** Papilla analis rectangular, truncated ventrally, with small posterior apophysis; sterigma sclerotized and asymmetrical, ventral margin with spine-like projections; ostium bursae opening ventrally at left size; ductus bursae and bursa copulatrix completely membranous, signa absent.



**Fig. 11.** Male genitalia of *Viuria acadia* sp. nov., paratype (DZ 47.183). **A–D.** Uncus and tegumen. **A.** Dorsal view. **B.** Ventral view. **C.** Right lateral view. **D.** Left lateral view. **E.** Valva, left lateral inner view. **F.** Valva, right lateral inner view. Scale bar: 500  $\mu\text{m}$ .

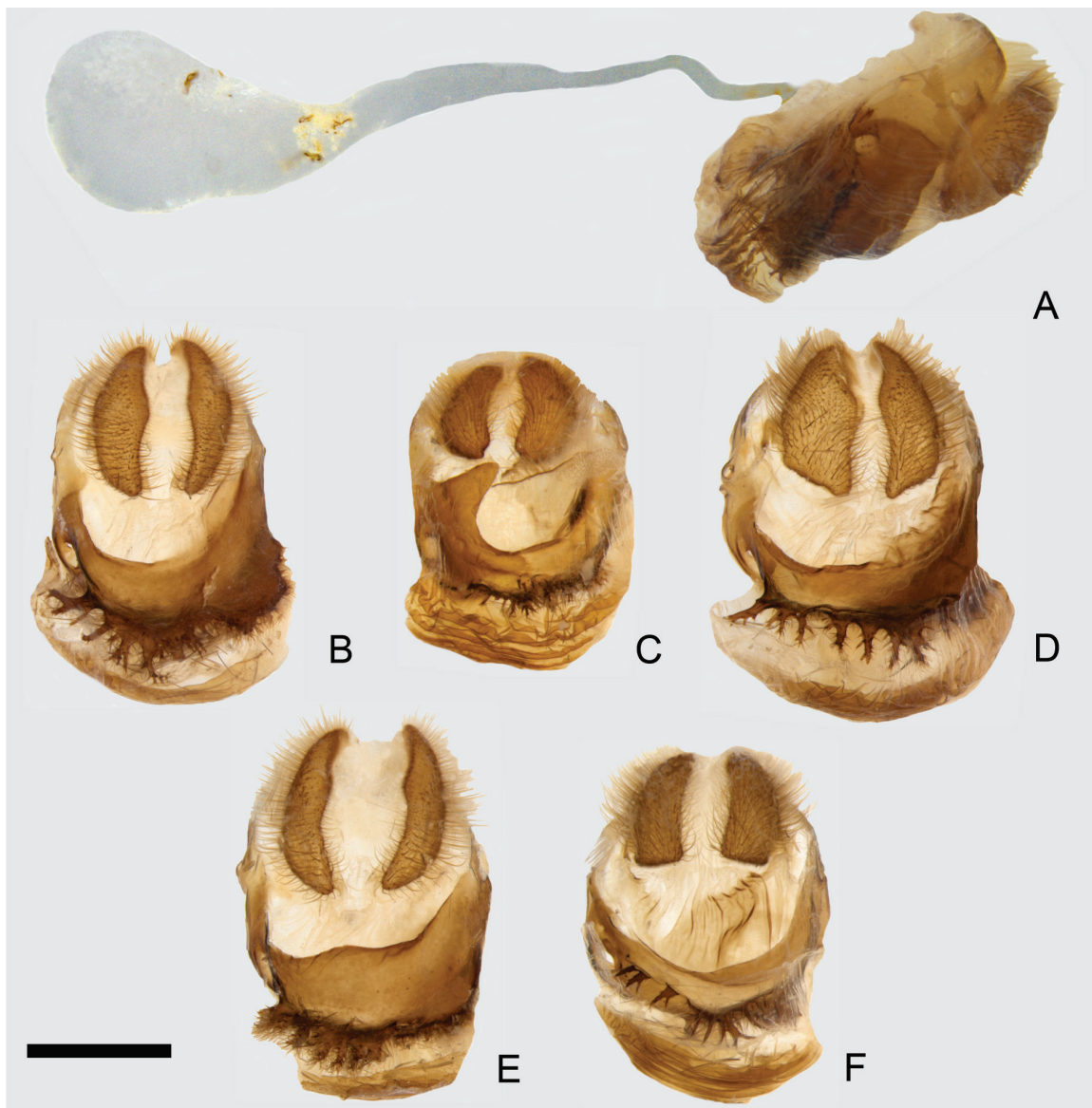


### Geographical distribution

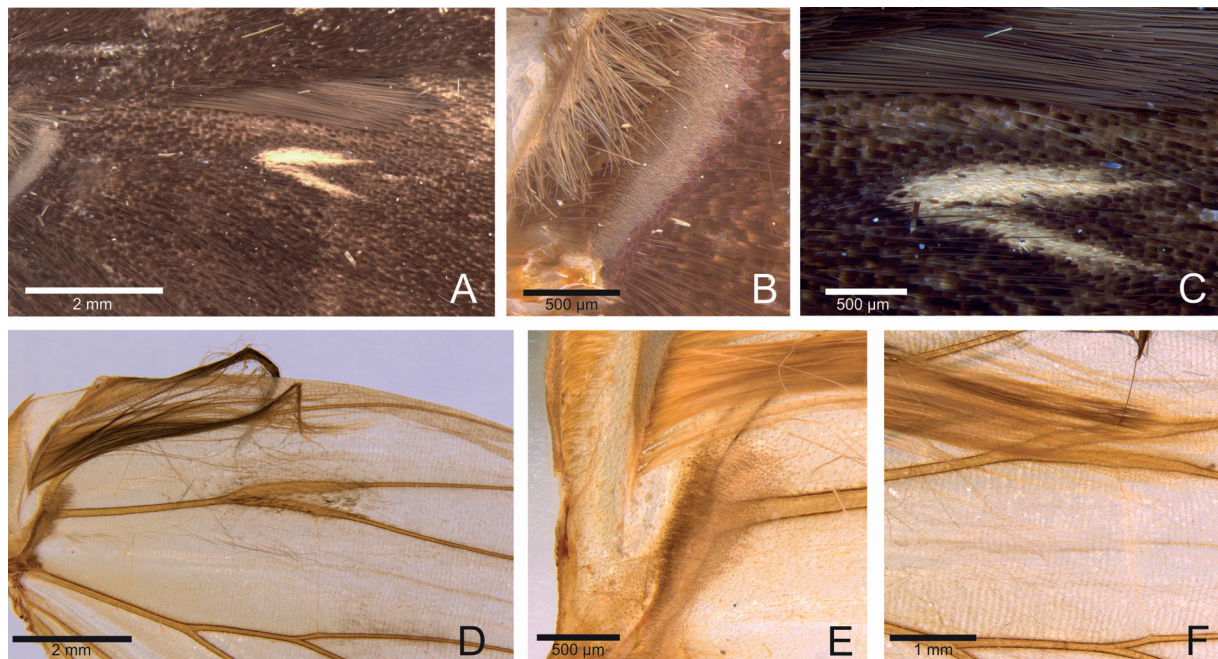
*Viuria acadia* sp. nov. is recorded in Ecuador (Cotopaxi) and in Brazil (Acre, Rondônia and Mato Grosso states) (Fig. 14).

### Discussion

In all species of *Viuria*, the males possess dark brown tufts on DHW covering a creamy androconial patch of modified scales (Fig. 13). In Lepidoptera, these modified scales are known to produce scent, which is spread with the help of the tufts as part of a courtship strategy in which males release pheromones to attract females (Barth 1960; Boppré 1989; Andersson *et al.* 2007). Once *Viuria* males possess these structures, it is expected that they perform the same function. It is worth mentioning that both males



**Fig. 12.** Female genitalia of species of *Viuria* Grishin, 2019. **A–B.** *Viuria herophile* (Harward, 1914) (DZ 47.201), left lateral view and sterigma. **C.** *V. licisca* (Plötz, 1882) (DZ 47.201), sterigma. **D.** *V. lista* (Evans, 1953) (DZ 47.201), sterigma. **E.** *V. inanna* sp. nov., paratype (DZ 52.498), sterigma. **F.** *V. acadia* sp. nov., paratype (DZ 52.524), sterigma.



**Fig. 13.** Patches of modified scales in DHW of species of *Viuria* Grishin, 2019. **A–D.** *Viuria lista* (Evans, 1953). **E–F.** *Viuria licisca* (Plötz, 1882). **A.** Overall view. **B.** Detail of the modified greyish scales in the swollen vein Sc+R1. **C.** Details of the creamy scales near the base of the swollen veins Rs and M1. **D–F.** Same sequence with diaphanized wings.



**Fig. 14.** Geographical distribution of species of *Viuria* Grishin, 2019.

and females have another patch of modified greyish scales in the swollen vein Sc+R1 (Fig. 13B, E). However, this structure is present in many males and females of Pyrginae but the exact function of these scales remains unknown.

Despite the lack of morphological synapomorphies for Pyrginae, the group is partially characterized by the presence of secondary sexual characters in most males (Warren *et al.* 2009). These characters include costal folds in the FW and metatibial hair tufts associated with thoracic pheromone glands. Still, these structures have been poorly explored in previous studies, and, to date, little is known about their detailed morphology (see Hernández-Roldán *et al.* 2014). In *Viuria*, the costal folds in FW, the metatibial hair tufts, and the thoracic pheromone glands are absent. The dark brown tufts on DHW covering a creamy androconial patch of modified scales is also present in some *Nisoniades*, *Mictris*, *Pellicia*, *Polycctor* and *Viola*, and may represent a putative synapomorphy for the clade (see Cong *et al.* 2019). From a taxonomic perspective, the morphology of these structures does not differ at an interspecific level within *Viuria* (see also Hernández-Roldán *et al.* 2014 for species of *Pyrgus*). Nevertheless, these organs vary among the skipper genera and should be studied in detail in further investigations.

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