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Three new species of *Lecteria* Osten Sacken, 1888 (Diptera: Tipulidae) from a scientific survey in Mitaraka (French Guiana)

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COUVERTURE / *COVER*:

River bed forest / palm swamp ('bas-fond'), site MIT-C-RBF2_01, Mitaraka (French Guiana), 28.II.2015 (photo: Marc Pollet). In médaillon, *Lecteria* (*Lecteria*) *teko* n. sp. male, holotype (photo: Jorge Mederos).

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Three new species of *Lecteria* Osten Sacken, 1888 (Diptera: Tipulidae) from a scientific survey in Mitaraka (French Guiana)

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ABSTRACT

In the present paper, three new species of *Lecteria* (*Lecteria*) Osten Sacken, 1888: *Lecteria* (*Lecteria*) *mitarakanea* n. sp., *Lecteria* (*Lecteria*) *teko* n. sp. and *Lecteria* (*Lecteria*) *wayana* n. sp., are described and illustrated, as a first step in the study of the Tipulidae Latreille, 1802 fauna from Mitaraka (French Guiana), collected during the "Our Planet Revisited" survey of 2015. The characteristics of the male genitalia allow to easily separate these three new species from the rest of the Neotropical species, in combination with the color pattern of legs, thorax and wings. The species are the first described in this genus from the Neotropics in almost half a century. Their discovery illustrates the significant contribution of this kind of scientific surveys in remote and isolated spots around the globe.

KEY WORDS

Craneflies,
Amazon basin,
Neotropics,
Maripasoula,
new species.

RÉSUMÉ

Trois nouvelles espèces de *Lecteria* Osten Sacken, 1888 (Diptera: Tipulidae) collectées lors d'une expédition scientifique au Mitaraka (Guyane).

Dans le présent article, trois nouvelles espèces de *Lecteria* (*Lecteria*) Osten Sacken, 1888 : *Lecteria* (*Lecteria*) *mitarakanea* n. sp., *Lecteria* (*Lecteria*) *teko* n. sp. et *Lecteria* (*Lecteria*) *wayana* n. sp., sont décrites et illustrées, comme une première étape dans l'étude de la faune de Tipulidae Latreille, 1802 du Mitaraka (Guyane), recueillie lors de l'expédition « La Planète revisitée » en 2015. Les caractéristiques des genitalia mâles permettent de séparer facilement ces trois nouvelles espèces des autres espèces néotropicales, en comparant les modèles de couleur des pattes, du thorax et des ailes. Elles sont les premières décrites de ce genre pour la région néotropicale depuis près d'un demi-siècle. Elles illustrent aussi la contribution significative de ce type d'expéditions scientifiques dans des régions reculées et isolées du globe.

MOTS CLÉS

Tipules,
bassin amazonien,
région néotropicale,
Maripasoula,
espèces nouvelles.

INTRODUCTION

The genus *Lecteria* Osten Sacken, 1888 has currently about 42 valid species, divided into three subgenera: *Lecteria*, *Neolecteria* Alexander, 1934 and *Psaronius* Enderlein, 1912 (Alexander 1969; Oosterbroek 2019). Although most species are recorded from the Neotropical (22 species) and Afrotropical (19) Regions, one species has been described from the Oriental region, the only representative of the subgenus *Neolecteria*. The twenty-two valid species in the Neotropics are equally divided between the nominotypical subgenus and the subgenus *Psaronius* (Oosterbroek 2019). After the revision of all Neotropical species included in the subgenus *Lecteria*, with the description of eight species and a key to all the known taxa from this area (Alexander 1969), no new species of *Lecteria* have been described until present. Ribeiro (2008) published a phylogenetic study that considers *Lecteria* as sister group of the clade formed by the genera *Clydonodorus* + *Conosia* and more recently Ribeiro & Blagoderov (2009) rediscovered *Lecteria* (*Lecteria*) *calopus* (Walker, 1856) in the Brazilian Atlantic Forest and offered the first images of both sexes, including the female holotype. Previously *L. calopus* was only known from this female holotype from an unknown locality.

As evidenced by the work of Alexander (1969), the color pattern of Neotropical species of the subgenus *Lecteria*, mainly the color of the legs and wings, provides key characters for the identification of the species. In the same paper, Alexander (1969) offers an identification key based mainly on differences of coloration and, as additional characters between closely related species, the structure of the male terminalia. In the present paper, we rely on the characteristics of the male genitalia for the elaboration of the key to the three newly described species. However, in the description of each new taxon, the key characters used by Alexander (1969), such as the color pattern in legs and wings, are also incorporated as supporting elements to separate the three new species from their closest neotropical relatives.

At present, at least two of the Neotropical species described within the subgenus *Lecteria* lack basic information, such as geographic origin and key morphological characters, in particular the genitalia. The available information on *Lecteria armillaris* (Fabricius, 1805) and *L. mattogrossae* Alexander, 1913 offers no reference to the genitalic structure since the type specimens have broken abdomens and therefore the sex of the type specimens of these two species remains unknown (Alexander 1969). Also, the distribution of *L. armillaris* remains unknown and the legs (key structures) of the holotype of *L. mattogrossae* are lost. Despite the total absence of legs in the only known specimen (holotype) of the latter species, Alexander (1969) included this species in a key with precisely the legs as first diagnostic feature, specifically the color pattern of the tarsi. He assumed that *L. mattogrossae* shows tarsi with a central white ring, which mainly involves the second and third tarsomeres. As can be interpreted from the text, Alexander's decision to include *L. mattogrossae* in the 1969 key is based on the similarity of the color pattern of its wing to those of *L. armillaris*, the tarsi of which are present in the

type specimen. In a similar way, legs were entirely lacking in one of the new species described here, *Lecteria teko* n. sp., which renders its inclusion in Alexander's key rather difficult. The widespread loss or lack of legs in specimens evidently urges the need of a new key for this group based on other morphological characters than only legs.

In 2015, the Museum national d'Histoire naturelle (MNHN), Paris and the NGO Pro-Natura International (France) co-organized the 5th edition of a large-scale biodiversity survey "Our Planet Revisited" or "La Planète revisitée" Guyane 2014-2015 expedition, also known as the "Mitaraka 2015 survey", conducted in French Guiana (Pollet *et al.* 2014, 2018; Pascal *et al.* 2015; Touroult *et al.* 2018). Both organizations jointly ran the "Our Planet Reviewed" programme (Krolow *et al.* 2017), which aims at rehabilitating taxonomical work that focuses on the largely neglected components of global biodiversity, i.e., invertebrates (both marine and terrestrial). Basic arthropod taxonomy and species discovery were at the heart of the survey, although forest ecology and biodiversity distribution modelling, nevertheless, were also part of the project. The Mitaraka 2015 survey produced a substantial number of Diptera samples, with several including Tipulidae Latreille, 1802 (Pollet *et al.* 2015, 2018). In the present paper, we describe three new species of *Lecteria* that were collected during this expedition.

MATERIAL AND METHODS

The expedition was conducted in the Mitaraka Mountains, a largely unknown and uninhabited area in the southwesternmost corner of French Guiana, directly bordering Surinam and Brazil. It is part of the Tumuc Humac mountain chain, extending east in Amapá region (Brazil) and west in southern Surinam. The area consists primarily of tropical lowland rain forest with scattered inselbergs, isolated hills that stand above the forest plains. From 22 February to 11 March 2015, a team of 32 researchers explored the area, including 12 invertebrate experts. During a second period (11-27 March), a second equal-sized team took over and a third smaller team returned to the site from 12 to 20 August 2015. The second author (MP) was the coordinator of the collected Diptera, and was also the only Diptera worker actively involved in this survey. For a complete understanding of the various environments studied in the Mitaraka area, as well as the array of sampling methods used during this expedition, see Krolow *et al.* (2017), Pollet *et al.* (2018) and Touroult *et al.* (2018). Invertebrate sampling was carried out near the base camp, on the drop zone (an area near the base camp that had been clear-cut entirely to allow helicopters to land) and, in particular, along four trails of approximately 3.5 km that started from the base camp in four different directions. Dipteran subsamples (mostly per family) taken during the expedition were subsequently disseminated among experts worldwide, in the case of Tipulidae to the first author (JM).

All collected material (including craneflies) was stored in 70% alcohol during the expedition. Despite the care with which the material was handled during the expedition, field working

conditions in remote areas are not always ideal for proper conservation of specimens. Craneflies are a group of very fragile Diptera, with a well-known tendency of losing the legs (and sometimes other key structures) after a normal process of capture, alcohol immersion, long distance transport and preliminary sorting/processing. Thus, although many specimens were stored in good conditions, a large part of the specimens proved damaged, making identification at the species level difficult.

Crane fly specimens remain preserved in 70% ethanol, and were described in this status. The genitalia were mounted on slides with Dimethyl Hydantoin Formaldehyde (DMHF). Specimens were examined with Motic SMZ-168 Zoom Stereo Microscope, Kyowa Unilux-12 83-483D, images were taken by multi-stack with iPhone SE and posteriorly processed with Helicon Focus 6. Measurements were made with an ocular reticule. We adopt the higher-level classification used by Alexander & Alexander (1970) and later by Gelhaus (2009), with Tipulidae considered a single family subdivided in three subfamilies: Tipulinae Latreille, 1802, *Cylindrotominae* Shiner, 1863 and *Limoniinae* Rondani, 1856. The morphological terminology mainly follows that of Gelhaus (2009) and Cumming & Wood (2009). The identification of the specimens was based on the key and descriptions provided by Alexander (1969), in his revision of the subgenus *Lecteria*.

Full labels are given for each type specimen. Labels are rectangular and white, unless otherwise mentioned. Specimens collected during the Mitaraka 2015 survey are deposited in the following institutions (indicated between brackets for each specimen): Muséum national d'Histoire naturelle (MNHN), Paris and Museu de Ciències Naturals de Barcelona (MCNB), Barcelona.

An inventory number starting with the initials ED (meaning Entomology and Diptera, respectively) was attached to each specimen deposited in MNHN and data captured in the related collection database (<https://science.mnhn.fr/institution/mnhn/collection/ed/item/search>). Likewise, an inventory number starting with the initials MZB (Former acronym Zoology Museum of Barcelona) was attached to each specimen deposited in MCNB and data captured in the related collection database (<http://zoologiaenlinia.museuciencies.cat>).

Tarsomeres in legs are indicated as I to V with I as most basal (metatarsus) and V as most apical tarsomere.

SYSTEMATICS

Eighty of a total of 223 invertebrate samples contained tipulid specimens, most of which were collected with a quadrat type of Malaise trap (SLAM, $n = 19$), and with yellow ($n = 17$), blue ($n = 16$) and white ($n = 12$) pan traps. Also, all five samples of the Malaise traps of 6 m long included Tipulidae. Representatives of this family were encountered in 19 of the 24 investigated sampling sites, including all those with trapping devices. Most samples ($n = 11$) were collected in one of the swamp forests along trail C ($n = 11$), all other sampling sites produced six or less samples. As mentioned before, however, the present paper focuses on the results on the genus *Lecteria* only.

For the present study, the type material of the species of the subgenus *Lecteria* described hitherto in the Neotropics could not be examined. Alexander described species almost exclusively from dry specimens, and largely based on the color pattern of some structures. Given that our study is based exclusively on specimens preserved in alcohol, we consider it unreliable to compare specimens preserved with different methods. As a result, the key below only includes the three species described in this paper. For future reference, however, male genitalia of nine other neotropical species of the subgenus *Lecteria* have been depicted in Figure 1.

Family TIPULIDAE Latreille, 1802
Subfamily LIMONIINAE Rondani, 1856

Genus *Lecteria* Osten Sacken, 1888

Lecteria Osten Sacken, 1888 31: 206.

TYPE SPECIES. — *Tipula armillaris* Fabricius, 1805 by original designation.

Lecteria (Lecteria) mitarakanea n. sp.
(Figs 1K; 2-4)

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TYPE MATERIAL. — **Holotype.** ♂ in 70% ethanol. First label: "FRENCH GUIANA, Mitaraka, MIT-DZ-RBF2, 02°13'59.3"N/54°27'00.3"W, 283 m, 28.II.2015-5.III.2015, M. Pollet leg. La Planète Revisitée Guyane 2015, MNHN PNI, APA 973-1/Sample code: Mitaraka/177". Second label: "*Lecteria (Lecteria) mitarakanea* Mederos & Pollet det. 2017". Third label: "HOLOTYPE/ED10572" (MNHN). Genitalia mounted on slide and labelled as follow: First label "FRENCH GUIANA, Mitaraka, MIT-DZ-RBF2, 02°13'59.3"N/54°27'00.3"W, 283 m, 28.II.2015-5.III.2015, M. Pollet leg." Second label "*Lecteria (Lecteria) mitarakanea* Mederos & Pollet det. 2017 HOLOTYPE". **Paratypes.** 1 ♀ in 70% ethanol. First label: "FRENCH GUIANA, Mitaraka, MIT-DZ-RBF2, 02°13'59.3"N/54°27'00.3"W, 283 m, 28.II.2015-5.III.2015, M. Pollet leg. La Planète Revisitée Guyane 2015, MNHN PNI, APA 973-1/Sample code: Mitaraka/177". Second label: "*Lecteria (Lecteria) mitarakanea* Mederos & Pollet det. 2017." Third label: "PARATYPE/ED10573" (MNHN). — 1 ♂ in 70% ethanol. First label: "FRENCH GUIANA, Mitaraka, MIT-C-SL, (MIT08), 02°14'07.7"N/54°26'41.5"W, 373 m, 02.III.2015-8.III.2015, tropical moist forest (slope), M. Pollet leg. La Planète Revisitée Guyane 2015, MNHN PNI, APA 973-1/Sample code: Mitaraka/132". Second label: "*Lecteria (Lecteria) mitarakanea* Mederos & Pollet det. 2017" Third label: "PARATYPE/MZB 2017-1500" (MCNB). — 1 ♀ in 70% ethanol. First label: "FRENCH GUIANA, Mitaraka, MIT-DZ-RBF1, 02°14'03.6"N/54°27'02.3"W, 270 m, 26.II.2015-2.III.2015, tropical wet forest (bas-fond), M. Pollet leg. La Planète Revisitée Guyane 2015, MNHN PNI, APA 973-1/Sample code: Mitaraka/175". Second label: "*Lecteria (Lecteria) mitarakanea* Mederos & Pollet det. 2017". Third label: "PARATYPE/MZB 2017-1499" (MCNB).

DIAGNOSIS. — *Lecteria mitarakanea* n. sp. can be distinguished from all other Neotropical *Lecteria* by the outer gonostylus extending into a single decurved process at apex, with the outer apical angle featuring a rounded pale crest (Figs 1K; 4), in combination with the morphology of the aedeagal complex: aedeagus short, not surpassing the interbase and parameres almost parallel. In ad-

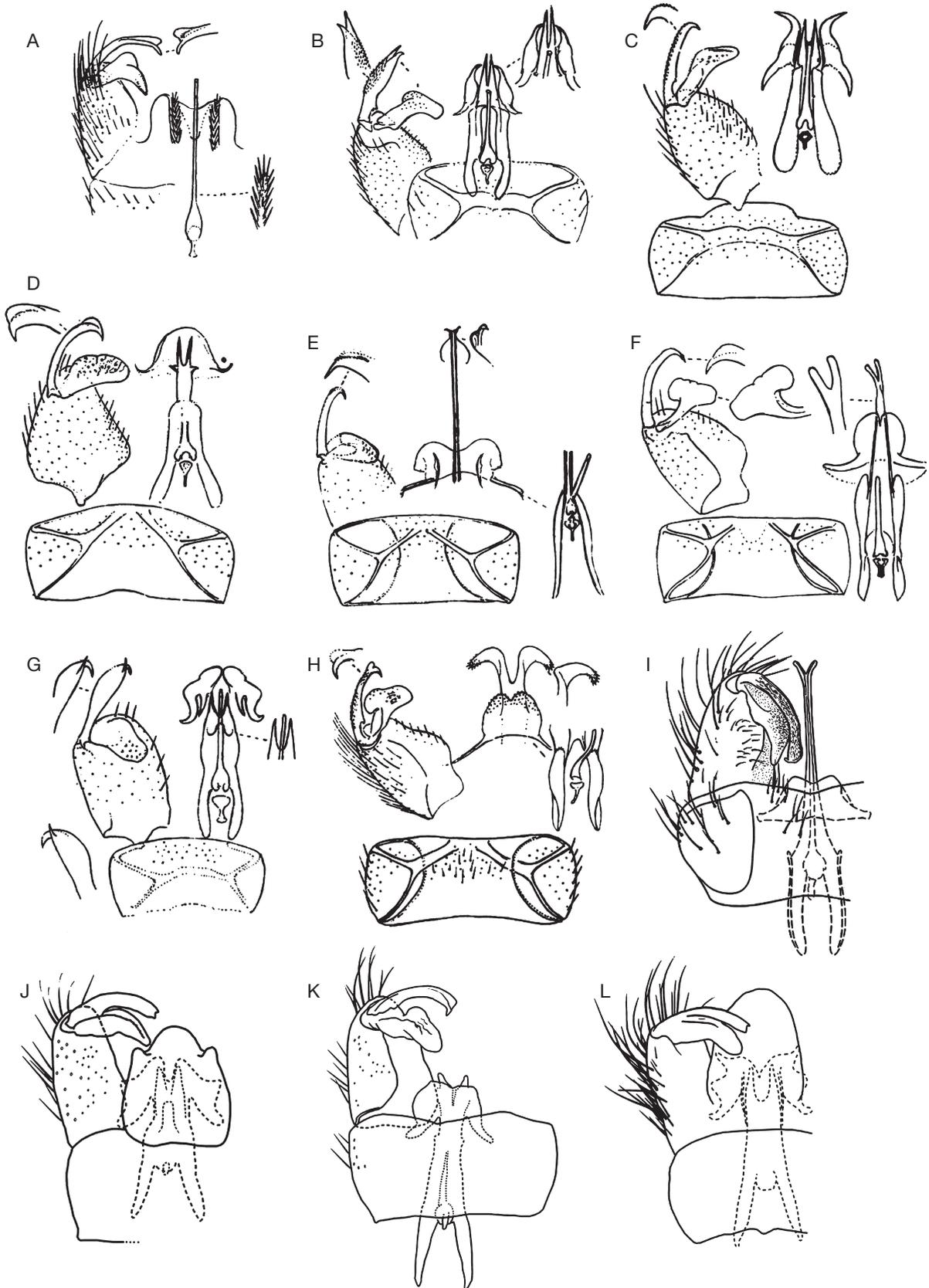


FIG. 1. — Terminalia of Neotropical species of *Lecteria* (*Lecteria*) Osten Sacken, 1888: **A**, *L. acanthosoma* Alexander, 1969; **B**, *L. acanthostyla* Alexander, 1969; **C**, *L. bicomuta* Alexander, 1969; **D**, *L. cetrata* Alexander, 1969; **E**, *L. fuscitarsis* Alexander, 1969; **F**, *L. retrorsa* Alexander, 1969; **G**, *L. simplex* Alexander, 1969; **H**, *L. epsilon* Alexander, 1969; **I**, *L. calopus* (Walker, 1856); **J**, *L. wayana* n. sp.; **K**, *L. mitarakanea* n. sp.; **L**, *L. teko* n. sp. A-H, modified by Alexander (1969); I, modified by Ribeiro & Blagoderov (2009).

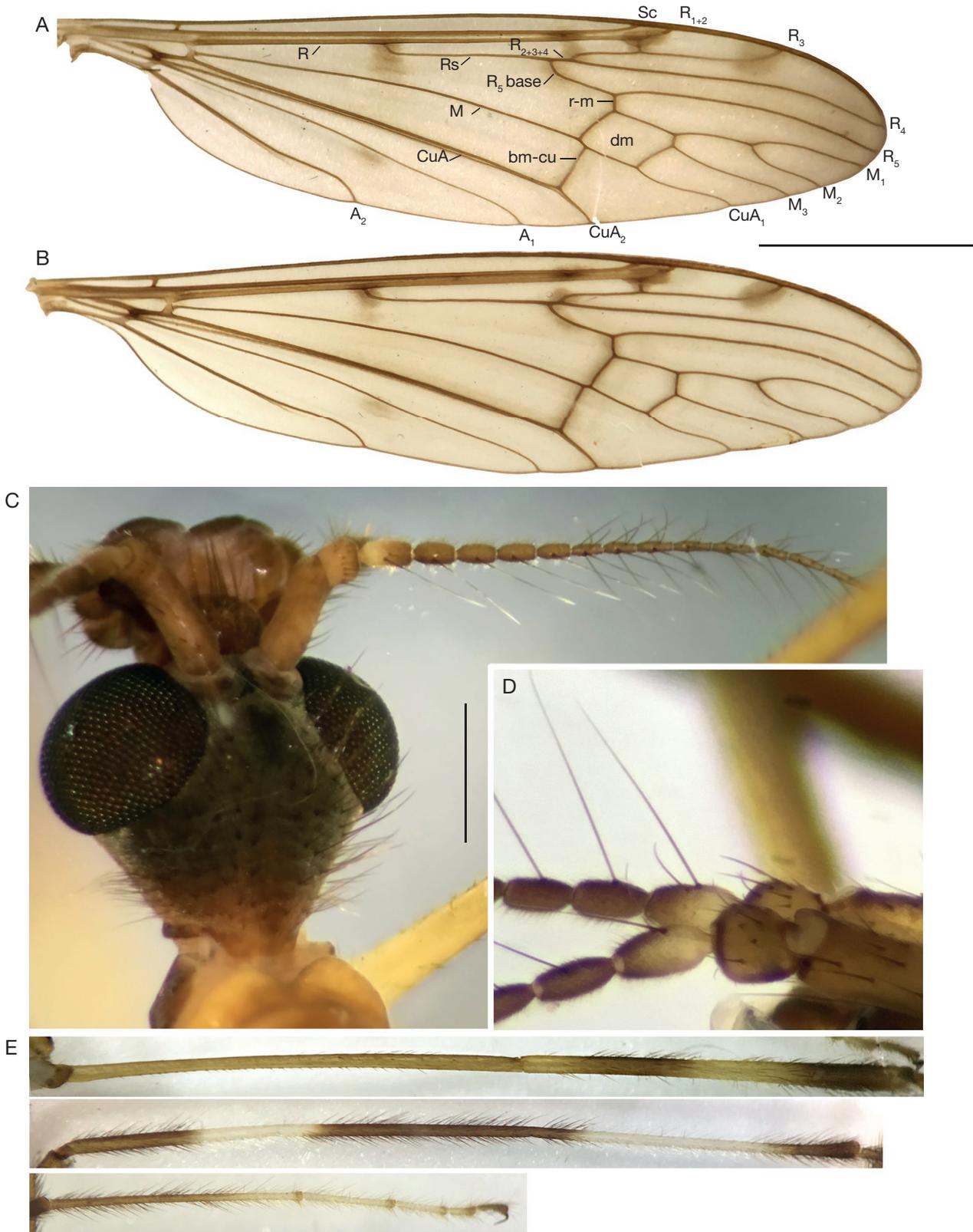


FIG. 2. — *Lecteria (Lecteria) mitarakanea* n. sp, male holotype (except otherwise mentioned): **A**, wing (male); **B**, wing (female, paratype ED10573); **C**, head; **D**, first antennal flagellomeres; **E**, femur, tibia and tarsus of hind leg (from top to bottom). Scale bars: A, B, 3 mm; C, 0.5 mm.



FIG. 3. — *Lecteria (Lecteria) mitarakanea* n. sp., thorax, male, holotype: **A**, lateral view; **B**, dorsal view. Scale bars: 1 mm.

dition, also distinct are the yellowish brown scape and pedicel, the first flagellomere with yellowish brown basal half (the apical half brown); and the tarsi (Fig. 2E) with tarsomere I almost completely brown to pale brown, with apical $\frac{1}{4}$ white, tarsomeres II to IV white, with pale brown apex (apical third in tarsomere IV) and tarsi V entirely pale brown.

ETYMOLOGY. — The name of this species is a latinized adjective which refers to the place where the species has been found, the Mitaraka massif in French Guiana.

DESCRIPTION

Male (holotype)

Body length. 13.2 mm (without antennae); wing length 12.3 mm; antennal length 2.5 mm; length of terminalia 1.0 mm.

Head. Dark brown dorsally, slightly lighter ventrally. Maxillary palpus dark brown, four palpomeres, ovoid, progressively shorter towards the apex. Antenna (Fig. 2C) brown, 16-seg-

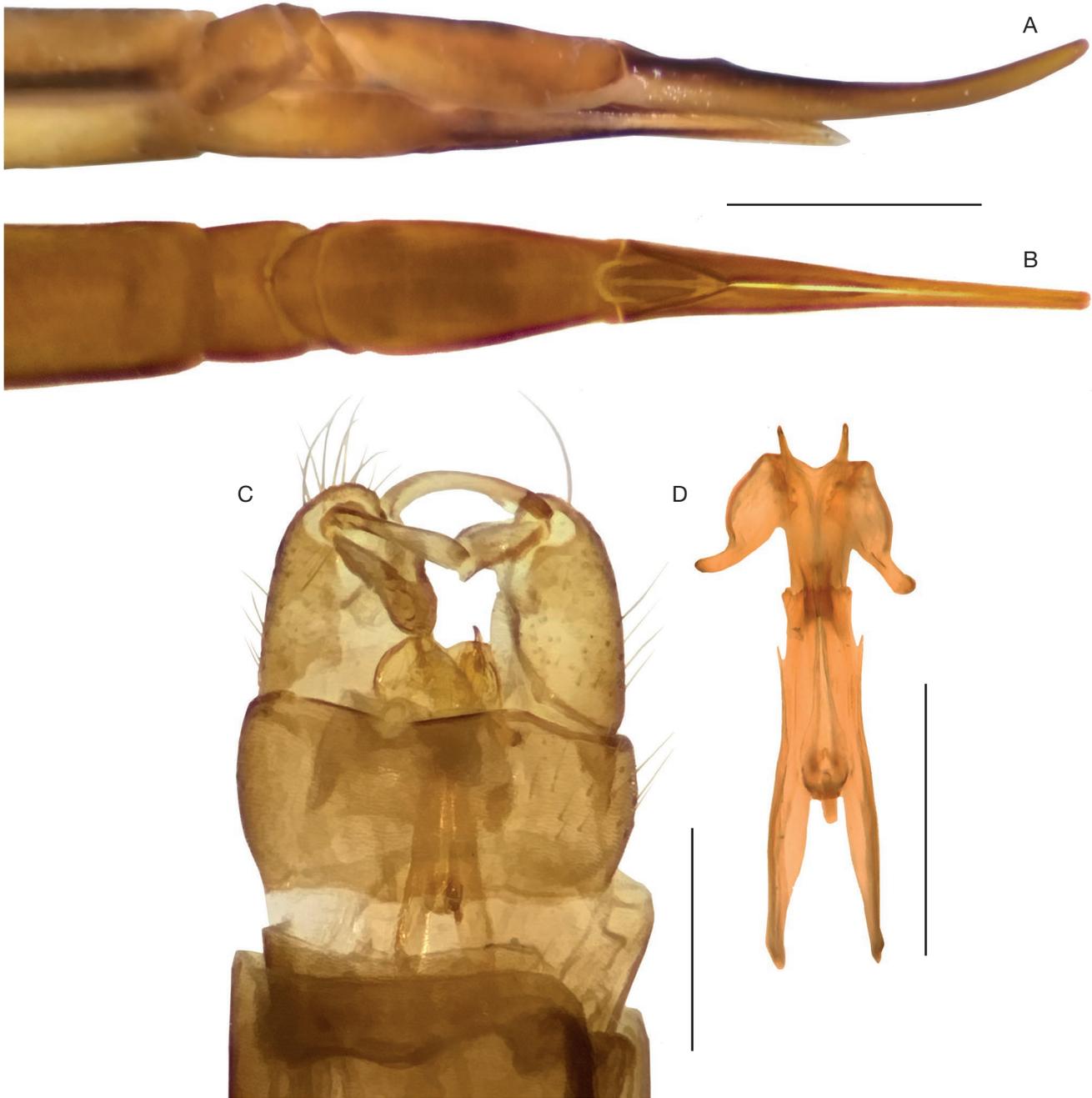


FIG. 4. — *Lecteria (Lecteria) mitarakanea* n. sp., terminalia: **A**, female ovipositor, lateral view; **B**, female ovipositor, dorsal view; **C**, terminalia (male, holotype), dorsal view, with tip of left inner gonostylus broken; **D**, aedeagal complex (dorsal view). Scale bars: A, B, 1 mm; C, D, 0.5 mm.

mented. Scape and pedicel yellowish brown. Flagellum with 14 flagellomeres, brown with basal half of first flagellomere yellowish brown. Flagellomeres 1 to 5 oval, decreasing in length towards apex, longer and slightly wider than the remaining flagellomeres. Flagellomeres 1-5 covered with short and thin microsetae and with just one verticil, except the first segment with two (Fig. 2D), the outermost verticil being the longest (latter character consistent in all examined specimens). The remaining flagellomeres with four or five verticils, not covered with thin microsetae, and the last flagellomere with eight verticils.

Thorax. Brown to yellowish brown. Pronotum yellowish brown. Mesoscutum brown, slightly yellowish brown in longitudinal central area, from prescutum to transverse suture. Scutellum brown. Mediotergite brown, dark brown at both lateral edges. Cervical sclerite brown. Anepisternum and anepimeron brown to yellowish brown, with a dark brown longitudinal stripe (Fig. 3), occupying the entire central part of the anepisternum and the upper part of the anepimeron. Lower half of anepimeron yellowish white. Membraneous area adjacent to the anterior spiracle and the anepisternum pale yellow, almost white, giving the effect of a white longitudinal stripe contrasting with the

more ventral dark brown longitudinal stripe described above. Laterotergite pale brown on its dorsal half (anatergite), almost yellowish white on ventral half (katatergite). Katepisternum yellowish brown in its upper two thirds, lower third brown. Meron, metakatepisternum and metanepisternum pale brown to yellowish. Halter with stem and knob pale brown, white at basis.

Wing. With pale brown background tinge (Fig. 2A), distal half slightly darker, and relatively well defined small brown spots at basis of R_s , R_{2+3+4} , base of R_5 , at R_{1+2} (stigma area) and at apex of R_3 . Less obvious, poorly defined brown areas at vein r-m, transverse veins of cell dm, at bifurcation of M_1 and M_2 , in basal transverse section of CuA_1 and a small dot midway of (and just below) A_1 .

Legs. Coxae white, with dorsal apex yellowish to yellowish brown. Trochanters pale brown. All legs (Fig. 2E) with the same color pattern. Femora yellowish brown in basal half or slightly more, slightly yellowish towards middle, followed by a dark brown band, another yellow band (subequal in length to anterior brown band) and finally another dark brown band at apex. Scarce and short setae in basal half of femur, until the beginning of the first brown band. Tibiae without tibial spurs, strongly annulated with brown to dark brown and white bands (see Fig. 2E). All tarsi (Fig. 2E) with the same color pattern. Tarsomere I almost completely brown to pale brown, with apical $\frac{1}{4}$ white. Tarsomeres II to IV white, with pale brown apex (apical third in tarsomere IV). Tarsomere V entirely pale brown. Tarsomeres I to IV with extreme apex pale brown. In all legs, abundant and long setae with the same color as the respective band. Tarsal claws dark brown to black.

Abdomen. All tergites yellowish brown to pale brown, sternites white. Tergites with a narrow dark brown stripe laterally, giving the abdomen the appearance of a continuous dark brown line, along its entire length, separating the yellowish brown dorsal part from the ventral white one. All tergites with a pale brown stripe on anterior and posterior margins, the anterior stripe wider and darker, discretely highlighting the yellowish brown background above. This color pattern paler towards the apical sternites.

Terminalia. Tergite 9 pale brown, approximately twice as wide as long (Fig. 4C), gonocoxite cone-shaped, approximately $1.5 \times$ as long as wide (Fig. 1K). Inner gonostylus slightly longer than outer gonostylus. Outer gonostylus extending at apex into a single curved process, forming an apical hook, its outer apical angle with a short and rounded pale crest before apex. Aedeagal complex (Fig. 4D): aedeagus short, not surpassing the interbase; parameres almost parallel; interbase concave in his posterior border.

Female

Body length. 18.8 mm (without antennae); wing length 13.0 mm; antennal length 2.5 mm; length of ovipositor 3.1 mm.

Thorax. As male except for the following features: thorax slightly darker than male, brown.

Wing. Basal transverse section of CuA_1 (Fig. 2B) located shortly before dm cell (in both female paratypes).

Abdomen. In general darker than the male, dorsally with a slightly darker, longitudinal, brown central stripe that stands out against the lighter brown background of the tergites. Sternites yellowish to pale brown.

REMARKS

According to the original description of Alexander (1969) the scape and pedicel of *L. cetrata*, the morphologically closest species to *L. mitarakanea* n. sp., are light brown with first flagellomere yellowish (in *L. mitarakanea* n. sp. scape and pedicel are yellowish brown, with basal half of first flagellomere yellowish brown and the distal half brown). Both species also show differences in the general color pattern of the thorax and abdomen. *Lecteria mitarakanea* n. sp. has an overall brown to yellowish brown thorax, without any stripe pattern dorsally or any conspicuous black area at the lateral end of the transverse suture as in *L. cetrata*. Finally, *L. mitarakanea* n. sp. has yellowish brown to pale brown tergites, with a pale brown stripe at anterior and posterior margin (with the anterior stripe wider and darker) while *L. cetrata* shows light brown tergites with posterior margin broadly yellowish.

Lecteria (Lecteria) teko n. sp.
(Figs 1L; 5-7)

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TYPE MATERIAL. — **Holotype.** ♂ in 70% ethanol. First label: "FRENCH GUIANA, Mitaraka, MIT-C-RBF1, 02°14'10.8"N/54°26'49.5"W, 258 m, 27.II.2015-8.III.2015, tropical wet forest (bas-fond), YPT, M. Pollet leg. La Planète Revisitée Guyane 2015, MNHN PNI, APA 973-1/Sample code: Mitaraka/133". Second label: "*Lecteria (Lecteria) teko* n. sp. Mederos & Pollet det. 2017". Third label: "HOLOTYPE/ED10574" (MNHN). Genitalia mounted on slide and labelled as follow: First label "FRENCH GUIANA, Mitaraka, MIT-C-RBF1, 02°14'10.8"N/54°26'49.5"W, 258 m, 27.II.2015-8.III.2015, M. Pollet leg.". Second label "*Lecteria (Lecteria) teko* Mederos & Pollet det. 2017 HOLOTYPE".

DIAGNOSIS. — Due to the loss of all legs in the holotype, it is impossible to compare *L. teko* n. sp. with the other species of the subgenus, by the absence of characters so important as the color pattern in the tarsi, but also in the femora and tibiae. However, the distinctness of the male genitalia of *L. teko* n. sp. proved sufficient to separate this species, especially by the presence of a wide and trilobed interbase with acute apices, a unique character in the subgenus (Fig. 7C), in combination with an outer gonostylus divided in two small spike-shaped processes at apex. In addition, *L. teko* n. sp. has a brown to dark brown thorax as general appearance, and pale brown to yellowish brown pleura with a brown longitudinal stripe from the cervical sclerites through the upper margin of the fore leg, anepisternum, anepimeron and ending in the anatergite.

ETYMOLOGY. — The name of this species, a noun in apposition, refers to the Tekos people, one of the two Amerindian peoples that inhabit the territory where the species was found i.e., Maripasoula, French Guiana.

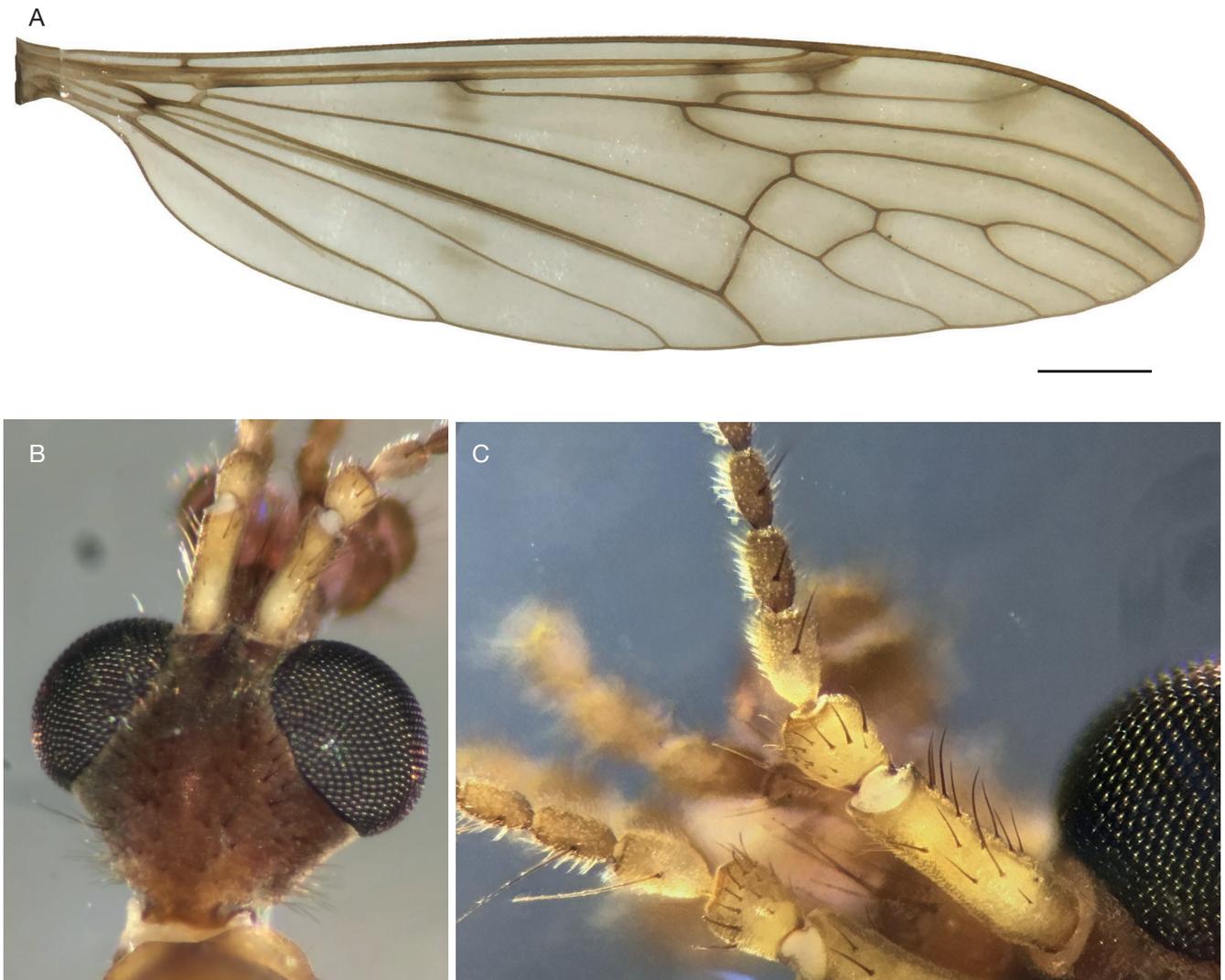


FIG. 5. — *Lectoria (Lectoria) teko* n. sp. male, holotype: **A**, wing; **B**, head; **C**, detail of the first antennal flagellomeres. Scale bar: 1 mm.

DESCRIPTION

Male (holotype)

Body length. 13.3 mm (without antennae); wing length 10.5 mm; antennal length 2.1 mm; length of terminalia 0.8 mm.

Head. Dark brown dorsally (Fig. 5B), and brown ventrally. Maxillary palpus brown to pale brown, four palpomeres, ovoid, the second and third subequal in length, the fourth palpomere the smallest. Antenna (Fig. 5C) mainly brown to pale brown, 16-segmented. Scape and pedicel pale brown. Flagellum with 14 flagellomeres, with segment 1 pale brown to yellowish brown, and the remaining brown, progressively paler towards the apex. Flagellomeres 1 to 5 oval, decreasing in length and width towards apex, longer and slightly wider than flagellomeres 6-14, former covered with short and thin microsetae and with one single verticil (flagellomeres 4-5 of right antenna with two verticils); flagellomeres 6-13 with five verticils, and the last flagellomere with nine verticils.

Thorax. Brown to dark brown, with some pale brown areas. Pronotum brown. Mesoscutum uniformly brown to pale brown, with center almost yellowish brown, from prescutum to transverse suture, bordered with narrow brown to pale brown stripe (Fig. 6). Scutellum dark brown, with almost black posterior and lateral margins. Mediotergite with dark brown area at its center, brown stripe-like areas bordering this central area, and with almost black lateral margins. Cervical sclerite dark brown. Anepisternum brown. Anepimeron brown at upper half (Fig. 6A), with pale brown posterior margin and pale brown at lower half. Membrane area adjacent to anterior spiracle pale, almost white, contrasting with brown longitudinal stripe formed by color pattern on anepisternum and anepimeron. Laterotergite brown on dorsal $\frac{2}{3}$, pale brown on ventral third (katatergite). Katepisternum with about dorsal half pale brown, brown on less than ventral half. Meron, metakatepisternum and metanepisternum brown to pale brown. Dark brown



FIG. 6. — *Lacteria (Lacteria) teko* n. sp. male, holotype, thorax: A, lateral view; B, dorsal view. Scale bars: 1 mm.

area at posterior margin of posterior spiracle, just below halter basis. Halter with stem and knob pale brown, white at its basis.

Wing. Almost with the same pattern as in *L. mitarakanea* n. sp. Background with a very pale brown tinge (Fig. 5A). Relatively well defined small brown spots at basis of RS and

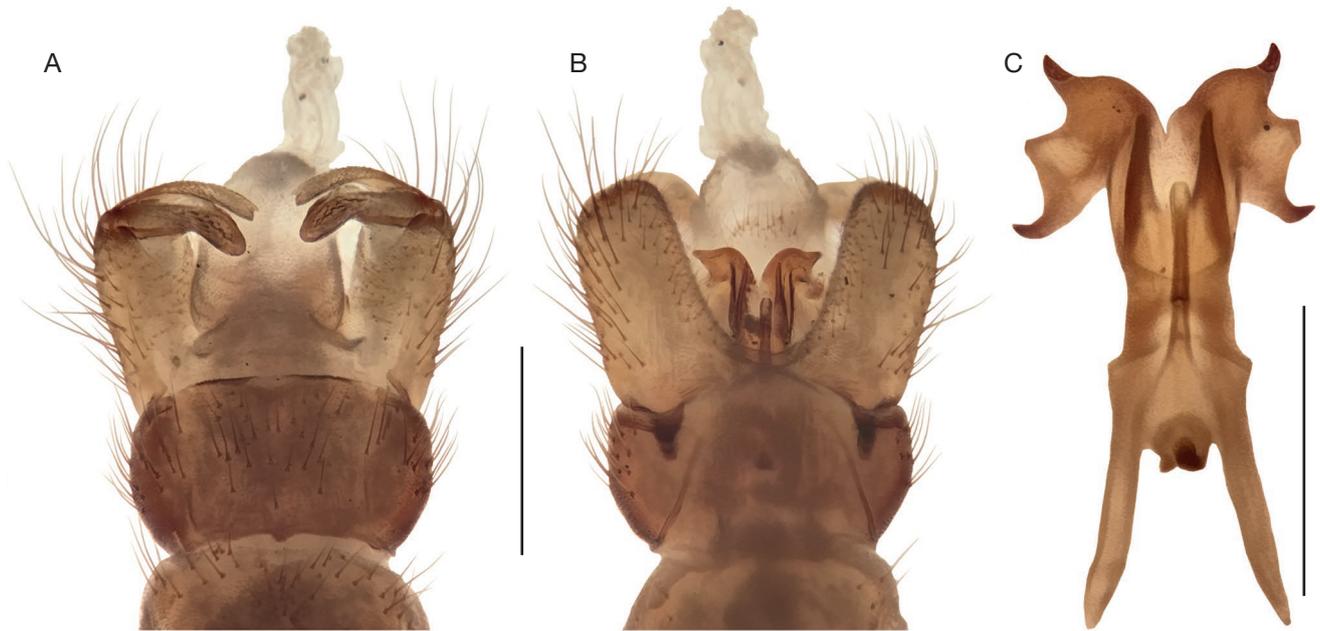


FIG. 7. — *Lecteria (Lecteria) teko* n. sp. male, holotype: **A**, terminalia, dorsal view; **B**, terminalia, ventral view; **C**, aedeagal complex (dorsal view). Scale bars: A, B, 0.5 mm; C, 0.3 mm.

R_{2+3+4} , at R_{1+2} (stigma area) and at the end of R_3 . Less obvious, poorly defined brown areas at basis of vein R_5 , vein r-m, transverse veins of cell dm, at bifurcation of M_1 and M_2 , in basal transverse section of CuA_1 , and a small spot midway of A_1 .

Legs. Nearly entirely lacking. Coxae almost white, pale brown in the dorsal third, fore coxa brown to dark brown on its dorsal margin (Fig. 6A). Trochanters brown.

Abdomen. All tergites pale brown, reminiscent (very subtle) of a longitudinal central, very broad brown stripe. Lateral margins of tergites 1-8 dark brown, both anterior and posterior margins whitish; 9th tergite completely brown. Sternites mainly white, with 8th and 9th sternites pale brown.

Terminalia. Tergite 9 brown, approximately twice as wide as long (Fig. 7). Gonocoxite cone-shaped (Fig. 1L), almost cylindrical, about twice as long as wide. Gonostylus terminal, outer gonostylus slightly longer than inner gonostylus. Outer gonostylus at apex divided in two small spike-shaped processes. Aedeagal complex (Fig. 7C): interbase wide, trilobed with acute apices. Aedeagus short and straight, not surpassing the interbase.

Female
Unknown.

REMARKS

The color pattern shown in the pleura of *L. armillaris* and *L. mattogrossae*, in combination with the coloration in the mesonotum, scutellum and mediotergite, differs markedly from the pattern in *L. teko* n. sp. According to Alexander (1969),

the thorax in *L. armillaris* has a reddish brown mesonotum and somewhat pruinose pleura, with a row of brown spots; the thorax in *L. mattogrossae* shows a light grayish brown scutum, a dull yellow scutellum and a mediotergite with a narrow indistinct brown median line and yellowish pleura, with a gray pruinosity and a dark brown stripe extending from behind the head to the wing base, involving the base of the fore coxa.

Lecteria (Lecteria) wayana n. sp. (Figs 1J; 8-10)

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TYPE MATERIAL. — **Holotype.** ♂ in 70% ethanol. First label: "FRENCH GUIANA, Mitaraka, MIT-C-RBF2, 02°14'03.4"N/54°26'53.0"W, 299 m, 06.III.2015, on vegetation along muddy trail and in swamp, SW, M. Pollet leg. La Planète Revisitée Guyane 2015, MNHN PNI, APA 973-1/Sample code: Mitaraka/078". Second label: "*Lecteria (Lecteria) wayana* Mederos & Pollet det. 2017". Third label: "HOLOTYPE/ED10575" (MNHN). Genitalia mounted on slide and labelled as follow: First label "FRENCH GUIANA, Mitaraka, MIT-C-RBF2, 02°14'03.4"N/54°26'53.0"W, 299m, 06.III.2015, M. Pollet leg.". Second label "*Lecteria (Lecteria) wayana* Mederos & Pollet det. 2017 HOLOTYPE".

DIAGNOSIS. — *Lecteria wayana* n. sp. can be distinguished by the color pattern of the pleura that offers a discrete effect of two very pale brown, almost white, transverse stripes in the middle of a brown background. Also typical is the dark brown mesoscutum, with two long pale brown longitudinal stripes in the center, parallel, and accompanied by another two, also pale brown, lateral stripes. Finally, the outer gonostylus is divided in two small spike-shaped processes apically, in addition to the aedeagal complex with the interbase featuring a deep cleft in the central posterior margin.



FIG. 8. — *Lecteria (Lecteria) wayana* n. sp. male, holotype: **A**, wing; **B**, head; **C**, detail of the first antennal flagellomeres. Scale bar: A, 1 mm.

ETYMOLOGY. — The name of this species, a noun in apposition, refers to the Wayana people, one of the two Amerindian peoples that inhabit the territory where the species was found i.e., Maripasoula, French Guiana.

DESCRIPTION

Male (holotype)

Body length. 16.7 mm (without antennae); wing length 12.0 mm; antennal length 2.7 mm; length of terminalia 1.2 mm.

Head. Brown dorsally, lighter brown ventrally. Dorsally with a lighter, longitudinal and thin stripe. Maxillary palpus pale brown to gray (Figs 8B; 9A), 4 palpomeres, ovoid, with the

fourth longer than the third. Antenna (Fig. 8C) pale brown, 16-segmented. Scape and pedicel pale brown, latter with second half brown. Flagellum with 14 flagellomeres, pale yellowish to white, progressively paler (whiter) towards the apex. Flagellomeres 1 to 5 oval, decreasing in length towards antennal apex, longer and slightly wider than the remaining flagellomeres. As in *Lecteria mitarakanea* n. sp., basal 5 flagellomeres covered with short and thin microsetae and with one single verticil, except for the first segment of right antennal segment with two, the outermost verticil being the longest. Last 9 segments with 4 or 5 verticils, not covered with thin microsetae, and last flagellomere with 8 verticils.



FIG. 9. — Thorax of *Lecteria (Lecteria) wayana* n. sp. male, holotype: **A**, lateral view; **B**, dorsal view. Scale bars: 1 mm.

Thorax. Brown to dark brown, with some pale brown areas. Pronotum brown to dark brown. Mesoscutum dark brown, with two very pale brown longitudinal stripes, parallel, from prescutum to almost transverse suture, both stripes separated by a thin grayish brown strip (Fig. 9B). Another two very pale brown lateral stripes, one at each side, of above mentioned stripes, reaching beyond the transverse suture. Scutellum brown. Mediotergite brown on basal half, yellowish pale to

white in apical half. Anepisternum and katepisternum pale brown with a small brown area at anterior edge. Anepimeron with pale brown anterior half, and brown posterior half. Laterotergite with brown anterior half, and pale brown posterior half. This color pattern featuring a discrete effect of two very pale brown transverse stripes in the middle of a brown area: the first (anterior) stripe running from the upper part of anepisternum to the middle coxa, the second (posterior)

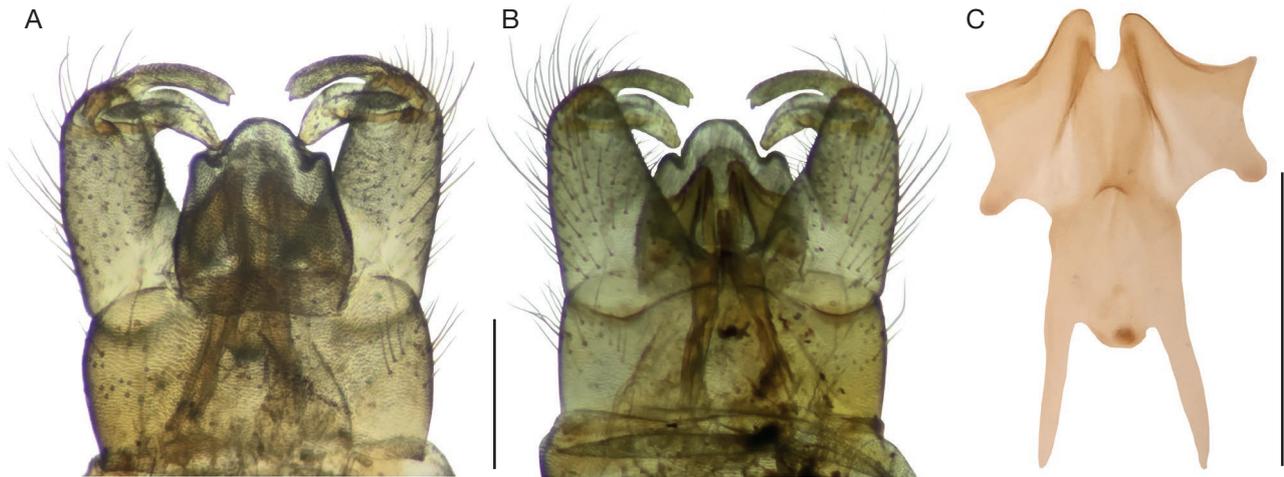


FIG. 10. — *Lecteria (Lecteria) wayana* n. sp. male, holotype: **A**, terminalia, dorsal view; **B**, terminalia, ventral view; **C**, aedeagal complex (dorsal view). Scale bars: 0.5 mm.

stripe from the upper part of anepimeron to the posterior coxa (Fig. 9A). Halter with stem very pale brown, almost white, and knob pale brown.

Wing. Almost hyaline, with a very subtle brownish pale tinge, without spots or any color pattern except the light brownish stigmal area (Fig. 8A). Veins light brownish, distinct against the hyaline background color of the wing.

Legs. Coxae pale brown, almost white in dorsal half. All legs with the same color pattern. Femora pale brown in slightly more than basal half, followed by a brown band, another pale brown band, slightly shorter than more basal brown band, and finally another dark brown band at apex, approximately as long as the more basal pale brown band. Scarce, short brown setae in the basal half of femur, until the beginning of the most basal brown band, latter with many brown setae. The pale brown band, in between the two brown bands, with white setae. Tibiae with tibial spurs lacking; with basal short pale brown band, followed by a whitish equal-sized band. Next, the entire central extension pale brown, interrupted by another whitish band, longer than more basal whitish band, and short pale brown band at apex. Tarsi with tarsomere I almost completely pale brown, whitish at apex. Tarsomeres II to IV whitish, all subtle pale brown at extreme apex. Tarsomere V pale brown. All legs with many long setae in the colored bands, concolorous with the respective bands. Tarsal claws dark brown.

Abdomen. All tergites brown to dark brown, with some paler areas, without any distinct pattern. Sternites brown with some pale brown areas. Tergites and sternites progressively darker towards the apex of the abdomen. Sides of the abdomen with a dark brown stripe.

Terminalia. Tergite 9 dark brown, approximately twice as wide as long (Fig. 10A). Gonocoxite cone-shaped (Figs 1J;

10A, B), almost cylindrical, about twice as long as wide. Outer gonostylus slightly longer than inner gonostylus. Outer gonostylus at apex divided in two small spike-shaped processes. Aedeagal complex (Fig. 10C): aedeagus short and straight, not surpassing the interbase; interbase with a deep cleft in the central posterior margin.

Female
Unknown.

REMARKS

According to the key by Alexander (1969) *L. wayana* n. sp. would fit the species group with “a darkened pattern of wing restricted”, which includes *L. armillaris* and *L. mattogrossae*. These two species, described from specimens with broken abdomen and therefore of unknown sex (Alexander 1969), however, show many differences with respect to *L. wayana* n. sp. *Lecteria wayana* n. sp. features brown pleura with two very pale brown, almost white, transverse stripes in the middle and a dark brown mesoscutum with two long pale brown longitudinal stripes in the center, parallel, and accompanied by another two, also pale brown, lateral stripes. On the contrary, in *L. armillaris* the mesonotum is reddish brown and pleura somewhat pruinose, with a row of brown spots, whereas *L. mattogrossae* shows a brown mesonotum with three darker brown bands, and grayish yellow pleura with a dark brown longitudinal stripe.

DISCUSSION

These three Neotropical species are the first to be described in this genus since almost half a century. Moreover, they are only a small sample of the great assumed diversity of Tipulidae emphasizing the need to carry out scientific surveys in poorly explored regions of the planet. Until now, only one species of the family Tipulidae was recorded from French

KEY TO THE SPECIES OF THE SUBGENUS *LECTERIA* RECORDED FROM MITARAKA, FRENCH GUIANA (MALES ONLY):

1. Outer gonostylus divided in two small spike-shaped processes apically 2
- Outer gonostylus extending into a single decurved process at apex, with the outer apical angle featuring a rounded pale crest (Figs 1K; 4) *Lecteria mitarakanea* n. sp.
2. Interbase wide, trilobed with acute apices. Aedeagal complex (Fig. 7C) *Lecteria teko* n. sp.
- Interbase not trilobed, with a deep cleft in the central posterior margin. Aedeagal complex (Fig. 10B)
..... *Lecteria wayana* n. sp.

Guiana (Oosterbroek, 2019), *Teucholabis* (*Teucholabis*) *melanocephala* (Fabricius, 1787). With the present work this list is raised to four species, but the revision of all the material of Tipulidae captured during the expedition to Mitaraka (999 specimens) suggests a preliminary figure of 114 morphospecies, belonging to 27 genera. A wide variety of sampling methods was deployed in Mitaraka, including Malaise traps, flight intercept traps, pan traps (blue, yellow and white), light traps, and direct sampling on vegetation among others (Touroult *et al.* 2018). This intense sampling effort produced six specimens of *Lecteria*: four of them (*L. mitarakanea* n. sp.) collected in blue pan traps, one (*L. teko* n. sp.) in a yellow pan trap and one (*L. wayana* n. sp.) with the sweepnet. The co-occurrence of these three new species of the subgenus *Lecteria* in Mitaraka is very interesting, but also the presence of four other species of the genus in the Guyana Shield region (Oosterbroek, 2019): *Lecteria* (*Psaronius*) *pygmaea* (Alexander, 1914); *L. (P.) obscura* (Fabricius, 1805); *L. (P.) obliterated* Alexander, 1913 and *L. (P.) fuscipennis* (Alexander, 1914). Among the hundreds of samples of craneflies already studied from surveys carried out by different Brazilian teams in several locations in the Atlantic Forest in Brazil (Ribeiro & Blagoderov 2009), only two specimens of *Lecteria* were retrieved from the samples, i.e., a single male and female of *L. calopus*. Similarly, during one year of sampling carried out by ZADBI project in Costa Rica (Borkent *et al.* 2018; Brown *et al.* 2018), and using multiple trapping methods, no *Lecteria* specimens were recorded (Jon Gelhaus, *pers. com.*).

In his review of the subgenus *Lecteria*, Alexander attributed great importance to the color pattern present in the species, particularly the color bands of the legs and the spots on the wings. He used these characteristics as first elements when separating groups of species, as is the case with those featuring totally brown tarsi and those with annulated tarsi (Alexander 1969). The natural degradation of pigmentation in specimens preserved in alcohol or other liquid mediums over the years, poses a problem at the time of its characterization, even in the short term. This is particularly worrisome when the coloration is a key element in the identification of the species, and without discarding the particular conditions in which the sample has been stored (light, temperature, other materials in contact with the sample) and the sampling method employed. Given the above, we believe in the need, whenever possible, to elaborate keys that allow us to separate the species with an emphasis on their morphological characteristics (including genitalic structures).

Acknowledgements

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