

New South American records of the Lestremiinae (Diptera: Cecidomyiidae), with an identification key to the Neotropical genera

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Abstract. Mycophagous midges of the subfamily Lestremiinae are widespread, yet their diversity in the Southern Hemisphere remains poorly understood. Six species in four genera were known to occur in South America: *Anarete buscki* Felt, 1915, *Anaretella perfecta* Carmo-Neto, Lamas & Urso-Guimarães, 2024, *Insulestremia sinclairi* Jaschhof, 2004, *Insulestremia amorini* Carmo-Neto, Lamas & Urso-Guimarães, 2021, *Insulestremia amenti* Carmo-Neto, Lamas & Urso-Guimarães, 2021, and *Lestremia nigra* Blanchard, 1852. This study consolidates recent findings on Lestremiinae in Brazil and neighboring countries, providing new faunistic records that summarizes the knowledge of their diversity. We present new records of seven species in four genera: *Anarete* Haliday, 1833 in Brazil, including the species *A. buscki* Felt, 1915 and *A. johnsoni* (Felt, 1908); *Conarete* Pritchard, 1951 in Brazil and Paraguay, including *C. eluta* Pritchard, 1951, *C. texana* Felt, 1912, and *C. sicyoidea* Li & Bu, 2002; *Lestremia* Macquart, 1826 in Brazil, represented by *L. leucophaea* Meigen, 1818; and *Wasmanniella* Kieffer, 1898 in Brazil and Peru. Notably, the Lestremiinae are now formally recorded for the first time in Paraguay and Peru, and *Wasmanniella* in the Neotropical Region. A key to the genera found in the Neotropical region is also presented.

Keywords. Bibionomorpha; Biodiversity; Neotropical Region; Taxonomy; Mycophagous midges.

INTRODUCTION

Tiny mycophagous midges of the family Cecidomyiidae are easily overlooked by researchers because they are inconspicuous, unlike the gall-forming species that leave showy traces of their presence in the form of entomogen galls and, therefore, have been studied more consistently around the globe (Gagné & Jaschhof, 2021). Nevertheless, the mycophagous taxa represent about 25% of the 6,590+ known species in the family, and they are ubiquitous in the natural environment as part of the recycling of nutrients by their association with decaying vegetal matter and fungi (Mamaev & Krivosheina, 1965; Jaschhof & Jaschhof, 2009).

The Lestremiinae *sensu* Jaschhof & Jaschhof (2009) is one of the five subfamilies within Cecidomyiidae composed entirely of mycophagous species. This subfamily is one of the most ancient clades of Cecidomyiidae (Sikora *et al.*, 2019), in-

cluding 13 extant genera and 107 extant and four fossil species (Carmo-Neto *et al.*, 2021; Gagné & Jaschhof, 2021; Nel, 2021). Lestremiines are recognized by the following combination of characters: the first tarsomere is longer than the second, a relatively short vein R_5 that joins the Costa well before the wing apex (except in *Eomastix* Jaschhof, 2009 and *Gongromastix* Enderlein, 1936), and a forked vein M_{1+2} , with the fork being longer than the stem (Fig. 1A).

Although not the most abundant of the cecidomyiids, Lestremiinae taxa have been documented as being notably widespread (Jaschhof & Jaschhof, 2011; Gagné & Jaschhof, 2021); species of the genera *Anaretella* Enderlein, 1911 and *Lestremia* Macquart, 1826 are listed as cosmopolitan (Gagné & Jaschhof, 2021). Notwithstanding, the records for the Southern regions are scarce, including the recent records of *Anaretella* for South America (Carmo-Neto *et al.*, 2024) and only a few

[†] The author passed away on July 17th, 2024. His contribution to this study was based on his doctoral research, which was fundamental for the development of the results presented. He submitted this manuscript to *Papéis Avulsos de Zoologia* two months before his passing.

genera besides the cosmopolitan ones: *Anarete* Haldy, 1833 for the Australasian Region; *Anarete*, *Conarete* Pritchard, 1951, and *Insulestremia* Jaschhof, 2004 for the Neotropical Region; and *Allarete* Pritchard, 1951 and *Conarete* for the Afrotropical Region.

The study of the Lestremiinae in the Neotropical Region began with the description of *Lestremia nigra* Blanchard, in 1852, from Chile. More than 60 years later, Felt described *Anarete buscki*, in 1915, from Cuba.

In 1994, Gagné added the record of *Conarete eluta* Pritchard for Dominica. Ten years later, Jaschhof (2004) recorded the occurrence of *A. buscki* in the Galapagos Islands, Ecuador, and erected the monotypic genus *Insulestremia* to include the species *I. sinclairi*. Altogether, six species in four genera are known to occur in South America, *Anarete buscki*, *Anaretella perfecta* Carmo-Neto, Lamas & Urso-Guimarães, 2024, *Insulestremia sinclairi*, *Insulestremia amorimi* Carmo-Neto, Lamas & Urso-Guim-

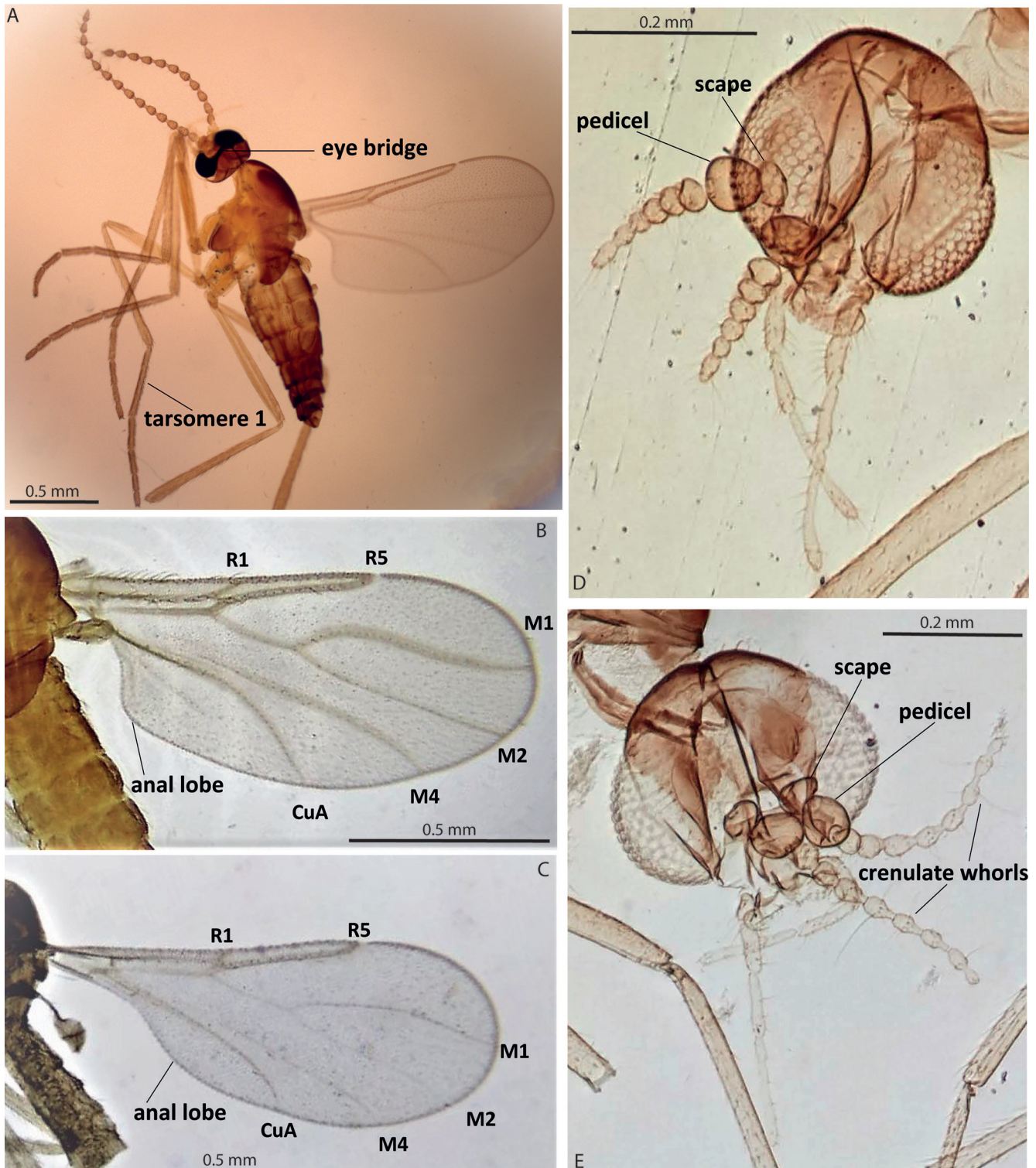


Figure 1. Lestremiinae male adult morphology, including (A) Habitus of adult male of *Anaretella defecta* Winnertz, without genitalia; (B) wing of *Insulestremia amorimi* Carmo-Neto, Lamas & Urso-Guimarães; (C) wing of *Wasmanniella* sp.; (D) head of *Anarete johnsoni* (Felt); (E) head of *Conarete eluta* Pritchard.

arães, 2021, *Insulestremia amenti* Carmo-Neto, Lamas & Urso-Guimarães, 2021, and *Lestremia nigra*.

In Brazil, mycophagous taxa such as the Lestremiinae and the Stomatosematidi have been completely unnoticed until recently (Carmo-Neto *et al.*, 2019, 2021, 2024). To further expand our knowledge of this fauna, and benefiting from several taxonomic initiatives promoted in Brazil, we studied samples from five of the major Brazilian biomes: the Amazon Forest, the Atlantic Forest, the Cerrado (Brazilian savannah), the Pantanal (Brazilian wetlands), and the Caatinga (dry tropical forest). Those biomes are known to be both rich in endemics and highly threatened by landscape changes (Brazil Flora Group, 2021; MMA, 2018), hence the increasing necessity of assessing their biodiversity. Additional samples from other South American countries were combined for the present inventory and the first identification key to the genera occurring in the Neotropical region is also presented.

MATERIAL AND METHODS

Specimens from Brazil examined in our study are from samples collected all over the country by various collecting initiatives (*e.g.*, Lamas *et al.*, 2023). Additionally, we obtained material from other South American countries which, along with the Brazilian specimens, will be deposited in the MZUSP. Types and determined specimens of described taxa were studied as reference material for the identifications. Morphological variation between our specimens and the reference material, when present, are noted in the Remarks. Reference material came from the institutions listed below (the respective contacts in parentheses):

MZUSP – Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil (curator Carlos Lamas)

NHRS – Naturhistoriska Riksmuseet, Stockholm, Sweden (curator Yngve Brodin)

SDEI – Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (curator Frank Menzel)

USNM – National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A. (Raymond Gagné)

Specimens were previously stored in 70% alcohol. They were first mounted into temporary slides with glycerin and characterized into morphospecies with compound microscope analysis; afterwards, the best preserved representants of each morphospecies were selected to be mounted into permanent slides with Canada balsam as described by Jaschhof & Jaschhof (2009), while the remaining specimens are kept in alcohol. The study focuses on the male specimens, as the taxonomy of the group is based on adult male morphology (Jaschhof & Jaschhof, 2009, 2011).

Photographs were taken by a DFK 23UX236 camera attached to the Nikon microscope. Stack images were obtained with the software CombineZP. Measurements of body size were taken from outstretched specimens, in-

cluding genitalia, with the software IC Measure. Morphological terminology followed Jaschhof & Jaschhof (2009), except for thorax and wing, which was updated following Cumming & Wood (2017). Classification and previous distributional data follow Gagné & Jaschhof (2021). Geographical data (longitude/latitude) were gathered from the labels of the samples; for some specimens, no precise locality data were available and for these we used geographical coordinates that are central to the specified area to plot the record in the maps. The maps were prepared in the Google INEGI (https://www.inegi.org.mx/servicios/api_map.html).

Abbreviations used: leg. (collectors); mun. (municipality); N.P. (National Park); s.m. (slide-mounted); S.T. (State Park); U.A.E. (United Arab Emirates); UEMS (Universidade Estadual de Mato Grosso do Sul); UFSCar (Universidade Federal de São Carlos); UNEMAT (Universidade do Estado de Mato Grosso); U.S.A. (United States of America); USP (Universidade de São Paulo).

RESULTS

We report here our findings after the study of 394 adult male specimens of Lestremiinae (507 specimens in total). This study provides the first published records of the subfamily in Paraguay and Peru (Fig. 2). We are reporting the new records of seven species in four genera (Table 1): *Anarete* Haliday, 1833 in Brazil, including the species *A. buscki* Felt, 1915 and *A. johnsoni* (Felt, 1908); *Conarete* Pritchard, 1951 in Brazil and Paraguay, including *C. eluta* Pritchard, 1951, *C. texana* Felt, 1912, and *C. sicyoidea* Li & Bu, 2002; *Lestremia* Macquart, 1826 in



Figure 2. Geographic distribution of Lestremiinae species newly reported in this study for South America.

Table 1. Number of genera, species, and specimens per State of Brazil that were included in this study.

Genus	Species	N m	N f	Country	State
1. <i>Anarete</i>	<i>A. buscki</i> (Felt)	48	3	Brazil	Mato Grosso, São Paulo
	<i>A. johnsoni</i> (Felt)	20	0	Brazil	São Paulo
3.	<i>C. eluta</i> Pritchard	2	0	Brazil	São Paulo
4. <i>Conarete</i>	<i>C. sicyoidea</i> Li & Bu	1	0	Brazil	Acre
		65	0	Paraguay	Pastoreo
5.	<i>C. texana</i> (Felt)	21	0	Brazil	Mato Grosso
6. <i>Lestremia</i>	<i>L. leucophaea</i> (Meigen)	6	0	Brazil	São Paulo
		228	104	Brazil	Acre, Alagoas, Amapá, Amazonas, Bahia, Espírito Santo, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Paraná, Paraíba, Rondônia, São Paulo, Santa Catarina
7. <i>Wasmanniella</i> sp		3	6	Peru	Cusco



Figure 3. Geographic distribution of Lestremiinae species for South America.

Brazil, represented by *L. leucophaea* Meigen, 1818; and *Wasmanniella* Kieffer, 1898 in Brazil and Peru., which are also the first records of this genus from the Neotropical Region. The updated scenario summarizes twelve species in six genera of Lestremiinae for South America (Fig. 3). The austral-most record for each genus is indicated and a key to the genera found in the Neotropical region is also presented.

New faunistic records

Genus *Anarete* Haliday, 1833

Refs: Edwards, 1938; Pritchard, 1951; Kim, 1967; Jaschhof & Jaschhof, 2011.

Distribution

Previous: Australasian, Holarctic, Neotropical, and Oriental regions. **New records:** Brazil (Neotropical).

Austral-most records: Brazil, São Paulo, Sorocaba (23°34'52.011"S, *A. buscki* and *A. johnsoni*, this study)

Anarete buscki (Felt, 1915)

Distribution

Previous: U.S.A. (Nearctic); Cuba, Galapagos Islands and Puerto Rico (Neotropical) (Gagné & Jaschhof, 2021). **New record:** Brazil (Neotropical).

Material examined: BRAZIL: Mato Grosso state, Nova Xavantina mun., campus UNEMAT, Malaise point 56, refugio, 1♂ s.m., 03.iv.1997, Batista, J.D. & team leg.; 2♂ s.m., 06.xii.2006; Mato Grosso state, Poconé mun., Malaise 50 (SISBIOTA-Diptera), Farm Rio Clarinho, wood's trail, 16°36'16,8"S, 56°43'19,0"W, 1♂ s.m., 16.viii-19.ix.2012, Lamas, Nihei & team leg.; Mato Grosso state, Poconé mun., Malaise 53 (SISBIOTA-Diptera), Farm Rio Clarinho, former road Transpantaneira, 16°35'28,7"S, 56°43'57,1"W, 5♂ s.m., 19.x-30.xii.2012, Lamas, Nihei & team leg.; São Paulo state, Ribeirão Preto mun., USP, Guest House, 593 m, sweeping, 21°09'54"S, 47°50'56"W, 3♂, 17.xii.2019, Buzati, Pirani & Riccardi leg.; sweeping, 3♂, 31.i.2020, P.R. Riccardi leg.; Malaise 1, 1♂, 17-28.xii.2019, Riccardi & Flores leg.; Malaise 1, 4♂ s.m., 28.xii.2019-09.i.2020, Riccardi & Flores leg.; Malaise 1, 1♂ s.m., 09-21.i.2020, Riccardi & Flores leg.; Malaise 2, 2♂, 17-28.xii.2019, Amorim & Riccardi leg.; Malaise 2, 7♂, 09-21.i.2020, P.R. Riccardi leg.; Malaise 2, 6♂ (1 s.m.), 21-31.i.2020, P.R. Riccardi leg.; Malaise 2, 8♂, 01-27.ii.2020, P.R. Riccardi leg.; São Paulo state, Sorocaba mun., campus UFSCar, flying at the window of Laboratory of Systematics of Diptera, 23°34'52.0"S, 47°31'37.9"W, 1♂ s.m. and 3♀, 07.x.2020, A.M. Carmo-Neto leg.; Malaise in vegetation behind Laboratory of Systematics of Diptera, 23°34'52.0"S, 47°31'37.9"W, 2♂, 04-21.i.2021;; 1♂, 21.i-05.iii.2021, A.M. Carmo-Neto leg.

Anarete johnsoni (Felt, 1908)

Distribution

Previous: U.S.A. (Nearctic); UK, Sweden, Germany, Japan, Latvia and Russia (Palearctic); Hawaiian Is.? (Australasian)

(Gagné & Jaschhof, 2021). **New record:** Brazil (**new to Neotropical region**).

Material examined: BRAZIL: São Paulo state, Ribeirão Preto mun., USP, Guest House, 593 m, Malaise 2, 21°09'54"S, 47°50'56"W, 1♂, 17-28.xii.2019, Amorim & Riccardi leg.; sweeping, 21°09'54"S, 47°50'56"W, 18♂, 17.xii.2019, Buzati, Pirani & Riccardi leg.; São Paulo state, Sorocaba mun., *campus* UFSCar, Malaise in vegetation behind Laboratory of Systematics of Diptera, 23°34'52.0"S, 47°31'37.9"W, 1♂, 18.xi-02.xii.2020, C.A. Garcia & A.M. Carmo-Neto leg.

Genus *Conarete* Pritchard, 1951

Refs: Pritchard, 1951; Jaschhof & Jaschhof, 2011.

Distribution

Previous: U.S.A. (Nearctic); Dominica (Neotropical) (Gagné & Jaschhof, 2021). **New records:** Brazil (Neotropical). **Austral-most records:** Paraguai, Caaguazú, Pastoreo (25°22'S, *C. sicyoidea*, this study).

Conarete eluta Pritchard, 1951

Distribution

Previous: U.S.A. (Nearctic); Dominica (Neotropical) (Gagné & Jaschhof, 2021). **New record:** Brazil (Neotropical).

Material examined: BRAZIL: São Paulo state, Ribeirão Preto mun., USP, Guest House, 593 m, Malaise 2, 21°09'54"S, 47°50'56"W, 2♂, 17-28.xii.2019, Amorim & Riccardi leg.

Remarks

The specimens found in Brazil present more than one tooth in the pretarsal claws, the ejaculatory apodeme slightly shorter, about 1.5 times as long as tegmen, and the eye bridge with two facets wider medially. As these are slight and continuous differences, we attributed it to intraspecific variations and assigned the specimens tentatively under the name *C. eluta*.

Conarete sicyoidea Li & Bu, 2002

Distribution

Previous: U.A.E. (Palearctic); China – Hainan (Oriental) (Gagné & Jaschhof, 2021). **New records:** Brazil, Paraguay (**new to Neotropical region**).

Material examined: BRAZIL: Acre, Bujari mun., Fe3, 09°20'01"S, 68°19'17"W, 1♂ s.m., 25.viii.2006, A.A. Agudelo, F.F. Xavier, M.M. Mendes & J.A. Rafael leg.; PAR-

AGUAY: Caaguazú mun., Pastoreo district, 65♂ (5 s.m.), 03-07.i.1972.

Conarete texana Felt, 1913

Distribution

Previous: U.S.A. (Nearctic) (Gagné & Jaschhof, 2021). **New record:** Brazil (**new to Neotropical region**).

Material examined: BRAZIL: Mato Grosso state, Poconé mun., Malaise 52 (SISBIOTA-Diptera), Farm Rio Clarinho, opposite riverbank of Rio Claro, 16°36'24.8"S, 56°43'16.7"W, 2♂ s.m., 19.x-26.xi.2012, 19♂ (10 s.m.), 19.ix-19.x.2012 Lamas, Nihei & team leg.

Genus *Lestremia* Macquart, 1826

Refs: Pritchard, 1951; Jaschhof & Jaschhof, 2003, 2009.

Distribution

Previous: Cosmopolitan (Gagné & Jaschhof, 2021). **New record:** Brazil (Neotropical). **Austral-most record:** New Zealand, Auckland Islands (50°43'S, *L. novaezelandiae*, Jaschhof & Jaschhof, 2003).

Lestremia leucophaea (Meigen, 1818)

Distribution

Previous: Australasian, Holarctic (Gagné & Jaschhof, 2021). **New record:** Brazil (**new to Neotropical region**).

Material examined: BRAZIL: São Paulo state, Ibitinga mun., environmental licensing: "Seringueira BA, clone/GA/1328 e RRIM 600", 3♂ s.m., 30.ii.1988, 1♂ s.m., 14.xii.1988; São Paulo state, Ribeirão Preto mun., USP, Guest House, 593 m, Malaise 1, 21°09'54"S, 47°50'56"W, 1♂ s.m., 10-17.xii.2019, 4♂, 17-28.xii.2019, Riccardi & Flores leg.

Genus *Wasmanniella* Kieffer, 1898

Refs: Pritchard, 1951; Jaschhof & Jaschhof, 2011.

Distribution

Previous: Holarctic, Oriental (Gagné & Jaschhof, 2021). **New records:** Brazil, Peru (**new to Neotropical region**). **Austral-most record:** Brazil, Santa Catarina, São Bento do Sul (26°15'50.8"S, *W. sp.*, this study).

Material examined: BRAZIL: Acre state, Senador Guionard mun., experimental farm Catuaba, *campus* Universidade Federal do Acre, Malaise, 10°04'28"S,

67°37'00"W, 13♂ (3 s.m.), 16-24.xi.2013, J.T. Câmara leg.; Alagoas state, Quebrângulo, Reserva Biológica Pedra Talhada, Malaise fifth trail, 1♂, 11-14.ix.2002, third trail, 3♂ and 1♀, 08-11.ix.2002, Penteado-Dias & team leg.; Amapá state, Serra do Navio mun., 00°52'28,1"S, 51°57'43,4"W, 2♂ and 1♀, 20.xi.2014, J.A. Rafael & F.F. Xavier Filho leg.; Amazonas state, Manaus mun., Reserva Biológica do Cueiras ZF2, 02°35'21"S, 60°06'55"W, 1♂, 06-09.viii.2013, Agudelo, A., Maldaner, C. leg.; Malaise, trail tower, 02°35'29"S, 60°12'53"W, 2♂, 03-06.vii.2015, D.D.D. Carmo, F. Xavier Filho & team leg.; km-14, 02°35'21"S, 60°06'55"W, small Malaise near tower, 45♂ (16 s.m.), 08-17.viii.2016, J.A. Rafael & F.F. Xavier Filho leg.; 6 m Malaise on the ground, 02°35'21"S, 60°06'55"W, 17♂ (9 s.m.) and 21♀, 01-15.x.2016, 02°35'21"S, 60°09'55"W, 1♂ and 1♀, 17-31.viii.2017, J.A. Rafael & F.F. Xavier Filho leg.; Amazonas state, Novo Airão mun., Ramal Mato Grosso, 02°48'51"S, 60°56'24"W, 2♂ (1 s.m.), 07-11.vii.2015, D.D.D. Carmo, F. Xavier Filho & team leg.; Amazonas state, Tapauá mun., Rio Ipixuna, Porto Cotinha, Malaise, 1♂ s.m. and 2♀ (1 s.m.), 08-13.x.2013, D.M.M. Mendens leg.; Bahia state, Mata de São João mun., Reserva de Sapiranga, Malaise point B5 (Biota FAPESP), 1♂, 22-25.viii.2001, M.T. Tavares & team leg.; Bahia state, Porto Seguro mun., N.P. Monte Pascal, 100-200 m, Malaise 1 in the woods, 16°53'S, 39°24'W, 3♂ and 5♀, 12.viii-02.ix.2013, B. Santos, M.T. Tavares & team leg.; Bahia state, Porto Seguro mun., Estação Ecológica Pau Brasil, 101 m, woods point 1, Malaise (Biota-FAPESP), 16°23'17.6"S, 39°10'55.6"W, 1♂ and 3♀, 17.v.2002, C.O. Azevedo & team leg.; 107 m, trail point 1, Malaise (Biota-FAPESP), 16°23'17.6"S, 39°10'55.6"W, 3♂, 17.v.2002, 3♂ and 2♀, 20.v.2002, C.O. Azevedo & team leg.; Espírito Santo state, Linhares mun., Reserva Biológica Sooretama, 23 m, Malaise point 5, trail, 18°58'02.7"S, 40°08'06.8"W, 2♂, 24-27.iii.2002, C.O. Azevedo & team leg.; 49 m, Malaise point 4 in the woods, 18°58'03"S, 40°08'03.6"W, 3♂ (1 s.m.), 21-24.iii.2002, C.O. Azevedo & team leg.; Espírito Santo state, Santa Teresa mun., Estação Biológica Santa Lucia, 867 m, Malaise point 5 in the woods, 19°58'19.5"S, 40°32'10.3"W, 1♂ and 1♀, 09-12.iv.2001, C.O. Azevedo & team leg.; Goiás state, Mineiros mun., N.P. de Emas, Malaise 1, parcel 2, forest, 17°54'8.011"S, 52°59'47.074"W, 1♂ and 17♀, 19.xii.2015-15.i.2016, 5♂ (1 s.m.) and 7♀, 19.iii-19.iv.2017; Malaise 2, parcel 4, Cerrado *sensu stricto*, 17°54'44.903"S, 52°59'20.648"W, 3♂ (1 s.m.) and 8♀, 17.xi-19.xii.2015, Oliveira, Lopes & Fava leg.; Mato Grosso state, Poconé mun., Malaise 52 (SISBIOTA-Diptera), Farm Rio Clarinho, opposite riverbank of Rio Claro, 16°36'24,8"S, 56°43'16,7"W, 1♂, 19.x-26.xi.2012, 4♂ (2 s.m.), 26.xi-30.xii.2012, Lamas, Nihei & team leg.; Malaise 53 (SISBIOTA-Diptera), Farm Rio Clarinho, former road Transpantaneira, 16°35'28,7"S, 56°43'57,1"W, 1♂ s.m., 19.x-30.xii.2012, Lamas, Nihei & team leg.; Mato Grosso do Sul state, Aquidauana mun., Reserva Ecológica, Universidade Estadual do Mato Grosso Sul, semideciduous seasonal forest, dense vegetation, Malaise 07 (SISBIOTA-Diptera), 20°26'03.7"S, 55°39'20.8"W, 1♂, 11-26.x.2012, Lamas, Nihei & team leg.; riparian forest,

Córrego Fundo, Malaise 09 (SISBIOTA-Diptera), 20°26'07.2"S, 55°39'32.8"W, 1♂ s.m., 11-26.iii.2012, Lamas, Nihei & team leg.; Mato Grosso do Sul state, Bodoquena mun., Serra da Bodoquena, transitional forest, farm Califórnia, Malaise 05 (SISBIOTA-Diptera), 20°41'53.5"S, 56°52'55.7"W, 1♂, 06-21.v.2012, Lamas, Nihei & team leg.; Mato Grosso do Sul state, Porto Murtinho mun., farm Retiro Conceição, trail Mata Bruta, 89 m, Malaise 33 (SISBIOTA-Diptera), 21°41'54.2"S, 57°45'57.1"W, 3♂, 15.v-01.vii.2012, 3♂ and 1♀, 01.vii-15.vii.2012, Lamas, Nihei & team leg.; Minas Gerais state, Botelhos mun., Córrego da onça, Malaise, forest, 21°40'90"S, 46°22'05"W, 1♂, 05-20.xi.2006, Amorim, Falaschi & Oliveira leg.; Paraná state, Morrestes mun., S.P. do Pau Oco, Malaise point 84, 1♂ s.m., 10-13.iv.2002, Tavares & team leg.; Paraná state, Ponta Grossa mun., Itaiacoca district, Malaise A, 25°07'03.7"S, 49°56'27.8"W, 2♂, 19-04.ix.2016, 1♂, 19-04.xi.2016, Almeida, M.C., Toletto, L., Santos, M.H leg.; Malaise B, 1♂, 19.iii-19.iv.2018, 1♂, 19.iv-21.v.2018, Almeida, M.C., Araújo, E., Santos, M.H leg.; Paraná state, Serranópolis mun., N.P. do Iguacu, Malaise - TEC - 03, 25°28'9.5"S, 53°51'57.6"W, 4♂ s.m. and 11♀, 10-15.i.2007; Paraíba state, João Pessoa mun., Malaise p6, 1♂, 25-28.vii.2002; Rio de Janeiro state, Itatiaia mun., N.P. do Itatiaia, Administração, rain forest, Malaise, 762 m, 22°27'17"S, 44°36'35"W, 7♂, 07-14.i.2016, Amorim & Silva leg.; Rondônia state, Cacaulândia mun., Sítio do Cabeça, 133 m, Malaise 25 (SISBIOTA-Diptera), 10°17'56.5"S, 63°14'12"W, 9♂ (4 s.m.), 15.x-04.xi.2011, Lamas, Nihei & team leg.; Rondônia state, Campo Novo, 10°40.128"S, 63°29.004"W, 4♂, 06-10.xii.2013, Amorim, Ament & Riccardi leg.; Rondônia state, Monte Negro mun., 10°16.347"S, 63°20.762"W, 1♂ s.m., 05-07.xii.2011, Amorim, Ament & Riccardi leg.; Rondônia state, Porto Velho mun., river Madeira, Área Mutum, Jirau hydroelectric, transects M6-M8, campaign 11, Malaise, 09°35'54.4"S, 65°02'53.7"W, 1♂, 17.vi-01.vii.2012, C.E.D. Sanhudo & F. Andriolli leg.; São Paulo state, Campos do Jordão mun., Malaise 5 (INCT), 5♂ (2 s.m.) and 1♀, 17.v.2010, N.W. Perioto & team leg.; S.P. Campos do Jordão, Malaise 1, 658 m, 22°42'07"S, 42°28'48"W, 1♂, 17-21.v.2015, Dell'Erba, R., Moraes, S.S., Quintero, A. & Silva, R.O. leg.; Horto Florestal, 1,546 m, Malaise 4 (INCT), 22°39'42.6"S, 45°27'28"W, 5♂ and 2♀, 14.iii.2011, Airton & Cassice leg.; São Paulo state, Jundiá mun., Serra do Japi (INCT), 23°14'19,1"S, 46°56'15,3"W, 2♂ and 5♀, 29.vi.2009, A.S. Soares leg.; Malaise 1 (INCT), 1,173 m, 23°14'29.6"S, 45°56'14,1"W, 7♂, 29.vi.2009, Malaise 3 (INCT), 1,173 m, 23°14'2.5"S, 45°56'18.5"W, 6♂ and 1♀, 29.vi.2009, A.S. Soares leg.; São Paulo state, Ribeirão Grande, S.P. Intervalles, Malaise point B1, 24°15'S, 48°10'W, 4♂ and 2♀, 13-16.xii.2000, M.T. Tavares & team leg.; Malaise point T1, 24°15'S, 48°10'W, 1♂, 13-16.xii.2000, M.T. Tavares & team leg.; São Paulo state, Ribeirão Preto mun., USP, Guest House, 593 m, Malaise 1, 21°09'54"S, 47°50'56"W, 1♂ s.m., 03-10.xii.2019, 1♂, 10-17.xii.2019, 4♂ (2 s.m.), 17-28.xii.2019, 1♂ s.m., 09-21.i.2020, Riccardi & Flores leg.; Malaise 2, 1♂ s.m., 01-27.ii.2020, P.R. Riccardi leg, 3♂ s.m., 28.xii.2019-09.i.2020, Amorim & Riccardi leg.; São Paulo

state, Salesópolis mun., Reserva Biológica Boracéia, trilha dos pilões, Malaise point 3, 23°39'04.8"S, 45°53'41.8"W, 1♂, 30.iii-02.iv.2001; Malaise point 6, 23°39'05.3"S, 45°53'51.7"W, 1♂, 02.iii-02.iv.2001, T.P. Amarante & team leg.; São Paulo state, São Luis do Paraitinga, S.P. da Serra do Mar, Núcleo Santa Virgínia, Malaise point 7 (INCT), 23°19'27.2"S, 45°05'38.5"W, 2♂, 22.x.2010, N.W. Perioto & team leg.; São Paulo state, Santo André mun., Reserva Biológica Paranapiacaba, Malaise 02, 23°46'44"S, 46°18'40"W, 2♂ s.m., 20.vi-23.viii.2011, Takakoshi & Ribeiro leg.; São Paulo state, Sertãozinho mun., Reserva Biológica Augusto Ruschi, Malaise, fragment 2, border, 1♂ s.m., 23.ii-03.iii.2011, D.S. Amorim & V.C. Silva leg.; white Malaise, fragment, 1♂, 11-25.v.2011, V.C. Silva, P.F. Donda & G. Ignácio leg.; São Paulo state, Sorocaba mun., campus UFSCar, first expedition, Malaise fragment 4, 11♂ (6 s.m.) and 1♀, 06.xi.09, Tauhyl leg.; São Paulo state, Teodoro Sampaio mun., S.P. Morro do Diabo, Malaise point 1, 22°36'15.8"S, 52°18'02.5"W, 2♂ and 10♀, 17.ii.2011, N.W. Perioto & team leg.; São Paulo state, Ubatuba mun., S.P. Serra do Mar, Malaise 02 trail, 23°21'43"S, 44°49'22"W, 2♂ and 1♀ s.m., 24.i.2002, N.W. Perioto & team leg.; Malaise 9, 1♂, 24.i.2002; Santa Catarina state, São Bento do Sul mun., Cepa – Rugendal, first Malaise – trail, 1♂ and 1♀, 16-19.x.2001; Santa Catarina state, São Francisco do Sul mun., Vila da Glória, fifth Malaise, trail (Biota-Fapesp), 1♂, 17-20.x.2001 (MZUSP); PERU: Cusco, 19 RD km W of Quincemil, Rio Araza tributary, 874 m, 13°26'10"S, 70°50'57"W, 3♂ and 6♀, 23-31.viii.2012, R.R. Cavichioli, J.A. Rafael, A.P.M. Santos & D.M. Takiya leg.

Remarks

Adults of *Wasmanniella* are largely uniform in their slender morphology. The genus has long been noted to be abundant outside the Holarctic Region, and potentially speciose (Jaschhof & Jaschhof, 2009, 2011). In this study, we recorded an abundance of *Wasmanniella* specimens, probably belonging to several unnamed species.

Identification key to the neotropical genera of Lemestriinae

1. Antennae with 6 to 9 flagellomeres; pedicel more than 1.5 times the length of scape (Figs. 1D-E)..... 2
- Antennae with 14 flagellomeres; pedicel subequal in length and width relative to scape (Fig. 4C) 3
2. Antennae with 6 to 7 flagellomeres; flagellomeres without neck and crenulate whorl of setae (Fig. 1D)..... *Anarete*
- Antennae with 7 to 9 flagellomeres; flagellomeres with neck and crenulate whorl of setae (Fig. 1E) *Conarete*
3. Eye bridge incomplete, without ommatidia dorsally (Fig. 4C); wing with only a slightly convex anal lobe (Fig. 1C)..... *Wasmanniella*
- Eye bridge complete (Fig. 1A); wing with strongly convex anal lobe (Fig. 1B) 4
4. Antennae with regular hair-shaped translucent sensilla (Fig. 4B); tegmen acuminate (Fig. 4D)..... *Lestremia*

- Antennae with furcate antennal translucent sensilla, arising from enlarged alveoli, and regular hair-shaped translucent sensilla (Fig. 4A); tegmen not acuminate (Fig. 4E-F)..... 5
- 5. Tegmen with subapical projections; gonostylus without megasetae; anterior portion of gonocoxal apodemes present (Fig. 4F) ... *Anarete*
- Tegmen without subapical projections; gonostylus with megasetae; anterior portion of gonocoxal apodemes absent (Fig. 4E) *Insulestremia*

GENERAL CONSIDERATIONS

The specimens of *Wasmanniella* were relatively abundant in the samples examined from the southern regions. Their previous absence from taxonomic studies may be attributed to the challenges associated with their identification. Similarly to *Anarete*, they are found across a diverse array of habitats. In contrast, specimens of *Lestremia* were found to be scarce, despite being reported as abundant in New Zealand and throughout the Holarctic Region (Jaschhof & Jaschhof, 2003, 2009). These findings suggest a shift in the relative dominance between these genera in the Neotropical region, as it is contrary to the pattern observed in the Northern Hemisphere.

Anarete and *Conarete* were recorded mainly in the central parts of Brazil, while their presence was rare in samples collected in the Amazon Forest and in the Atlantic Forest, particularly along the eastern coast. These findings align with previous studies suggesting their predominance in open habitats, including deserts, where they gather into swarms (Kim, 1967; Jaschhof, 2004; Jaschhof & Jaschhof, 2011).

The widespread occurrence of some species represents another significant contribution of the new records. Species of *Conarete* may display distribution and phenotypic diversity at levels comparable to the widespread species such as *Anarete defecta* Winnertz, 1870, *Lestremia cinerea* Macquart, 1826, and *L. leucophaea*. This is evidenced by the presence of *C. sicyoidea* in South America and the intraspecific variation reported for *C. eluta*. Future studies focused on unraveling the diversity of southern *Wasmanniella* should consider the same aspects.

Our key is the first for the Neotropical genera of Lestremiinae. As such, it is the first key to include the identification of the genus *Insulestremia*, which is exclusively Neotropical. By providing this information, we hope to facilitate future studies of the Lestremiinae in the region. The biodiversity account presented here includes samples from threatened and severely degraded localities and can serve as a reference for future studies on the conservation and recovery of their fauna.

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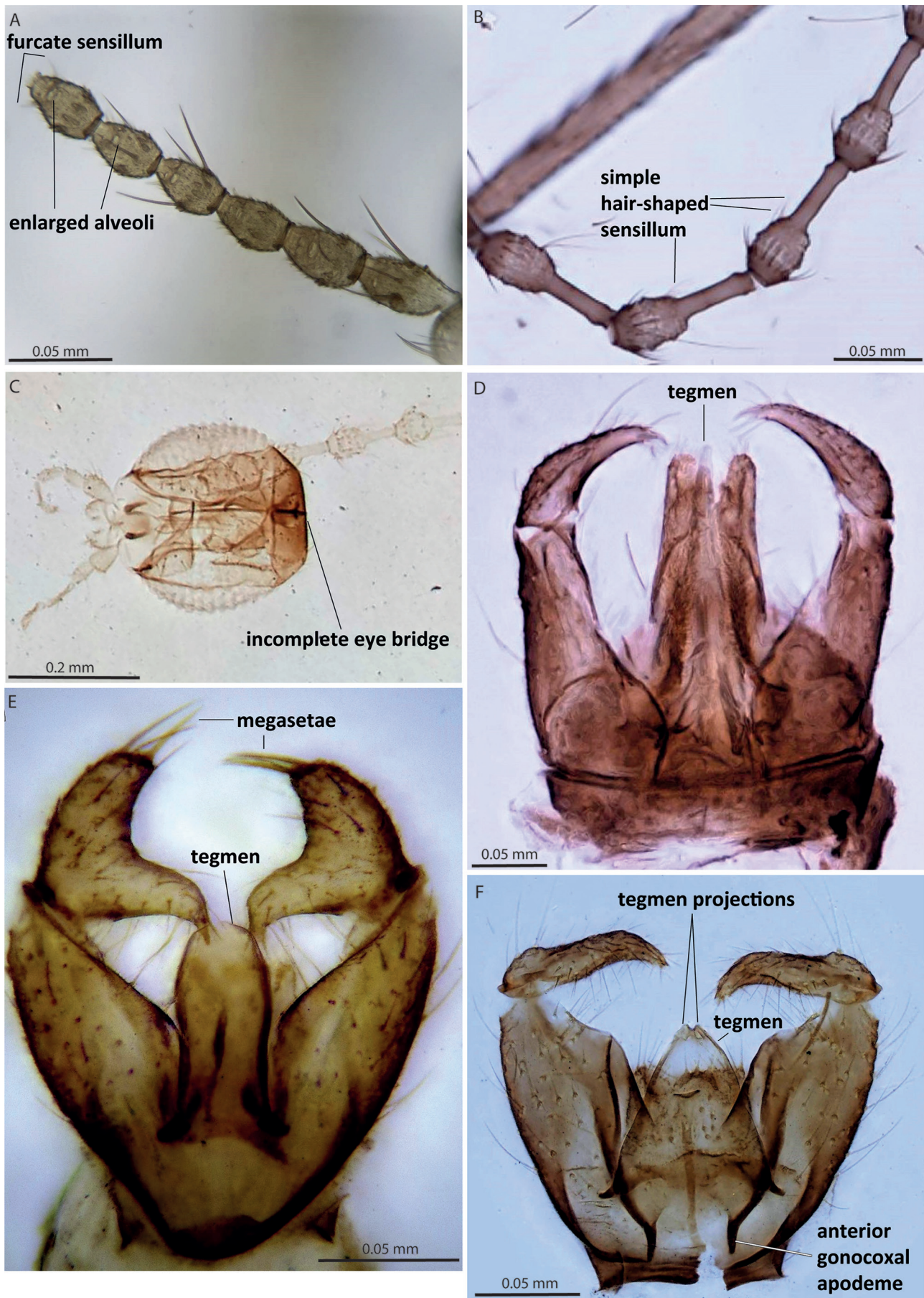


Figure 4. Lestremiinae male adult morphology, including (A) Antenna of *Insulestremia amorimi* Carmo-Neto, Lamas & Urso-Guimarães; (B) Antenna of *Lestremia leucophaea* (Meigen); (C) head of *Wasmanniella clauda* Pritchard; (D) terminalia of *Lestremia leucophaea* (Meigen); (E) Terminalia of *Insulestremia amorimi* Carmo-Neto, Lamas & Urso-Guimarães; (F) Terminalia of *Anaretella defecta* Winnertz.

the discussion of the results; they reviewed and approved the final version of the paper.

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