



Argentinian phlebotomine fauna, new records of Phlebotominae (Diptera: Psychodidae) for the country and the province of Chaco

ENRIQUE A. SZELAG^{1,3,4,6}, JOSE D. ANDRADE FILHO², JUAN R. ROSA³, MATIAS A. PARRAS^{1,4}, MARINA STEIN^{3,4}, MARIA G. QUINTANA^{1,4,5} & OSCAR D. SALOMON^{1,4}.

¹Instituto Nacional de Medicina Tropical, Jujuy s/n, Puerto Iguazú, Misiones, Argentina. E-mail: odanielsalomon@gmail.com

²Centro de Referência Nacional e Internacional para Flebotomíneos, Grupo de Estudos em Leishmaniose, Centro de Pesquisas René Rachou, Av. Augusto de Lima 1715, Belo Horizonte, MG, Brazil. jandrade@cpqrr.fiocruz.br

³Instituto de Medicina Regional, Universidad Nacional del Nordeste. Av. Las Heras 727, Resistencia, Chaco, Argentina. E-mail: inmedreg@unne.edu.ar

⁴Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICET). C.A.B.A, Argentina.

⁵Instituto Superior de Entomología “Dr. Abraham Willink”, Universidad Nacional de Tucumán. Miguel Lillo 205. San Miguel de Tucumán. Argentina.

⁶Corresponding author. E-mail: szelag_enrique@yahoo.com.ar; enriqueszelag@gmail.com

Sand flies are insects of medical and veterinary importance, because some species are able to transmit several pathogens such as *Bartonella* spp., *Phlebovirus* spp., and protozoan parasites of the genus *Leishmania* (Ross). They are widely distributed in the Americas, with recordings ranging from Canada to Argentina. Approximately 500 Phlebotominae species are known in the Americas, of which it is considered that at least 56 are involved in the transmission of leishmaniasis (Maroli *et al.* 2012). Previous studies have shown that the phlebotomine fauna in Argentina consists of 32 species distributed in 14 provinces (Quintana *et al.* 2012; Sábio *et al.* 2015; Salomón *et al.* 2010). Of these species, *Lutzomyia longipalpis* (Lutz & Neiva), *Nyssomyia neivai* (Pinto), *Ny. whitmani* (Antunes & Coutinho), *Cortelezzii* complex [*Evandromyia cortelezzii* (Brèthes) – *Ev. sallesi* (Galvão & Coutinho)], *Micropygomyia quinquefer* (Dyar) and *Migonemyia migonei* (França) have been found with DNA of *Leishmania* spp. (Moya *et al.* 2015). Five new records of species in the province of Chaco, obtained from different projects carried out between 2001 and 2015, four of which are also new records for Argentina, are described in this article. Their importance as potential vectors and the correct determination of the sympatric species is also discussed.

The biogeographical Chaco province is divided by its annual rainfall gradient into two clearly differentiated subregions: the Eastern region (Wet Chaco) and the Western region (Dry Chaco). The former presents a wet Atlantic rainfall pattern where biomes form parkland and savanna with abundant rainfall in summer and fall. On the other hand, the Western subregion has a dry continental and semi-arid rainfall pattern (Morrone 2001).

Phlebotominae captures were held monthly in the two biogeographical subregions by installing mini CDC light traps (Sudia & Chamberlain 1962) at 1.5 meters above the ground, being active for 12 hours (from 7pm to 7am). In the Western Chaco subregion captures were made during the period 2006–2008 on two consecutive nights in Nueva Población hamlet approximately 40 km from the city of Misión Nueva Pompeya (nearest town). In the Eastern Chaco subregion, captures were made overnight from 2001 to 2013 in the towns of Margarita Belen, Colonia Benitez (1° de Mayo Department), Tres Isletas (Maipú Department), Resistencia and Barranqueras (San Fernando Department). In the transitional area Wet Chaco/Dry Chaco: Pampa del Indio, monthly collections were made on two consecutive nights during the period 2013–2015. In each town, a house with favorable environmental conditions for vector development was selected (shaded, decaying organic matter, animals close to the house and patches of forest ≥ 100 m). Three light traps were placed in each of the houses in: 1) intradomiciliary sites (inside house or veranda); 2) peridomiciliary sites (pens or animal's resting places, near the house); 3) extradomiciliary sites (patches of forest, no less than 100 m. from the house).

The Phlebotominae captured after diafanization were mounted according to the technique proposed by Forattini (1973). Species identification and classification were performed in accordance with the key proposed by Galati (2003) with modifications by Galati (2015). Distribution and known habitats of species were described according to Galati (2015) and Aguiar & Medeiros (2003), respectively. The dates, places of capture and coordinates were listed for each species, as well as, sex and number of species caught by date.

Genera, subgenera and species previously recorded in Argentina

Brumptomyia avellari (Costa Lima), *Br. brumpti* (Larrousse), *Br. guimaraesi* (Coutinho & Barretto), *Br. pinto* (Costa Lima), *Evandromyia (Aldamyia) evandroi* (Costa Lima & Antunes), *Ev. (Barrettomomyia) cortelezii*, *Ev. (Bar.) sallesi*, *Expapillata firmatoi* (Barretto, Martins & Pellegrino), *Micropygomyia (Sauromyia) oswaldoi* (Mangabeira), *Mi (Sau.) peresi* (Mangabeira), *Mi. (Sau.) quinquefer*, *Migonemyia (Migonemyia) migonei*, *Martinsmyia alphabetica* (Fonseca), *Nyssomyia neivai*, *Ny. whitmani*, *Lutzomyia (Lutzomyia) longipalpis*, *Oligodontomyia* sp., *Pintomyia (Pintomyia) bianchigalatae* (Andrade Filho, Aguiar, Dias & Falcão), *Pi. (Pin.) damascenoi* (Mangabeira), *Pi. (Pin.) fischeri* (Pinto), *Pi. (Pin.) pessoai* (Coutinho & Barretto), *Pi. (Pifanomyia) misionensis* (Castro), *Pi. (Pif.) monticola* (Costa Lima), *Pi. (Pif.) torresi* (Le Pont & Desjeux), *Psathyromyia (Forattiniella) pascalei* (Coutinho & Barretto), *Pa. (Psathyromyia) baratai* (Sábio, Andrade & Galati), *Pa. (Psa.) bigeniculata* (Floch & Abonnenc), *Pa. (Psathyromyia) lanei* (Barretto & Coutinho), *Pa. (Psa.) punctigeniculata* (Floch & Abonnenc), *Pa. (Psa.) shannoni* (Dyar), *Sciopemyia sordellii* (Shannon & Del Ponte), *Trichophoromyia auraensis* (Mangabeira).

New recordings in Argentina

Evandromyia (Aldamyia) aldafalcaoae (Santos, Andrade Filho & Honer).

Chaco, Eastern biogeographical region—Margarita Belén (27°26'34"S 58°54'13"W): 1 male 06-II-2012; "Monte Alto", Resistencia (27°16'48"S 59°1'11"W): 1 male 04-XII-2013; Barranqueras (27°30'50"S 58°58'20"W): 1 male 15-III-2010, 1 female 07-X-2010. Transitional Area—Pampa del Indio (25°52'29.9"S 59°49'25.5"W): 1 male, 2 females 10-I-2013; 1 male, 1 female 11-III-2014; 4 males, 3 females 09-IV-2015. Caught in peridomicile (associated with kennels and pigsty), intradomicile (veranda) and on edge of forest.

Known distribution. Brazil (Mato Grosso do Sul) in intradomicile and peridomicile associated with poultry.

Evandromyia (Aldamyia) termitophila (Martins, Falcão & Silva).

Chaco, Western biogeographical region - Nueva Población, Misión Nueva Pompeya (24°58'18"S 61°21'25"W): 1 male 10-X-2008; Paraje Lalelay, Tres Isletas (26°20'22"S 60°15'44"W): 1 female 04-IV-2011, captured in intradomicile and peridomicile associated with a pigsty and a henhouse.

Known distribution. Bolivia, Brazil (Widely distributed in the country, with nearest recordings to Argentina in the states of Mato Grosso, Mato Grosso do Sul and São Paulo). This species has been found in wild animal burrows, especially those of the order Xenarthra, in crevices of rocks and associated with farm animals around rural dwellings.

Evandromyia (Barrettomomyia) corumbaensis (Galati, Nunes, Oshiro & Rego).

Chaco, Eastern biogeographical region—Colonía Benítez (27°19'16"S 58°59'53"W): 1 male 19-III-2012; Monte Alto, Resistencia (27°16'48"S 59°1'11"W): 2 males 09-IV-12 and 17-I-2013. Western biogeographical region - Nueva Población, Misión Nueva Pompeya (24°58'18"S 61°21'25"W): 7 males 21-XI-2006, 09-I-2007, 21-III-2007, 01-X-2007 and 13-XII-2007; 8 females 25-IV-2007, 01-X-2007, 13-XII-2007 and 15-XII-2008, captured in peridomicile and extradomicile.

Known distribution. Bolivia, Brazil (Widely distributed in the country, with nearest recordings to Argentina in the states of Goiás, Mato Grosso, Mato Grosso do Sul and Minas Gerais). Captured in intradomicile and peridomicile (associated with chickens, dogs, pigs and horses), on the forest edge and in rock crevices and caves.

Psathyromyia (Forattiniella) campograndensis (Oliveira, Andrade Filho, Falcão & Brazil)

Chaco, Eastern biogeographical region—Km 31, Margarita Belén (27°10'S 58°58'W): 1 female 20-XI-2001, 1 female 19-IV-2002, 1 female 21-IV-2003, captured on the edge of the forest.

Known distribution. French Guyana, Brazil (Roraima, Amapá, Amazonas, Mato Grosso do Sul). It has been recorded in woods, henhouses in the peridomicile and intradomicile.

New recording in the province of Chaco

Psathyromyia (Psathyromyia) bigeniculata (Floch & Abonnenc)

Chaco, Eastern biogeographical subregion—Margarita Belén (27°26'34"S 58°54'13"W): 6 males 15-XII-2011, 2 males 27-III-2013, captured in extradomicile site; Monte Alto, Resistencia (27°16'48"S 59°1'11"W): 1 female 17-V-2006, 2 males 25-IV-2006, 1 male 6-IX-2008, 1 female 15-XII-2011, 1 male 14-I-2013, captured in peridomicile (pigsty and henhouse) and extradomicile.

Male and female previously identified as *Pa. shannoni* in Resistencia peridomicile site cited by Rosa *et al.* (2010).

Known distribution. French Guyana, Brazil (Amapá, Amazonas, Pará, Bahia, São Paulo, Mato Grosso do Sul). It was described in intradomicile, peridomicile (associated with animal pens) and forest.

The recordings presented herein, not only contribute to the description of the composition of Argentinian fauna, but also extend the southern limit of known distribution of these species, being this, its southernmost recording on the continent.

Evandromyia corumbaensis, distributed in the Cerrado province (Galati 2015) with *Ev. cortelezii*, *Ev. sallesi* and *Ev. spelunca* constitute the Cortelezii complex, in which the females can hardly be differentiated and males are distinguished by morphological characters often difficult to observe, thus leading to misidentifications (Carvalho *et al.* 2011). Based on these observations, it is emphasized that the Cortelezii complex (so far only consisting in Argentina of *Ev. cortelezii* and *Ev. sallesi*), should be analyzed in future studies considering the inclusion of *Ev. corumbaensis* to the Argentinian fauna. *Evandromyia aldafalcaoae* in its turn, considered to be restricted to the state of Mato Grosso do Sul, extends its known distribution into the Chaco domain. This distribution is consistent considering that both species are recorded in a transitional zone between the Pantanal and the Cerrado of Brazil, the latter considered very similar in landscape and composition of flora to the Chaco province (Morrone 2001).

Psathyromyia campograndensis and *Ev. termitophila* are also recorded in the Amazonian domain as well in Brazilian Chaco domain (Cerrado and Caatinga provinces) (Galati 2015), suggesting a possible as yet unregistered distribution in Paraguay.

Psathyromyia shannoni, having several species as junior synonyms, until recently was considered the taxon with the widest distribution in the Americas, from the United States to Argentina. However, one of the species considered as its junior synonym, *Pa. bigeniculata*, has been revalidated and the majority of specimens of the cis-Andean region that had been identified as *Pa. shannoni* belong in fact to *Pa. bigeniculata* (Sábio *et al.* 2014). On the basis of the observations of these latter authors, *Phlebotomus microcephalus* (Barretto & Duret), another junior synonym of *Pa. shannoni* described from Chaco, Argentina, needs to have its taxonomic status evaluated. Further, among other specimens identified as *Pa. shannoni*, including those from Argentina, there exists another species, *Pa. baratai*, recently described by Sábio *et al.* (2015). Based on the morphological differences presented by Sábio *et al.* (2014) to distinguish *Pa. bigeniculata* from *Pa. shannoni* the presence of *Pa. bigeniculata* in the Chaco region is confirmed, not only at the sites sampled in this study but also by specimens existing in previous collection (Rosa *et al.* 2010). These findings reinforce Sábio's proposal, and emphasize the need for a review of the specimens identified as *Pa. shannoni* in Argentina, to determine the actual distribution of *Pa. bigeniculata* and *Pa. baratai*, and the possible presence of other members of the Shannoni complex.

The record of *Oligodontomyia* sp. in Argentina is the southernmost record of Phlebotominae in the world. Captured with Malaise trap in Somuncura plateau (Río Negro Province) was originally identified as *Lutzomyia* sp. by Muzón *et al.* (2002). Later it has been determined that the individual belongs to *Oligodontomyia* genus, unfortunately it was not possible to determine it at species level because of the bad condition of the specimen. Further studies in the area will be focalized in Phlebotominae fauna, in order to capture this species and to determine either if this is one of the three *Oligodontomyia* species described in the world, or if it is a new species of the Argentinean Patagonia.

Also draws attention the presence of *Th. auraensis* in Argentina. This record was cited after the determination of the a single male, from a revision of collection material, recorded as 1954, Puerto Iguazú, Misiones Province (Spinelli *et al.* 1999). The species has not been captured again, even after intensive regular captures carried out in the same region during the last decade, neither the specimen of the collection could be observed again by other researchers. The known distribution of *Th. auraensis* is currently restricted to the Amazonas rain forest in Bolivia, Brazil, Colombia, Peru, Suriname and Venezuela. Therefore, it is necessary to review the Argentinean record to determine if this species is actually distributed in the Paranaense and Amazonian subregions, with two of the largest rainforests of South America, or if it is just restricted to the Amazon rain forest.

While the role of these species in the transmission of *Leishmania* parasites is unknown, it should be noted that the Cortelezii complex has been incriminated as the probable vector of Cutaneous Leishmaniasis (CL) in Argentina due to its high abundance in sporadic outbreaks of CL, and as it has been found naturally with the DNA of *Le. braziliensis* in the Western Chaco region (Rosa *et al.* 2012). Even though during those captures only specimens of *Ev. cortelezii* and *Ev. sallesi* were identified, it should be highlighted that the present recordings also include the presence of *Ev. corumbaensis* at the sampling site. Thus, future studies may be oriented toward identifying the possible natural infection of *Ev. corumbaensis* in the region. On the other hand *Ev. cortelezii* and *Ev. termitophila* have been found in Brazil naturally infected with *Le. infantum* (syn *Le. chagasi*) by the use of molecular methods (Carvalho *et al.* 2008; Saraiva *et al.* 2010). While molecular determination of infection with *Leishmania* does not necessarily imply confirmation of this species as a vector, the presence of *Ev. termitophila* and specimens of the Cortelezii complex, should be considered for study in areas with active transmission of *Le. infantum* in the country, in order to determine their possible role in the transmission cycle and the consequent associated risk.

With the new recordings presented in this paper, the total number of known species in the country has thus been

expanded to 36, and the number of species reported in the Argentinian Chaco bioregion to 19. The Chaco has now therefore becomes the second province in terms of the number of species cited in the country, after the province of Misiones.

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