

New records of mosquitoes (Diptera: Culicidae) from Misiones Province, Argentina

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Primeros registros de mosquitos (Diptera: Culicidae) de la provincia de Misiones, Argentina

RESUMEN. Las siguientes especies representan el primer registro de la Argentina: *Culex (Anoedioporpa) canaanensis* Lane & Withman, *Culex (Anoedioporpa) originator* Gordon & Evans, *Culex (Culex) declarator* Dyar & Knab, *Culex (Melanoconion) ribeirensis* Forattini & Sallum, *Culex (Microculex) neglectus* Lutz, *Culex (Microculex) pleuristriatus* Lutz, *Orthopodomyia fascipes* Coquillett y *Wyeomyia (Wyeomyia) medioalbipes* Lutz. Las especies *Anopheles (Nyssorhynchus) guarani* Shannon y *Ochlerotatus (Ochlerotatus) rhyacophilus* (Da Costa Lima) fueron recientemente rescatadas de la sinonimia de *Anopheles (Nyssorhynchus) lutzii* Cruz y *Ochlerotatus (Ochlerotatus) scapularis* (Rondani). Las siguientes especies corresponden a nuevos registros de la provincia de Misiones: *Anopheles (Anopheles) neomaculipalpus* Curry, *Coquillettidia (Rhynchoaenia) fasciolata* (Lynch Arribalzaga), *Culex (Culex) acharistus* Root, *Culex (Culex) tatoi* Casal & García, *Culex (Culex) usquatus* Dyar y *Toxorhynchites (Lynchiella) guadeloupensis* (Dyar & Knab). Con estos nuevos registros el número de especies citadas se eleva a 189 de la provincia de Misiones y 242 de Argentina.

PALABRAS CLAVE. *Anoedioporpa*. *Culex*. *Microculex*. *Melanoconion*. *Orthopodomyia fascipes*. *Wyeomyia medioalbipes*.

ABSTRACT. The following species represent first records for Argentina: *Culex (Anoedioporpa) canaanensis* Lane & Withman, *Culex (Anoedioporpa) originator* Gordon & Evans, *Culex (Culex) declarator* Dyar & Knab, *Culex (Melanoconion) ribeirensis* Forattini & Sallum, *Culex (Microculex) neglectus* Lutz, *Culex (Microculex) pleuristriatus* Theobald, *Orthopodomyia fascipes* (Coquillett) and *Wyeomyia (Wyeomyia) medioalbipes* Lutz. The species *Anopheles (Nyssorhynchus) guarani* Shannon and *Ochlerotatus (Ochlerotatus) rhyacophilus* (Da Costa Lima), recorded for Argentina, were recently resurrected from the synonymy of *Anopheles (Nyssorhynchus) lutzii* Cruz and *Ochlerotatus (Ochlerotatus) scapularis* (Rondani). The following species represent the first report for Misiones Province: *Anopheles (Anopheles) neomaculipalpus* Curry, *Coquillettidia (Rhynchoaenia) fasciolata* (Lynch Arribalzaga), *Culex (Culex) acharistus* Root, *Culex (Culex) tatoi* Casal & García, *Culex (Culex) usquatus* Dyar. With these new records the number of mosquito species for Misiones Province increases to 189 while for Argentina to 242.

KEY WORDS. *Anoedioporpa*. *Culex*. *Microculex*. *Melanoconion*. *Orthopodomyia fascipes*. *Wyeomyia medioalbipes*.

INTRODUCTION

Information about mosquito species distribution in a given area is crucial to determine the risk of pathogen transmission. Mosquito studies in Argentina have increased in the late years, but interesting regions of the country as Misiones Province are still poorly surveyed. The major biodiversity of Argentine mosquitoes is present in this province, with 174 out of the 232 species cited for the country (Rossi *et al.*, 2006; Visintin *et al.*, 2010; Campos *et al.*, 2011). Misiones is one of the most attractive provinces of the country because of tourism and the commercial exchange with Brazil and Paraguay. Due to past outbreaks of Malaria and Yellow Fever in the region, Misiones was surveyed for mosquito diversity, mainly using CDC- light traps; as a consequence some species were recorded based on a single or few adults, without data of immature stages. The aim of this report is to increase the knowledge in the distribution of the mosquito species of Misiones Province, from the survey of natural and artificial larval habitats in the vicinity of Iguazú and Moconá Falls.

MATERIAL AND METHODS

Study area. The sampled areas were three protected forests, *Parque Nacional Iguazú* (PNI), *Parque Provincial Saltos del Moconá* (PPSM) and *Parque Provincial Esmeralda* (PPE), and two deforested ones near Iguazú and Moconá Falls. The first, PNI, (25° 41' S, 54° 26' W) is a native forest of 58,600 ha surrounding Iguazú Falls in northwestern Misiones Province. The PNI contacts the city of Puerto Iguazú through a forest with intense deforestation activity and with cutaneous leishmaniasis and yellow fever (25° 39' S, 54° 33' W) (Holzman *et al.*, 2010; Salomón *et al.*, 2009). The native forest extends 170 km southeastern PNI through other protected areas and contacts Moconá Falls. These areas are PPSM (27° 9' S, 53° 53' W) and PPE (26° 53' S, 53° 53' W) with 999 and 31,619 ha, respectively. Authorizations were required for carrying out the samplings. The mentioned areas belong to the southernmost border of the Atlantic Forest, one of the most diverse and threatened of the world (Giraudó *et al.*, 2003) and are part of the "green corridor" (*corredor verde*) of Misiones Province. The region is characterized by a subtropical climate without a marked dry season, rainfalls between 1600-2000 mm/year and mean

temperature about 20.1 °C with extreme temperatures of -6 and 40° C. The vegetal physiognomy of the Atlantic Forest is as follows: a low stratus composed by fungi, ferns and herbaceous plants (Gramineae); a medium stratus with shrubs, cacti, medium-sized bamboos and trees; and a high stratus with giant bamboo, palms and trees higher than 30 m. Epiphytes like orchids, ferns, bromeliads and species of the family Araceae are present in all stratus. The presence of swamps and streams in the landscape is also common (Martinez-Crovetto, 1963).

Material examined. Studied specimens came from immature stages collected from different larval habitats and adults caught in the field with net or CDC- light traps. Natural larval habitats included bamboo internodes, bromeliad axils, fallen leaves, marshes, puddles, rock holes, streams, tree holes and waterlogged soils. Artificial containers like plastic jars, washbasins, swimming pools, plastic bottles and tires were also sampled. Larvae were collected with pipette, tube or dipper according to the habitat. Because the work was carried out in protected areas only a few specimens were collected per sampling unit. Artificial containers with *Aedes* species were destroyed after examination. Some larvae were mounted and other larvae and all pupae were reared up to the adult stage. CDC- light traps were set in four farms in the rural zone and in two natural environments that connect PNI with the urban zone of PI. Adults were also captured with a net during day and night hours by feeding, flying or resting. Specimens from the collection of *Museo de La Plata* (Argentina) (MLP) were also reviewed. The species identification was based on fourth instar larvae or adults, male genitalia and cibarial armature for *Culex* (*Melanoconion*) females. Specimens were mounted by standard protocols and deposited in the MLP.

Abbreviations were used as follows: male (M), female (F), larvae (L), pupae (P), pupal exuviae (Pe), larval exuviae (Le), and male genitalia (MG). When referring to many samples the coordinates are those of the sample place (e.g. PNI). When possible, coordinates of the exact sampling point are given and the number of decimals was according to the precision of the data. Datum of the coordinates corresponds to WGS-84.

Most specimens were collected by EL, identified by GR and EL, in the case of specimens from the collection of MLP, the collector and identifier are indicated. For the identification of the species, the

following publications were consulted: Lane (1953), Lane & Withman (1951) for specimens of *Culex* (*Microculex*); Bram (1967), Casal & García (1971) for *Culex* (*Culex*); Berlin & Belkin (1980), Duret (1950), Casal *et al.* (1968) for *Culex* (*Anoedioporpa*); Castro & Bresanello (1952a) for *Coquillettidia*; Forattini & Sallum (1993) for *Culex* (*Melanoconion*); Nagaki *et al.* (2010, 2011) for *Anopheles*; Sallum *et al.* (1988), Reinert (2000) for *Ochlerotatus*; Zavorzink (1968), Castro & Bresanello (1952b), Da Costa Lima (1935) for *Orthopodomyia*; Buijning (1959) for *Wyeomyia*; van der Kuyp (1954), Augier *et al.* (2003) for *Toxorhynchites*.

The world-wide distribution of species was taken from WRBU (2013), the distribution in Argentina is developed by GCR. The abbreviation for genera and subgenera is according to Reinert (2009).

RESULTS

FIRST RECORDS FROM ARGENTINA

- *Culex* (*Anoedioporpa*) *canaanensis* Lane & Whitman: PPSM, 5 F, 2 M, 7 Le, 7 Pe, collected as larvae from a tree hole (27° 9' 15" S, 53° 54' 8" W), VI/4/2011. Current distribution: Argentina (Misiones), Brazil.

- *Culex* (*Anoedioporpa*) *originator* Gordon & Evans: PNI, 4 M, 2 MG, 9 F, 8 L, 2 Pe, 2 Le, collected as larvae from six tree holes from July 2009 to January 2010. Current distribution: Argentina (Misiones), Brazil, French Guiana, Grenada, Trinidad and Tobago.

- *Culex* (*Culex*) *declarator* Dyar & Knab: PI (25° 36' S, 54° 34' W) and Cabureí (25° 35' S, 54° 5' W), 2 M, 2 MG, IV/30/1967, J. Bejarano coll.; PNI (25° 41' S, 54° 27' W) 1 M, 1 MG collected with UV light, specimen 2925 MLP, X/1982, D. Carpintero (Sr.) coll. Current distribution: from United States of America to Uruguay and Argentina (Misiones).

- *Culex* (*Melanoconion*) *ribeirensis* Forattini & Sallum: PNI, 1 M, 1 MG, 24 H adults collected near to a swamp (25° 40' 41" S, 54° 26' 56" W) and a stream (25° 40' 32" S, 54° 26' 50" W), with CDC- light trap and a net during the night from February 2005 to June 2007; PPE, 2 P collected from a stream, 2 F, 2 Pe, (26° 53' 46" S, 53° 52' 46" W), VII/9/2012. Current distribution: Argentina (Misiones), Brazil.

- *Culex* (*Microculex*) *neglectus* Lutz: PNI, 2 L, collected from giant bamboo internodes (*Gua-dua chacoensis*) at the coast of the Iguazú River (25° 32' 47" S, 54° 17' 45" W), V/17/2006, 1 M, 1 MG, 1 F, 2 Pe, 2 Le. Current distribution: Argentina (Misiones), Brazil.

- *Culex* (*Microculex*) *pleuristriatus* Theobald: specimens collected from bromeliads at the PPSM (27° 9' 10" S; 53° 54' 6" W), 2 M, 1 MG, 2 Le, 2 Pe, VI/2/2011; PPE (26° 53' 54" S; 53° 53' 47" W) 1 F, 1 Pe, 1 Le, VII/9/2012. Current distribution: Argentina (Misiones), Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Suriname, Trinidad and Tobago, Venezuela.

- *Orthopodomyia fascipes* (Coquillett): Larvae collected from tree holes from PNI (25° 40' 48" S, 54° 27' 0" W) from July 2007 to November 2010, 7 M, 4 MG, 13 F, 12 Pe, 3 Le, 13 L. Current Distribution: Argentina (Misiones), Bolivia, Brazil, Colombia, Costa Rica, Ecuador, French Guiana, Nicaragua, Panama, Perú, Suriname, Trinidad and Tobago, Venezuela.

- *Wyeomyia* (*Wyeomyia*) *medialbipes* Lutz: individuals collected from bromeliads at PNI (25° 41' 2" S, 54° 26' 43" W) from January to June 2011, 5 M, 3 MG, 17 F, 1 P, 22 Pe, 13 L, 19 Le. Current distribution: Argentina (Misiones), Brazil, Suriname, Trinidad and Tobago.

SPECIES RECENTLY RESURRECTED

- *Anopheles* (*Nyssorhynchus*) *guarani* Shannon: collected with CDC- light trap in a recently deforested area of PI (25° 41' S, 54° 38' W), V/2007, 1 F. Two pupae collected from a stream at PPE (26° 59' 40" S, 53° 57' 59" W), VII/9/2012, 1 M, 1 F, 1 Pe. Lane (1953) synonymized *An. guarani* with *An. lutzii* Cruz; Nagaki *et al.* (2011) revalidated *An. guarani* as a valid species. According to the literature, the species is present in the following localities of Misiones Province: PNI, Montecarlo, Eldorado, Puerto Piray, Colonia Carataguay, Las Delicias and Los Helechos (Duret, 1950) (specimens not revised). Current distribution: Argentina (Misiones), Brazil.

- *Ochlerotatus* (*Ochlerotatus*) *rhyacophilus* (Da Costa Lima): PNI, larvae collected from basalt holes in the coast of Iguazú River (25° 39' S, 54° 27' W) from October 2006 to November 2009

and from fallen leaves, (25° 40' 59" S, 54° 26' 36" W), IX/5/2009. The species was cited by García & Casal (1968) from larvae collected in rock holes and adults from PNI. Arnell (1976) synonymized it with *Oc. (Och.) scapularis* (Rondani) (as *Aedes*) and Sallum *et al.* (1988) performed a redescription of the species and returned the valid taxonomic rank of species. Current distribution: Argentina (Misiones), Brazil.

NEW RECORDS FROM MISIONES PROVINCE

- *Anopheles (Anopheles) neomaculipalpus* Curry: Apóstoles Department, RN 14 and Anchico stream (27° 42' 36" S, 55° 41' 18" W), IX/11/2002, 1 F, Rossi coll. Current distribution: Argentina (Chaco, Corrientes, Formosa, Misiones, Salta, Santa Fe), Belize, Bolivia, Brazil, Colombia, Costa Rica, El Salvador, Guatemala, México, Panamá, Paraguay, Perú, Trinidad and Tobago, Venezuela.

- *Coquillettidia (Rhynchotaenia) fasciolata* (Lynch Arribáza): El Soberbio (27° 17' 31" S, 54° 12' 28" W), 1 F CDC- light trap, XI/2006, M. D'Oria coll. Current distribution: Argentina (Buenos Aires, Chaco, Formosa, Jujuy, Misiones, Santa Fe, Tucumán), Belize, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, French Guiana, Guyana, Honduras, Nicaragua, Panama, Perú, Suriname, Trinidad and Tobago, Uruguay, Venezuela

- *Culex (Culex) acharistus* Root: PNI, 1 L, collected from basalt hole (25° 39' 19" S, 54° 27' 25" W), I/7/2010. PPE (26° 53' 42" S, 53° 53' 39" W), 1 M, 1 MG, 1 Pe, pupa collected from fallen leaves. Current distribution: Argentina (Buenos Aires, Chubut, Córdoba, Corrientes, Jujuy, Misiones, Neuquén, Río Negro, Tucumán), Brazil, Chile, Colombia.

- *Culex (Culex) tatoi* Casal & García: PI, 1 L, collected from wetland (25° 36' 40" S, 54° 33' 37" W), XII/14/2011. PNI, 3 L, 1 M, 1 MG, larvae collected from pools and wetlands (25° 40' 55" S, 54° 27' 5" W), II/23/2007. Current distribution: Argentina (Buenos Aires, Córdoba, La Pampa, Misiones, Río Negro, Jujuy, Tucumán).

- *Culex (Culex) usquatus* Dyar: PI, specimens collected from wetland (25° 36' 37" S, 54° 33' 37" W), XII/14/2011, 2 M, 2 MG, 1 F, 3 Pe, 2 L, 3 Le. PNI (25° 40' 45" S, 54° 27' 21" W), 2 M, 1

MG, 1 F, 1 Pe, 1 L, 1 Le, IX/2006 and II/13/2010. Current distribution: Argentina (Formosa, Jujuy, Misiones, Salta), Belize, Brazil, Guatemala, México, Panamá, Paraguay, Suriname.

EXTENSION OF DISTRIBUTION

- *Anopheles (Anopheles) annulipalpis* Lynch Arribáza: Wanda (25° 58' S, 54° 34' W), 3 F, VIII/1972, H. Hepper coll. Current distribution: Argentina (Buenos Aires, Chaco, Corrientes, Entre Ríos, Mendoza, Misiones, Santa Fe), Uruguay.

- *Culex (Carrollia) soperi* Antunes & Lane: Wanda (25° 58' S, 54° 34' W), 1 M, VIII/1994, D. Carpintero (Sr.) coll. and det.; PNI, larvae captured on a piece of bamboo on the ground (25° 35' 43" S, 54° 22' 30" W), VII/20/2011, 2 M, 2 Pe, 2 Le. This is the second record of the species, which has only been mentioned from San Pedro and RN 14, Misiones Province. Current distribution: Argentina, Brazil.

- *Toxorhynchites (Lynchiella) guadeloupensis* (Dyar & Knab): PNI, 1 F, 2 Pe, 1 Le, collected from internodes of the giant bamboo (*Guadua chacoensis*) (25° 33' 47" S, 54° 17' 45" W), V/17/2006. Current distribution: Argentina (Catamarca, Corrientes, Jujuy, Misiones, Salta, Tucumán), Brazil, Colombia, Dominica, Guadeloupe, Haiti, Montserrat, Suriname, Trinidad and Tobago, Venezuela.

COMMENTS AND CONCLUSIONS

In this contribution we present the first record of eight mosquito species for Argentina and the first record of other five species for Misiones province. The records of *An. guarani* and *Oc. rhyacophilus* recently removed from synonymy by Nagaki *et al.* (2010, 2011) which were previously mentioned for the province by Duret (1950) and Casal & García (1968), and the extension of the distribution of other three species are also presented. About *Anopheles annulipalpis*, it is worth noting that Carcavallo *et al.* (1995) mentioned its presence in the province of Misiones without providing more information. With respect to *Toxorhynchites guadeloupensis* it was mentioned as *Toxorhynchites guadalupensis* by Campos *et al.* (2011). This record, which should be regarded as the first for the province, was not mentioned by the authors. With these additions to the Culicidae fauna, the number of species

present in Argentina increases from 232 to 242, and from 174 to 189 for Misiones Province.

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