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

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RESUMEN. Las siguientes especies representan el primer registro de la Argentina: Culex (Anoeedioporpa) canaanensis Lane & Withman, Culex (Anoeedioporpa) 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) rhacophilus (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 (Anoedioporpa) neomaculipalpus Curry, Coquillettidia (Rhynchotaenia) 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.


ABSTRACT. The following species represent first records for Argentina: Culex (Anoeedioporpa) canaanensis Lane & Withman, Culex (Anoeedioporpa) 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) rhacophilus (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 (Rhynchotaenia) 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.

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 last 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 southeast of 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 (Giraudo 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 & Whitman (1951) for specimens of *Culex* (*Microculex*); Bram (1967), Casal & Garcia (1971) for *Culex* (*Culex*); Berlin & Belkin (1980), Duret (1950), Casal et al. (1968) for *Culex* (*Anoediopora*); 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; Zavortink (1968), Castro & Bresanello (1952b), Da Costa Lima (1935) for Orthopodomyia; Bruijning (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* (*Anoediopora*) *canaanensis* Lane & Whitman: PPSM, 5 F, 2 M, 7 Le, 7 Pe, collected as larvae from a tree hole (27º 9' 15'' S, 53º 54' 8'' W), VI/4/2011. Current distribution: Argentina (Misiones), Brazil.

- *Culex* (*Anoediopora*) *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* (*Melanoconion*) *ribeirensis* Forattini & Sallum: PNI, 1 M, 1 MG, 24 H adults collected near to a swamp (25º 40' 41'' S, 54º 26' 56'' W) and a stream (25º 40' 32'' S, 54º 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, (26º 53' 46'' S, 53º 52' 46'' W), VII/9/2012. Current distribution: Argentina (Misiones), Brazil.


- *Culex* (*Microculex*) *pleuristriatus* Theobald: specimens collected from bromeliads at the PPSM (27º 9' 10'' S; 53º 54' 6'' W), 2 M, 1 MG, 2 Le, 2 Pe, VI/2/2011; PPE (26º 53' 54'' S; 53º 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 (25º 40' 48'' S, 54º 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*) *medioalbipes* Lutz: individuals collected from bromeliads at PNI (25º 41' 2'' S, 54º 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*) *guaranii* Shannon: collected with CDC- light trap in a recently deforested area of PI (25º 41' S, 54º 38' W), V/2007, 1 F. Two pupae collected from a stream at PPE (26º 59' 40'' S, 53º 57' 59'' W), VII/9/2012, 1 M, 1 F, 1 Pe. Lane (1953) synonymyzed *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.

and from fallen leaves, (25º 40’ 59’’ S, 54º 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) synonymyzed 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 (27º 42’ 36’’ S, 55º 41’ 18’’ W), IX/11/2002, 1 F, Rossi coll. Current distribution: Argentina (Chaco, Formosa, Misiones, Salta, Santa Fe), Belize, Bolivia, Brazil, Colombia, Costa Rica, El Salvador, Guatemala, México, Panamá, Paraguay, Perú, Trinidad and Tobago, Venezuela.


- Culex (Culex) acharistus Root: PNI, 1 L, collected from basalt hole (25º 39’ 19’’ S, 54º 27’ 25’’ W), I/7/2010. PPE (26º 53’ 42’’ S, 53º 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, Rio Negro, Tucumán), Brazil, Chile, Colombia.


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

- Culex (Carrollia) soperi Antunes & Lane: Wanda (25º 58’ S, 54º 34’ W), 1 M, VIII/1994, D. Carpintero (Sr.) coll. and det.; PNI, larvae captured on a piece of bamboo on the ground (25º 35’ 43’’ S, 54º 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 (Gua-dua chacoensis) (25º 33’ 47’’ S, 54º 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 & Garcia (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...
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LITERATURE CITED


