ISSN 1809-127X (online edition)

Check List
Journal of species lists and distribution

Lists of Species

Culicidae, province of Misiones, northeastern Argentina

José Martín D'Oria [1], Dardo Andrea Martí [1]* and Gustavo Carlos Rossi [2]

1 Laboratorio de Genética Evolutiva, Facultad de Ciencias Exactas, Químicas y Naturales. UNaM. CONICET - Félix de Azara 1552, (3300) Posadas, Misiones, Argentina.
2 Centro de Estudios Parasitológicos y de Vectores (CEPAVE) CCT CONICET, La Plata- UNLP Calle 2 Nº 584, (1902) La Plata, Argentina.
* Corresponding author. E-mail: *darmarti@yahoo.com.ar*

Abstract: We present a preliminary list of the Culicidae species collected in seven localities at the province of Misiones, Argentina, since the mosquito fauna of this region is poorly known. Mosquito sampling was carried out during spring-summer, between August 2006 and January 2007, the months of highest abundance of these insects. Collection of specimens was made with a CDC-like trap (Center for Disease Control and Prevention) in peri-urban zones. Sixty-five species were identified. The geographic distribution of *Anopheles darlingi*, *Uranotaenia davisi* and *Howardina fulvithorax* is extended.

Introduction

The province of Misiones has a surface of 30,000 km^2 and is located between Paraguay and Brazil; it comprises part of the phytogeographic region of the semi-deciduous Atlantic forest in its northern portion and the southernmost area of the Distrito de los Campos. Mean temperatures range from 15 °C in winter to 26 °C in summer, with a mean annual rainfall of 1,800 mm. The remainder of the interior Atlantic forest was recently estimated as 41-55 % of the original area (between 11,000 km^2 to 17,000 km^2). This environment is a moderator of the climate, preserving a high level of humidity in the atmosphere and influencing high biodiversity in the flora, thus favouring the existence of a great diversity of animal species (Giraudo *et al.* 2003).

With the exception of the city of Posadas (Figure 1), all other collection sites in this study were within the area bound on the east by the Parque Estadual do Turvo, state of Rio Grande do Sul, Brazil, and in the north by the Parque Estadual Foz do Iguaçu, state of Paraná, Brazil, a region with the lowest anthropic degradation within the geographic area considered (Giraudo *et al.* 2003).

At present, about 3,622 species of mosquitoes are known in the World (Harbach and Kitching 1998; W.R.B.U. 2008). Until now, 226 (6.23 %) of them have been recorded in Argentina, of which 165 were found in the province of Misiones (Rossi *et al.* 2006). Many of these species are actual or potential vectors of infectious agents that can cause important human diseases (Consoli and Lourenço-de-Oliveira 1994; Forattini 2002). The goal of this study was to update the record of mosquito species in seven localities of the province of Misiones, with emphasis in the eastern region along the Uruguay River coast, where Culicidae fauna was poorly known.

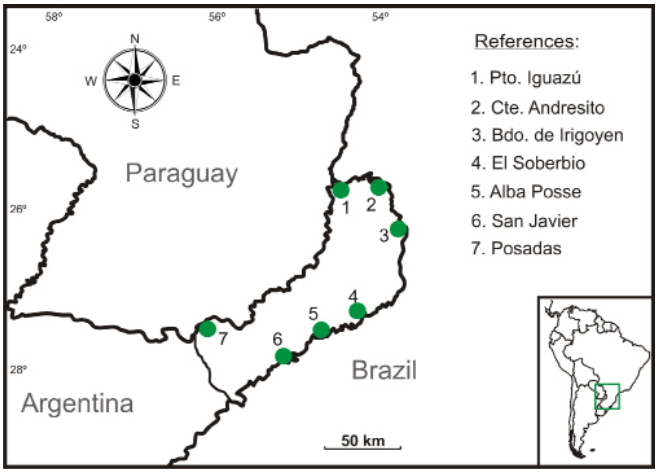

Figure 1. Location of the study areas. See details in the text.

Material and Methods

The sampling localities were near zones of cross-border step, with high harbour and commercial activity and with an international bridge crossing of people between Argentina, Paraguay and Brazil (Figure 1). The sampling localities were (1) Puerto Iguazú (25°35'28" S, 54°33'38" W); (2) Comandante Andresito, with two sampling sites, (2a) Prefectura Naval Argentina post (25°35'25" S, 53°59'20" W), and (2b) Gendarmería Nacional Argentina post (25°36'02" S, 53°58'19" W); (3) Bernardo de Irigoyen (26°16'13" S, 53°39'28" W); (4) El Soberbio (27°17'08" S, 54°11'48" W); (5) Alba Posse with two sampling sites, (5a) Aduana de Alba Posse (27°34'17" S, 54°40'40" W) and (5b) Alba Posse (27°34'10" S, 54°40'43" W); (6) San Javier (27°53'34" S, 55°08'03" W) and (7) Posadas (27°25'11" S, 55°51'41" W).

Capture of adult mosquitoes was carried out with a CDC-like trap, with minor modifications (Sudia and Chamberlain 1962). Samples were obtained monthly from August 2006 to January 2007; the climatic data of the seven sampling localities recorded during the present work are shown in Table 1. Traps were operated during 20 continuous hours in each site. They were set at 1.7 m above ground. The attractive element in this type of trap is carbon dioxide (CO_2-baited), supplied by a cylinder with a gas-flowmeter, calibrated to released 0.4 l/h, and four LED light bulbs. Traps were recovered after the scheduled time, and specimens collected and mounted for identification using taxonomic keys (Darsie 1985).

The abbreviation of genera and subgenera is based on Reinert (2001) *Howardina*, *Ochlerotatus* and *Stegomyia* are considered as genera according to Reinert (2000), as well as Lutzia accordingly to Tanaka (2003). Voucher specimens of each species were deposited in the collection of the

Table 1. Climatic data for the sampling localities of the province of Misiones, Argentina. Mean monthly rainfall (mm) / mean monthly temperature (ºC). ND= No data available.

Localities	2006					2007
	August	September	October	November	December	January
(1) Puerto Iguazú	63.0 / ND	47.8 / ND	55.0 / ND	25.6 / ND	26.2 / ND	26.2 / ND
(2) Cte. Andresito	17.4 / 18.7	34.6 / 20.4	16.5 / 25.7	15.6 / 25.4	18.8 / 27.4	24.4 / 27.2
(3) Bernardo de Irigoyen	29.1 / 15.8	17.2 / 18.7	26.7 / 21.5	16.8 / 19.8	26.4 / 23.2	31.5 / 21.8
(4) El Soberbio	21.7 / 16.3	14.2 / 18.7	17.9 / 21.6	32.0 / 21.6	17.6 / 24.7	26.8 / 24.6
(5) Alba Posse	18.2 / ND	13.5 / ND	35.6 / ND	23.8 / ND	25.6 / ND	15.0 / ND
(6) San Javier	28.7 / 15.9	21.1 / 17.6	30.5 / 24.3	24.9 / 24.0	27.1 / 28.3	22.9 / 28.4
(7) Posadas	23.0 / 18.3	20.8 / 18.4	27.1 / 23.9	35.4 / 23.6	19.7 / 28.3	28.8 / 27.7

Museo de La Plata, Argentina (MLP). Authorization for collecting specimens in the protected areas was provided by Dirección de Flora y Fauna, Ministerio de Ecología de Misiones, Argentina.

Results and Discussion

More than 2,000 specimens were collected, 1,702 were identified (1,656 females and 46 males), corresponding to 65 known species within 18 genera (Table 2); the remaining specimens could not be identified because of the damage produced by the trap. The most diverse tribe was Aedini (21 species) followed by Sabethini (17 species) and Culicini (15 species).

Uranotaenia davisi was collected in December 2006 and January 2007 in the city of El Soberbio. This species was previously reported from the province of Formosa, Argentina, by Duret (1950). *Howardina fulvithorax* was also collected in Eldorado. This is the first report for both species in Misiones.

This preliminary study on the richness of mosquito species carried out during six months, mainly in eastern localities of Misiones, contributes to the knowledge of the mosquito fauna in densely inhabited peri-urban zones. Several species collected during this work are indicated as vectors of infectious agents in the Neotropical region (Table 2); however, there are not enough records in Argentina about the possibility that all these mosquitoes were vectors in the country.

Anopheles albitarsis s.l. is considered a complex of species (Albitarsis Complex), being collected in the sampling area with *An. deaneorum* (Rosa Freitas 1989). Both species can only be reliably identified by means of the clipeal setae in the head of the fourth-instar larva. The other species of the complex have not been mentioned in the area and their identification can only be done through other technical methods, such as molecular DNA analysis (Wilkerson *et al.* 1995). *Anopheles albitarsis* is considered a secondary vector of malaria in Argentina, while *An. darlingi* is the principal vector of the disease, at least in the north-eastern area of the Country (Bejarano 1960).

Anopheles darlingi is considered the most efficient vector of malaria in the Amazon basin and part of South America (Rubio-Palis and Zimmerman 1997; Rossi and Almirón 2004). The previous record of this species in the province of Misiones was from the Corpus locality (27°7'04" S, 55°32'34" W), near the Paraná River from a single badly preserved mosquito (Tricio et al. 2002). In the present

Table 2. Species of Culicidae (Diptera) collected in seven localities of the province of Misiones, Argentina, from August 2006 to January 2007. Loc = Locality referenced in Figure 1; ♀/♂ = number of females and males specimens collected; * = species indicated as vectors of infectious agents in the Neotropical region.

Taxon	Loc	♀	♂
Family Culicidae			
Subfamily Anophelinae			
Genus *Anopheles* Meigen			
An. (Anopheles) fluminensis Root	5, 2	11	0
An. (Ano.) mediopunctatus (Theobald)	6	13	0
*An. (Nyssorhynchus) albitarsis s.l.** Lynch Arribalzaga	4	4	0
*An. (Nys.) darlingi** Root	3	4	0
An. (Nys.) evansae (Brethes)	1, 2, 5	31	0
An. (Nys.) rondoni (Neiva and Pinto)	1, 7, 3, 4	74	2
An. (Nys.) triannulatus (Neiva and Pinto)	3	18	1
Genus *Chagasia* (Cruz)			
Ch. fajardi (Lutz)	2, 3	40	0
Subfamily Culicinae			
Tribe Aedeomyiini			
Genus *Aedeomyia* Theobald			
Ad. (Aedeomyia) squamipennis (Lynch Arribalzaga)	1	11	0
Tribe Aedini			
Genus *Howardina* Theobald			
Howardina fulvithorax (Lutz)	4	2	0
Genus *Ochlerotatus* Lynch Arribalzaga			
*Oc. (Ochlerotatus) albifasciatus** (Macquart)	1	25	0
*Oc. (Och.) crinifer** (Theobald)	2	7	0
Oc. (Och.) fluviatilis (Lutz)	4, 5, 7	37	3
*Oc. (Och.) fulvus** (Wiedemann)	1	3	1
Oc. (Och.) hastatus Dyar	5, 2, 3, 4	53	1
*Oc. (Och.) scapularis** (Rondani)	1, 2, 3	49	2
Oc. (Och.) serratus s.l.* (Theobald)	1, 2, 4-6	67	0
Oc. (Och.) synchytus Arnell	2	4	0
Och. (Protomacleaya) terrens (Walker)	2-3	8	1
Genus *Stegomyia* Linnaeus			
*St. aegypti** (Linnaeus)	1, 4, 7	6	0
*St. albopicta** (Skuse)	1	3	0
Genus *Psorophora* Robineau-Desvoidy			
Ps. (Janthinosoma) albigenu (Peryassu)	4	52	0

Table 2. (Continued)

Taxon	Loc	♀	♂
Ps. (Jan.) albipes (Theobald)	2-6	96	5
Ps. (Jan.) cyanescens (Coquillett)	4	4	0
Ps. (Jan.) discrucians (Walker)	2, 4	15	0
*Ps. (Jan.) ferox** (Von Humboldt)	2-5	116	11
Ps. (Jan.) lutzii (Theobald)	5	5	0
Ps. (Psorophora) ciliata (Fabricius)	4	31	0
Ps. (Pso.) cilipes (Fabricius)	4	27	0
Genus *Haemagogus* Willinston			
*Hg. (Conopostegus) leucocelaenus** (Dyar and Shannon)	1-6	66	0
Tribe Culicini			
Genus *Culex* Linnaeus			
Cx. (Culex) bidens Dyar	3	5	3
Cx. (Cux.) brethesi Dyar	3	5	0
Cx. (Cux.) chidesteri Dyar	3	7	1
Cx. (Cux.) coronator Dyar and Knab	3-5	51	3
Cx. (Cux.) dolosus Complex Lynch Arribalzaga	7	5	0
Cx. (Cux.) dolosus Lynch Arribalzaga	1-5, 7	31	4
*Cx. (Cux.) quinquefasciatus** Say	1, 3-5, 7	27	1
Cx. (Melanoconion) pilosus (Dyar and Knab)	1-3-7	17	4
Genus *Lutzia* Theobald			
Lutzia bigoti Bellardi	2	7	0
Tribe Mansoniini			
Genus *Coquillettidia* Dyar			
Cq.(Rhynchotaenia) fasciolata (Lynch Arribalzaga)	3, 4	236	3
Cq.(Rhy.) hermanoi (Lane and Coutinho)	4	5	0
Cq.(Rhy.) juxtamansonia (Chagas)	2	4	0
Cq.(Rhy.) nigricans (Coquillett)	3, 4	9	0
Cq.(Rhy.) shannoni (Lane and Antunes)	7	3	0
Cq.(Rhy.) venezuelensis (Theobald)	3, 4	15	0
Genus *Mansonia* Blanchard			
Ma. (Mansonia) humeralis Dyar and Knab	7, 1	75	0
*Ma. (Man.) titillans** (Walker)	7, 1	38	0
Tribe Sabethini			
Genus *Limatus* Theobald			
Limatus durhamii Theobald	1, 6, 2, 4	17	0
Genus *Onirion* Harbach and Peyton			
On. brucei (Del Ponte and Cerqueira)	3	6	0
Genus *Sabethes* Robineau-Desvoidy			
Sa. (Peytonulus) identicus Dyar and Knab	3	9	0
Sa. (Sabethes) albiprivus Theobald	5, 6	11	0
Sa. (Sab.) belisarioi Neiva	2	6	0
Sa. (Sab.) purpureus (Theobald)	6	4	0
Genus *Trichoprosopon* Theobald			
Tr. compressum Lutz	3	22	0
Tr. pallidiventer (Lutz)	3, 4, 5	35	0
Tr. simile Lane and Cerqueira	3, 6	28	0
Genus *Wyeomyia* Theobald			
Wy. (Phoniomyia) flabellata Lane and Cerqueira	2	9	0
Wy. (Pho.) pilicauda Root	4	5	0
Wy. (Wyeomyia) codiocampa Dyar and Knab	1	7	0
Wy. (Wyo.) limai Lane and Cerqueira	3	13	0
Wy. (Wyo.) oblita (Lutz)	4, 5	7	0
Wy. aporonoma Dyar and Knab	1	16	0
Wy. mystes Dyar	5	9	0
Wy. serratoria (Dyar and Nunez Tovar)	1	21	0
Wyeomyia spp.	1	3	0
Tribe Uranotaeniini			
Genus *Uranotaenia* Theobald			
Ur. (Uranotaenia) davisi Lane	4	6	0

work, the distribution of *An. darlingi* is extended to Bernardo de Irigoyen (Figure 1), approximately 200 km to the northeast of Corpus city.

Ochlerotatus albifasciatus was incriminated as vector of the Western Equine Encephalitis virus (WEE) in central Argentina, reaching to northern Patagonia (Aviles *et al.* 1992). *Stegomyia aegypti* is vector of Dengue viruses in north-western and northeastern Argentina (Avilés *et al.* 1999). The first report of West Nile virus (WNV) in birds in Argentina was reported in 2004 (Díaz *et al.* 2008), and its isolation from equines in 2006 (Morales *et al.* 2006), *Culex pipiens quinquefasciatus* possibly being the vector in our Country as in other parts of the World.

Another *Flavivirus*, St. Louis Encephalitis virus (SLE) is transmitted by *Cx. pipiens* quinquefasciatus in Argentina (Mitchell *et al.* 1980; Contigiani and Spinsanti 2002; Diaz *et al.* 2003). According to Bejarano (1959a; b), *Haemagogus leucocelaenus* could be vector of Yellow Fever virus (YF). Recently, Vasconcelos *et al.* (2003) reported the detection of YF antigen by immunohistochemistry in the liver samples of dead monkeys from the municipalities of Santo Antonio das Garruchos and Missfies, state of Rio Grande do Sul, Brazil. Unfortunately, there are no data in Argentina on mosquitoes that were responsible for the human cases of Yellow Fever in the rural areas of the municipalities of San Vicente and Eldorado in province of Misiones, reported during April 2008.

We would emphasize the presence of the principal vectors of Yellow Fever or Dengue viruses, *i.e.*, *Haemagogus leucocelaenus*, *Stegomyia aegypti* and *Stegomyia albopicta* in the province. The last species can be found in wild, rural, urban and peri-urban environments and could connect the selvatic and urban cycles of the Yellow Fever (Consoli and Lourenço-de-Oliveira 1994). In this framework, the presence of these vectors deserves major attention by sanitary authorities.

Acknowledgments: The authors are indebted to Mr. Ernesto R. Krauczuk (Flora and Fauna director MERNRyT) for allowing collection of mosquitoes in protected areas. The research of J.M.D. was supported by a scholarship of CEDyT. The continuous support of Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) and Universidad Nacional de Misiones (UNaM) is acknowledged. The authors are also grateful to Dr. Claudio J. Bidau for kindly reviewing the manuscript, to Eric Stolar (INTA, Cerro Azul) for climatic data assistance and to Mr. Henry R. Rupp by the English language revision.

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Received: July 2009
Revised: October 2009
Accepted: October 2009
Published online: March 2010
Editorial responsibility: Ana Lúcia Tourinho