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AN UPDATE OF MOSQUITOES OF ARGENTINE PATAGONIA WITH NEW DISTRIBUTION RECORDS

GUSTAVO C. ROSSI¹ AND DARÍO VEZZANI²

ABSTRACT. The objective of this study was to update mosquito species distribution in Argentine Patagonia based on new field collections and to examine the material deposited in the La Plata Museum. *Culex coronator*, *Cx. brethesi*, and *Cx. castroi* represented new records for the region, increasing mosquito fauna of Patagonia to 15 species. The expansion of the geographic distribution of *Cx. apicinus*, *Cx. articularis*, and *Cx. eduardoi* at the province level was also provided. Current knowledge about mosquito fauna of Patagonia is restricted mainly to geographic distribution records. Further studies on the bionomic of mosquito species in Patagonian conditions are needed.

KEY WORDS Argentina, *Culex*, *Aedes*, geographic distribution, Patagonia

INTRODUCTION

The first mentions of *Culex* and *Aedes* mosquitoes in Patagonia go back to almost a century ago (Edwards and Shannon 1927). At the end of the 1950s only 6 species were recorded by Castro et al. (1959) and Bachmann and Bejarano (1960). Two decades later, a revision of the geographic distribution of mosquitoes of Argentina by Mitchell and Darsie (1985) cited a total of 9 species for the 5 provinces included in Patagonia. From then onward, only 3 species were added to the list of Patagonian mosquitoes by Leguizamón and Carpintero (2004), Muzón et al. (2005), and Burrioni et al. (2007). In addition, a few studies expanded the distribution records of these mosquitoes at the province or locality level (Almirón et al. 1995a, Marinone 2002, Rossi et al. 2008).

Despite the early interest on Patagonian mosquitoes, only 12 mosquito species have been collected through this vast region. The aim of this study is to summarize the mosquito fauna obtained in recent surveys in Patagonia and to update the species distribution in the 5 Argentine provinces included in this region.

MATERIALS AND METHODS

Patagonia is located in the southern cone of South America, bordered to the north by the Colorado River, to the east by the Atlantic Ocean, and to the west by the Andean cordillera. It extends about 1,800 km in a north–south direction through the Argentine provinces of Río Negro, Neuquén, Chubut, Santa Cruz, and Tierra del Fuego. This vast territory of

787,400 km² belongs to 4 biogeographic provinces (Subantarctic, Monte, Patagonica, and Altoandina), including a wide range of climate conditions as described by Cabrera and Willink (1973).

Mosquito collections used in the present study came mainly from 2 surveys performed in December 2006 (spring) in Río Negro and February 2008 (summer) in Chubut and Santa Cruz provinces. During these surveys, a total of 27 sites were inspected for mosquitoes as shown in Table 1. Immature specimens were collected from water sources with the help of a 500-ml dipper, and, when possible, 4th-stage larvae and pupae were reared individually to obtain larval and/or pupal exuviae and associated adults. Adult specimens were collected with an entomological net and/or Centers for Disease Control and Prevention traps or Malaise trap. In addition to these collections, some previous collections made by one of the authors (GCR) or colleagues (G. Spinelli, D. Carpintero Jr., L. Giambelluca, P. Pessacq, M.F. Achinelly, and J.C. Mariluis) were also included in the study. Finally, the specimens collection of La Plata Museum (LPM) were reviewed.

In the laboratory, taxonomic identifications of larvae and adults were carried out according to Lane (1953), Bram (1967), Casal and García (1967), Darsie (1985), and Rossi (2006). Males conserved in alcohol were used to confirm species presence, based on the observation of genitalia. Generic and subgeneric classification of Culicidae was based on Knight and Stone (1977) and further changes according to WRBU (2010) as applicable to the mosquitoes of Argentina. The use of *Phytotelmatomyia* as a subgenus of *Culex* was followed from Rossi and Harbach (2008). Genera and subgeneric abbreviations were used according to Reinert (2001). The abbreviations used are M (males), Mg (male genitalia), F (females), P (pupae), Pe (pupal exuviae), L (larvae), and Le (larval exuviae). Adult specimens were pinned, and immatures and male genitalia were mounted on microscope slides in Canada

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Table 1. Geographic location and details of the sites surveyed in 2006 and 2008 in Patagonia.¹

Code	Coordinates	Altitude (masl)	Description	Mosquito presence
RN-1	40°57'41.1"S, 66°38'20.8"W	481	Valcheta stream, elementary school in Paraje Chipauquil	No
RN-2	41°09'18.6"S, 67°34'40.3"W	1,055	Arreic shallow lake, Puesto de Lata in Ea Jaguar Musso, Paraje Chasicó	No
RN-3	40°40'39"S, 66°09'47.7"W	210	Valcheta stream, Valcheta	No
RN-4	40°58'25"S, 66°39'14.7"W	630	Spring affluent of Valcheta stream, police station in Paraje Chipauquil	No
RN-5	40°59'24.1"S, 66°40'35.7"W	620	Spring affluent of Valcheta stream, Ea El Rincón	Yes
RN-6	41°08'35.1"S, 67°27'34.6"W	1,000	Spring affluent of Comi Có stream, Ea La Rinconada	Yes
RN-7	41°08'28"S, 67°35'43.9"W	961	Creek affluent of Trenetq stream, Ea Jaguar Musso, Paraje Chasicó	Yes
RN-8	41°08'28"S, 67°35'43.9"W	961	Creek affluent of Trenetq stream, Ea Jaguar Musso, Paraje Chasicó	Yes
RN-9	41°06'23.7"S, 67°27'43.1"W	870	Comi Có stream, Comi Có	No
RN-10	40°30'22.7"S, 66°32'22.4"W	220	Nahuel Niyeu stream, National Route 23, Nahuel Niyeu station	No
SC-1	46°54'34.9"S, 71°51'54.4"W	1,060	Spring affluent of Ceballos stream, Provincial Route 41	Yes
SC-2	48°37'49.26"S, 70°43'5.52"W	580	Extensive swamp formed by the overflowing of the Endorreic River, km 91.5 of Provincial Route 29, Ea La Angostura	Yes
SC-3	47°39'5.4"S, 68°37'53.58"W	500	Spring modified for human use, Provincial Route 12, Ea Aguada del Cuero	Yes
SC-4	46°46'34.08"S, 71°45'41.28"W	910	Spring affluent of Ceballos stream, Provincial Route 41, 35 km south of Los Antiguos	No
SC-5	46°47'24.84"S, 71°47'28.92"W	900	Creek next to Provincial Route 41, 38 km south of Los Antiguos	No
SC-6	47°05'17.1"S, 71°49'38.5"W	1,250	Pool next to Ceballos stream, Provincial Route 41	No
SC-7	48°37'49.26"S, 70°43'5.52"W	580	Creek next to Provincial Route 29, Ea La Angostura	No
SC-8	48°30'49"S, 69°40'34"W	650	Pool in a creek course affluent of Deseado stream, Provincial Route 12, 78 km north of Gobernador Gregores	No
SC-9	46°52'46.86"S, 68°05'14.1"W	150	"Mallin" in affluent of Deseado stream, Provincial Route 12, 15 km south of Pico Truncado	No
CB-1	42°43'43.59"S, 69°35'50.43"W	390	Road ditch 50 m apart of Chubut River, Provincial Route 12 next to Paso del Sapo	Yes
CB-2	45°33'39.9"S, 69°03'27.3"W	300	Senguer River, Camping La Isla in Colonia Sarmiento	Yes
CB-3	42°34'51.42"S, 70°04'20.64"W	580	Affluent of Chubut River, Volcán Piedra Parada	Yes
CB-4	45°35'13"S, 69°04'09"W	270	Ditch for tree irrigation in a square of Sarmiento city	Yes
CB-5	45°33'40.14"S, 69°03'26.7"W	420	Pool in a creek course affluent of Senguer River	No
CB-6	44°49'47.4"S, 70°07'26.58"W	520	Pool in a creek course affluent of a stream with no name, National Route 40	No
CB-7	42°39'23"S, 69°48'08"W	600	Shallow temporary pool, Provincial Route 12, 55 km east to Piedra Parada	No
CB-8	42°38'34.44"S, 70°19'5.1"W	420	Shallow temporary pool, Provincial Route 12, east to Piedra Parada	No

¹ RN, SC, and CB means Río Negro, Santa Cruz, and Chubut Provinces, respectively.

balsam. All the specimens with collector's information were deposited in LPM.

RESULTS

Eleven out of 27 sites surveyed during the spring of 2006 and summer of 2008 were positive for mosquito presence. These included 4 out of 10 in Río Negro, 3 out of 9 in Santa Cruz, and 4 out of

8 in Chubut. A total of 203 immatures and 27 adults were collected. After rearing immatures to adults, we identified 39 M, 6 Mg, 43 F, 87 Pe, 20 P, 31 Le, and 65 L. During these surveys, the species found were *Culex acharistus* Root, *Cx. apicinus* Philippi, *Cx. articularis* Philippi, *Cx. eduardoi* Casal and García, *Cx. pipiens* Linnaeus, and *Aedes (Ochlerotatus) albifasciatus* (Macquart). In addition, the material collected by

Table 2. Geographic distribution of mosquitoes from Patagonia, Argentina.¹

	Reported in our study	Neuquén	Río Negro	Chubut	Santa Cruz	Tierra del Fuego
<i>Culex (Allimanta) tramazayguesi</i>	No		a			
<i>Cx. (Culex) acharistus</i>	Yes	a	a	b		
<i>Cx. (Cux.) apicinus</i>	Yes	f	d	f	f	
<i>Cx. (Cux.) articularis</i>	Yes	a	a	f		
<i>Cx. (Cux.) coronator</i>	Yes		f			
<i>Cx. (Cux.) dolosus</i>	No	a	b	b		
<i>Cx. (Cux.) brethesi</i>	Yes		f		f	
<i>Cx. (Cux.) eduardoi</i>	Yes			e	f	
<i>Cx. (Cux.) pipiens</i>	Yes	a	a	a	a	
<i>Cx. (Cux.) spinosus</i>	No		a			
<i>Cx. (Phytotelmatomyia) castroi</i>	Yes		f			
<i>Aedes (Ochlerotatus) albifasciatus</i>	Yes	a	a	a	a	a
<i>Ae. (Och.) scapularis</i>	No		a			
<i>Ae. (Och.) serratus</i>	No		a			
<i>Orthopodomyia peytoni</i>	No		c			
Number of mosquito species (previous-updated)		5-6	11-14	5-7	2-5	1-1

¹ Letters a-f correspond to the information compiled by the following: a = Mitchell and Darsie (1985); b = Almirón et al. (1995a); c = Leguizamón and Carpintero (2004); d = Muzón et al. (2005); e = Burroni et al. (2007); f = present study.

others or pertaining to LPM added *Cx. coronator* Dyar and Knab, *Cx. brethesi* Dyar, and *Cx. castroi* Casal and García to our database. In total, these findings represented 3 new mosquito records for Patagonia and the expansion of the geographic distributions of 3 other species at the province level (Table 2). Six species previously recorded in Patagonia were not found either during our surveys or in the additional material examined.

A brief description of the geographic distribution of the listed species is as follows.

Culex (Culex) acharistus: This species was found in Brazil, Chile, and the Argentine provinces of Buenos Aires, Chubut, Córdoba, Jujuy, Neuquén, Misiones, Río Negro, and Tucumán. Examined material: RN-6: 1 M, 1 Mg, 3 F, 8 Pe, 4 L; RN-7: 4 L; RN-8: 1 F, 1 Pe, 4 L; Lago Nahuel Huapi (Río Negro Province): 1 P male with the complete genitalia mounted in a slide, 1 P, 2 Le, 8 L; Aluminé (Neuquén Province): 4 L, Spinelli coll.; and Mallín Río Frío next to Trevelin (Chubut Province): 1 Le, 1 P, II-28-2009, Pessacq coll.

Culex (Culex) apicinus: According to WRBU (2010) *Cx. apicinus* is restricted to Chile, Bolivia, and Peru. However, it is also well documented in the Argentine provinces of Buenos Aires, Catamarca, Córdoba, Corrientes, Jujuy, La Pampa, La Rioja, Mendoza, Río Negro, San Luis, and Santa Fé (Mitchell and Darsie 1985, Rossi et al. 2008). Examined material: RN-5: 1 M; RN-6: 9 M, 12 F, 24 Pe, 9 Le, 5 L; RN-7: 6 M, 3 F, 9 Pe, 4 Le, 2 P, 9 L; RN-8: 2 M, 7 Pe; CB-3: 8 M, 5 F, 13 Pe, 2 Le; SC-1: 1 M, 2 F, 2 Pe; Cholar (Neuquén Province): 7 L, 12-XI-1994, Spinelli coll.; and Futalaufquen (Chubut Province): 4 L, XII-1995, Spinelli coll. The specimens of Chubut, Santa Cruz, and Neuquén represent new provincial records.

Culex (Culex) articularis: This species was recorded in Andean regions of Argentina, Chile, Ecuador, and Peru. In Argentina, it was previously found in Neuquén and Río Negro provinces. Examined material: RN-5: 2M, 2 Mg, 2 F, 4 Pe, 4 Le, 2 L; RN-7: 2 L; and Esquel (Chubut Province): 1 F, II-28-2009, Pessacq coll. The specimen of Chubut represents a new provincial record.

Culex (Culex) brethesi: This species is present in Uruguay, Argentina, and Brazil, with an indication in the WRBU catalog for the Brazilian records in question. In Argentina it is widely distributed in the provinces of Buenos Aires, Córdoba, Corrientes, Entre Ríos, La Pampa, Mendoza, Misiones, Santa Fé, and Santiago del Estero. Examined material: General Conesa (Río Negro Province): 1 M with its associated genitalia (slide no. 2380), III-1993, Carpintero (Sr.) coll.; and Futalaufquen (Chubut Province): 1 F, Spinelli coll. Both specimens are new provincial records.

Culex (Culex) coronator: This species is present in all countries from the USA to Argentina. Examined material: General Conesa (Río Negro Province): 1 M with the associate genitalia (slide no. 2759), I-1991, Carpintero (Sr.) coll. This is the southernmost finding of the species and a new provincial record.

Culex (Culex) eduardoi: According to Knight and Stone (1977) and WRBU (2010), this species is present only in Argentina. However, it has also been found in southern Brazil (Lopes 1997, Costa Riveiro et al. 2002). In Argentina, it is well represented in Buenos Aires (type locality) and was recently reported from one locality of Chubut Province by Burroni et al. (2007). Examined material: CB-1: 1 F, 1 Pe, 1 Le, 1 P,

1 L; CB-2: 1 M, 1 MG, 1 Pe, 1 Le, 18 L; Esquel (Chubut Province): 1 L; and SC-2: 5 P (1 with complete genitalia), 5 Le, 2 L. Its presence in Santa Cruz is a new provincial record. Taxonomic note: Our specimens are very similar to those of Sarmiento City in Chubut Province sent by N. Burroni. The larvae of *Cx. eduardoi* from Patagonia show small differences with the specimens of Buenos Aires Province as follows: the bigger length of setae 1, 3-M, 13-T, and 1-I, the presence of 1–2 bigger accessory denticles in the pecten spines, the conspicuous presence of spicules in thorax and abdomen, and the small length of the caudal segment (X).

Culex (Culex) pipiens: The 2 principal species of the cosmopolitan *Cx. pipiens* complex (i.e., *Cx. pipiens s. str.* and *Cx. quinquefasciatus* Say) occur in Argentina. Both species and intermediate forms were found in Buenos Aires Province, but toward the south, in Patagonia, only *Cx. pipiens* has been recorded (Almirón et al. 1995b). Examined material: CB-3: 1 M, 1 Mg, 1 F, 2 Pe; CB-4: 6 L; Esquel (Chubut Province): 2 F, 1 L, II-2009, Pessacq coll.; Las Grutas (Río Negro Province): 1 M, 1 Mg, 2 F, I-2004, Giambelluca coll.; and General Conesa (Río Negro Province): 1 M, 1 Mg, I-1991, Carpintero (Sr.) coll.

Culex (Phytotelmatomyia) castroi: This species is present in Paraguay, Uruguay, and the Argentine provinces of Buenos Aires, Corrientes, Entre Ríos, and Misiones (Rossi and Harbach 2008). Examined material: The unique larvae from the LPM collection corresponds to the slide no. 7432 from the Administración Nacional de Laboratorios de Salud "Dr. Carlos G. Malbrán" (formerly Instituto Nacional de Microbiología), and currently it corresponds to slide no. 2357 of LPM. The specimen is from Fortín Uno (Río Negro Province), VIII-1952, without other data. It is a new provincial record and the southernmost finding of the species.

Aedes (Ochlerotatus) albifasciatus: This species is distributed in Argentina, Bolivia, Chile, Paraguay, Uruguay, and Brazil (WRBU 2010). According to Edwards (1930), there has been some doubt about the Macquart's type from Brazil, and all the known synonymies belong to specimens from Chile (Dyar 1928, WRBU 2010). Although this species was not frequently reported in Brazilian studies coupled with some doubts about the type locality, its presence was recently confirmed in southern states by Marcondes et al. (2003) and Cardoso et al. (2005). In Argentina, this is the only species distributed throughout the country. Examined material: CB-2: 4 M, 2 F, 7 Pe, 5 Le, 1 P, 1 L; CB-4: 1F, 2 Pe, 1 P, 1 L; Futalaufquen (Chubut Province): 1 M, 1 Mg, Spinelli coll.; Sarmiento (Chubut Province): 2 M, 1 F, I-1960, Bachmann and Bejarano coll., Bachmann det.; Trelew (Chubut Province): 1M, 1 F, II-1960, Bachmann coll. and det.; SC-2: 7 F,

3 P; SC-3: 3 M, 14 F, 6 Pe, 7 P; Gobernador Gregores (Santa Cruz Province): 5 F, 15 M, 6 F, X-1996, Spinelli coll.; Laguna del Desierto (Santa Cruz Province): 11 F, XII-1996, Spinelli coll.; Lago Frío (Santa Cruz Province): 4 F, XII-1995, Spinelli coll.; Punta Magallanes in Perito Moreno (Santa Cruz Province): 6 F, XII-1998, Mariluis coll.; Aluminé Lake (Neuquén Province): 4 L, Spinelli coll.; Covunco (Neuquén Province): 2 M, 2 F, IV-1960, Bachmann coll. and det.; Zapala (Neuquén Province): 1 M, 2 F, IV-1960, Bachmann coll. and det.; General Conesa (Neuquén Province): 3 M, 2 Mg, 1 F, I-1991, Carpintero (Sr.) coll. and det.; Fontana Lake (Río Negro Province): 4 M, 2 Mg, 22 F, 1 Pe, 1 Le, 12-XII-1995, Spinelli coll.; Fortín Uno (Río Negro Province): without data, 2 F, V-1932, and 3 F, I-1937, del Ponte coll. and det.; idem, without data, 1 F, I-1960, Bachmann and Bejarano coll., Bachmann det.; and Lapataia (Tierra del Fuego Province): 6 F, XII-2000, Achinelly coll.

DISCUSSION

The present study updates the mosquito fauna of Patagonia up to 15 species. Among them, *Ae. albifasciatus* is the most abundant and widespread in steppe and lakes areas, whereas *Cx. apicinus* is the best represented in the Somuncurá Plateau, and *Cx. articularis* distribution is restricted to the Andean areas. Four species, namely, *Cx. eduardoi*, *Cx. pipiens*, *Cx. dolosus* Lynch Arribalzaga, and *Cx. acharistus* could be considered as widespread in Patagonia but in low abundance. The other 8 species (i.e., *Cx. tramazayguesi* Duret, *Cx. coronator*, *Cx. spinosus* Lutz, *Cx. brethesi*, *Cx. castroi*, *Ae. scapularis* (Rondani), *Ae. serratus* (Theobald), and *Orthopodomyia peytoni* Leguizamón and Carpintero remain as isolated records.

Two of the most common species in Patagonia, *Ae. albifasciatus* and *Cx. pipiens*, are well recognized as mosquitoes of medical and/or veterinary concern. In Argentina, *Ae. albifasciatus* is the main vector of the western equine encephalomyelitis (Mitchell et al. 1987, Avilés et al. 1992), whereas *Cx. pipiens* (as *Cx. quinquefasciatus*) was incriminated as vector of Saint Louis encephalitis (Mitchell et al. 1983, Díaz et al. 2006). The later species is also considered a bridge vector of the West Nile virus (Hamer et al. 2008), recently detected in horses in Argentina (Morales et al. 2006). Both species are also considered potential vectors of the canine heartworm, *Dirofilaria immitis* (Leidy) (Vezzani et al. 2006). In addition, yellow fever and Venezuelan equine encephalitis viruses have been isolated from *Ae. scapularis* (Arnell 1976), and TROCARA and AURA viruses from *Ae. serratus* (Sabattini et al. 1998, Travassos da Rosa et al. 2001).

Since the entomological expedition of Edwards and Shannon (1927), an increasing number of

mosquito records from Patagonia have been observed. Unfortunately, the knowledge about mosquito fauna of Patagonia remains restricted mainly to geographic distributions and some habitat descriptions. Accordingly, the different aspects of the bionomic of Patagonian mosquitoes are practically unknown, with few exceptions (e.g., Burróni et al. 2007). Further studies on the ecology of this small group of mosquitoes of Patagonia are needed to enhance our understanding of mosquito bionomics in extreme environmental conditions. The information will be useful in assessing the transmission risk of mosquito-borne pathogens in Patagonia.

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