

Mosquitoes (Diptera: Culicidae) of the meridian zone of the subtropical mountainous rainforest of Argentina: update on the fauna and geographical distribution

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Abstract: We report here three new mosquito records in the Yungas ecoregion [*Culex (Culex) dolosus*, *Culex (Microculex) Pleuristriatus* Series and *Howardina* sp.] and the expansion of the distributions of 17 species of the genera *Anopheles*, *Culex*, *Aedes*, *Psorophora*, and *Toxorhynchites* for Argentina. These findings broaden the total number of species recorded for northwestern Argentina to 174, from which number 57 species are distributed in the Tucumán province, 21 in the Catamarca, and 96 in the Salta. Also included is information on immature instars collected in phytotelmata.

Key words: new records; phytotelmata; Neotropical Region

The distribution of mosquito species inhabiting Argentina has changed in recent years. To date, 242 species of mosquito have been described in the country belonging to the genera *Aedeomyia*, *Aedes*, *Anopheles*, *Chagasia*, *Coquillettidia*, *Culex*, *Haemagogus*, *Isostomyia*, *Limatus*, *Mansonia*, *Onirion*, *Orthopodomyia*, *Psorophora*, *Runchomyia*, *Sabethes*, *Shannoniana*, *Toxorhynchites*, *Trichoprosopon*, *Uranotaenia*, and *Wyeomyia*. In northwestern Argentina, 56 species of Culicidae have been cited for Tucumán province, while 20 and 96 species of that family have been cited for Catamarca and Salta provinces, respectively (ROSSI 2015).

Dipterología Argentina (LYNCH ARRIBÁLZAGA 1891), the first work on mosquitoes in Argentina, marked the beginning of mosquito research in the country. PATTERSON (1911) first sampled mosquitoes in northwestern Argentina and recorded the presence of *Anopheles*, BRÈTHES (1916) wrote elaborate notes concerning the relationship between mosquitoes and malaria, and SHANNON & DEL PONTE (1927) also contributed greatly to the knowledge of the mosquitoes in the country. Subsequently, the number of species in Argentina recorded increased, reaching 159 by 1960 (CASTRO et al. 1959, 1960) and 208 in 1985 (MITCHELL & DARSIE) with the recording of 13 species in

Catamarca, 43 in Tucumán, and 74 in Salta. CAMPOS & MACIÁ (1998) reported 210 species, adding 13, 46, and 74 species in Catamarca, Tucumán, and Salta, respectively.

Mosquitoes of the family Culicidae are the insects most relevant to public-health issues, since dozens of species are capable of transmitting infections such as malaria, filariasis, dengue, chikungunya, Venezuelan equine encephalitis, and yellow fever, as well as etiologic agents such as West Nile virus, Zika virus, and various emerging and reemerging arboviruses. These have been responsible for a number of cases of illnesses and deaths in both tropical and temperate countries, particularly during the current decade (CALISHER et al. 1981; BERTI et al. 2015; CARBAJO & VEZ-ZANI 2015).

The transmission of malaria and dengue has been reported in northwestern Argentina. Dengue, transmitted by *Aedes aegypti* (Linnaeus, 1762), is caused by a dangerous and prevalent arbovirus that largely affects humans. In 1997, *Ae. aegypti* was detected in the Tucumán province, with a particularly high risk having been reported in the communities of San Pablo, Las Talitas, Tafi Viejo, and Yerba Buena (AUGIER 2000). Since then, the disease has occurred periodically and sporadically up until 2009, when the epidemic outbreak at that time produced the first indigenous cases in the province, with the capital (San Miguel de Tucumán) and the city of Aguilares in the department of Río Chico as the most highly affected locations (infection rates of 1.06‰ and 9.98‰, respectively (RAMÍREZ et al. 2013).

Human malaria, caused by parasites of the genus *Plasmodium*, transmitted through bites from infected species of *Anopheles* (WORLD HEALTH ORGANIZATION 2008), is one of the most serious parasitic diseases in tropical ecosystems. In Argentina, the once wide geographical distribution of malaria now appears to be reduced to the northwest and northeast of the country, where malaria

is still a major endemic parasitic disease (MINISTERIO DE SALUD DE LA NACIÓN 1997; CURTO et al. 2003; DANTUR JURI et al. 2009). In the northwest of the country, changes in land use during the last century have led to a different driver of malarial transmission, now indirectly linked to gradual changes in the Yungas ecoregion, which area has provided new habitat for larvae sites for the vector *Anopheles (Anopheles) pseudopunctipennis* Theobald, 1901. Until the 1940s, the northern area of the Yungas ecoregion was a preserved rainforest overall, while in the southern part of the Yungas, there are sugarcane and citrus crops, and more recently, soybeans. At present, the dynamics of the Yungas are altered and the northern area exhibits important modifications of the landscape due to the severe forestry, the recurrence of fires and greater pressure of the agriculture (BROWN 2009). These alterations to the environment and landscape indirectly lead to changes in the local climate. These influences, combined with human migration from southern Bolivia into northwestern Argentina since the second half of the 20th century, might explain the current distribution and abundance of *An. pseudopunctipennis* and the regional endemicity of malaria (DANTUR JURI et al. 2009, 2014).

Furthermore, in Argentina, strains of western equine encephalitis virus have been isolated in *Ad. squamipennis* (Lynch Arribáizaga, 1878), *An. albitarsis* Lynch Arribáizaga, 1878, *Ae. scapularis* (Rondani, 1848), *Ae. albifasciatus* (Macquart, 1838), *Ps. pallescens* Edwards, 1922 among other mosquitoes along with strains of the St. Louis encephalitis virus in *Cx. (Cux.) quinquefasciatus* Say, 1823 (MITCHELL et al. 1987; SABATTINI et al. 1985, 1998). The latter species is of major epidemiologic significance because of a wide distribution in the country and a facile adaptability to unfavorable environments.

Because of such major medical relevance and the limited number of studies in the area, a constant updating of the diversity and distribution of culicids in the subtropical mountain forests of Argentina is of a high priority.

The Yungas, or subtropical mountain rainforest ecoregion, extends from the Bolivian border (21°59.961' S) to the northern Catamarca Province (21°36.374' S) in Argentina and also includes portions of the Salta, Jujuy, and Tucumán provinces (BROWN & MALIZIA 2004).

The climate is characterized as subtropical, but owing to the rugged topography, the region is climatically diverse. Precipitation is highly seasonal and mostly concentrated in the summer months. The native vegetation is arboreal and with a closed canopy, except near roads and along creek, where the canopy is more open. Canopy vegetation are represented by *Blepharocalyx salicifolius* (Kunth) O. Berg, 1956 (Myrtaceae), *Enterolobium contortisiliquum* (Vell.) Morong, 1893 (Fabaceae), *Juglans australis* (Griseb.) Burkart 1969 (Fabaceae), *Piper tucumanum* C. DC., 1898 (Piperaceae), *Eugenia uniflora* L., 1753 (Myrtaceae), *Urera baccifera* (L.) Gaudich, ex Wedd 1852 (Urticaceae), *Solanum riparium* Pers., 1805 (Solanaceae), meanwhile in open areas, *Tipuana tipu* (Benth.) O. Kuntze, 1898 (Fabaceae), *Jacaranda mimosifolia*

D. Don, 1822 (Bignoniaceae), *Anadenanthera colubrina* var. *cebil* (Griseb) Altschul, 1964 (Fabaceae), *Tabebuia avellanae* Lorentz ex Griseb., 1879 (Bignoniaceae), *Heliocarpus popayanensis* Kunth, 1823 (Malvaceae), *Fagara coco* (Gillies ex Hook. & Arn.) Engl., 1896 (Rutaceae), *Tecoma stans* (L.) Juss. ex Kunth, 1819 (Bignoniaceae), *Salix humboldtiana* Willd., 1806 (Salicaceae), and *Carica quercifolia* (A. St. Hil.) Hieron, 1882 (Caricaceae); lianas as, Bignoniaceae, Ulmaceae and Amarantaceae are the most abundant families. In addition, the canopy provides support for epiphytic vascular plants such as the Bromeliaceae (*Aechmea distichantha* Lem. 1853 and *Vriesea friburgensis* var. *tucumanensis* (Mez) L.B.Sm. 1952 Polipodaceae, Asplaniaceae, and Piperaceae (GRAU 2005; BROWN et al. 2006).

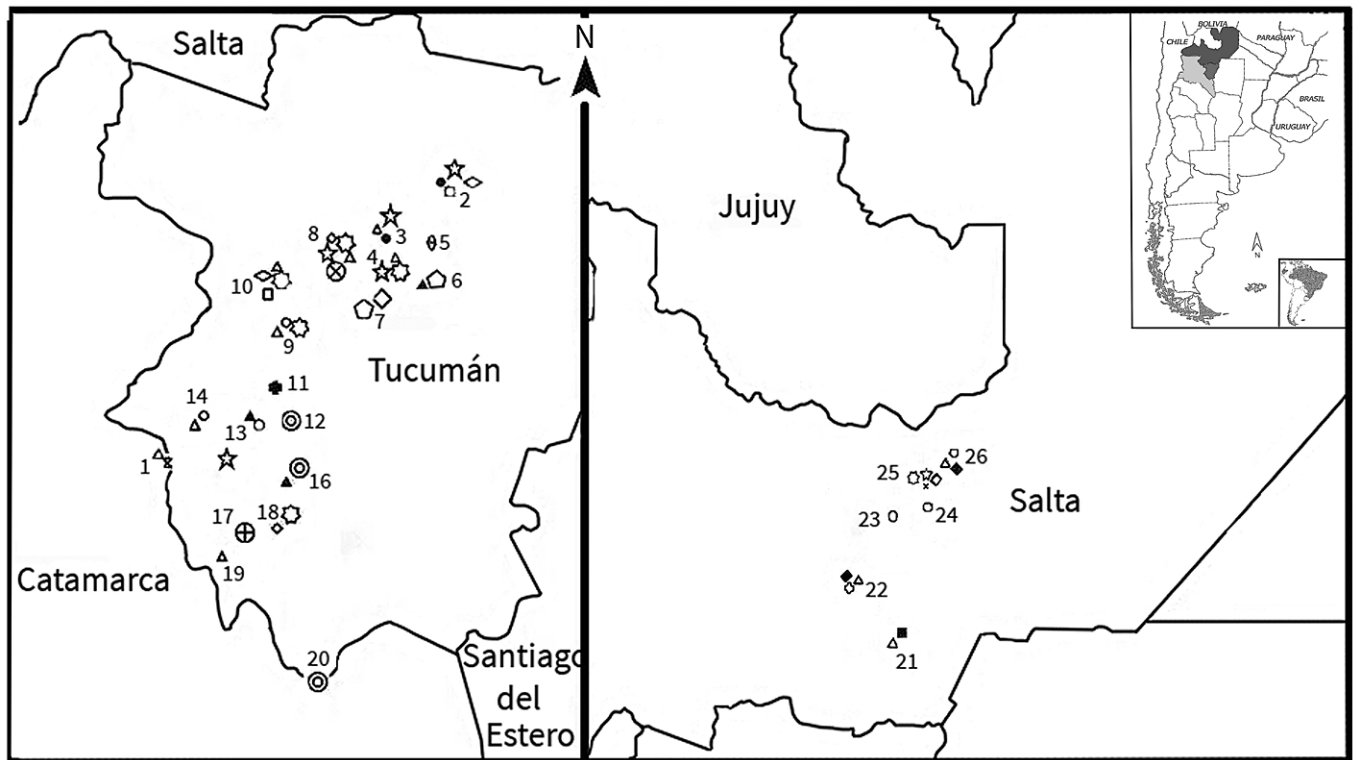
Samples of mosquitoes were collected during three study periods: the first during 2011–2012 at different localities in Tucumán province, the second in November, 2014 likewise in Tucumán but also including a locality in Catamarca province, and the third during October and November 2015 in Salta province. The samples were collected from rivers, streams, and phytotelmata, and collections were carried out both in the Yungas and in anthropic environments (Figures 1, 2–8).

Adult specimens were collected with Centers for Disease Control (CDC) light traps with ultraviolet and visible light placed in two types of environments (anthropic and forested), with a manual aspirator, or with a hand net. Otherwise, immature specimens were collected from Bromeliaceae (*Aechmea distichantha* and *Vriesea friburgensis* var. *tucumanensis*) (Figures 7–8) with a pipette, or with a dipper from puddles, pools in streams, or from slow flowing areas of rivers, either along the banks or between rocks.

A portion of the immature specimens (fourth instar larvae and pupae) were reared to adults, whereas the rest were preserved in 80% (v/v) aqueous ethanol. Adults were mounted on pins, and certain still immature instars and genitalia were mounted with Canada balsam on slides.

The collections were organized as follows: MLP 4410-4422: (4 M, 4 F, 8 L, 8 Le, 8 Pe, MG); where the number preceded by the abbreviation MLP corresponds to the number of the collection in the División Entomología, Museo de La Plata, and (4 M, 4 F, 8 L, 8 Le, 8 Pe, MG) refers to the number of specimens followed by the abbreviations M, male; F, female; L, larva; P, pupa; Le, larval exuviae, Pe, pupal exuviae; MG, male genitalia. This information is followed by the date, locality, geographic coordinates (recorded using a GPS receiver), and altitude above sea level (a.s.l.).

The species classification used follows HARBACH (2014) and WILKERSON et al. (2015) for the tribe *Aedini*. For the identification of specimens, the following literature was used: for *Culex (Cux.)* BRAM (1967) and CASAL et al. (1966); for *Cx. (Mcx.)*, LANE & WHITMAN (1951); for *Cx. (Mel.)*, DURET (1953b); for *Anopheles (Nyssorhynchus)* FARAN & LINTHICUM (1981) and LINTHICUM (1988); for *Aedeomyia*, DARSIE (1985); and for *Howardina* and *Ae. (Ochlerotatus)*, BERLIN (1969) and DARSIE (1985). *Toxorhynchites tucumanus* Brèthes, 1926 was identified using the original descrip-



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| ⊕ <i>Aedeomyia (Aedeomyia) squamipennis</i> | ● <i>Anopheles (Nyssorhynchus) rangeli</i> | ⊙ <i>Culex (Culex) quinquefasciatus</i> |
| □ <i>Aedes (Howardina) sp.</i> | ○ <i>Culex (Culex) apicinus</i> | ▲ <i>Culex (Melanoconion) aliciae</i> |
| ◇ <i>Aedes (Ochlerotatus) crinifer</i> | ◆ <i>Culex (Culex) coronator</i> | ◇ <i>Culex (Microculex) Pleuristriatus Series</i> |
| ⊗ <i>Aedes (Stegomyia) aegypti</i> | ◊ <i>Culex (Culex) chidesterei</i> | ✱ <i>Culex (Microculex) imitator</i> |
| ○ <i>Anopheles (Anopheles) pseudopunctipennis</i> | ⊗ <i>Culex (Culex) dolosus</i> | ◊ <i>Psorophora (Janthinosoma) cyanescens</i> |
| ■ <i>Anopheles (Nyssorhynchus) albitarsis</i> | ☆ <i>Culex (Culex) fernandesi</i> | ⊗ <i>Toxorhynchites (Lynchiella) guadeloupensis</i> |
| △ <i>Anopheles Nyssorhynchus argyritarsis</i> | ● <i>Culex (Culex) maxi</i> | |

Figure 1. Distribution map of culicid species in Catamarca, Tucumán and Salta provinces, northwestern Argentina. Catamarca: 1-Las Quintas River; Tucumán: 2-Loro River, 3-San Javier River, 4-Sierra San Javier Park, 5-Horco Molle Experimental Reserve, 6-San Pablo, 7-Potrerros de Las Tablas, 8-El Duraznillo Stream, 9-Los Sosa River station 1, 10-Los Sosa River station 2, 11-La Florida Provincial Reserve, 12-El Molino, 13-Alpachiri, 14-El Calao Stream, 15-El Celeste Stream, 16-Los Sarmientos, 17-Villa Batirua, 18-Marapa River, 19-Chavarría River, 20-Rumi Punco; Salta: 21-De Las Conchas River, 22-Las Cañas Stream, 23-La Hachada Stream, 24-Castellanos River, 25-Santa Ana River, 26- Puesto La Cruz.

tions of this species and *Tx. guadeloupensis* (DYAR & KNAB, 1906), and the redescriptions by BONNE & WEPSTER (1925) and VAN DER KUYP (1954). Voucher specimens were deposited in the División Entomología, Museo de La Plata.

New provincial records

***Culex (Culex) dolosus* s.l.** (Lynch Arribáizaga, 1891)

Material examined: Catamarca province, Andalgalá, Las Quintas River and Provincial Route (PR) N° 1; 27°22'06.34" S, 065°58'52.48" W; 1,557 m a.s.l.; 4 M, 4 F, 8 L, 8 Le, 8 Pe (MLP 4410-4422); extracted from a puddle between rocks in a river bed with *An. argyritarsis*; 11-XI-2014; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: With this record, the number of species is

increased to 21 for Catamarca province. The current distribution of this species in Argentina includes the provinces of Buenos Aires, Chubut, Córdoba, Corrientes, Entre Ríos, La Pampa, La Rioja, Misiones, Neuquén, Río Negro, Salta, Santa Fé, and Tucumán (ROSSI 2015). *Culex dolosus* is a common species in Argentina. The presence of postspiracular scales in both sexes separates this species from *Culex eduardoi* Casal & García, 1966.

Culex (Microculex) Pleuristriatus Series (Theobald, 1907)

Material examined: Tucumán province, Tafí Viejo, El Cadilal, Loro River; 26°37'24.99" S, 065°11'06.23" W; 550 m a.s.l.; 1 L (MLP 4392); extracted from phytotelmata of *Aechmea distichantha*, 13-XI-2014, G. Rossi coll. and det. Tafí del

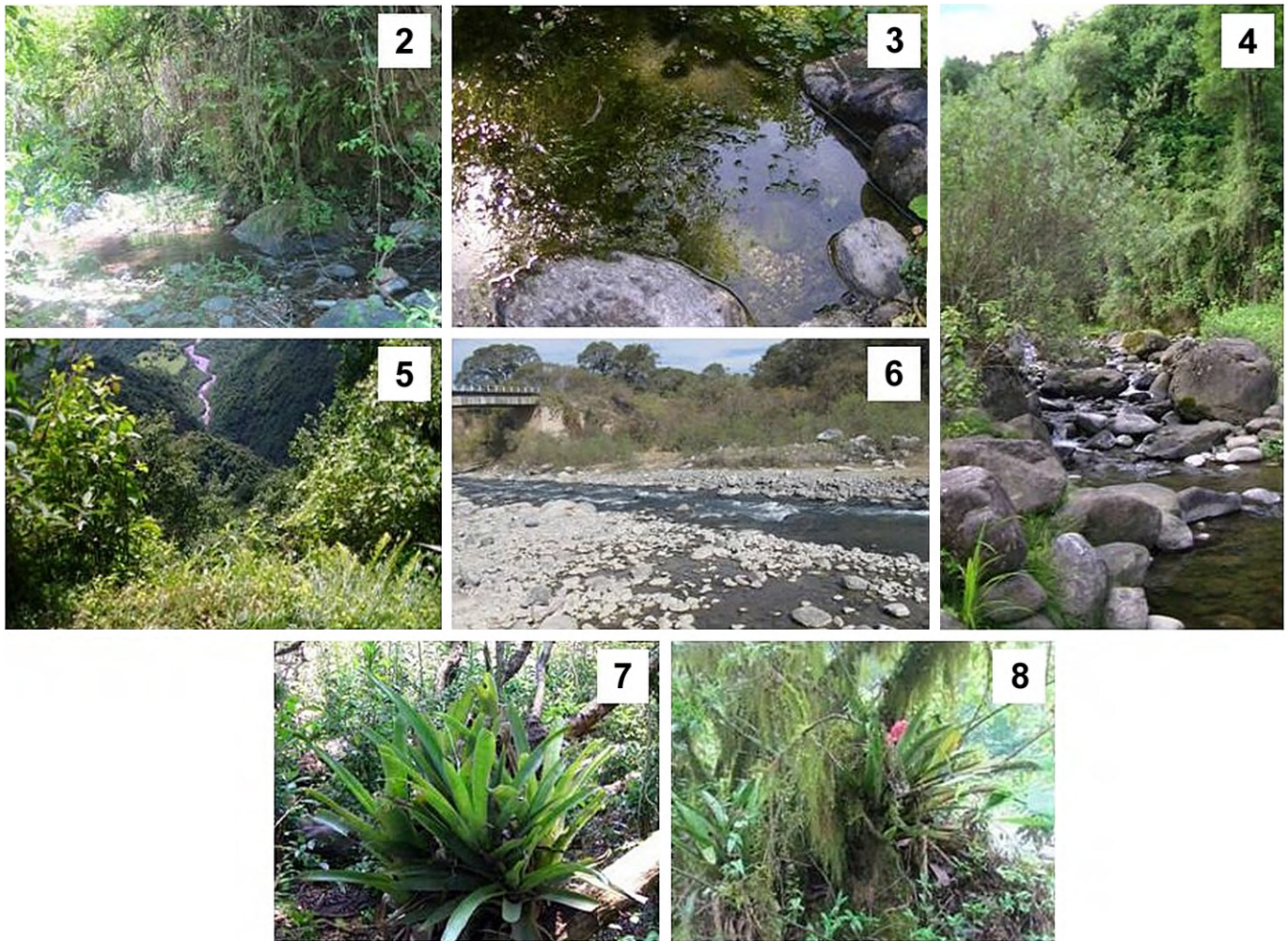


Figure 2–8. Some of the mosquito collection sites along the subtropical mountainous rainforest of Argentina. **2:** El Duraznillo Stream, Tucumán province. **3:** El Calao stream, Tucumán province. **4:** Puddle in Los Sosa River, Tucumán province. **5:** Las Quintas River, Catamarca province. **6:** De Las Conchas River, Salta province. **7:** *Vriesea friburgensis* var. *tucumanensis*. **8:** *Aechmea distichantha*. Photos by C.A. Veggiani Aybar and G.C. Rossi.

Valle, PR N° 307, Los Sosa River station 2; 26°58'15.31" S, 065°39'32.02" W; 1,730 m a.s.l.; 2 L (MLP 4508); extracted from phytotelmata of *A. distichantha*; 13-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det.

Remarks: In Argentina, *Culex davisi* Kumm, 1933 belonging to the Pleuristriatus Series (LANE & WITHMAN 1951), has been cited. Because of the difficulty of the identification at the species level, the specimen having not reached the fourth stage, and the poor description of the larva of *Cx. davisi*, we did not feel confident in the identification of this specimen at the species level.

Howardina sp.

Material examined: Tucumán province, Tafí Viejo, El Cadillal, Loro River; 26°37'24.99" S, 065°11'06.23" W; 550 m a.s.l.; 4 L third instar (MLP 4507); extracted from phytotelmata of *A. distichantha*; 13-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Tafí del Valle, PR N° 307, Los Sosa River station 2; 26°58'15.31" S, 065°39'32.02" W; 1,730 m a.s.l.; 2 L third instar (MLP 4500); extracted from phytotelmata of *A. distichantha*; 13-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det.

Remarks: The larvae could not be reared to adults. The

immature forms of *Howardina* species present in Argentina have not been described. Moreover, none of the five species known from Argentina have been reported from Tucumán province. All members of the genus, as far as known, are container breeders. Immature stages have been reported from holes in rocks and trees, broken bamboo, plant parts on the ground, leaf axils of bromeliads and aroids, and flower bracts of heliconias (BERLIN 1969). The absence of the 12-I bristle and the presence of the promontory from where the 4-X bristles arise distinguish this genus from *Aedes*.

Expansion of the geographic distribution

Aedeomyia (Aedeomyia) squamipennis (Lynch Arribáizaga, 1878)

Material examined: Tucumán province, Juan Bautista Alberdi, Villa Batiruana; 27°38'17.49" S, 065°44'44.19" W; 528 m a.s.l.; 2 F (MLP 4394); collected with CDC light traps with UV-light placed in a forested environment; 26-XI-2012; C. Veggiani Aybar coll., G. Rossi det.

Remarks: The only previous report of this species in Tucumán province was by SHANNON & DEL PONTE (1927)

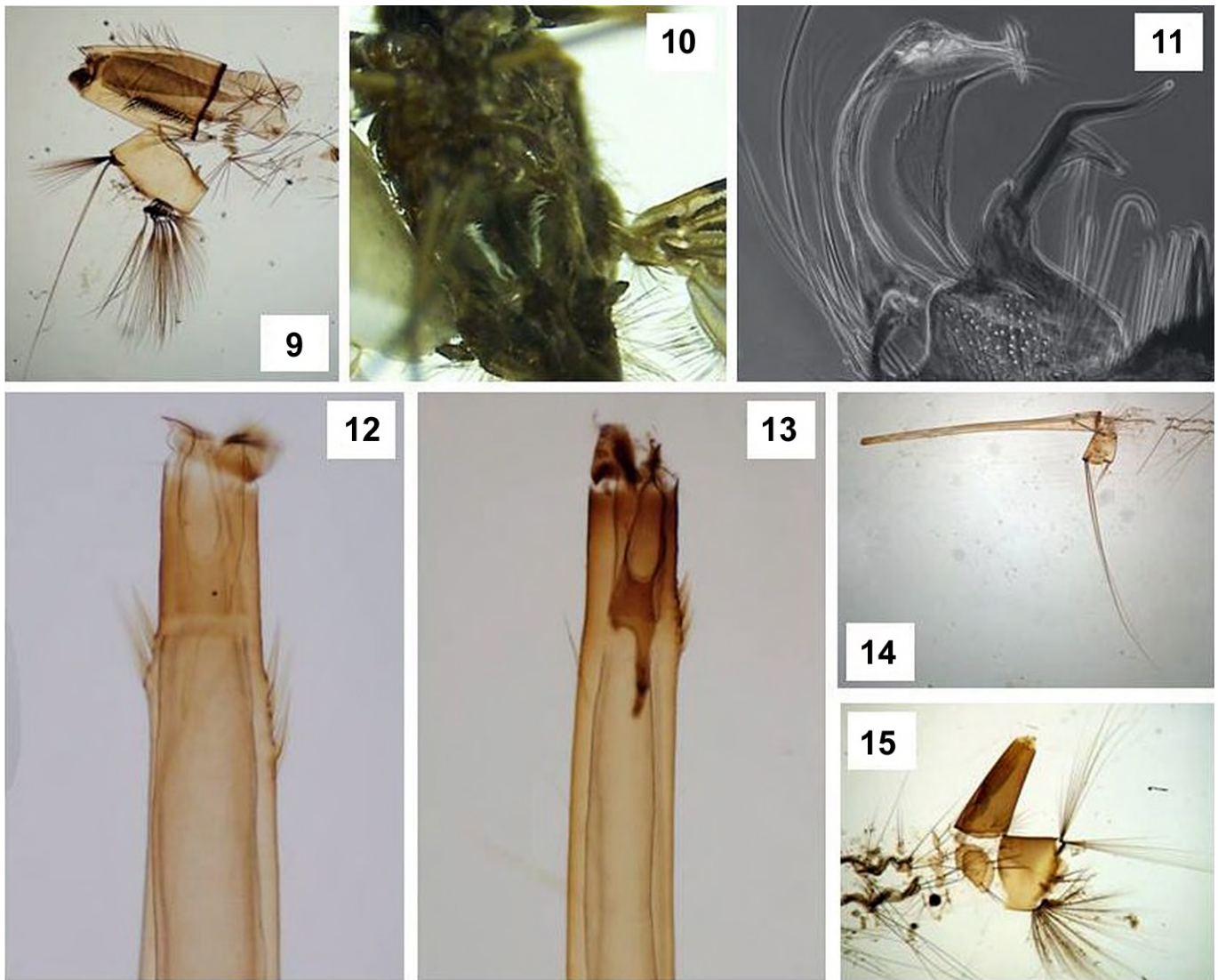


Figure 9–15. Morphological details of some specimens. **9:** Siphon with dorsolateral setae of *Aedes (Ochlerotatus) crinifer*. **10:** Two longitudinal rows of white scales on sternum I in *Anopheles (Nyssorhynchus) albitarsis*. **11:** Apex of gonocoxite of *Culex (Culex) apicinus*. **12:** Apex of siphon of *Culex (Culex) coronator* with crown of strong spines. **13:** Apex of siphon of *Culex (Culex) maxi* with dorsal spines. **14:** Siphon of *Culex (Microculex) imitator*. **15:** Siphon of *Toxorhynchites (Lynchiella) guadeloupensis*. Photos by GC Rossi.

but no specific locality was mentioned. Tufts of scales in the femurs and short and thick flagellomeres distinguish this species from other Culicini.

Aedes (Ochlerotatus) crinifer (Theobald, 1903)
(Figure 9)

Material examined: Tucumán province, Lules, El Duraznillo Stream road to Mala Mala; 26°48'21.25" S, 065°28'26.06" W; 980 m a.s.l.; 2 L (MLP 4379); extracted from phytotelmata of *A. distichantha* with larvae of *Cx. imitator*, *Cx. fernandesi*, and *Tx. guadeloupensis*; 13-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Juan Bautista Alberdi, Marapa River, picnic area, Batirua; 27°37'23.69" S, 065°44'18.45" W; 490 m a.s.l.; 2 L (MLP 4407); extracted from phytotelmata of *A. distichantha* along with *Tx. guadeloupensis*; 10-XI-2014; M. Donato coll., G. Rossi det.

Remarks: In Tucumán province, only two records (adult captured at Monte Bello and Concepción) were documented for *Ae. crinifer* from (DURET 1951). Only one record of

an immature stage of *Ae. crinifer* in phytotelmata exists; this was from cut bamboo at Teresopolis, Brazil (DAVIS 1944 in ARNELL 1976) and found when temporary ground pools had dried. The present capture was from between the leaves of *A. distichantha*, and likewise, was during a period of drought. In this species, the siphon with two or three pairs of anterolateral bristles (Figure 9), subequal in size to seta 1-S, is unique for members of the genus *Aedes*.

Aedes (Stegomyia) aegypti (Linnaeus, 1762)

Material examined: Tucumán province, Lules, El Duraznillo Stream road to Mala Mala; 26°04'21.25" S, 065°28'26.06" W; 980 m a.s.l.; 4L (MLP 4700); extracted from phytotelmata of *V. friburgensis* var. *tucumanensis*; 13-XI-2014; C. Veggiani Aybar coll. and det. Lules, El Duraznillo Stream road to Mala Mala; 26°48'21.25" S, 065°28'26.06" W; 980 m a.s.l.; 2 L (MLP 4692); extracted from phytotelmata of *V. friburgensis* var. *tucumanensis* and *A. distichantha*; 4-III-2015; C. Veggiani Aybar coll. and det.

Remarks: Specimens of *Ae. aegypti* were collected with larvae of *Tx. guadeloupensis* and represent the first report of this species in the bromeliad *V. friburgensis* var. *tucumanensis*. *Aedes aegypti* was previously reported from Monte Bello, Río Chico department, where it was living in *A. distichantha* (STEIN et al. 2013). The number of comb scales on VIII with their large subapical spinules is characteristic of this species.

Anopheles (Anopheles) pseudopunctipennis (Theobald, 1901)

Material examined: Tucumán province, Chicligasta, Alpachiri; 27°20'20.29" S, 065°46'04.39" W; 569 m a.s.l.; 1 F (MLP 4693); collected with CDC light traps with white-light placed in a forested environment; 13-IX-2012; C. Veggiani Aybar coll., G. Rossi det. Chicligasta, El Calao Stream and PR N° 365; 27°19'16.31" S, 065°53'37.70" W; 1,000 m a.s.l.; 1 F, 1 L, 1 Pe (MLP 4255/4358); extracted from a puddle between rocks in the stream bed; 09-XI-2014; C. Veggiani Aybar colls., G. Rossi det. Tafí del Valle, PR N° 307, Los Sosa River station 1; 26°56'49.00" S, 065°40'02.19" W; 1,844 m a.s.l.; 2 M, 2 L, 2 Pe (MLP 4471/4477/4501/4502); extracted from a puddle between rocks in the river bed; 09-XI-2014; C. Veggiani Aybar colls., G. Rossi det. Salta province, Metán, Lumbrera, Puesto La Cruz; 24°49'34.86" S, 064°25'24.17" W; 645 m a.s.l.; 1 M, 1 Pe (MLP 4612); extracted from a puddle between rocks in the stream bed; 29-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det. Anta, La Hachada Stream and PR N° 5; 25°05'7.19" S, 064°44'5.17" W; 742 m a.s.l.; 1 L (MLP 4634); extracted from a puddle between rocks in the stream bed; 29-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det. Anta, Castellanos River and PR N° 5; 25°01'51.49" S, 064°34'02.89" W; 681 m a.s.l.; 1 F, 1 Pe (MLP 4638); extracted from a puddle between rocks in the river bed; 01-XI-2015; C. Veggiani Aybar and Rossi colls., G. Rossi det. Anta, Santa Ana Stream, 7 km N from Anta; 24°51'57.89" S, 064°28'27.15" W; 722 m a.s.l.; 3 L (MLP 4652); extracted from phytotelmata of *A. distichantha*; 01-XI-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: In Salta province, *An. pseudopunctipennis* had been recorded at more than 90 locations up to the 1960s (CASTRO et al. 1959, 1960). In recent years, this species has been recorded only at San Ramón de la Nueva Orán, El Oculito, and Aguas Blancas (DANTUR JURI et al. 2009). *Anopheles pseudopunctipennis* is the most common and abundant species of Anophelini in the Yungas area.

Anopheles (Nyssorhynchus) albitarsis (Lynch Arribálzaga, 1978)
(Figure 10)

Material examined: Salta province, Metán, De Las Conchas River; 25°28'34.28" S, 064°58'33.13" W; 873 m a.s.l.; 3 M, 1 G, 1 F, 4 Pe (MLP 4600-4603); extracted from a puddle between rocks in the river bed; 28-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: This species has been reported from 15 loca-

tions in the province, but all those records were from the late 1950s and 1960s (CASTRO et al. 1959, 1960; LINTHICUM 1988). The presence of two longitudinal rows of white scales on sternum I (Figure 10) is found in *An. brasiliensis* and *An. deaneorum*, but the Ta-III-2 with 90% dark basal separates this species from *An. brasiliensis* (20–40% dark), while the Ta-I-3 with a white ring, among other details, separates it from *An. deaneorum* (Ta-I-3 dark).

Anopheles (Nyssorhynchus) argyritarsis (Robineau-Desvoidy, 1827)

Material examined: Tucumán province, Yerba Buena, San Javier River and PR N° 340; 26°46'48.91" S, 065°23'37.91" W; 908 m a.s.l.; 3 M, 3 MG, 4 F, 1 Le, 7 Pe (MLP 4424-4431); extracted from a puddle between rocks in the river bed; 08-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Yerba Buena, RP N° 340, viewpoint in Sierra San Javier Park; 26°48'10.81" S, 065°21'15.12" W; 1,154 m a.s.l.; 1 F, 7 L, 1 Pe (MLP 4457/4469/4470); extracted from phytotelmata of *A. distichantha*; 08-XI-2014; M. Donato coll., G. Rossi det. Tafí del Valle, PR N° 307, Los Sosa River station 1; 26°56'49.00" S, 065°40'02.19" W; 1,844 m a.s.l.; 6 F, 3 M, 5 L, 3 Le, 8 Pe (MLP 4472-4476/4478-4480/4482/4486/4487/4498); extracted from a puddle between rocks in the river bed; 09-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Juan Bautista Alberdi, Escaba de Arriba, Chavarría River; 27°38'23.57" S, 065°47'33.92" W; 656 m a.s.l.; 2 M, 2 F, 5 L, 3 Pe (MLP 4397-4401); extracted from a puddle between rocks in the river bed; 10-XI-2014; G. Rossi and C. Veggiani Aybar coll., G. Rossi det. Chicligasta, El Calao Stream and PR N° 365; 27°19'16.31" S, 065°53'37.70" W; 1,000 m a.s.l.; 7 L (MLP 4359/4360); extracted from a puddle between rocks in the stream bed; 11-XI-2014; G. Rossi and C. Veggiani Aybar coll., G. Rossi det. Lules, El Duraznillo stream road to Mala Mala; 26°48'21.25" S, 065°28'26.06" W; 980 m a.s.l.; 1 M, 2 F, 2 Pe (MLP 4364/4367/4386/4387); extracted from phytotelmata of *V. friburgensis* var. *tucumanensis*; 13-XI-2014; G. Rossi and C. Veggiani Aybar coll., G. Rossi det. Tafí del Valle, PR N° 307, Los Sosa River station 2; 26°58'15.31" S, 065°39'32.02" W; 1,844 m a.s.l.; 2 F, 6 L, 2 Pe (MLP 4484/4487/4489/4496); extracted from phytotelmata of *A. distichantha*; 13-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Catamarca province, Andalgalá, Las Quintas River and PR N° 1; 27°22'06.34" S, 065°58'52.48" W; 1,557 m a.s.l.; 3 F, 2 Le, 4 Pe (MLP 4488-4491/4499); extracted from a puddle between rocks in the river bed; 11-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Salta province, Metán, Lumbrera, Puesto La Cruz; 24°49'34.86" S, 064°25'24.17" W; 645 m a.s.l.; 7 L (MLP 4626); extracted from a puddle between rocks in the stream bed; 29-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det. Metán, Las Cañas River and PR N° 5; 25°06'41.18" S, 064°44'05.17" W; 725 m a.s.l.; 5 L (MLP 4630); extracted from puddle between rocks in the river bed; 29-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: In Salta province, *An. argyritarsis* has been reported from over 40 locations (CASTRO et al. 1959, 1960). In recent years, this species was recorded at Quebrada Itiyuro (by CASAL in LINTHICUM (1988)), Rosario de la Frontera (GALANTE et al. 2014), San Ramón de la Nueva Orán, El Oculito, and Aguas Blancas (DANTUR JURI et al. 2014). The striking find of *An. argyritarsis* in bromeliads because according to LINTHICUM (1988) this species occurs in ground pools and occasionally in artificial containers; it is in these habitats probably because of the dry atmosphere. Similarly, *Ae. crinifer* has been found breeding in the same type of phytotelmata. *Anopheles argyritarsis* is the second most common species of *Anopheles* in the area. The bare anterior mesepimeron, the costa vein of the wing with basal dark spot almost equal to the humeral pale spot, and the vein R3 with two dark spots all separate this specimen from *Anopheles darlingi* Root, 1926, a species that has not been reported from the Yungas.

Anopheles (Nyssorhynchus) rangeli (Gabaldon, Covarrubias & López, 1940)

Material examined: Tucumán province, Monteros, La Florida Provincial Reserve; 27°13'17.79"S, 065°37'31.10"W; 467 m a.s.l.; 1 M, 1 MG, 1 F (MLP 4687-4691); collected with CDC light traps with UV-light placed in a forested environment; 09-V-2012; C. Veggiani Aybar colls, G. Rossi det.

Remarks: This species was previously reported from Tucumán province at Concepción, Iltico (AUGIER 2001) and Sargento Moya (DANTUR JURI et al. 2010a). *Anopheles rangeli* presents the hind tarsomere 2 with basal dark band usually equal to or greater than 0.25 times length of the tarsomere, the upper mesanepimeron often with 1–4 pale obovate scales, and a pale humeral spot less than 1.5 times the length of the basal dark spot. These features separate this species from *Anopheles oswaldoi* Peryassú, 1922, which presents the hind tarsomere 2 with a basal dark band usually less than 0.25 times the length of the tarsomere and with the upper mesanepimeron often with 1–4 pale obovate scales; the wing with a humeral pale spot greater than 1.5 times the length of the basal dark spot. The *An. rangeli* male genitalia present the ventral claspette with a concentration of long setae (near 1.5 times the width of the aedeagus) and a small preapical plate, oval and heavily sclerotized; in *An. oswaldoi* the ventral claspette is with setae along the basal margin of the basal lobule of length about 2.0 times the width of the aedeagus, and with the preapical plate usually crescent-shaped and moderately to strongly sclerotized (LINTHICUM 1988).

Culex (Culex) apicinus (Philippi, 1865)
(Figure 11)

Material examined: Salta province, Metán, Las Cañas River and PR N° 5; 25°06'41.18"S, 064°44'05.17"W; 725 m a.s.l.; 1 M, 1 MG, 1 L, 1 Pe (MLP 4629/4632); extracted from a puddle between rocks in the river bed; 29-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: In Salta province, this species has been reported from Quebrada de Escoipe (ROSSI et al. 2008) and Tartagal (ROSSI 2015). The larvae of *Cx. apicinus* present the setae 1a, b-S appearing between the teeth of pecten, 1-S in 5 or 6 pairs; the siphon index is lower than 3.3; the head, siphon, and saddle are very sclerotized. The male genitalia are different from other species of *Culex* (Figure 11).

Culex (Culex) coronator (Dyar & Knab, 1906)
(Figure 12)

Material examined: Tucumán province, Tafi del Valle, PR N° 307, Los Sosa River station 2 river; 26°58'15.31"S, 065°39'32.02"W; 1,844 m a.s.l.; 1 M, 3 F, 2 Le, 5 Pe (MLP 4481, 4488-4491, 4499); extracted from a puddle between rocks in the river bed, 13-XI-2014; C. Veggiani Aybar and G. Rossi colls., G. Rossi det. Yerba Buena, San Javier River and PR N° 340; 26°46'48.91"S, 065°23'37.91"W; 908 m a.s.l.; 1 M, 1 MG, 1 Pe (MLP 4432, 4434); extracted from a puddle between rocks in the river bed; 08-XI-2014; C. Veggiani Aybar and G. Rossi colls., G. Rossi det. Salta province, Metán, Lumbreira, Puesto La Cruz; 24°49'34.86"S, 064°25'24.17"W; 645 m a.s.l.; extracted from a puddle between rocks in the stream bed; 29-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det. Metán, Las Cañas River and PR N° 5; 25°06'41.18"S, 064°44'05.17"W; 725 m a.s.l.; 1 L (MLP 4631); extracted from a puddle between rocks in the river bed; 29-X-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: In Tucumán province, this species was recorded from Monte Bello and Aguilares (CASTRO et al. 1959, 1960). DYAR (1928: 388) commented that "Mr. Max Kisliuk caught undoubted specimens of this species in Argentina, May 4, 1927, on the train going from Tucumán to Jujuy". In Salta province, this species was recorded from Isasmendi Stream and Arias River (Capital department) (RÁMIREZ et al. 1999), Chañar Muyo, El Bordo, Metán, and Tabacal (DURET 1953a). *Culex coronator* is distinguished from the other species of *Culex* by presenting the siphon with a prominent crown of dorsal and ventral subapical spines (Figure 12).

Culex (Culex) chidesteri (Dyar, 1921)

Material examined: Tucumán province, Lules, Potreros de Las Tablas; 26°52'16.21"S, 065°25'30.10"W; 705 m a.s.l.; 1 M, 1 MG (MLP 4395); collected with CDC light traps with UV-light placed in anthropic environment; 11-I-2012; C. Veggiani Aybar coll., G. Rossi det. Lules, San Pablo; 26°52'18.94"S, 065°18'45.06"W; 442 m a.s.l.; 1 M, 1 MG (MLP 4396); collected with CDC light traps with UV-light placed in a forested environment; 12-III-2012; C. Veggiani Aybar coll., G. Rossi det.

Remarks: In the samples collected with the CDC traps, many females of *Cx. (Cux.)* were found that were not quantified or classified owing to their poor condition and to the slight differences between species. *Culex chidesteri* differs in the male genitalia from the most similar species by the

absence of a dorsal process, and the lateral plate with about 15 teeth. In the closely related species, *Cx. cuyanus* Duret, 1968 and *Cx. riojanus* Duret, 1968, both of arid regions, and in *Cx. fernandesi*; the dorsal process is present, while the lateral plate presents 3–10, 10–15, and 6–7 teeth, respectively.

Culex (Culex) fernandesi (Casal, García & Cavalieri, 1966)

Material examined: Tucumán province, Yerba Buena, PR N° 340, viewpoint in Sierra San Javier Park; 26°48'10.81"S, 065°21'15.12"W; 1,154 m a.s.l.; 9 M, 6 F, 16 L, 15 Le, 15 Pe (MLP 4463-4465); extracted from phytotelmata of *A. distichantha* beside *An. argyritarsis*; 08-XI-2014; A. Siri and M. Donato colls., G. Rossi det. Yerba Buena, PR N° 340, viewpoint in Sierra San Javier Park; 26°48'10.81"S, 065°21'15.12"W; 1,154 m a.s.l.; 1 F (MLP 4435); collected with mouth aspirator; 08-XI-2014; G. Rossi coll. and det. Chicligasta, El Celeste Stream and PR N° 365; 27°20'31.01"S, 065°51'21.47"W; 820 m a.s.l.; 1 L, 3 Pe (MLP 4361/4362); extracted from a puddle between rocks in the stream bed; 11-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Lules, El Duraznillo Stream road to Mala Mala; 26°48'21.25"S, 065°28'26.06"W; 980 m a.s.l.; 1 F, 1 Pe (MLP 4372); extracted from phytotelmata of *A. distichantha* along with *An. argyritarsis*, *Ae. crinifer*, *Cx. imitator*, and *Tx. guadeloupensis*; 13-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Tafi Viejo, El Cadillal, Loro River; 26°37'24.99"S, 065°11'06.23"W; 550 m a.s.l.; 1 M, 1 F, 2 Le, 2 Pe (MLP 4393/4394); extracted from phytotelmata of *A. distichantha* along with *Cx. (Mcx.) Pleuristriatus* Series; 13-XI-2014; G. Rossi and C. Veggiani Aybar colls., G. Rossi det. Salta province, Anta, Santa Ana Stream, 7 km N from Anta; 24°51'57.89"S, 064°28'27.15"W; 722 m a.s.l.; 2 M, 2 MG, 6 L, 2 Pe (MLP 4644/4648/4653); extracted from a puddle between rocks in the stream bed; 01-XI-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: This species has been reported from Sargento Moya, Monteros department, Tucumán province (DANTUR JURI et al. 2012). In Salta province, only two reports are known, one from Quebrada de Piquirenda (CASAL et al. 1966)—the type locality of the species—and the other from Tartagal (ROSSI 2015). The larvae of *Cx. fernandesi* present the setae 5, 6-C with nine or more branches and the abdomen with many stellate setae. The adults are characterized by the presence of scales in the antennal pedicel and the hind tibia with a clearly visible white ring, in addition to being the only *Culex (Culex)* whose larvae have been shown to develop in bromeliads.

Culex (Culex) maxi (Dyar, 1928)

(Figure 13)

Material examined: Tucumán province, Yerba Buena, San Javier River and PR N° 340; 26°46'48.91"S, 065°23'37.91"W; 908 m a.s.l.; 1 F, 1 Le, 1 Pe (MLP 4435); extracted from a puddle between rocks in the river bed; 08-XI-2014; C. Veggiani Aybar coll., G. Rossi det. Tafi Viejo, El Cadillal, Loro River; 26°37'24.99"S, 065°11'06.23"W; 550 m a.s.l.; 1 L

(MLP 4395); extracted from a puddle between rocks in the river bed; 13-XI-2014; C. Veggiani Aybar coll., G. Rossi det.

Remarks: *Culex maxi* adults present a hind tarsomere marked with quite distinct pale scales, while the larvae are characterized by a siphon with 2–4 small subapical spines on the dorsal side only (Figure 13).

Culex (Culex) quinquefasciatus (Say, 1823)

Material examined: Tucumán province, La Cocha, Rumi Puncu; 27°59'18.21"S, 065°34'33.53"W; 531 m a.s.l.; 1 M, 1 MG (MLP 4697); collected with CDC light traps with white-light placed in a forested environment; 02-IV-2012; C. Veggiani Aybar coll., G. Rossi det. Río Chico, Los Sarmientos; 27°25'04.92"S, 065°41'35.43"W; 394 m a.s.l.; 1 M, 1 MG (MLP 4698); collected with CDC light traps with white-light placed in a forested environment; 14-III-2012; C. Veggiani Aybar coll., G. Rossi det. Chicligasta, El Molino; 27°20'12.91"S, 065°41'33.62"W; 422 m a.s.l.; 1 M, 1 MG (MLP 4699); collected with CDC light traps with UV-light placed in anthropic environment; 15-III-2012; C. Veggiani Aybar coll., G. Rossi det.

Remarks: This species has been recorded once in December 1950 at Concepción, Chicligasta department (DURET 1953a) and once at Monte Bello, Río Chico department (there in epiphytic bromeliads; Stein et al. 2013).

Culex (Melanoconion) aliciae (Duret, 1953)

Material examined: Tucumán province, Lules, San Pablo; 26°52'18.94"S, 065°18'45.06"W; 442 m a.s.l.; 1 M, 1 MG (MLP 4687); collected with CDC light traps with UV-light placed in a forested environment; 12-III-2012; C. Veggiani Aybar coll., G. Rossi det. Río Chico, Los Sarmientos; 27°25'04.92"S, 065°41'35.43"W; 394 m a.s.l.; 2 M, 2 MG (MLP 4690/4691); collected with CDC light traps with UV-light placed in a forested environment; 14-III-2012; C. Veggiani Aybar coll., G. Rossi det. Chicligasta, El Molino; 27°20'12.91"S, 065°41'33.62"W; 422 m a.s.l.; 2 M, 2 MG (MLP 4688/4689); collected with CDC light traps with UV-light placed in anthropic environment; 15-III-2012; C. Veggiani Aybar coll., G. Rossi det.

Remarks: In samples collected with CDC light traps, many females of *Cx. (Mel.)* were neither quantified nor classified because of their poor condition and owing to the minimal differences between the species. *Culex aliciae* has been reported from Sargento Moya, Monteros department (DANTUR JURI et al. 2012). In males of this species, the apical median process of the lateral plate has small teeth; the basal hook is attached to the lateral plate at a right angle; and the IX-tergite lobes are almost rectangular and with small projections on the inner upper corners. The species of the Conspirator Group, *Cx. martinezi* Casal & García, 1968 and *Cx. lucifugus* Komp, 1936, have not been captured for many years.

Culex (Microculex) imitator (Theobald, 1903)

(Figure 14)

Material examined: Salta province, Anta, Santa Ana Stream, 7 km N from Anta; 24°51'57.89" S, 064°28'27.15" W; 722 m a.s.l.; 1 M, 2 L, 2 Le, 2 Pe (MLP 4645/4669-51); extracted from phytotelmata of *A. distichantha*; 01-XI-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: In Salta province, the only record for *Cx. imitator* comes from San Ramón de la Nueva Orán, Orán department (ROSSI 2015). The adult of the species is distinguishable by the characteristic pattern of silvery scales on the thorax and the clear basal bands of scales on the tarsi, while in the larva, the siphonal index is greater than 10, and the posterior margin of saddle is without spicules (Figure 14).

***Psorophora (Janthinosoma) cyanescens* (Coquillett, 1902)**

Material examined: Tucumán province, Yerba Buena, Horco Molle Experimental Reserve; 26°41'17.02" S, 065°19'10.20" W; 658 m a.s.l.; 1 F (MLP 4490); collected under a canopy with a mouth aspirator when trying to bite, at mid-morning; 08-XI-2014; G. Rossi coll. and det.

Remarks: This species was previously reported from San Miguel de Tucumán and Quebrada de Lules (SHANNON 1926). *Psorophora cyanescens* is distinguished by the completely dark wing, the toothed tarsal claws, and the entirely dark-scaled hind tarsomeres; the other species of *Janthinosoma* present at least some of the hind tarsomeres marked with pale scales.

***Toxorhynchites (Lynchiella) guadeloupensis* (Dyar & Knab, 1906)**
(Figure 15)

Material examined: Tucumán province, Yerba Buena, PR N° 340, viewpoint in Sierra San Javier Park; 26°48'10.81" S, 065°21'15.12" W; 1,154 m a.s.l.; 2 M, 3 Le, 3 Pe (MLP 4441/4459/4466); extracted from phytotelmata of *A. distichantha*, along with larvae of *An. argyritarsis*, *Cx. fernandezi*, and *Cx. imitator*; 08-XI-2014; A. Siri and M. Donato colls., G. Rossi det. Tafí del Valle, PR N° 307, Los Sosa River station 1; 26°56'49.00" S, 065°40'02.19" W; 1,844 m a.s.l.; 1 M, 1 F, 2 Le, 2 Pe (MLP 4483/4489); extracted from phytotelmata of *A. distichantha*, along with larvae of *An. argyritarsis* and *Cx. coronator*; 09-XI-2014; G. Rossi coll. and det. Juan Bautista Alberdi, Marapa River, picnic area Batiruana; 27°37'23.69" S, 065°44'18.45" W; 490 m a.s.l.; 2 M, 4 Le, 1 P, 3 Pe (MLP 4402-4406); extracted from phytotelmata of *A. distichantha*, along with *Ae. crinifer*; 10-XI-2014; M. Donato coll., G. Rossi det. Lules, El Duraznillo Stream road to Mala Mala; 26°48'21.25" S, 065°28'26.06" W; 980 m a.s.l.; 2 M (one with entomological net), 1 MG, 3 F, 1 L, 3 Le, 3 Pe (MLP 4368/4373-4378/4383); extracted from phytotelmata of *A. distichantha* along with *An. argyritarsis*, *Ae. crinifer*, *Cx. imitator*, and *Cx. fernandezi*; 13-XI-2014; A. Siri and M. Donato colls., G. Rossi det. Tafí del Valle, PR N° 307, Los Sosa River station 2; 26°58'15.31" S, 065°39'32.02" W; 1,730 m a.s.l.; 3 L, 2 Pe (MLP 4494/4495/4497/4500); extracted from phytotelmata of *A. distichantha* along with *Cx. imitator*;

13-XI-2014; G. Rossi coll. and det. Salta province, Anta, Santa Ana Stream, 7 km N from Anta; 24°51'57.89" S, 064°28'27.15" W; 722 m a.s.l.; 1 L (MLP 4647); extracted from phytotelmata of *A. distichantha*; 01-XI-2015; C. Veggiani Aybar and G. Rossi colls., G. Rossi det.

Remarks: In Salta province, this species was reported previously from Pocitos and Tartagal (CASTRO et al. 1959, 1960) and San Ramón de la Nueva Orán (MANGUDO et al. 2015), but collected in tree holes. In Tucumán province, specimens were obtained from bromeliads as larvae at Acheral, Aconquija Park (San Miguel de Tucumán), Concepción, Monte Bello, Quebrada de Lules, and Tafí Viejo (CASTRO et al. 1959, 1960) and at Timbó Viejo and Famaillá (AUGIER et al. 2003). The specimens collected in the present study were identified as *Tx. guadeloupensis*, a species considered as occurring in Argentina. However, it presents certain differences with a native species as it is *Tx. tucumanus* (Brèthes 1926, as *Megarhynus*) currently a synonym of *Tx. guadeloupensis*. The breeding sites of both species collected were bromeliads. Table 1 summarizes the most visible differences. The identity of specimens in Argentina is currently under review (Figure 15).

The present study represents an update of the list of species recorded for northwestern Argentina. With the addition of unregistered species, the number of records increased to 21 for the province of Catamarca and 57 for the province of Tucumán. Among the species recorded, *Ae. aegypti*, *An. pseudopunctipennis*, *An. argyritarsis*, *Cx. coronator*, *Cx. maxi*, and *Cx. quinquefasciatus* are the only ones that have been recognized in the region as major vectors of disease in humans (MITCHELL et al. 1985; DÍAZ 2009; PISANO et al. 2010a, 2010b).

Several authors have reported the presence of *Ae. aegypti* from a wide variety of habitats in urban areas in Argentina, which indicates the ability of this species to adapt to new anthropic conditions (CAMPOS 1993; CAMPOS & MACIÁ 1996; AVILÉS et al. 1997; SCHWEIGMANN et al. 1997; AUGIER 1998; ALMIRÓN & LUDUEÑA ALMEIDA 1998; STEIN et al. 2002, 2011; CAMPOS et al. 2011). In the present work, larvae of *Ae. aegypti* were collected in the bromeliads *Aechmea distichantha* and *Vriesea friburgensis*; its presence in *V. friburgensis* is the first such record for the region. In Brazil, *Ae. aegypti* has also been collected from bromeliads in gardens (FORATTINI et al. 2000; MOCELLIN et al. 2009) although some authors suggested that those habitats do not contribute to the occurrence of immature stages of the insect (MOCELLIN et al. 2009; SANTOS et al. 2010). Other studies in Argentina have reported tree holes in Aguaray, Salta province (MANGUDO et al. 2011), axils of Araceae in Puerto Iguazú, Misiones province (CAMPOS et al. 2011), and axils of *A. distichantha* in Iltico and Monte Bello, Tucumán province (STEIN et al. 2013) as natural habitats for the species.

Since the beginning of the 20th century, *An. pseudopunctipennis* has been described as the main vector of malaria in northwestern Argentina, although *An. argyritarsis* is a pos-

Table 1. Comparison of the morphological characters of adults of *Toxorhynchites guadeloupenensis* and *Tx. tucumanus*.

Species	<i>Tx. guadeloupenensis</i>	<i>Tx. tucumanus</i>
Source	DYAR & KNAB 1906	BRÉTHES 1926
Adult male		
Scutum color	Green	Greenish with violet and blue scales
Scutum with midline	Present	Absent
Scutum with lateral line	Present	Present
Scales on first flagellomere	Without crest or erect scales	Dark blue scales
Palpi	Violet, mauve at apex	Violet with brass and mauve rings at apex
Tergal color	Dull greenish to blue and violet, seven segments golden-purple	I dark green, II–V blue and violet, VI–VIII golden with violet scales, last segments different
Sternal color	Entirely golden	Brass clear with violet median stripe
Adult female		
Scutum color	Metallic green and blue	Greenish with violet and blue scales
Scutum with midline	Blue	Absent
Scutum lateral line	Green	Metallic greenish
Scales on first flagellomere	Without crest or erect scales	Dark blue scales
Palpi	Violet, mauve apex	Violet with brass and mauve rings at apex
Tergal color	Dull greenish to blue and violet, seven segments golden-purple	Violet-blue peppered with dark green
Sternal color	Entirely golden	Clear, midline dark
Foretarsomere 2	White outside	White outside except apex
Hindtarsomere 4	Partially white	Dark

sible vector (EDWARDS 1928; DANTUR JURI et al. 2010a). Malaria has been regarded as endemic with epidemic outbreaks from September to October and from May to June, with the abundance of *An. pseudopunctipennis* changing throughout the year based on weather conditions. Recent studies have documented that populations of *An. pseudopunctipennis* and *An. argyritarsis* fluctuate in autumn and spring; with temperature, rainfall, and relative humidity acting as important predictors of the abundance of those vectors (DANTUR JURI et al. 2010b, 2014). In the present study, both species were collected in forested environments; the immature stages were found among rocks in rivers and streams. *Anopheles argyritarsis* was also collected in the bromeliads *A. distichantha* and *V. friburgensis*, and these collections are the first in the region of this species in phytotelmata.

Moreover, *Cx. quinquefasciatus* is a vector of the St. Louis encephalitis virus in Argentina (DIAZ 2009), as well as other arboviruses, including the Oropouche virus in Brazil, and is responsible for the vertical transmission of the Japanese encephalitis virus in Australia (LOURENÇO DE OLIVEIRA & DA SILVA 1985; JOHANSEN et al. 2001). This species was found in the same urban sites that *Ae. aegypti* inhabits, although the behavior of *Cx. quinquefasciatus* differs widely (SCHWEIGMANN et al. 1997; ALMIRÓN & LUDUEÑA ALMEIDA 1998; STEIN et al. 2002, 2011). In this study, we only recorded adult specimens, while immature forms were found in epiphytic bromeliads in the Tucumán province (STEIN et al. 2013).

In addition, the circulation of the Venezuelan equine encephalitis virus complex has been documented in northern Argentina, such as in the examples of the Rio-Negro and Pixuna viruses in *Cx. coronator* and *Cx. maxi* (MITCHELL et al. 1985; PISANO et al., 2010a) and of the Pixuna virus in *Ae. aegypti*, the latter having been collected in Tucumán

(PISANO et al. 2010b).

Finding mosquitoes in phytotelmata strongly suggests that more research is needed in order to understand the behavior of these species in the Yungas ecoregion, but also, how bromeliads contribute as habitats for larvae of medically relevant mosquitoes. In addition, further investigations into the distribution patterns of the species reported here, together with ecological studies, will not only allow updates on the mosquito fauna but also aid appropriate surveillance measures before the possible emergence of the Zika and Chikungunya viruses along with the reemergence of the dengue virus in northwestern Argentina.

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