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Mosquito Records From Mexico: The Mosquitoes (Diptera: Culicidae) of Tamaulipas State

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ABSTRACT To document the diversity and distribution of mosquito species inhabiting the Mexican state of Tamaulipas, collection trips were conducted to all physiographic regions (Grand Northamerican Plains, Coastal Plain of North Gulf, and Sierra Madre Oriental) and subregions across the state. Additionally, we re-examined mosquito specimens in two Mexican entomological collections: the Collection of Insects and Mites of Medical Importance and the Collection of Arthropods of Medical Importance. In total, 3,931 specimens were collected. These represent the two Culicidae subfamilies Anophelinae and Culicinae, 10 tribes, 17 genera, 27 subgenera, 80 named species, and 2 undescribed species. Of these, 3 tribes, 6 genera, 7 subgenera, and 20 species are new records for the mosquito fauna of Tamaulipas. Fourteen species recorded in the historical records were not found in collections made for this study. Taxonomic notes, new distribution limits, and comments about the medical importance of some of the species collected are reported.

RESUMEN Para conocer la diversidad y distribución de las especies de mosquitos del estado de Tamaulipas, México se realizaron colectas de campo en las distintas regiones fisiográficas del mismo: Grandes Llanuras de Norteamérica, Llanura Costera del Goflo Norte y Sierra Madre Oriental. También se revisaron dos colecciones entomológicas mexicanas: Colección de Insectos y Ácaros de Importancia Médica (IAIM) y la Colección de Artrópodos de Importancia Médica (CAIM). Un total de 3,931 especímenes fueron colectados representando las dos subfamilias de Culicidae: Anophelinae y Culicinae; se reportan 10 tribus, 17 géneros, 27 subgéneros, 80 especies nominales y 2 especies indescritas; de estas, 3 tribus, 6 géneros, 7 subgéneros y 18 especies resultaron ser nuevos registros de distribución para la culicofauna de Tamaulipas. 14 especies reportadas en los registros históricos no fueron colectadas en el presente estudio. Así mismo, se incluyen notas taxonómicas, nuevos rangos de distribución y la importancia médica de algunas especies colectadas.

KEY WORDS mosquito, Tamaulipas, Mexico, country record, new record

Information regarding mosquitoes (family Culicidae) in the state of Tamaulipas, Mexico, is very limited, and up-to-date information about the diversity and distribution of species in the state is not available. As part of faunistic studies of the mosquito species in all states of Mexico, we conducted collection trips in all the physiographical regions (Grand Northamerican Plains, Coastal Plain of North Gulf, and Sierra Madre Oriental) and subregions of Tamaulipas. Additionally, we obtained environmental and ecological data from the sites where specimens were collected.

A current checklist of the different mosquito species that inhabit Tamaulipas state is provided in this study. Also, biological notes are provided for some species of the Nearctic and Neotropical regions that reach their distributional limits within the state. The species collected for this study and those located in existing entomological collections are listed in the collection records

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of this study summarized in Supp Appendix 1 (online only). An index of species from Tamaulipas state with a list of the collections in which they have been found is provided in Supp Appendix 2 (online only), and lists of the species recorded in each of the regions and subregions of Tamaulipas state is provided in Supp Appendix 3 (online only).

Materials and Methods

Study Area. Tamaulipas state is located in northeastern Mexico, between the 22° 12′31″ and 27° 40′42″ N latitude and the 97° 08′38″ and 100° 08′ 52″ W longitude. The state has an area of 80,175 km^2. It is bordered to the north by the states of Nuevo Leon and Texas, to the south by the states of San Luis Potosi and Veracruz, to the west by the states of Nuevo Leon and San Luis Potosi, and to the east by the Gulf of Mexico. The state is divided into three physiographic regions and seven subregions (Fig. 1; subregions in parenthesis): Grand Northamerican Plains (Plains of Coahuila and Nuevo Leon); Coastal Plain of North Gulf (Coastal Plain of Tamaulipas, Sierra de San Carlos, Plains and Hills, Sierra de Tamaulipas); and Sierra Madre Oriental (Grand Folded Sierra, Sierras and Occidental Plains) (Instituto Nacional de Estadística y Geografía 2010). A description of the regions and subregions of Tamaulipas and a list of the municipalities sampled in each are given in Table 1.

Specimen Collection. Immature stages and adult mosquitoes were collected in specific locations in the three physiographic regions of the state (Table 1). The collections were conducted in both the dry and rainy seasons from 2006 to 2010. Immature stages were collected from any available water body. Some parameters as pH and dissolved salts of the habitat water were measured using a portable tester (Hanna Hi98129). Larvae and pupae were transported to the Laboraotiorio de Entomología Médica of the Universidad Autónoma de Nuevo León (LEM-UANL), the Laboratorio de Parasitología of Universidad Autónoma Agraria Antonio Narro Unidad Laguna, or both. A portion of fourth-instar larvae from each collection was mounted on microscope slides using Euparal as the mounting medium, while the rest of the live larvae were placed in individual emergence tubes with the intention of obtaining adults and immature skins associated with individual specimens. Male genitalia were dissected to assist with identification when it was required. Adults were collected in the field using CDC light traps and/or biting/landing on collection personnel, and they were killed using triethylamine vapor and later mounted on insect pins. The depositories of specimens are given in Supp Appendix 1 (online only).

Review of Entomological Collections. Two entomological collections were reviewed for additional records of mosquitoes in Tamaulipas state: the Colección de Insectos y Ácaros de Importancia Médica (IAIM), deposited in the LEM-UANL, and the Colección de Artrópodos de Importancia Médica (CAIM), deposited in the Instituto de Diagnóstico y Referecnia Epidemiológica. Some of the biological data that we report for *Aedes amabilis* Schick and *Aedes podographicus* Dyar and Knab were obtained during studies of parasitism in mosquitoes (Reyes et al. 2013).

Results

In total, 3,931 specimens in 293 collections were studied. Among the specimens were 966 whole larvae; 327 larval exuviae; 440 pupal exuviae; 57 whole pupae; 1,794 adult ♀; 293 adult ♂; and 54 dissected male genitalia. The mosquito fauna of Tamaulipas state is composed of the two Culicidae subfamilies Anophelinae and Culicinae, 10 tribes, 17 genera, 27 subgenera, and 82 species (Table 2). All Culicidae tribes known to occur in Mexico occur in Tamaulipas state. In this study, 3 tribes (Aedeomyiini, Sabethini, and Toxorhynchitini); 6 genera (*Aedeomyia*, *Lutzia*, *Limatus*, *Sabethes*, *Wyeomyia*, and *Toxorhynchites*); 7 subgenera (*Aedeomyia*, *Aedimorphus*, *Microculex*, *Lutzia*, *Sabethoides*, *Wyeomyia*, and *Lynchiella*); 18 named species [*Anopheles eiseni* Coquillett, *Anopheles franciscanus* McCracken, *Aedes vexans* (Meigen), *Aedes trivittatus* (Coquillett), *Ae. amabilis*, *Ae. brelandi* Zavortink, *Ae. podographicus*, *Aedeomyia squamipennis* (Lynch Arribálzaga), *Culex declarator* Dyar and Knab, *Culex imitator* Theobald, *Culex lactator* Dyar and Knab, *Lutzia bigoti* (Bellardi), *Limatus durhamii* Theobald, *Sabethes chloropterus* (von Humboldt), *Wyeomyia mitchellii* (Theobald), *Toxorhynchites grandiosus* (Williston), *Tx. moctezuma* (Dyar and Knab), and *Uranotaenia geometrica* Theobald]; and two undescribed species are reported for first time in Tamaulipas and represent new occurrence records for the state.

Biological Notes. We provide notes for the 20 species newly reported from Tamaulipas in this study and for two additional species, *Aedes albopictus* (Skuse) and *Culex restrictor* Dyar and Knab, whose occurrence in the state merits mention. Additional locality and ecological information for each species can be found in Supp Appendix 1 (online only).

Anopheles (Anopheles) eiseni. This species is reported to occur in Mexico, all Middle American countries except Nicaragua, and several South American countries. This is the first record for this species in Tamaulipas state. We reared five larvae collected from a discarded tire in the shade in Gómez Farías (collection 152). This location is near El Cielo Biosphere Reserve, where oak-pine forest is dominant. The water in this breeding site was colored with tannins produced by fallen leaves. Associated species collected in the same breeding site were *Ae. podographicus*, *Culex thriambus* Dyar, and *Lt. bigoti*.

Anopheles (Anopheles) franciscanus. Because this species was separated from *An. pseudopunctipennis* Theobald and given specific status, few records of it under the name *An. franciscanus* have been published for Mexico. However, there are recent records where this species is still reported under older names such as *Anopheles willardi* Vargas,

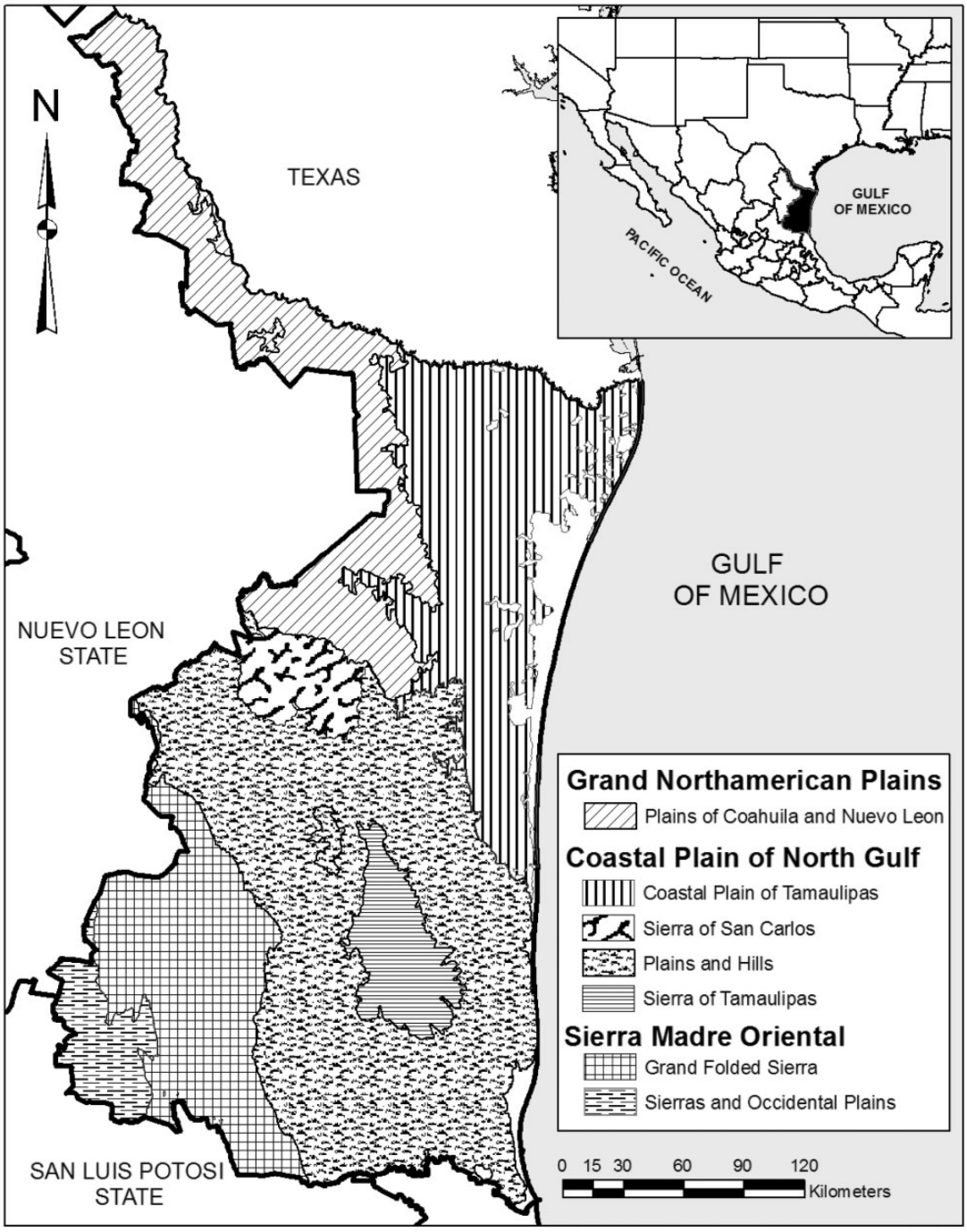

Fig. 1. Physiography of Tamaulipas state.

An. pseudopunctipennis-willardi, or *An. pseudopunctipennis-franciscanus*. This species has been reported from the United States and Mexico. Immature stages were collected from a pond with algae (collection 213), a marsh with floating aquatic vegetation (collection 217), and a metal watering trough for animals shaded by shrubs (collection 223), in rural areas in Llera and Casas counties. This is the first report of this species in Tamaulipas state.

Aedeomyia (Aedeomyia) squamipennis. This is the only species of genus *Aedeomyia* in the Neotropical region. This is the first record for this species in Tamaulipas state and the most northern record in America. Immature stages of this species were collected in

Table 1. Description of Tamaulipas state physiography and list of municipalities sampled

Region/(subregion)	Municipalities sampled	Description of regions/(subregions)
Grand Northamerican Plains		Extends from Alberta and Saskatchewan, Canada, to Northeastern Mexico. Broad plains covered by grasslands.
(Plains of Coahuila and Nuevo Leon)	Burgos, Camargo, Guerrero, Gustavo Díaz Ordáz, Mier, Miguel Alemán, Nuevo Laredo, Reynosa, Río Bravo, Méndez.	(Only the strip bordering the Rio Grande and the eastern extreme of the subregion. Dominated by hills and plains).
Coastal Plain of North Gulf		Extends from Florida to Texas and south in eastern Mexico to the state of Veracruz. The soils may be saline and dominated by halophilic vegetation. This region surrounds the Sierra de San Carlos and the Sierra de Tamaulipas.
(Coastal Plain of Tamaulipas)	Aldama, Altamira, Ciudad Madero, Matamoros, San Fernando, Soto la Marina, Tampico, Valle Hermoso.	(Covered by marine sediments, very close to sea level, dominated by grasslands that may flood periodically, extending to the coast).
(Sierra de San Carlos)	Cruillas, San Carlos.	(Constituted of united intrusive igneous mountains associated with limestone regions. Dominated by oak forests above 1,000 m).
(Plains and Hills)	Abasolo, Güemez, Hidalgo, Llera, Mainero, Mante, Victoria, Villagrán, Xicoténcatl.	(Sandy and clayey soils. Entire subregion covered by plains interrupted by hills. Dominated by xerophilous vegetation).
(Sierra de Tamaulipas)	Casas, Padilla.	(Similar to Sierra de San Carlos, both sub-regions representing isolated mountain ranges with oak forests above 1,000 m).
Sierra Madre Oriental		Extends somewhat parallel to the coast of the Gulf of Mexico from the northern border of Mexico south to Puebla state, with extensions that reach the state of Durango, Mexico, and Big Bend National Park, Texas. Fundamentally is a united Sierra with folded stratum. Overlaps Nearctic and Neotropical regions.
(Grand Folded Sierra)	Antiguo Morelos, Gómez Farías, Jaumave, Nuevo Morelos, Pamillas,	(With elevations over 2,500 m Great vegetational diversity related to climatic variation, from montane forests to tropical forests. Includes El Cielo Biosphere Reserve).
(Sierras and Occidental Plains)	Bustamante, Miquihuana, Tula,	(Located to the west of the Grand Folded Sierra, dominated by limestone mountains and soils, generally an arid subregion with xerophilous vegetation).

Tancol, Tampico, from a swamp with floating aquatic vegetation in a swampy region (collection 42).

Aedes (Aedimorphus) vexans. This species was collected in only one location in San Fernando County. Immature species were found in a pond with abundant emergent aquatic vegetation in a region of shrubs. Associated species were *Psorophora cyanescens* (Coquillett) and *Psorophora ciliata* (F.) (collection 267). *Ae. vexans* can be a serious nuisance in the late summer in northeastern Mexico, where it is very abundant in the states of Nuevo Leon and Coahuila (Ortega 2010). Although these states are adjacent to Tamaulipas, this is the first record for *Ae. vexans* in Tamaulipas state.

Aedes (Ochlerotatus) trivittatus. The current distribution for this species is all North American countries. This is the first report for this species in Tamaulipas state. This was one of the most abundant human-biting species collected as adult females. We collected this species biting when sunlight was present in grassland, oak forest, and tropical rain forest in Tula, Cruillas, and Gómez Farías counties, respectively (collections 202, 236, 258, 262, 281, 286). The immature stages were collected in a pond with emergent vegetation in Matamoros County (collection 276).

Aedes (Ochlerotatus) Undescribed Species 1. Two undescribed species of *Aedes* were collected during our survey. One, belonging to the Scapularis Group, was collected at El Milagro and Sierra San Carlos, both in the county of Cruillas. At El Milagro, females were collected biting/landing on collecting personnel in a sunny, unshaded place in an oak forest (collection 281). In the Sierra San Carlos, females were collected under the same conditions except in partial shade (collection 286). Associated species were *Ae. trivittatus*, *Ae. brelandi*, and *Haemagogus equinus* Theobald in collection 281, and *Ae. brelandi*, *Ae. trivittatus*, *Hg. equinus*, and *Ps. cyanescens* in collection 286.

Aedes (Protomacleaya) amabilis. This species was originally described by Schick (1970a) from six females collected biting landing in Cueva del Nacimiento del Agua and Presidio, Veracruz State of Mexico. We collected fourth-instar larvae from a cement artificial container filled with rain water (collection 203) and females biting in shade in a tropical rain forest (collection 253), both collections in Gómez Farías County. Collections of larvae of *Ae. amabilis* made at this same locality by Reyes et al. (2013) studying parasitism in mosquitoes show that tree holes are the natural breeding site of this species. Females of *Ae. amabilis* were attracted to humans with the intent of biting; it is a persistent species that keeps biting even when the host is moving. The medical importance of this species is unknown. This species represents a new record for Tamaulipas state, and the tropical forest of Gómez Farías County could be the northern limit of its distribution.

Aedes (Protomacleaya) brelandi. Previously known only to occur in the Chisos Mountains, Big Bend National Park, Texas, this species is recorded for second time outside of the United States and for the first time in Mexico (Sánchez-Trinidad et al. 2014). This species was collected in only one location, Cruillas, near the Sierra de San Carlos (collections 281, 286, 290). Adult females were attracted to humans. The site was an oak forest with partial shade; no immature stages of this species were collected in this location. Additional Mexican collections of *Ae. brelandi* are reported in an article on the Triseriatus Group in Mexico (Sánchez-Trinidad et al. 2014).

Aedes (Protomacleaya) podographicus. Probably the most frequent *Protomacleaya* and tree hole species in

Table 2. Checklist of the mosquito species that occur in Tamaulipas state of Mexico

Taxa	F.R.	P.S.
Anopheles (Anopheles)		
1. bradleyi King	VM	✓
2. crucians Wiedemann	IM	✓
3. ***eiseni*** **Coquillett**	**NSR**	✓
4. franciscanus **McCracken**	**NSR**	✓
5. *pseudopunctipennis* Theobald	Ma	✓
6. punctipennis (Say)	Ma	X
7. quadrimaculatus Say	Ma	✓
8. vestitipennis Dyar and Knab	VM	✓
Anopheles (Nyssorhynchus)		
9. albimanus Wiedemann	Ma	✓
10. argyritarsis Robineau-Desvoidy	VM	✓
Aedes ***(Aedimorphus)***		
11. **vexans (Meigen)**	**NSR**	✓
Aedes (Howardina)		
12. quadrivittatus (Coquillett)	Be	✓
Aedes (Ochlerotatus)		
13. bimaculatus (Coquillett)	EC	✓
14. epactius Dyar and Knab	IM	✓
15. mitchellae (Dyar)	Va	X
16. scapularis (Rondani)	EC	✓
17. sollicitans (Walker)	Va	✓
18. taeniorhynchus (Wiedemann)	Va	✓
19. thelcter Dyar	Ma	X
20. trivittatus **(Coquillett)**	**NSR**	✓
21. **Undescribed sp. 1**		✓
Aedes (Protomacleaya)		
22. amabilis **Schick**	**NSR**	✓
23. brelandi **Zavortink**	**NSR**	✓
24. podographicus **Dyar and Knab**	**NSR**	✓
25. triseriatus (Say)	DV	✓
26. zoosophus Dyar and Knab	Va	✓
27. Undescribed sp. 2		✓
Aedes (Stegomyia)		
28. aegypyi (Linneaus)	Va	✓
29. albopictus (Skuse)	IM	✓
Haemagogus (Haemagogus)		
30. equinus Theobald	Va	✓
Psorophora (Grabhamia)		
31. columbiae (Dyar and Knab)	Ma	✓
32. discolor (Coquillett)	Ma	✓
33. signipennis (Coquillett)	Ma	✓
Psorophora (Janthinosoma)		
34. albipes (Theobald)	HB	X
35. cyanescens (Coquillett)	Ma	✓
36. ferox (von Humboldt)	Va	✓
37. mexicana (Bellardi)	HB	X
Psorophora (Psorophora)		
38. ciliata (Fabricius)	Ma	✓
39. howardii Coquillett	Va	X
40. stonei Vargas	DV	X
Aedeomyia (Aedeomyia)		
41. squamipennis **(L. Arribálzaga)**	**NSR**	✓
Culex (Anoedioporpa)		
42. restrictor Dyar and Knab	DV	✓
Culex (Culex)		
43. bidens Dyar	IM	✓
44. coronator Dyar and Knab	EC	✓
45. declarator **Dyar and Knab**	**NSR**	✓
46. interrogator Dyar and Knab	Ma	✓
47. nigripalpus Theobald	EC	✓
48. quinquefasciatus Say	Va	✓
49. restuans Theobald	DV	✓
50. salinarius Coquillett	EC	✓
51. stigmatosoma Dyar	IM	✓
52. tarsalis Coquillett	DV	✓
53. thriambus Dyar	DV	✓
Culex (Melanoconion)		
54. educator Dyar and Knab	Va	✓
55. erraticus (Dyar and Knab)	Va	✓
56. inhibitator Dyar and Knab	EC	✓
57. iolambdis Dyar	Va	✓
58. peccator Dyar and Knab	Va	X
59. pilosus (Dyar and Knab)	EC	X
60. taeniopus Dyar and Knab	Va	X
Culex ***(Microculex)***		
61. imitator **Theobald**	**NSR**	✓
Culex (Neoculex)		
62. territans Walker	DV	X
Culex (Phenacomyia)		
63. corniger Theobald	DV	✓
64. lactator **Dyar and Knab**	**NSR**	✓
Deinocerites		
65. mathesoni Belkin and Hogue	Va	X
66. pseudes Dyar and Knab	Ma	✓
Lutzia (Lutzia)		
67. bigoti **(Bellardi)**	**NSR**	✓
Culiseta (Culiseta)		
68. inornata (Williston)	DV	✓
69. particeps (Adams)	DV	✓
Coquillettidia (Rhynchotaenia)		
70. nigricans (Coquillett)	HB	✓
Mansonia (Mansonia)		
71. indubitans Dyar and Shannon	DV	X
72. titillans (Walker)	Va	✓
Orthopodomyia		
73. signifera (Coquillett)	Va	✓
Limatus		
74. durhamii **Theobald**	**NSR**	✓
Sabethes (Sabethoides)		
75. chloropterus **(von Humboldt)**	**NSR**	✓
Wyeomyia (Wyeomyia)		
76. mitchellii **(Theobald)**	**NSR**	✓
Toxorhynchites (Lynchiella)		
77. grandiosus **(Williston)**	**NSR**	✓
78. moctezuma **(Dyar and Knab)**	**NSR**	✓
Uranotaenia (Pseudoficalbia)		
79. syntheta Dyar and Shannon	DV	✓
Uranotaenia (Uranotaenia)		
80. geometrica **Theobald**	**NSR**	✓
81. lowii Theobald	EC	✓
82. sapphirina (Osten Sacken)	DV	✓

The previous literature records are abbreviated: Ma, Martini (1935); VM, Vargas and Martínez (1956); Va, Vargas (1956); EC, Eads and Campos (1963); Be, Berlin (1969); DV, Díaz-Najera and Vargas (1973); HB, Heinemann and Belkin (1977); IM, Ibáñez and Martínez (1994); and NSR, new state record, in boldface. F.R., first recorded; P.S., present study. In last column, a checkmark (✓) indicates the species was collected during this study and an X indicates it was not collected.

tropical forests in coastal regions in Mexico, this species is recorded for first time in Tamaulipas state (collections 118, 138, 141, 143, 144, 150, 152, 155, 156, 157, 184, 185, 197, 202, 204, 205, 208, 227, 230, 280, 284, 285). The species is known from both the Gulf and Pacific coasts of Mexico. On the Pacific Coast, the northern limit of distribution is Sinaloa State (Heinemann and Belkin 1977), while on the Gulf of Mexico, the northern limit is Tamaulipas state. Females were attracted to humans, and immature stages were collected in a great variety of breeding sites such as tree holes, discarded tires, and other artificial containers filled with rain water. At the location Rincon de Murillo, this species was collected by filling a dry tree hole with drinking water and collecting the first-instar larvae 2 h later. When Reyes et al. (2013) studied parasitism of mosquitoes in the tropical forest of Gómez Farías in late 2007, all tree holes that we checked were

positive for this species, and high numbers of adult females were attracted to humans. However, in 2009, in this same location, these researchers found few tree holes contained this species, although several tree holes were positive for *Ae. amabilis*, and females of *Ae. albopictus* were very abundant and attracted to humans. In this case, we believe that there is interspecific competition between these species, and based on the number of specimens collected at this location during recent years, we believe *Ae. amabilis* is moving from southern Mexico through the Mesoamerican corridor to reach northern extensions that are inhabited by *Ae. podographicus* or other tree hole species of *Protomacleaya*.

Aedes (Protomacleaya) Undescribed Species 2. The second undescribed species collected during our survey belongs to a previously unknown group of *Protomacleaya*. All collections were made in an oak forest at Santa Elena, county of Casas. Immature stages were collected from tree holes (collection 225, without associated species; collection 227, with *Ae. podographicus*, *Hg. equinus*, and *Cx. declarator*) and from a discarded tire (collection 229, with *Culex nigripalpus* Theobald). Adults were collected resting in a tree hole (collection 226).

Aedes (Stegomyia) albopictus. The second most important vector of dengue fever in the world, this pantropical species has been reported in several countries around the world. Although this species was reported from Tamaulipas previously by Ibáñez and Martínez (1994) and Reyes et al. (2013), we summarize information about its spread and abundance in the state here. This species was collected from several kinds of breeding sites such as discarded tires, glass bottles, ponds, and tree holes and biting/landing on collecting personnel in several locations such as Cruillas, Gómez Farías, Llera, Matamoros, Reynosa, and Valle Hermoso. Associated species were *Culex quinquefasciatus* Say in ponds, *Ae. podographicus, Aedes zoosophus* Dyar and Knab, *Aedes aegypti* (L.), and *Culex salinarius* Coquillett in discarded tires, and *Ae. aegypti, Aedes epactius* Dyar and Knab, *Culex coronator* Dyar and Knab, *Cx. quinquefasciatus*, and *Cx. salinarius* in other artificial containers such as flower vases. As reported by Reyes et al. (2013), in 2007 we put ovitraps in several locations in tropical rain forest in Gómez Farías, which were 90% positive for *Ae. podographicus*, *Cx. restrictor*, *Li. durhamii*, and *Tx. moctezuma*; however, in 2009, the same number of ovitraps in the same locations in the same season was 100% positive for *Ae. albopictus* and *Tx. moctezuma*. Correlated with this fact, *Ae. albopictus* was not present among the species collected in CDC light traps operating both day and night at this location in 2007, but in 2009, high numbers of *Ae. albopictus* were collected in light traps run both day and night. We believe that *Ae. albopictus* is an important factor affecting the composition of the mosquito fauna in tropical regions of Tamaulipas state through time, displacing native species such as *Li. durhamii* that share the same kind of breeding sites.

Culex (Anoedioporpa) restrictor. The subgenus *Anoedioporpa* is represented in Mexico by *Culex conservator* Dyar and Knab and *Cx. restrictor*. Although the latter species was reported from Tamaulipas by Díaz-Najera and Vargas (1973), since it was not recorded as far north as Tamaulipas in the revision of *Anoedioporpa* by Berlin and Belkin (1980), we list it here to verify that it does occur in the state. Adults and immature stages were collected in tree holes (collections 138, 143, 144, 155, 197, 204) and discarded tires (collections 157, 231).

Culex (Culex) declarator. This species may have been recorded from Tamaulipas state as *Culex virgultus* Theobald by Díaz-Nájera and Vargas (1973), but because that is not certain, we record *Cx. declarator* as a new state record here. See *Cu. virgultus* in "Species and names deleted from the Tamaulipas mosquito fauna" for further clarification. We collected the immatures of *Cx. declarator* from several different habitats, including ponds (collections 263, 269), a tree hole (collection 227), discarded tires (collections 112, 224, 284), and other artificial containers (collections 222, 282).

Culex (Microculex) imitator. Only two *Microculex* species have been reported in Mexico, *Cx. imitator* and *Culex rejector* Dyar and Knab. This is the first record of *Cx. imitator* and subgenus *Microculex* in Tamaulipas state. Immature stages were collected from bromeliad leaf axils in association with *Aedes quadrivittatus* (Coquillett) in El Cielo Biosphere Reserve (collection 146). Apparently, this species does not feed on humans.

Culex (Phenacomyia) lactator. This is the most northern record of *Cx. lactator* in America. Immature stages of this species were collected from a swamp with abundant aquatic vegetation in Tampico near the coast. Associated species were *Anopheles bradleyi* King, *Anopheles vestitipennis* Dyar and Knab, *Cx. coronator*, *Culex erraticus* (Dyar and Knab), *Culex iolambdis* Dyar, and *Uranotaenia sapphirina* (Osten Sacken) (collection 18).

Lutzia (Lutzia) bigoti. In Mexico, the genus *Lutzia* is represented by *Lutzia allostigma* Howard, Dyar and Knab and *Lt. bigoti*. This is the first record of *Lt. bigoti* in Tamaulipas state. Immature stages were collected from a tree hole with turbid water, in total shade, and feeding on *Ae. podographicus* and *Cx. restrictor* (collection 144); in a discarded tire with colored water, in partial shade, and cohabiting with *Cx. thriambus* (collection 147); and in a discarded tire with clean water, in partial shade, and feeding on *An. eiseni*, *Ae. podographicus*, and *Cx. thriambus* in pine-oak forest (collection 152). All three sites were in Gómez Farías, located in the El Cielo Biosphere Reserve. In Jaumave and Ciudad Victoria, immatures were collected from artificial containers with *Anopheles albimanus* Wiedemann (collection 29) and *Culex bidens* Dyar (collection 44).

Limatus durhamii. One of the Neotropical genera collected for first time in Tamaulipas state is *Limatus*, which in Mexico is represented by two species, *Limatus asulleptus* (Theobald) and *Li. durhamii*. *Li. durhamii* is a small and pretty mosquito that had been recorded in several South and Central American countries. The species was collected in Gómez Farías county, which appears to be its northern distribution limit. Immature stages of *Li. durhamii* were collected from two artificial containers filled with rain water: a

glass bottle with clear water (collection 139) and a plastic flower vase with colored water (collection 205); *Ae. podographicus* was collected in association with *Li. durhamii* breeding in the flower vase. Additionally, a single adult female was collected in rain forest at the same location, approaching a human during gentle rain (collection 156). The tribe Sabethini, genus *Limatus* and species *Li. durhamii* are recorded for first time in Tamaulipas state.

Sabethes (Sabethoides) chloropterus. The genus *Sabethes*, subgenus *Sabethoides,* and species *chloropterus* are recorded for first time in Tamaulipas state. We collected adult females flying to humans with the intent to bite in a shaded tropical forest in Gómez Farías (collections 156, 258, 262). We did not find immature stages of this species.

Wyeomyia (Wyeomyia) mitchellii. This tropical species is recorded for first time in Tamaulipas state. It is an anthropophagus species that was taken in biting/landing collections in tropical rain forest in Gómez Farías (collections 141, 145, 156, 202, 258). The immature stages were collected from bromeliad leaf axils in this same location (collection 201).

Toxorhynchites (Lynchiella) grandiosus. There are three species belonging to *Toxorhynchites* that occur in Mexico: *Tx. grandiosus*, *Toxorhynchites haemorrhoidalis superbus* (Dyar and Knab), and *Tx. moctezuma*. *Tx. grandiosus* has been reported for Guatemala and Mexico. This is the first record for it in Tamaulipas state. A single fourth-instar larva was collected from a water tank with clean water in El Cielo Biosphere Reserve with associated species *Ae. podographicus, Cx. thriambus,* and *Ur. geometrica* (collection 151).

Toxorhynchites (Lynchiella) moctezuma. For many years, continuing even to the present day, the taxonomy of *Toxorhynchites* inhabiting northeastern Mexico and southeastern United States has been doubtful. Recently, Zavortink and Chaverri (2009) studied the taxonomy and distribution of *Toxorhynchites theobaldi* (Dyar and Knab) occurring in Middle America, including southeastern Mexico, and they resurrected *Tx. moctezuma* and *Toxorhynchites hypoptes* (Knab) from synonymy with *Tx. theobaldi*. *Tx. moctezuma* was collected in several locations in Tamaulipas state. In the tropical forest in Gómez Farías, it developed in a tree hole and fed on *Ae. podographicus* and *Cx. restrictor* (collection 197). In Casas, this species was collected from a tree hole where it fed on *Ae. podographicus* (collection 230) and a discarded tire with colored water in partial shade where it fed on *Cx. restrictor* (collection 231). In Cruillas, it was collected from a discarded tire in association with *Ae. epactius, Ae. podographicus, Cx. declarator,* and *Cx. quinquefasciatus* (collection 284) and a tree hole also containing *Ae. podographicus* (collection 285).

Uranotaenia (Uranotaenia) geometrica. This species is recorded for the first time in Tamaulipas state. It rarely bites warm-blooded animals, including humans (Lane 1943). We collected this species on only one occasion, at San Jose Ranch, in the El Cielo Biosphere Reserve. Immature stages were found in a water tank filled with clear and clean water used for human consumption (collection 151). There were a few fallen leaves on the bottom of the container, and it was in complete shade in cloud forest. *Ur. geometrica* was found in association with *Ae. podographicus* and *Cx. thriambus* and was fed upon by *Tx. grandiosus.* According to Galindo et al. (1954), the immatures of this species are normally found in open sunlit ground pools with abundant aquatic vegetation where they are frequently associated with anopheline larvae.

Discussion

Species Groups Based on Ecology and Distribution. Based on our collection records and the known distribution of the mosquito species collected in Tamaulipas, four groups of species are recognized. The species of each group have similar geographical distributions, share the same kind of breeding habitat, and reach their northern or southern distributional limits in the state. The broader distribution of all mosquito species collected in Tamaulipas state is summarized in Table 3.

Group 1 (Fig. 2). Arboricolous breeding species that occur in forested areas of the Nearctic region, including northeastern Mexico: *Ae. brelandi*, *Aedes triseriatus* (Say), and *Ae. zoosophus*. Although *Ae. brelandi* has been reported to occur only in the Chisos Mountains, Big Bend National Park, Texas, *Ae. triseriatus* has been reported to occur in the eastern United States and southeastern Canada. *Ae. zoosophus* occurs in the south central United States and northeastern Mexico. The three species are arboricolous, breeding predominantly in tree holes, and are attracted to humans with the intention of biting. They also belong to the Triseriatus group of *Aedes (Protomacleaya)*; the other species belonging to this group is *Aedes hendersoni* Cockerell, which is sympatric with *Ae. triseriatus* in the eastern United States. Although historical mosquito records indicate the presence of *Ae. triseriatus* in several southern states of Mexico, we believe that those records are based on misidentified specimens that are actually other species of subgenus *Protomacleaya*, perhaps species in the Terrens group. The southern limit of distribution for the species of Group 1 is the center of Mexico through the Sierra Madre Oriental, including the state of Tamaulipas, where all species of this group have been collected in an oak forest in the Sierra de San Carlos. The great numbers of live oak trees here provide the holes that, when filled with rain water, are used as breeding sites by these species. All the species of Group 1 are treated in more detail in an article of the Triseriatus group in Mexico (Sánchez-Trinidad et al. 2014).

Group 2 (Fig. 3). Ground pool breeding species that extend from the Nearctic region into northeastern Mexico: *Aedes thelcter* Dyar, *Culex territans* Walker, and *Culiseta inornata* (Williston). These species develop in ground pools and spread from the Nearctic region into the Coastal Plain of Tamaulipas, which represents the southern limit of distribution for this group of species in western North America. *Ae. thelcter* occurs in several southcentral and western United

Table 3. Distribution of the Culicidae fauna of Tamaulipas state

Taxa	Dis	Taxa	Dis	Taxa	Dis
An. bradleyi	MEX	*Ps. columbiae*	C-M	*Cx. pilosus*	NEO
An. crucians	NEO	*Ps. discolor*	MEX	*Cx. taeniopus*	NEO
An. eiseni	NEO	*Ps. signipennis*	MEX	*Cx. imitator*	NEO
An. franciscanus	MEX	*Ps. albipes*	NEO	*Cx. territans*	HOL
An. pseudopunctipennis	NEO	*Ps. cyanescens*	NEO	*Cx. corniger*	NEO
An. punctipennis	MEX	*Ps. ferox*	NEO	*Cx. lactator*	NEO
An. quadrimaculatus	MEX	*Ps. mexicana*	MEX	*De. mathesoni*	C-M
An. vestitipennis	NEO	*Ps. ciliata*	NEO	*De. pseudes*	NEO
An. albimanus	NEO	*Ps. howardii*	NEO	*Lt. bigoti*	NEO
An. argyritarsis	NEO	*Ps. stonei*	END	*Cul. inornata*	MEX
Ae. vexans	CSP	*Ad. squamipennis*	NEO	*Cul. particeps*	C-M
Ae. quadrivittatus	NEO	*Cx. restrictor*	NEO	*Or. signifera*	C-M
Ae. bimaculatus	NEO	*Cx. bidens*	NEO	*Cq. nigricans*	NEO
Ae. epactius	NEO	*Cx. coronator*	NEO	*Ma. indubitans*	NEO
Ae. mitchellae	MEX	*Cx. declarator*	NEO	*Ma. titillans*	NEO
Ae. scapularis	NEO	*Cx. interrogator*	NEO	*Li. durhamii*	NEO
Ae. sollicitans	C-M	*Cx. nigripalpus*	NEO	*Sa. chloropterus*	NEO
Ae. taeniorhynchus	NEO	*Cx. quinquefasciatus*	PNT	*Wy. mitchellii*	C-M
Ae. thelcter	MEX	*Cx. restuans*	MEX	*Tx. grandiosus*	NEO
Ae. trivittatus	MEX	*Cx. salinarius*	MEX	*Tx. moctezuma*	NEO
Ae. amabilis	END	*Cx. stigmatosoma*	NEO	*Ur. syntheta*	MEX
Ae. brelandi	MEX	*Cx. tarsalis*	MEX	*Ur. geometrica*	NEO
Ae. podographicus	NEO	*Cx. thriambus*	NEO	*Ur. lowii*	NEO
Ae. triseriatus	MEX	*Cx. educator*	NEO	*Ur. sapphirina*	MEX
Ae. zoosophus	MEX	*Cx. erraticus*	MEX		
Ae. aegypti	PNT	*Cx. inhibitator*	NEO		
Ae. albopictus	PNT	*Cx. iolambdis*	NEO		
Hg. equinus	NEO	*Cx. peccator*	C-M		

CSP, cosmopolitan; PNT, pantropical; C-M, Caribbean–Mexico–USA; END, endemic for Mexico; MEX, Mexico (Overlapping Nearctic and Neotropical regions); NEO, neotropical; HOL, holarctic.

States (California, New Mexico, Oklahoma, and Texas) and, disjunctly, in Florida. In Mexico, it occurs in the northern part of the Coastal Plain of Tamaulipas, which appears to be its southern distributional limit. This species may be found in overflow pools from irrigation ditches and temporary rain-filled pools (Carpenter and LaCasse 1955). *Cu. territans* and *Cs. inornata* breed in ground pools, swamps, and ponds, and *Cs. inornata* can also develop in artificial containers with polluted water (Carpenter and LaCasse 1955). These species are widespread in the United States and Canada; in Mexico, they occur on the Coastal Plain of Tamaulipas and are not recorded farther south.

Group 3 (Fig. 4). The species that comprise this group breed in phytotelmata and artificial containers in tropical forests in the Neotropical region and extend into northeastern Mexico and reach their northern limit in Tamaulipas state. Species included in the group are *An. eiseni*, *Ae. quadrivittatus*, *Ae. amabilis*, *Ae. podographicus*, *Cx. restrictor*, *Cx. imitator*, *Li. durhamii*, *Sa. chloropterus*, and *Tx. grandiosus*. The typical breeding habitat of *Ae. quadrivittatus* and *Cx. imitator* is epiphytic bromeliad leaf axils filled with rain water, and the presence of these mosquito species in a particular region depends directly on the presence of the host plants. Several different epiphytic bromeliad species spread through the Grand Folded Sierra of the Sierra Madre Oriental, these mountains comprising part of the Tropical Mesoamerican Corridor. In Tamaulipas state, the presence of bromeliads is restricted to El Cielo Biosphere Reserve. Although humid mountains and oak forests occur north of this reserve, bromeliads do not grow there. Species such as *Ae. quadrivittatus* and *Cx. imitator* reach their northern distribution limit in the tropical and oak forests of El Cielo Biosphere Reserve, where bromeliads are numerous. Two of the tropical species that develop in tree holes, *Ae. podographicus* and *Cx. restrictor,* reach their northern distribution limit in the northern oak forests of the Sierra de San Carlos, while the third, *Ae. amabilis,* was only collected in the tropical forest of Gómez Farías. Oak forests are widespread in the United States and Canada, but these mosquito species have not dispersed into those countries. The change of environmental conditions and/or interspecific competition with more northern tree hole mosquito species must limit the northern dispersion of the tree hole species of Group 3. Other species belonging to this group, such as *An. eiseni*, *Li. durhamii*, *Sa. chloropterus*, and *Tx. grandiosus,* develop in diverse kinds of phytotelmata and artificial containers and reach their northern limit of distribution in El Cielo Biosphere Reserve.

Group 4 (Fig. 5). This group includes *Anopheles argyritarsis* Robineau-Desvoidy, *An. vestitipennis, Ad. squamipennis, Cx. lactator,* and *Ur. geometrica,* which are pond, swamp, and marsh breeding species that are widespread in the Neotropical region. These species usually develop in brightly lit bodies of water with abundant floating and emergent aquatic vegetation. They have spread into Tamaulipas from the Neotropical region, particularly from humid, wet, swampy regions southeast of Tamaulipas state in Veracruz State. Southern Tamaulipas is the northern limit of distribution for these species.

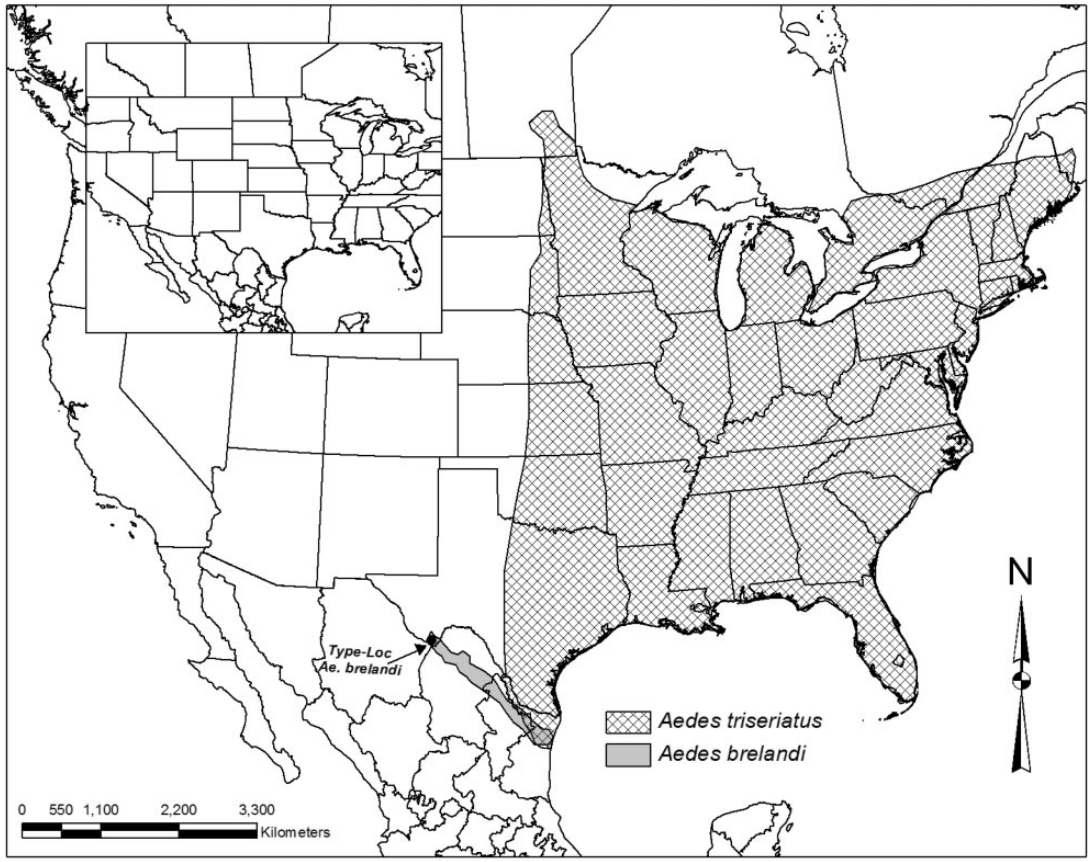

Fig. 2. Arboricolous breeding species that occur in the Nearctic region and northeastern Mexico.

Species and Names Deleted From the Tamaulipas Mosquito Fauna. Some species reported to occur in Tamaulipas state in earlier publications are not considered to occur in the state in this study. In some cases, the names of these species have been changed since they were reported, and in other cases, the reports may have been based on misidentifications. In this section, the species deleted from the state fauna and the reasons for the deletions are given, organized by the authors of the articles in which the species were reported.

Martini (1935)

Anopheles rondoni (Neiva and Pinto). This species is known to occur only in Argentina, Bolivia, Brazil, and Paraguay, and it does not occur in Mexico. The record is probably based on misidentified specimens of another species of subgenus *Nyssorhynchus*, such as *An. albimanus* or *An. argyritarsis*. Faran (1980) believed that Martini's record was based on *An. albimanus*.

Psorophora confinnis (Lynch Arribálzaga). Belkin et al. (1970) resurrected *Psorophora columbiae* (Dyar and Knab) from synonymy with the widespread species *Ps. confinnis* and applied the name to populations in the eastern United States. They noted that at least some populations of the *Ps. confinnis* complex in Mexico and Central America may be conspecific with *Ps. columbiae*. The population of the *Ps. confinnis* complex in Tamaulipas state belongs to *Ps. columbiae* form *columbiae* (Moncayo et al. 2008).

Culex fatigans Wiedemann. Both the names *Cx. fatigans* and *Cx. quinquefasciatus* were used for the same species until Stone (1957) presented arguments for using *Cx. quinquefasciatus* as the valid name and synonymizing *Cx. fatigans* with it.

Vargas (1956)

Deinocerites spanius (Dyar and Knab). Before they were described as a distinct species, Texas populations of *Deinocerites mathesoni* Belkin and Hogue were considered to be *De. spanius*. Because the type locality of *De. mathesoni* is Brownsville, Texas, the species undoubtedly occurs south of the international border in Tamaulipas state of Mexico. We believe that the Vargas record of *De. spanius* in Tamaulipas most likely refers to *De. mathesoni*. In his

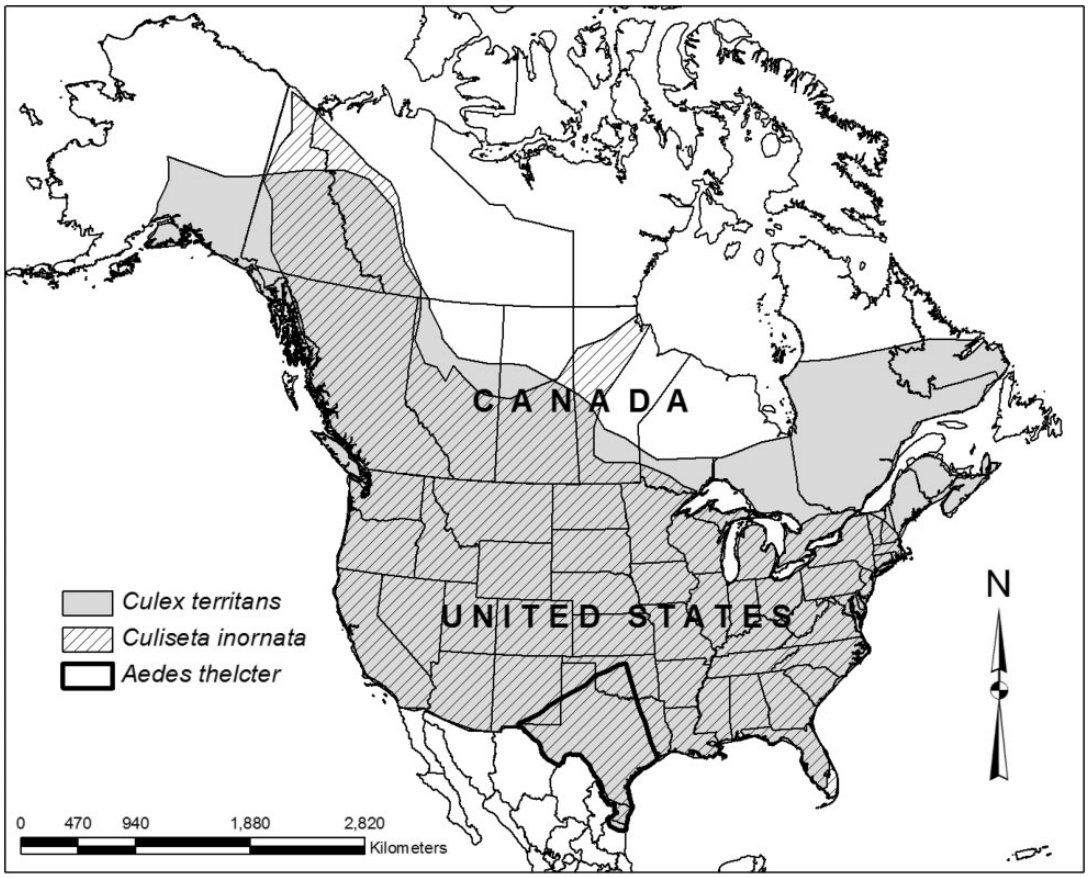

Fig. 3. Ground pool breeding species that occur in the Nearctic region and northeastern Mexico.

revision of *Deinocerites*, Adames (1971) also thought the Vargas record of *De. spanius* in Tamaulipas state probably referred to *De. mathesoni* and he speculated that *De. mathesoni* probably extended south as far as Veracruz.

Eads and Campos (1963)

Aedes terrens (Walker). At the time of the report by Eads and Campos, *Ae. terrens* was considered to be a widespread species, occurring throughout Mexico, Central America, and South America. In his revision of the Terrens Group, Schick (1970a,b) restricted *Ae. terrens* to populations in South America, and today the species is known to occur in Argentina, Brazil, Colombia, French Guyana, Paraguay, Surinam, and Venezuela. Schick resurrected numerous species from synonymy with *Ae. terrens* and described numerous new species, many of which occur in Mexico. Because *Ae. terrens* does not occur in Mexico, the Eads and Campos record undoubtedly refers to some other species of the Terrens group of *Aedes (Protomacleaya)*, quite possibly to the commonly collected *Ae. podographicus*.

Culex pipiens L. Because *Cx. quinquefasciatus* is considered by some to be a subspecies of *Cx. pipiens* occurring in warmer temperate and tropical regions, this record undoubtedly refers to *Cx. quinquefasciatus*. The true *Cx. pipiens* occurs in more temperate regions of the world, and in the western hemisphere, it occurs in the northern United States and Canada and in Argentina and Uruguay.

Díaz-Najera and Vargas (1973)

Aedes atropalpus (Coquillett). Until it was divided into two species by Zavortink (1972), *Ae. atropalpus* was considered to be a widespread species extending from eastern Canada to Panama. *Ae. epactius*, the more western and southern of the two species, is the one that occurs in Mexico. As currently interpreted, *Ae. atropalpus* occurs naturally only in the eastern United States and southeastern Canada and as an introduction in Europe (Medlock et al. 2012).

Culex peus Speiser. *Cx. peus* was mistakenly considered to be the senior synonym of *Culex stigmatosoma* Dyar from 1958 (Stone 1958) until 1988 (Strickman 1988), at which time it was discovered that it was actually the senior synonym of *Cx. thriambus*. To avoid the confusion that would have resulted from transferring the name *Cx. peus* from *Cx. stigmatosoma* to *Cx. thriambus*, Eldridge and Harbach

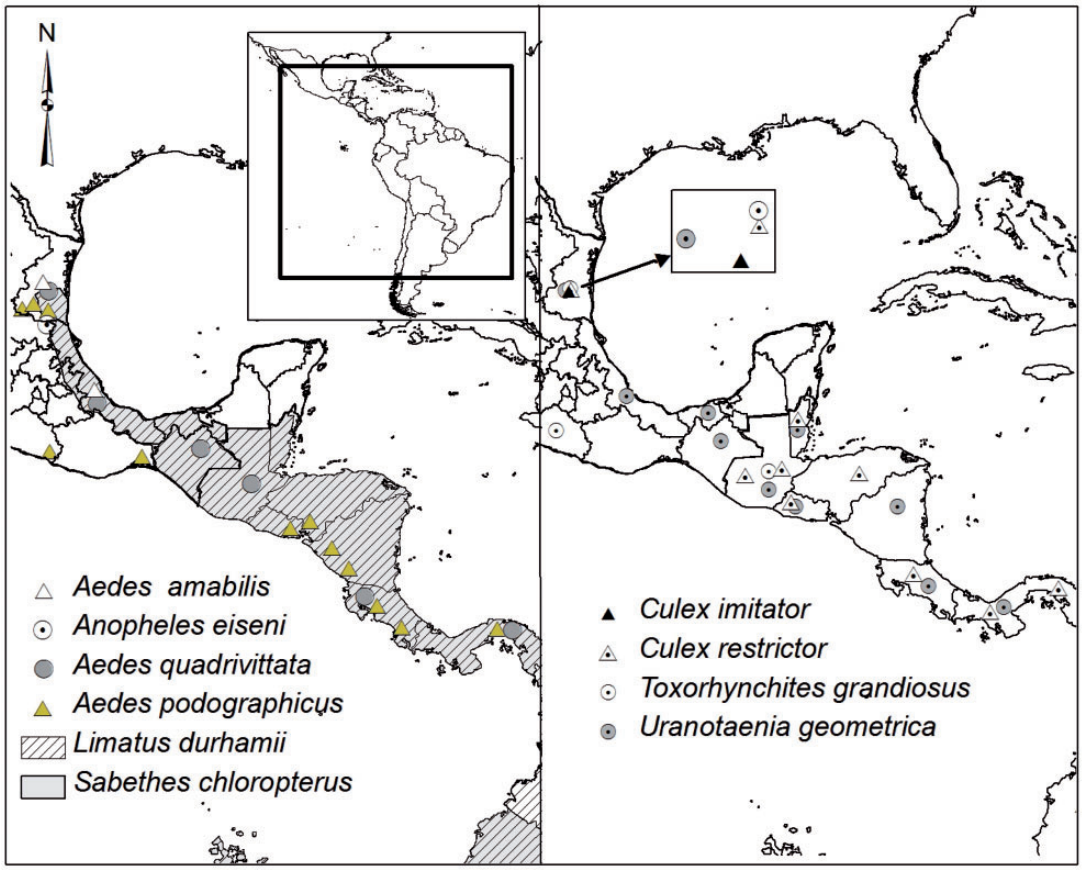

Fig. 4. Phytotelmatic and artificial container breeding species that spread from the neotropical region into northeastern Mexico.

(1989) petitioned the International Commission on Zoological Nomenclature to suppress the name *Cx. peus* and conserve the names *Cx. stigmatosoma* and *Cx. thriambus.* As reported by Eldridge and Harbach (1992), the Commission approved the petition.

Culex opisthopus Komp. Synonymized with *Culex taeniopus* Dyar and Knab by Sirivanakarn and Belkin (1980).

Culex reevesi Wirth. This species is definitely known to occur only along the coast of the Pacific Ocean from central California to northern Baja California (Bohart and Washino 1978). Díaz-Najera and Vargas (1973) reported the species from several Mexican states, including southern ones (Colima), inland ones (Coahuila, Nuevo Leon), and Tamaulipas on the Gulf Coast. We consider it highly unlikely that *Cx. reevesi* occurs in these areas and believe all these records are based on misidentifications.

Cx. virgultus. *Cx. virgultus*, described from Brazil, is currently considered to be a *nomen dubium* (Knight and Stone 1977). For the brief period from 1951 (Lane 1951) to 1957 (Stone 1957), the name was used for the widespread species *Cx. declarator.* Because Díaz-Najera and Vargas (1973) report both *Cx. declarator* and *Cx. virgultus* from Mexico, it is not clear to what species their records of *Cx. virgultus* refer. Although it is possible that their record of *Cx. virgultus* from Tamaulipas refers to *Cx. declarator*, because that is not certain, we report *Cx. declarator* as a new Tamaulipas state record.

Heinemann and Belkin (1977)

Psorophora Confinnis group. The Confinnis group (*Psorophora: Grabhamia*) includes the taxa *Ps. confinnis*, *Ps. columbiae* form *columbiae*, *Psorophora columbiae* form *toltecum* (Dyar and Knab), and *Psorophora jamaicensis* (Theobald) (Moncayo et al. 2008). The geographic distribution of each taxon is restricted, but there is a hybrid zone between *Ps. columbiae* forms *columbiae* and *toltecum* in central Texas (Moncayo et al. 2008). The taxon that occurs in the eastern United States and along the Atlantic coast of Mexico, as well as Middle America, is *Ps. columbiae* form *columbiae*.

Culex coronator group. The Coronator group (*Culex s.s.*) includes *Culex camposi* Dyar, *Cx. coronator*, *Culex covagarciai* Forattini, *Culex ousqua* Dyar,

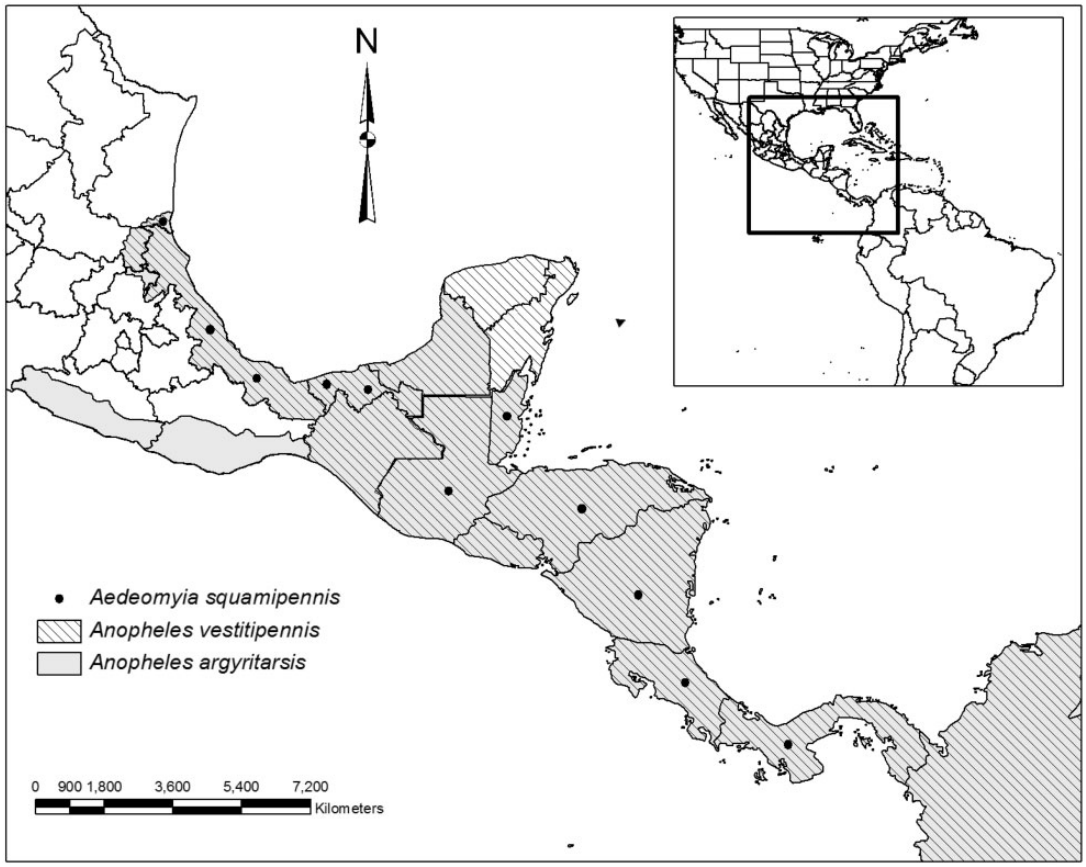

Fig. 5. Pond, swamp, and marsh breeding species that spread from the neotropical region to northeastern Mexico.

Culex usquatissimus Dyar, and *Culex usquatus* Dyar. In Mexico, *Cx. coronator* (*s.s.*), *Cx. ousqua,* and *Cx. usquatus* have been reported. The only way to separate the species of this complex using morphology is by the male genitalia, which offer diagnostic structures distinctive for each species (Dyar 1922). Male genitalia were dissected whenever *Cx. coronator* (*s.l.*) was collected, and all our specimens correspond to the specific description of *Cx. coronator* (*s.s.*).

Species From Adjacent Regions That May Occur in Tamaulipas. Numerous species of mosquitoes that have not yet been reported from Tamaulipas occur in adjacent areas and can logically be expected to occur within the state. Included among these are 11 species that have been recorded in the Lower Rio Grande Valley of Texas: *Aedes dorsalis* (Meigen), *Aedes infirmatus* Dyar and Knab, *Aedes nigromaculis* (Ludlow), *Aedes sticticus* (Meigen); *Anopheles barberi* Coquillett; *Coquillettidia perturbans* (Walker); *Culex abominator* Dyar and Knab and *Culex chidesteri* Dyar; *Orthopodomyia alba* Baker; and *Psorophora horrida* (Dyar and Knab) and *Psorophora mathesoni* Belkin and Heinemann (Darsie and Ward 2005, Texas A & M 2013).

Table 4. Medical importance of the Culicidae of Tamaulipas state

Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
An. crucians	X														
An. pseudopunctipennis	X														
An. punctipennis	X														
An. quadrimaculatus	X	X													
An. albimanus	X														
An. argyritarsis	X														
Ae. vexans		X													
Ae. scapularis			X		X		X								
Ae. taeniorhynchus		X					X	X							
Ae. trivittatus		X										X			
Ae. triseriatus		X									X				
Ae. aegypti				X	X								X		
Ae. albopictus				X	X								X	X	
Hg. equinus					X										
Ps. ferox							X								
Ps. columbiae							X								
Cx. nigripalpus						X		X		X					
Cx. quinquefasciatus		X	X			X			X	X					
Cx. restuans						X				X					
Cx. tarsalis						X			X	X					X
Cx. taeniopus							X								
Cul. inornata						X			X						
Ma. titillans			X				X								

1. Malaria; 2. *Dirofilaria immitis*; 3. *Wuchereria bancrofti*; 4. Dengue Fever; 5. Yellow Fever; 6. West Nile Virus; 7. Venezuelan Equine Encephalitis; 8. Eastern Equine Encephalitis; 9. Western Equine Encephalitis; 10. St. Louis Encephalitis; 11. LaCrosse Encephalitis; 12. Trivittatus Virus; 13. Chikungunya Virus; 14. Japanese Encephalitis Virus; 15. California Encephalitis Virus

Tamaulipas Mosquitoes of Public Health Importance. Some of the species reported in this study have medical importance for humans and veterinary importance for animals because they are vectors of pathogens causing diseases. Examples are *Ae. aegypti* and *Ae. albopictus*, which were collected in many locations of the state; both species are vectors of viruses causing dengue fever and hemorrhagic dengue fever. In Mexico and Tamaulipas state, dengue fever and dengue fever with hemorrhagic symptoms represent the most important mosquito-transmitted diseases. We recommend conducting vector competence studies on poorly known mosquito species that feed on humans and whose medical importance is unknown. In Table 4, the important public health species that occur in Tamaulipas state are listed. These species must to be watched closely to determine their future dispersion patterns in Tamaulipas state.

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