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Ciencias Naturales e Ingenierías

# Nuevos registros de especies de mosquitos (Diptera: Culicidae) de la Comarca Lagunera de Durango, México

# New records of mosquito species (Diptera: Culicidae) in La Comarca Lagunera, Durango, Mexico

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**Resumen**

**Introducción**: Un número notable de mosquitos tienen gran importancia médica y veterinaria debido a que transmiten numerosos patógenos que causan enfermedades en los animales y los seres humanos, por lo que conocer su taxonomía y distribución es fundamental para aplicar estrategias de control correctas. El objetivo de este estudio fue determinar la presencia de especies de mosquitos y su distribución en la Comarca Lagunera del estado de Durango, México.

**Método**: Entre agosto y noviembre de 2018 fueron colectados mosquitos adultos utilizando aspiradores de campo (Insectzookas) en diferentes sitios de reposo en cuatro municipios. También se tomaron muestras de los hábitats acuáticos para la colecta de etapas inmaduras. Los especímenes

adultos se mataron utilizando cámaras letales con vapores de trietilamina, mientras que las larvas y las pupas se almacenaron en tubos individuales para obtener los estadios adultos y las exuvias asociadas. Todo el material se transportó al Laboratorio de Biología Molecular del Departamento de Parasitología de la Universidad Autónoma Agraria Antonio Narro, Unidad Laguna (UAAAN-UL) para su montaje e identificación taxonómica. Las especies fueron identificadas usando claves taxonómicas para la región.

**Resultados**: En total se colectaron 689 mosquitos (286 machos y 403 hembras) pertenecientes a 15 especies de las cuales *Anopheles franciscanus* McCracken, *Culex erythrothorax* Dyar y *Toxorhynchites moctezuma* (Dyar y Knab) son nuevos registros para el Estado de Durango. La especie más abundante fue *Cx. quinquefasciatus* Say con 364 (56.2%) especímenes, seguida de *Aedes aegypti* (Linnaeus) (21.3%) y *Ae. vexans* (Meigen) (7.7%).

**Conclusión**: 13 de las 15 especies colectadas están asociadas a la transmisión de algún patógeno de importancia médica o veterinaria en México. Con la adición de los nuevos registros, la lista de mosquitos distribuidos en el estado de Durango alcanza un total de 38 especies. La información generada en este estudio deberá ser útil para la Secretaría de Salud del estado de Durango para el control de las enfermedades transmitidas por mosquitos en la región de la Comarca Lagunera.

**Palabras clave:** listado; distribución; primer registro; culícidos; vectores; Durango; mosquitos; Comarca Lagunera; México

## Abstract

**Introduction**: Many mosquitoes are of great medical and veterinary importance because they transmit numerous pathogens which cause diseases in animals and humans; thus, knowing their taxonomy and distribution is pivotal for implementing the correct control strategies. The aim of this study was to determine the occurrence of mosquito species and their distribution in La Comarca Lagunera in the state of Durango, Mexico.

**Method**: Adult mosquitoes were collected at different resting sites in four municipalities between August and November 2018 using Insectzookas. Aquatic habitats were also sampled for immature stages. Adult specimens were killed using lethal chambers with triethylamine vapors; while larvae and pupae were stored in individual tubes to obtain the adult stages and associated exuviae. All material was transported to the Molecular Biology Laboratory of the Parasitology Department of

the Universidad Autónoma Agraria Antonio Narro, Unidad Laguna (UAAAN-UL) for mounting and taxonomical identification. Species were identified using taxonomic keys for the region.
**Results**: In total, 689 mosquito specimens (286 males and 403 females) were collected belonging to 15 species, among them *Anopheles franciscanus* McCracken, *Culex erythrothorax* Dyar, and *Toxorhynchites moctezuma* (Dyar and Knab) are new records for Durango State. The most abundant species was *Cx. quinquefasciatus* Say with 364 (56.2%) specimens, followed by *Aedes aegypti* (Linnaeus) (21.3%) and *Ae. vexans* (Meigen) (7.7%).
**Conclusion**: 13 out of 15 species collected are associated with the transmission of an arbovirus of relevant medical or veterinary importance in Mexico. There are now 38 species recorded for Durango. The information in this study is directly relevant for the Health Ministry in Durango State for the control of vector borne diseases in the region.
**Keywords:** checklist; distribution; first record; culicides; vectors; Durango; mosquitoes; Comarca Lagunera; Mexico

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# Introduction

The majority of mosquitoes are hematophagous insects of great medical and veterinary relevance because the females of numerous species can transmit pathogens which cause diseases in animals and humans (Harbach, 2020). Some of these pathogens are arboviruses, for example: Dengue Virus (DENV), Zika Virus (ZIKV), Chikungunya Virus (CHIKV), Yellow Fever Virus (YFV), Western Equine Encephalomyelitis Virus (WEEV) (Liria and Navarro, 2010; Díaz-González *et al.*, 2015; Turell *et al*., 2015). Mosquitoes causes greater morbidity and mortality in humans than any other groups of organisms (Harbach, 2020). High densities of biting females result in a significant biting issue, especially in touristic areas (Meisch, 1994).

There are 3,578 described mosquito species which are found in most habitats and terrestrial ecosystems (Harbach, 2020); all species are classified in two subfamilies Anophelinae and Culicinae within the Culicidae family, which include approximately 113 genera. In Mexico, there have been 20 genera and approximately 250 species recorded in the country. For Durango State in particular, presently there are only 35 species reported (Vargas, 1956; Vargas and Martínez-Palacios, 1956; Díaz Nájera and Vargas, 1973; Sudia *et al*., 1975; Duarte-Andrade *et al*., 2019; Hernández Amparan *et al.*, 2020).

Durango State is situated in the center-northwestern region of Mexico. The weather is warm and dry, but it is temperate and humid during the rainy season (INEGI, 2019). It has a surface of 123,181 $km^2$, placing it as the fourth largest territory in Mexico (INEGI, 2019). In addition, there are five physiographical regions (La Sierra Madre Occidental, Sierras and Northern Plains, Sierra Madre Oriental, Mesa del Centro, and Pacific Coastal Plains), allowing for a high diversity of ecosystems within the State. With the exception of the Evergreen Tropical Forest or High-Altitude Jungle, almost all types of vegetation in Mexico are present in Durango (González Elizondo *et al*., 2006). Therefore, Durango State has environmental conditions to sustain a high number of mosquito species, including those that have relevant medical and veterinary importance in Mexico.

In the last five years, The Ministry of Health have reported an average of 280 cases of DENV per year, while cases of ZIKV, CHIKV and malaria averaged one per year (DGE, 2019). The presence of cases implies a potential risk of disease growth if conditions are present (López Vélez y Molina Moreno, 2005). On the other hand, cattle farming is one of the key economic activities in northern Durango; especially in the zone known as La Comarca Lagunera. Cattle are affected by the presence of certain species of the genus *Psorophora* (Robineau-Desvoidy), large mosquitoes that have a marked zoophilic behavior and large densities during the rainy season, causing weight loss and reduction in milk production (Meisch, 1994).

In spite of the critical economic importance of mosquitoes, investigation into mosquitoes in Durango State have been neglected. In our study, we aimed to document occurrence and distribution of mosquito species in seven localities in La Comarca Lagunera, with the aim to update the checklist of culicid species present in the State, which would facilitate the control strategies performed by the Ministry of Health in this region.

# Methods

## Specimens collection and taxonomic identification

Collection of immature and adult stages were carried out in seven localities: Cañón de Fernández (25°18′24.09”N–103°43′58.09”W), Predio La Isla (25°30′16”N–103°37′24”W), 6 de Enero (25°31′12.97”N–103°35′47.92”W), Gómez Palacio (25°35′42.96”N–103°29′38.95”W), Venecia (25°46′52.12”N–103°21′4.33”W), Bermejillo (25°52′55.97”N–103°37′25.77”W) and Tlahualilo (26°6′29”N–103°26′20.77”W) (**Fig. 1**). Collection was scheduled between 18:00 and 21:00 hours. These localities belong to four municipalities (Gómez Palacio, Lerdo, Mapimí and Tlahualilo) of La Comarca Lagunera, northeastern Durango, Mexico, which are included in the physiographical region of Sierras and Northern Plains, subregion Bolsón de Mapimí, which include isolated mountains and wide plains where endorheic basins are common (González Elizondo *et al*., 2006).

Field work was completed between August and November 2018 in the rainy season following the collecting protocol of Belkin *et al*. (1967). In this case, available water bodies were sampled using dippers and pipettes, while adult mosquitoes were directly collected from resting places or by landing catches using a field aspirator (Insectzookas, BioQuip No. 2888A, Compton, CA). Adult specimens were killed using lethal chambers with triethylamine vapors and stored into vials (Ortega-Morales *et al*., 2019). All material was transported to the Molecular Biology Laboratory of the Parasitology Department of the Universidad Autónoma Agraria Antonio Narro, Unidad Laguna (UAAAN-UL) for mounting and taxonomical identification. Larvae and pupae were stored on individual tubes to obtain the adult stages and associated exuviae (Ortega-Morales *et al*., 2010).

Species were identified using the keys of Wilkerson *et al*. (1990) and Darsie and Ward (2005). All specimens were deposited at the Culicidae Collection of the UAAAN-UL under accession number: 01021018-6E, 01061018-PI, 01071018-B, 01100818-CF, 01121018-V, 01131018-GP, 01160818-T, 01270918-B, and 01310818-6E.

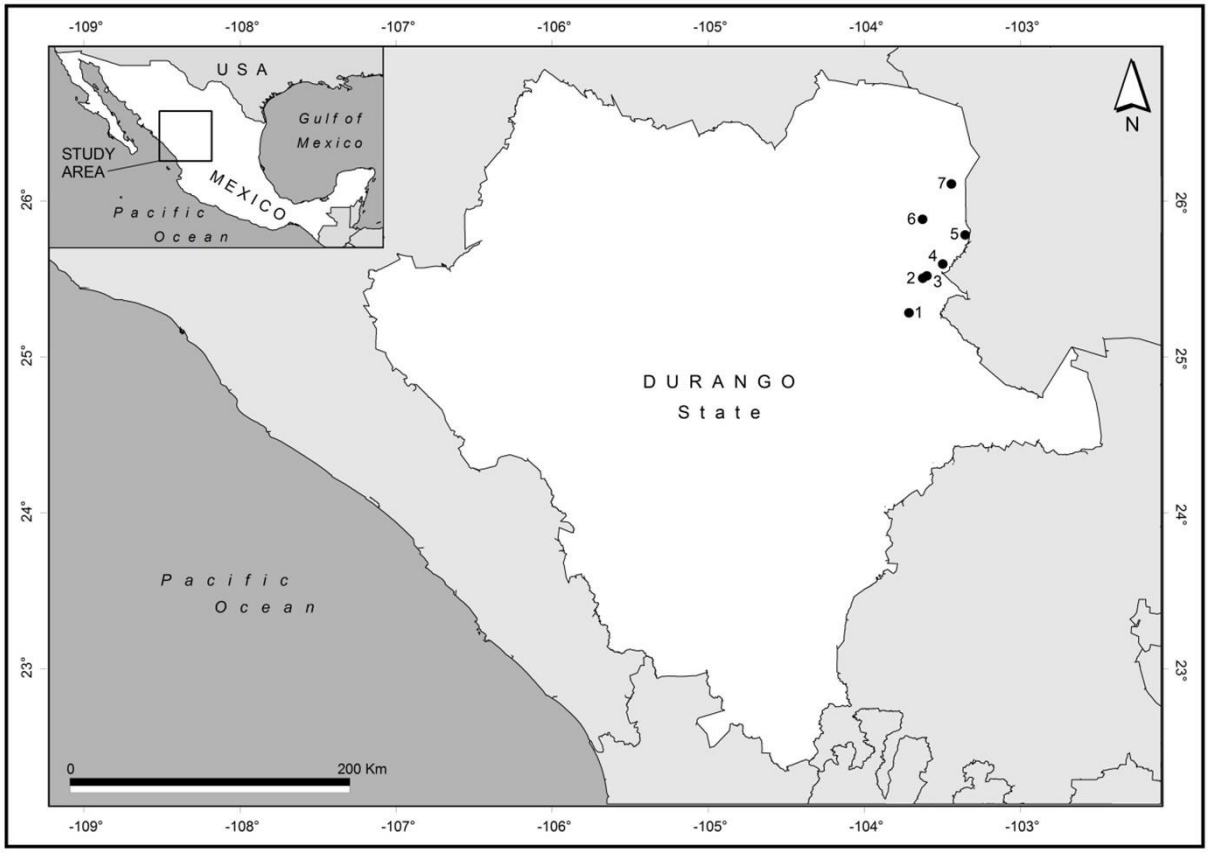


**Fig. 1.** Study area showing the mosquito's collection sites in Durango State, Mexico. **1** = Cañón de Fernández; **2** = Predio La Isla; **3** = 6 de Enero; **4** = Gómez Palacio; **5** = Venecia; **6** = Bermejillo; and **7** = Tlahualilo.

**Fig. 1.** Área de estudio mostrando los sitios de colecta de mosquitos en el estado de Durango, México.

**1** = Cañón de Fernández; **2** = Predio La Isla; **3** = 6 de Enero; **4** = Gómez Palacio; **5** = Venecia; **6** = Bermejillo; y **7** = Tlahualilo.

## Checklist of the mosquito species in Durango

In order to obtain information about which mosquito species have been previously recorded in Durango, we carried out a literature review in the web pages of "Systematic Catalogue of Culicidae" hosted by the Walter Reed Biosystematics Unit (www.wrbu.org) (WRBU, 2005), the

Mosquito Taxonomic Inventory (Harbach, 2020), and other databases such as PubMed Health, BIOSIS, Medline, Zoological Records, GBIF (Global Biodiversity Information Facility) and Google Scholar, using keywords such as "records, mosquitoes, Culicidae, Durango State, Mexico". The classification criteria of the Family Culicidae proposed by Wilkerson *et al*. (2015) was followed in the present study.

# Results

## Morphological identification

In total, 689 mosquitoes were collected (403 females and 286 males) belonging to two subfamilies (Anophelinae and Culicinae), three tribes (Aedini, Culicini and Toxorhynchitini), five genera (*Anopheles*, *Aedes*, *Psorophora*, *Culex* and *Toxorhynchites*), nine subgenera (*Anopheles*, *Aedimorphus*, *Georgecraigius*, *Ochlerotatus*, *Stegomyia*, *Grabhamia*, *Janthinosoma*, *Culex* and *Lynchiella*) and 15 species. Of the 15 species, 13 (87%) have relevant medical importance in Mexico (**Table 1**).

**Table 1.** Species collected in northeastern Durango, Mexico, and their medical/veterinary importance.

**Tabla 1.** Especies colectadas en el noreste de Durango, México y su importancia médica/veterinaria.

| Species | F* | M* | T* | Sampled point* | Medical/veterinary importance |
|---|---|---|---|---|---|
| *Anopheles franciscanus* | 1 | 0 | 1 | PI | *Plasmodium vivax* Grassi and Feletti, 1890 laboratory conditions (WRBU, 2005). |
| *Anopheles pseudopunctipennis* | 2 | 3 | 5 | PI, CF, V | Malaria (Hoffmann, 1989). |
| *Aedes vexans* | 49 | 4 | 53 | 6E, GP, PI, CF | EEEV, WEEV, SLEV, ZIKAV (Turell *et al*., 2005a; Gendernalik *et al*., 2017). |

| | | | | | |
|---|---|---|---|---|---|
| *Aedes epactius* | 27 | 7 | 34 | B, GP | JCV, SLEV (Hardy *et al*., 1980; Heard *et al*., 1991). |
| *Aedes trivittatus* | 1 | 0 | 1 | PI | TVTV, *Dirofilaria immitis* (Leidy, 1856) (WRBU, 2005). |
| *Aedes aegypti* | 64 | 83 | 147 | B, GP, T | DEN, YF, CHIKV, ZIKAV (Christophers, 1960; Díaz-González *et al*., 2015; Chouin Carneiro *et al*., 2016; WRBU, 2005). |
| *Psorophora columbiae* | 10 | 0 | 10 | B, GP | RVFV, WNV (Bolling *et al*., 2005; Turell *et al*., 2015). |
| *Psorophora signipennis* | 0 | 1 | 1 | B | WEEV (Crane *et al*., 1983). |
| *Psorophora ferox* | 1 | 1 | 2 | PI | *Dermatobia hominis* (L.), ROCV, VEEV, WEEV, EEEV, ILHV (Carpenter and LaCasse, 1955; de Souza-Lopes *et al*., 1981; Mitchell *et al*., 1987; Kulasekera *et al*., 2001; Cupp *et al*., 2004; Turell *et al*., 2005b). |
| *Culex coronator* | 1 | 0 | 1 | PI | Unknown. |
| *Culex erythrothorax* | 8 | 0 | 8 | V,T | WNV (Goddard *et al*., 2002). |
| *Culex quinquefasciatus* | 212 | 175 | 387 | 6E,B,GP, PI,V,T | *Wuchereria bancrofti* (Cobbald, 1877) Seurat, 1921, WEEV, SLEV, WNV, ZIKAV (Carpenter and LaCasse, 1955; Rutledge *et al*., 2003; Guedes *et al*., 2017). |
| *Culex stigmatosoma* | 0 | 2 | 2 | 6E | WNV, SLEV (Goddard *et al*., 2002; Reisen *et al*., 2005). |
| *Culex tarsalis* | 21 | 7 | 28 | B,GP,PI, V,T | WEEV, SLEV (Reeves *et al*., 1947; WRBU, 2005). |
| *Toxorhynchites moctezuma* | 6 | 3 | 9 | PI | Without medical importance. |

**EEEV**: Eastern Equine Encephalomyelitis Virus; **WEEV**: Western Equine Encephalomyelitis Virus; **SLEV**: St. Louis Encephalitis Virus; **ZIKV**: Zika Virus; **JCV**: Jamestown Canyon Virus; **TVTV**: Trivittatus Virus; **DEN**: Dengue Virus; **YFV**: Yellow Fever Virus; **CHIKV**: Chikungunya Virus; **RVFV**: Rift Valley Fever Virus; **WNV**: West Nile Virus; **VEEV**: Venezuelan Equine Encephalitis Virus; **ILHV**: Ilheus Virus; **ROCV**: Rocio Virus.

***F** = Female; **M** = Male; **T** = Total; **V** = Venecia; **6E** = 6 de Enero; **B** = Bermejillo; **GP** = Gómez Palacio; **T** = Tlahualilo; and **CF** = Cañón de Fernández.

**EEEV**: Virus de la Encefalomielitis Equina del Este; **WEEV**: Virus de la Encefalomielitis Equina Occidental; **SLEV**: Virus de la Encefalitis de San Luis; **ZIKV**: Virus Zika; **JCV**: Virus de Jamestown Canyon; **TVTV**: Virus Trivittatus; **DEN**: Virus del Dengue; **YFV**: Virus de la Fiebre Amarilla; **CHIKV**: Virus Chikungunya; **RVFV**: Virus de la Fiebre del Valle del Rift; **WNV**: Virus del Nilo Occidental; **VEEV**: Virus de la Encefalitis Equina Venezolana; **ILHV**: Virus del Ilheus; **ROCV**: Virus Rocio.

***F** = Hembra; **M** = Macho; **T** = Total; **V** = Venecia; **6E** = 6 de Enero; **B** = Bermejillo; **GP** = Gómez Palacio; **T** = Tlahualilo; y **CF** = Cañón de Fernández.

*Culex quinquefasciatus* Say with 364 specimens (56.2%) was the most abundant species followed by *Ae. aegypti* (21.3%) and *Ae. vexans* (7.7%). *Culex quinquefasciatus* and *Cx. tarsalis* Coquillett, were widely distributed across the study area. The former was collected in all localities; while collections in the locality 6 de Enero, unyielded any specimens of the latter species (**Table 1**). *Anopheles (Ano.) franciscanus* (McCracken), *Cx.* (*Cul.*) *erythrothorax* Dyar, and *Tx.* (*Lyn.*) *moctezuma* (Dyar and Knab), constitute new records for the culicid fauna in Durango State increasing the number to 38 species (**Table 2**).

**Table 2.** Updated checklist of the mosquito species found in Durango State.
**Tabla 2.** Lista actualizada de las especies de mosquitos presentes en el estado de Durango.

| Taxon | Previous record |
|---|---|
| *Anopheles* (*Anopheles*) | |
| 1. *aztecus* Hoffman | VM |
| 2. *eiseni* Coquillett | VM |
| 3. *franciscanus* McCraken* | |
| 4. *pseudopunctipennis* Theobald | VM |
| 5. *punctipennis* (Say) | VM |
| *Aedes* (*Aedimorphus*) | |
| 6. *vexans* (Meigen) | S |
| *Aedes* (*Georgecraigius*) | |
| 7. *epactius* Dyar and Knab | DV |
| *Aedes* (*Lewnielsenius*) | |
| 8. *muelleri* Dyar | HB |
| *Aedes* (*Ochlerotatus*) | |
| 9. *angustivittatus* Dyar and Knab | S |
| 10. *campestris* Dyar and Knab | V |
| 11. *nigromaculis* (Ludlow) | DV |
| 12. *sollicitans* (Walker) | DV |
| 13. *trivittatus* (Coquillett) | S |
| *Aedes* (*Protomacleaya*) | |
| 14. *schicki* Zavortink | HB |
| *Aedes* (*Stegomyia*) | |
| 15. *aegypti* (Linnaeus) | AR |
| *Haemagogus* (*Haemagogus*) | |
| 16. *anastasionis* Dyar | HA |
| *Psorophora* (*Grabhamia*) | |
| 17. *columbiae* (Dyar and Knab) | HB |

| | |
|---|---|
| 18. *signipennis* (Coquillett) | HB |
| *Psorophora* (*Janthinosoma*) | |
| 19. *ferox* (von Humboldt) | DA |
| *Culex* (*Culex*) | |
| 20. *coronator* Dyar and Knab | AR |
| 21. *erythrothorax* Dyar* | |
| 22. *nigripalpus* Theobald | AR |
| 23. *quinquefasciatus* Say | DV |
| 24. *salinarius* Coquillett | HA |
| 25. *stigmatosoma* Dyar | DV |
| 26. *tarsalis* Coquillett | S |
| 27. *thriambus* Dyar | DV |
| *Culex* (*Melanoconion*) | |
| 28. *erraticus* Dyar and Knab | AR |
| *Culex* (*Microculex*) | |
| 29. *rejector* Dyar and Knab | AR |
| *Culex* (*Neoculex*) | |
| 30. *arizonensis* Bohart | DV |
| *Lutzia* (*Lutzia*) | |
| 31. *bigoti* (Bellardi) | HA |
| *Culiseta* (*Culiseta*) | |
| 32. *particeps* (Adams) | DV |
| 33. *inornata* (Williston) | HA |
| *Coquillettidia* (*Coquillettidia*) | |
| 34. *perturbans* Walker | AR |
| *Mansonia* (*Mansonia*) | |
| 35. *indubitans* Dyar and Shannon | HA |
| *Orthopodomyia* | |
| 36. *kummi* Edwards | HB |
| *Toxorhynchites* (*Lynchiella*) | |
| 37. *moctezuma* (Dyar and Knab)* | |
| *Uranotaenia* (*Uranotaenia*) | |
| 38. *lowii* Theobald | HA |

**V:** Vargas, (1956); **VM:** Vargas and Martínez-Palacios, (1956); **DV:** Díaz-Nájera and Vargas, (1973); **S:** Sudia *et al.* (1975); **HB:** Heinemann and Belkin, (1977); **AR:** Ávila-Rodríguez *et al*. (2013); **HA:** Hernández-Amparan *et al.* (2020); **DA:** Duarte-Andrade *et al*. (2019).

The new records provided in this study are indicated with an asterisk (*).

**V:** Vargas, (1956); **VM:** Vargas y Martínez-Palacios, (1956); **DV:** Díaz-Nájera y Vargas, (1973); **S:** Sudia *et al*. (1975); **HB:** Heinemann y Belkin, (1977); **AR:** Ávila-Rodríguez *et al*. (2013); **HA:** Hernández-Amparan *et al*. (2020); **DA:** Duarte-Andrade *et al*. (2019).

Los nuevos registros proporcionados en este estudio se indican con un asterisco (*).

# Discussion

## Distribution of mosquito species in Comarca Lagunera, Durango

In the municipality of Gómez Palacio, seven species of mosquitoes have already been reported (Sudia *et al*., 1975; Heinemann and Belkin, 1977; Ávila-Rodríguez *et al*., 2013); two additional species (*An. pseudopunctipennis* and *Cx. erythrothorax*) are reported in this study, bringing up the total of nine species in this municipality. In Lerdo, five species were previously recorded (Ávila-Rodríguez *et al*., 2013; Duarte-Andrade *et al*., 2019); we found seven additional species in this study (*An. franciscanus*, *An. pseudopunctipennis*, *Ae. vexans*, *Ae. trivittatus*, *Cx. coronator*, *Cx. tarsalis*, and *Tx. moctezuma*) resulting in 12 species identified. In Mapimí municipality, Ávila-Rodríguez *et al*. (2013) only four species had been reported. Here we identified three more species (*Ps. columbiae*, *Ps. signipennis*, and *Cx. tarsalis*) resulting in seven species in the area. Until now, the mosquito species in Tlahualilo were unknown. Four species were reported in this study (**Table 1**), highlighting the importance of continuing entomological surveillance within vector control programs in the country (Azari-Hamidian *et al*., 2010; Chan-Chable *et al*., 2019; Hernández-Triana *et al*., 2019).

There have been other species recorded in several other municipalities within La Comarca Lagunera in Durango State. For example, the records in Simón Bolivar such as *Ae. epactius*, *Cx. coronator*, *Cx. quinquefasciatus* and *Cx. stigmatosoma* were recorded by Ávila-Rodríguez *et al*. (2013), while Ávila-Rodríguez *et al*. (2013) recorded *Ae. aegypti*, *Ae. epactius*, *Cx. quinquefasciatus*, *Cx. stigmatosoma* and *Cx. tarsalis* for San Luis del Cordero. Up to now, there were only 14 species recorded for the area of La Comarca Lagunera from Durango (Sudia *et al*., 1975; Heinemann and Belkin, 1977; Ávila-Rodríguez *et al*., 2013; Duarte-Andrade *et al*., 2019).

This study confirms the presence of these species and add other five (*An. franciscanus*, *An. pseudopunctipennis*, *Ae. trivittatus*, *Cx. erythrothorax*, and *Tx. moctezuma*) increasing to 19 the number of taxa found in this region.

In general, *An. pseudopunctipennis* and *Ae. aegypti* are the most relevant species from a medical point of view found in this study. *Anopheles pseudopunctipennis* is one of the main malaria vectors in Mexico (Loyola *et al.*, 1991; Santamarina Mijares *et al*., 1999), with two and three cases being reported by the Ministry of Health in 2015 and 2018 in the study area, respectively (DGE, 2019). *Aedes aegypti* is the main vector of CHIKV, DENV and ZIKV in Mexico; in Durango state there have been an average of 280 cases of DENV between 2015 to 2019, and two to three cases of CHINK and ZIKV (DGE, 2019). In addition, as mentioned earlier, cattle farming is the most important economic activity in La Comarca Lagunera; thus, it is paramount to carry out further bio surveillance studies of arboviruses in target species such as *Ps. columbiae*, *Ps. signipennis* and *Cx. quinquefasciatus* aimed to determine the pathogens transmitted to livestock in the region. From all species, *Cx. quinquefasciatus* was the most abundant species with a wider distribution.

## Updated checklist of mosquitoes species from Durango

The mosquito species in Durango State is relatively poorly known, and previous have only covered the fauna from few cities and municipalities (Sudia *et al*., 1975; Heinemann and Belkin, 1977; Ávila-Rodríguez *et al*., 2013; Duarte-Andrade *et al*., 2019; Hernández-Amparan *et al*., 2020). Only eight studies have focused on mosquito fauna in Durango State between 1956 to 2020, in which 12 genera, 20 subgenera and 35 species were reported (Vargas, 1956; Vargas and Martínez-Palacios, 1956; Díaz Nájera and Vargas, 1973; Sudia *et al.*, 1975; Heinemann and Belkin, 1977; Ávila-Rodríguez *et al*., 2013; Duarte-Andrade *et al*., 2019; Hernández-Amparan *et al*., 2020) (**Table 2**). This study adds three new records in Durango State increasing the number to 38 species. The most biodiverse genera are *Culex* (11 spp.), *Aedes* (10 spp.) and *Anopheles* (5 spp.) (**Table 2**).

*Anopheles franciscanus* (McCracken) is distributed across USA and Mexico (WRBU, 2005). In Mexico, this species has been found in the following states: Aguascalientes, Baja

California, Baja California Sur, Chiapas, Chihuahua, Coahuila, Hidalgo, Jalisco, Nuevo León, Oaxaca, Quintana Roo, Sonora, Tamaulipas and Zacatecas (Vargas and Martínez Palacios, 1956; Casas Martínez and Orozco Bonilla, 2006; Ortega-Morales *et al*., 2010; Bond *et al*., 2014; Ortega-Morales *et al*., 2015). The females of *An. franciscanus* are active during the twilight and rarely enters human dwellings to feed as they mainly feed on mammals such as sheep (WRBU, 2005). Larvae were collected in ponds with abundant green algae, swamps with floating aquatic vegetation and metal troughs (Ortega-Morales *et al*., 2015). Larvae of *An. franciscanus* were collected in a small stream with dense aquatic vegetation in the recreation area of La Isla. Durango is the fifteenth State in Mexico where *An. franciscanus* has been found. Therefore, this species has the potential to be widely distributed in northern Mexico.

*Culex erythrothorax* (Dyar 1907) – This species has been recorded from Colombia, Mexico, Panama and USA (WRBU, 2005). In Mexico, *Cx. erythrothorax* can be found in Baja California, Colima, Guanajuato, Guerrero, Hidalgo, Mexico city, Mexico State, Michoacán, Nuevo León, Tamaulipas, and Tlaxcala (Díaz Nájera and Vargas, 1973; Muñoz Cabrera *et al*., 2006; Ortega-Morales *et al*., 2013; Espinoza-Gómez *et al*., 2013; Ortega-Morales *et al*., 2015, 2019). *Culex erythrothorax* is the main vector of West Nile Virus (WNV) in the region (Goddard *et al*., 2002). Its larvae have been collected in swamps, while the adults have been caught landing on collecting personnel and resting areas in the shade (Espinoza-Gómez *et al*., 2013; Ortega-Morales *et al*., 2019). Utilizing the Insectzooka, five females of *Cx. erythrothorax* were collected in the locality of Venecia, and three females in Tlahualilo that were resting on the vegetation near animal farms. Durango is the twelfth State where the species is recorded.

*Toxorhynchites moctezuma* (Dyar and Knab) – This species has a wider distribution, extending from the south of the USA, to Central America (Zavortink and Chaverri, 2009). In Mexico, it has been recorded in the states of Campeche, Guerrero, Hidalgo, Jalisco, Oaxaca, Quintana Roo, San Luis Potosí, Tabasco, Tamaulipas and Veracruz (Heineman and Belkin, 1977; Mis Ávila *et al*., 2013; Ortega-Morales *et al*., 2015, 2019). The larva of *Tx. moctezuma* can develop in tree holes, bamboo internodes, nut shells, and artificial containers (Zavortink and Chaverri, 2009). Despite the females of *Tx. moctezuma* which are phytophagous, the species is considered a great biological control due to the predatory behavior of its larva, which feed upon other mosquito species (Collins and Blackwell, 2000). In our study, we collected nine larvae of *Tx. moctezuma* in a discarded tyre containing rainwater, where six females and three males were obtained.

Based upon the current distribution of *Tx. moctezuma* (Zavortink and Chaverri, 2009), the records of *Tx. theobaldi* for the states of Chiapas, Michoacán, Morelos and Yucatán (Díaz-Nájera and Vargas, 1973; Villegas-Trejo *et al*., 2010) belong to *Tx. moctezuma*. Therefore, Durango becomes the fifteenth state where this species has been collected and it constitutes its northernmost distribution record in Mexico.

Finally, 13 of the 15 species collected in this study are of medical and veterinary importance. The current list of mosquitoes present in the state of Durango reaches a total of 38 species. The information generated in this study should be useful for the Secretary of Health of the State of Durango, Mexico, specifically for the region of La Comarca Lagunera.

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