

SCIENTIFIC NOTE

FIRST RECORDS OF *Aedes tormentor* AND *Culex panocossa* AS A RESULT OF VECTOR SURVEILLANCE ACTIVITIES CONDUCTED DURING THE CHARACTERIZATION OF FOCI OF EASTERN EQUINE ENCEPHALITIS IN TAMAULIPAS, MEXICO

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ABSTRACT. We report the 1st records of *Aedes tormentor* and *Culex panocossa* throughout vector surveillance events carried out in putative foci of eastern equine encephalitis in Tamaulipas, Mexico. Formerly, *Ae. tormentor* had been reported in, at least, 2 Central American countries and Mexico. In Mexico, reports were from the states of Campeche, Chiapas, Quintana Roo, and Veracruz. Records of *Ae. tormentor* in these 4 Neotropical states were recently reviewed and eliminated; thus, the southernmost geographic distribution for this species is considered to be the state of Tamaulipas Mexico in its neotropical zone. Further, *Cx. panocossa* had been collected in Guerrero, Tabasco, and Veracruz. In Tamaulipas, there are 82 species of mosquitoes, being the 4th state accounting for the highest mosquito species diversity of 11 states in which comprehensive studies have been conducted on the subject of mosquito distribution.

KEY WORDS *Aedes tormentor*, *Culex panocossa*, 1st records, Tamaulipas, Mexico

In Mexico, 2 genera of the Culicidae family hold the highest number of species: *Aedes* with 68 species in 10 subgenera and *Culex* with 62 species in 8 subgenera and 1 species within *nomen dubium* subgenus. In the last reassessment of mosquito fauna from Tamaulipas, it showed 82 species (Ortega-Morales et al. 2015); however, *Psorophora stonei* (Vargas) and *Mansonia indubitans* (Dyar and Shannon) were removed (Ortega-Morales et al. 2023). Tamaulipas is the 4th Mexican state with the highest mosquito species diversity of 11 states where comprehensive studies have been conducted on the topic of mosquito distribution (Ortega-Morales et al. 2023). In Tamaulipas, there are 18 species of *Aedes* divided in 5 subgenera: *Aedimorphus*

(1 species); *Howardina* (1 species); *Ochlerotatus* (9 spp.); *Protomacleaya* (5 spp. and 1 undescribed); and *Stegomyia* (2 species). In addition, there are 23 species of *Culex* divided in 6 subgenera: *Anoediorpora* (1 species); *Culex* (11 spp.); *Melanoconion* (7 spp.); *Microculex* (1 species); *Neoculex* (1 species); and *Phenacomyia* (2 spp.).

Within this scenario, from October through November 2022, an outbreak in horses of eastern equine encephalitis (EEE) virus was reported by officials of the animal health division of the Mexican Agriculture Ministry (Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria (SENASICA). Comisión México-Estados Unidos para la Prevención de la Fiebre Aftosa y otras Enfermedades Exóticas de los Animales (CPA). Secretaría de Agricultura y Desarrollo Rural [SADER] 2022). The outbreak affected and killed officially about 9 domestic horses (*Equus ferus caballus* L.) in the coastal region of the municipality of Aldama, Tamaulipas (World Animal Health Information System 2022; event 4743, Paris, France). The event raised alarm due to its potential implications for public and veterinary health and brought about intensive vector surveillance activities in supposedly putative foci of EEE of northeastern Mexico.

During May 24–26, 2023, mosquito surveys were conducted in the Aldama municipality and surrounding areas at Barra del Tordo village, a coastal tourist resort of Tamaulipas State in the Gulf of Mexico. Chiefly among objectives of the study was to find EEE virus-infected mosquitoes. Ten Centers for Disease Control and Prevention (CDC) light traps baited with octanol and incandescent light were deployed from 1800 to 0900 h and checked daily. Mechanical aspirators were used to catch host-seeking mosquitoes by human

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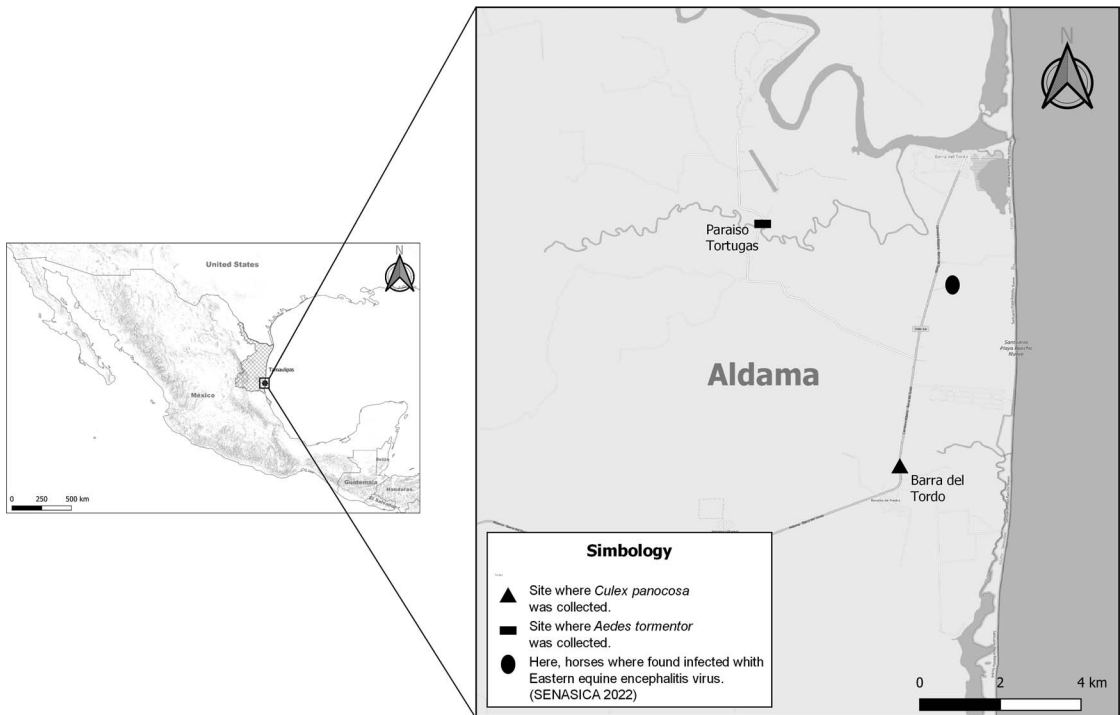


Fig. 1. Collection sites of *Aedes tormentor* and *Culex panocossa* in Tamaulipas, Mexico.

landing collection. Collected mosquitoes were killed with chloroform vapors and identified using specific keys (Sirivanakarn 1982, Sallum and Forattini 1997, Harrison et al. 2016) through a stereomicroscope (Leica® model M80, Carl-Zeiss, Oberkochen, Germany). Mosquitoes were pooled in vials and preserved under cryogenic conditions for further analysis.

On May 25, 2023, mosquitoes were also collected by human landing collection during daylight hours in a tropical forest shaded site near to the shoreline of Barra del Tordo village (22°58'34.87"N, 97°47'21.55"W, 20 m above sea level; Fig. 1). Here, 1 single adult female of *Aedes tormentor* Dyar and Knab was collected; associated species were *Aedes scapularis* (Rondani), *Aedes taeniorhynchus* (Wiedemann), *Aedes podographicus* Dyar and Knab, *Aedes albopictus* (Skuse), *Haemagogus equinus* Theobald, and *Psorophora ferox* (von Humboldt). *Aedes tormentor* was 1st described by Dyar and Knab (1906) from specimens collected in Baton Rouge, LA. Geographic distribution of this species is throughout the southeastern and east central USA (Burkett-Cadena 2013), Guatemala (Martini 1935, Clark-Gil and Darsie 1983), Honduras (Knight and Stone 1977), and Mexico. The 1st reports in Mexico were in Campeche by Martini (1935) and Vargas (1949). Multiple mentions have been provided by Vargas (1956), Díaz-Nájera and Vargas (1973), Pletsch (1977), Ibáñez-Bernal et al. (1990), Ortega-Morales et al. (2010), Deardorff et al. (2011), Ibáñez-Bernal et al. (2011), Sotomayor-Bonilla et al. (2017), Bond

et al. (2020), Abella-Medrano et al. (2020), Chan-Chablé et al. (2020), and Tzuc-Dzul et al. (2023) in Campeche, Chiapas, Quintana Roo, and Veracruz. *Aedes tormentor* has also been mentioned in Mexican mosquito-species catalogs by Darsie (1996) and Ortega-Morales et al. (2023).

However, occurrence records of *Ae. tormentor* in Guatemala Honduras, and the Neotropical region of Mexico were reviewed and eliminated from the mosquito species checklist as the geographic distribution of this species was supposedly restricted to the Nearctic region. Thus, the *Ae. tormentor* reports from the southern Mexican Neotropical region are erroneous because species misidentification in the Serratus Group showing a similar scutal scale color pattern, such as *Ae. serratus* (Theobald; Talaga et al. 2023), which has a median longitudinal pale stripe on the scutum. As a consequence, the geographic distribution of *Ae. tormentor* in Mexico has been updated. Namely, the southernmost geographic distribution, located in the neotropical settings of Tamaulipas for *Ae. tormentor*, as we report here. The *Ae. tormentor* female is readily differentiated among Nearctic species of *Aedes* by the scutum with a median longitudinal pale stripe from head to scutellum, narrower at the posterior end, postprocoxal membrane, antepre-notum, and postspiracular areas without patch of pale scales, and hind tarsi without pale bands, and the black lateral scale patches on the head not reaching the eyes because 2–3 rows of narrow white scales are bordering the eyes (Harrison et al. 2016). Although females of *Ae. tormentor* can bite humans during the

day, the medical importance of this species is unknown (Breeland et al. 1961).

On May 26, 2023, mosquitoes and sand flies were also collected using CDC light traps deployed in a mangrove site from Paraíso Tortugas village (23° 2'5"N, 97°49'21"W, 20 m above sea level; Fig. 1). One single adult female of *Culex panocossa* (Dyar) was collected; associated species were *Ae. scapularis*, *Culex erraticus* (Dyar and Knab), *Deinocerites pseudus* Dyar and Knab, *Mansonia titillans* (Walker), and *Psathyromyia texana* (Dampf). *Culex panocossa* was 1st described by Dyar (1923) from specimens collected in Bas Obispo, Canal Zone, Panama. Shortly after, this species and closely related species, *Culex ocosa* Dyar and Knab, were synonymized with *Culex aikenii* Aiken and Rowland by Dyar (1925). Later, *Cx. aikenii* was invalidated; thus, *Cx. ocosa* and *Cx. panocossa* were resorted by Belkin (1970). *Culex panocossa* has been reported in Belize, Brazil, Colombia, Costa Rica, El Salvador, the USA, Guatemala, Jamaica, Mexico, Panama, and Venezuela (Wilkerson et al. 2021, Blosser and Burkett-Cadena 2017). In Mexico, *Cx. panocossa* was 1st reported in Guerrero, Tabasco, and Veracruz (as *Cx. aikenii*) by Martini (1935) and later by Martínez-Palacios (1952), Vargas (1956), Díaz-Nájera and Vargas (1973), and García-Aldrete and Pletsch (1976). Additional mentions of *Cx. panocossa* in Tabasco and Veracruz were by Ibáñez-Bernal et al. (2011), Méndez-López et al. (2016), Torres-Chable et al. (2017), and Ortega-Morales et al. (2019). Other records in Mexico of *Cx. panocossa* were by Foote (1954), Belkin et al. (1970), Darsie (1996), Sallum and Forattini (1997), and Ortega-Morales et al. (2023).

However, no records of *Cx. panocossa* in Tamaulipas has been done. Namely, the northernmost geographic distribution for this species in Mexico is the Neotropical zone (Cuervo-Robayo et al. 2020) of Tamaulipas as set forth herein. The *Culex panocossa* female is differentiated among species of the subgenus *Melanoconion*, Spissipes section, by vertex with erect forked scales totally dark brown, narrow falcate scales dark on median dorsal area along coronal suture, whitish laterally, pleural integument yellowish with dark spots on postpronotum and postspiracular area, acrostichal setae absent, mesokatepisternum without patch of broad scales on upper corner and mesepimeron without a patch of setae on median portion; hind tarsi all dark scaled, and terga II–VII dark scaled with basolateral patches of white scales (Sriwanakarn 1982, Sallum and Forattini 1997). It is noteworthy that *Cx. panocossa* is an important vector of the Venezuelan equine encephalitis virus in Central America and Mexico (Scherer et al. 1971, Tempelis and Galindo 1975).

In summary, *Ae. tormentor* and *Cx. panocossa* were included in Tamaulipas mosquito checklist of 82 species currently: 19 species of *Aedes* and 24 of *Culex*.

Specimens were deposited at the Culicidae Collection of the Parasitology Department in the Agrarian

Autonomous University Antonio Narro–Laguna unit, Mexico, under the accession numbers 01250523-BT and 02260523-BT for *Ae. tormentor* and *Cx. panocossa*, respectively.

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