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SCIENTIFIC NOTE

First Record of *Culex* (*Microculex*) *daumastocampa* (Diptera: Culicidae) in Mexico, with Notes on *Cx. rejector* and *Cx. imitator*

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Abstract
Culex (*Microculex*) *daumastocampa* Dyar & Knab was originally described by Dyar and Knab (Proc US Nat Mus 35:53–70, 1908) from larvae collected at axils of bromeliads in Port San Felipe, Panama. *Culex daumastocampa* is found in Colombia, Venezuela, Panama, Suriname, Costa Rica, Nicaragua, Guatemala, and Mexico, although its presence had not been reported suggesting its northernmost distribution. In Mexico, the subgenus *Microculex* had included *Cx. rejector* Dyar and Knab, and *Cx. imitator* Theobald. However, after that collection specimens were re-examined along with other specimens collected during 2016 in Chiapas (all specimens are available in the Culicidae Collection of the Universidad Autonoma Agraria Antonio Narro Unidad Laguna [UAAAN-UL], Mexico). *Culex daumastocampa* is now reported for the first time in Mexico, *Cx. rejector* for Chiapas, and *Cx. imitator* removed from the checklist of previous reports as to be present in Mexico.

The subgenus *Microculex* of *Culex* (Diptera: Culicidae) includes 33 species, which are distributed in the Neotropical Region encompassing from Northeastern Mexico through Argentina. The immature stages usually inhabit epiphytic bromeliads serving as breeding sites, although they are also found in bamboo internodes. Harbach (2013) reported that "the larvae have antennae shorter than head; in most species, it is constricted beyond seta 1-A, which is inserted about 0.8 mm from base. Setae 2-C weakly developed or absent; seta 3-P shorter than seta 1, 2-P. Comb scales with many scales in patch. Siphon usually very long and slender. Seta 1-S distal to pectin. Saddle long and complete. Seta 1-X very small branched. Seta 2, 3-X long and single. Ventral brush (seta 4-X) with 4 pairs of setae on gird. The adults are relatively small in size. Head presenting narrow scales on vertex and orbital line. Palpus of males longer than proboscis with five palpomeres. Scutum with pattern of dark, golden or silvery scales. Antepronotum with narrow scales. Mesokatepisternum with scales. Lower mesepimeral seta present. Vein R2 and R3 of wing with narrow scales. Legs entirely dark-scaled in some species or tarsi with basal pale bands in most species. Abdominal terga dark-scaled (Harbach 2013)".

Culex daumastocampa Dyar and Knab larvae can be recognized by the antennae uniformly shaped, the apical part not more slender with the tuft at the outer third. The comb scales with many spines arranged in a triangular patch. Siphon long with four pairs of setae in straight line at the outer middle section (Fig 1). Adult females are small with a black stripe on pleurae at the base of coxae. Mesonotum brown without pale scales. Head with narrowed and curved scales in vertex. The base of fore tarsi with small and indistinct scales (Dyar 1928).

An entomologic survey was conducted in Chiapas, Mexico, to collect immature and/or adult stages of mosquitoes during the rainy season of August 2016. Mosquito collection was

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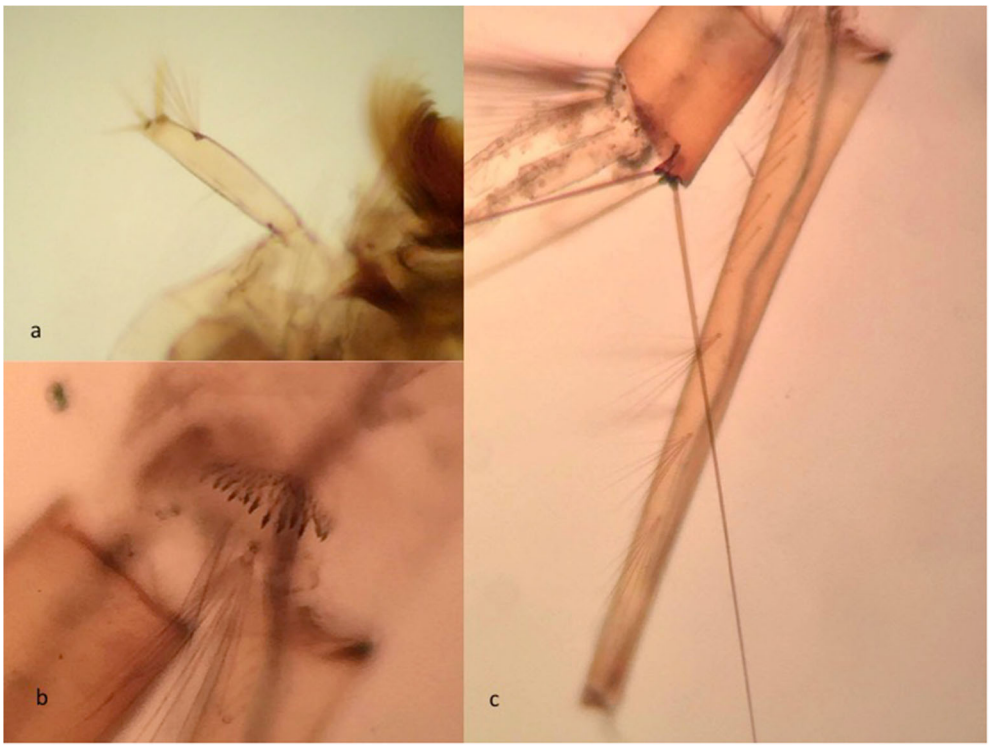

Fig 1 Fourth instar larvae of *Culex daumastocampa*. (a) Antenna. (b) Comb scales. (c) Siphon.

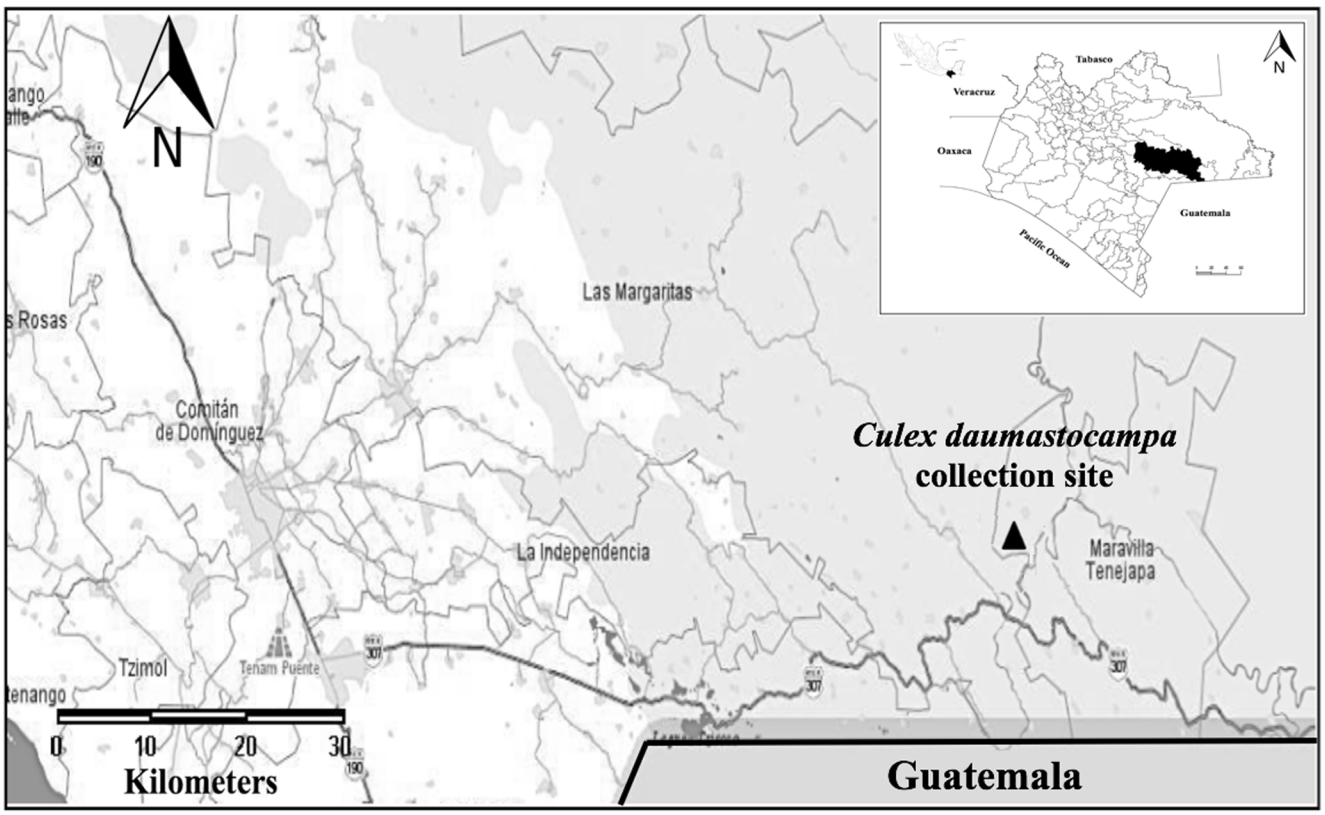

Fig 2 Map showing the collection site of *Culex daumastocampa* in Mexico.

comprehensive on breeding sites poorly explored such as axils of epiphytic and terrestrial bromeliads including other phytotelmata as bamboo internodes, fallen fruits, and tree holes. Immature stages were kept alive in individual tubes using the same water of the breeding site and transported to Universidad Autónoma Agraria Antonio Narro Unidad Laguna (UAAAN-UL) for identification using taxonomic keys and related literature. Immature stages were reared until adulthood and the associated exuviae held. Four larvae of 4th instar were killed using hot water (60–70°C) and mounted in euparal on microscope slides. Temperature, pH, and dissolved salts of water in breeding sites were determined using a portable Hanna® tester (mod. HI-98129). In August 13, 2016, mosquito stages were collected from axils of one arboreal epiphytic bromeliad 3 m above the ground, with colored water and abundant leaves at the bottom of axils, in the community of Nueva Jerusalem belonging to Margaritas municipality of Chiapas (16°11′34.3″N 91°22′47.3″W) (Fig 2; Table 1). Here, four 4th instar larvae of *Cx. daumastocampa* were collected in association with *Cx. rejector* Dyar and Knab, *Wyeomyia abebela* Dyar and Knab, and *Wy. melanopus* Dyar.

The larvae, male and female of *Cx. daumastocampa*, were originally described by Dyar and Knab (1908) from specimens collected at axils of bromeliads in Porto Bello, Fort San Felipe, Panama. Later, Howard *et al* (1915) described, in detail, all life stages but not the eggs of *Cx. daumastocampa*, from specimens collected by A. H. Hennings in 1909 providing additional records for Panama. In 1918, Dyar described the male genitalia of *Cx. daumastocampa* and provided a taxonomic key for all species of *Microculex* and Bonne and Bonne-Wepster (1925) reported *Cx. daumastocampa* in Suriname for the first time. Additional descriptions of larvae, adult female, and male genitalia have been provided by Dyar (1928), Rozeboom and Komp (1950), and Lane (1953). The lectotype designation was given by Stone and Knight (1957).

Culex daumastocampa has been collected in association with *Wy. bicornis* (Root) and *Wy. zinzala* Zavortink at 2550 masl in the Central Coast Mountain Range of Venezuela (Navarro *et al* 2010). Currently, *Cx. daumastocampa* is distributed in Colombia, Venezuela, Panama, Suriname, Costa Rica, Nicaragua, Guatemala (WRBU 2005), and Mexico (this work; Fig 2).

Table 1 Records of *Culex rejector* at the Culicidae Collection in UAAAN-UL. All misidentifications from Tamaulipas, Hidalgo, and San Luis Potosí were corrected. *A*♀, adult female; *A*♂, adult male; *G*♂, male genitalia; *LE*, larval exuviae; *PE*, pupal exuviae; *WL*, whole 4th instar larvae. All specimens were collected from arboreal axils of bromeliads. pH, dissolved salts (PPM), and temperature (°C) of water in breeding sites are shown.

Collection date	Location/county	State	Coordinates	Elevation (m.a.s.l.)	pH/PPM/ temp.	Specimen
24/07/2007	Casa de Piedra/Gómez Farías	Tamaulipas	23°3′56.5″N 99°13′37.4″W	1430	7.7/–/23	2A♀, 3A♂, 3G♂ 2LE-PE, 3PE, 10 WL
9/04/2012	La Montaña/Tlanchinol	Hidalgo	21°0′47.7″N 98°38′57.4″W	1588		2PE-A♀, 4WL
9/04/2012	Carretera/Xochicoatlán	Hidalgo	20°46′12.9″N 98°41′ 53.5″W	1836	4.8/12/15	2PE-A♀, 2PE-A4♂, 17WL
11/11/2012	Aquixquillo/Huejutla	Hidalgo	21°6′43.6″N 98°34′50.7″W	317	6.6/25/25	1LE-PE-A♀, 4WL
14/09/2013	Sótano de las Golondrinas/Aquismón	San Luis Potosí	21°36′1.2″N 99°6′5″W	900	7.03/8/21	1PE-A♂-G♂
14/09/2013	Sótano de las Golondrinas/Aquismón	San Luis Potosí	21°36′1.2″N 99°6′5″W	90	6.40/5/21	1LE-PE-A♀, 2PE-A♀, 1WL
14/09/2013	Sótano de las Golondrinas/Aquismón	San Luis Potosí	21°36′1.2″N 99°6′5″W	900	6.34/9/21	2PE-A♀, 2G♂
14/09/2013	Sótano de las Golondrinas/Aquismón	San Luis Potosí	21°36′1.2″N 99°6′5″W	900	6.76/10/21	1PE-A♀, 1A♀
1506/2013	Lajas/Aquismón	San Luis Potosí	21°35′50.3″N 99°4′ 40.4″W	244	6.6/3/23	1G♂
28/06/2015	Grutas del Coconá/Teapa	Tabasco	17°33′48.2″N 92°55′ 42.4″W	48		9WL
19/10/2015	San Miguel/Huimanguillo	Tabasco	17°58′20.6″N 93°45′ 55.2″W	45	7.0/94/26	4WL
13/08/2016	Las Nubes/Tenejapa	Chiapas	16°11′57.9″N91°19′59.3″ W	385	7.5/147/28	2WL
13/08/2016	Las Nubes/Tenejapa	Chiapas	16°11′57.9″N 91°19′ 59.3″W	385	8.8/38/28	5WL
13/08/2016	Jerusalén/Margaritas	Chiapas	16°11′34.3″N 91°22′ 47.3″W	333	6.6/42/29	1WL

Only two species of subgenus *Microculex* had been reported in Mexico: *Culex imitator* Theobald, and *Cx. rejector* Dyar and Knab. *Cx. imitator* was originally described from specimens collected at axils of bromeliads in São Paulo, Brazil (Theobald 1903). The species is currently distributed in Argentina, Brazil, Colombia, Ecuador, French Guiana, Guyana, Honduras, Panama, Suriname, Trinidad and Tobago, Uruguay, and Venezuela (WRBU 2005). In Mexico, *Cx. imitator* was originally recorded by Knight and Stone from specimens of unknown origin (1977), indicating no evidence of collecting site while additional records were reported by Darsie (1996), Ordóñez-Sánchez (2013), Pérez-Ventura (2014), and Ortega-Morales *et al.* (2015). *Cx. rejector* was originally described from immature stages collected at axils of bromeliads in Veracruz, Mexico (Dyar and Knab 1906). *Cx. rejector* is distributed in Belize, Costa Rica, Guatemala, Honduras, Mexico, and Nicaragua (WRBU 2005). In Mexico, this species had been reported in the states of Campeche, San Luis Potosí, Tabasco, and Veracruz (Howard *et al.* 1915, Dyar 1928, Martini 1935, Vargas 1956, Díaz-Nájera and Vargas 1973, Heinemann and Belkin 1977), but not for the state of Chiapas (this work). Morphological differences between these species are the following: *Cx. imitator*. Larvae: seta 6-III-VI with four hairs, comb scales with shorter spines and rows deep. Adults: tarsal rings of hind leg with broad white rings, thoracic markings silvery, palpi of male white-ringed. *Cx. rejector*. Larvae: seta 6-III-VI with two hairs, comb scales with very long spines. Adults: tarsal rings of hind leg with narrow white rings, thoracic markings (if present) scarcely silvery, palpi of male dark

The occurrence of *Cx. imitator* in Mexico is uncertain mainly due to the following: (a) The unknown origin of the original record in Mexico. Knight and Stone (1977) report the presence of *Cx. imitator* for the first time in Mexico; however, they do not indicate the provenance of the material nor were the specimens deposited; thus, there is no way to corroborate their record; (b) based on previous records of mosquito collections, Darsie (1994) published a checklist of Mexican species, including *Cx. imitator*; surely this record corresponds to that of Knight and Stone (1977). Subsequently, the presence of *Cx. imitator* has been reported in the states of Hidalgo (Ordóñez-Sánchez 2013), San Luis Potosi (Pérez-Ventura 2014), and Tamaulipas (Ortega-Morales *et al.* 2015). All the specimens associated with the aforementioned records were deposited in the Culicidae Collection of the UAAAN-UL and were re-examined in the light of the present work; our examination showed that all specimens were conspecific with *Cx. rejector*; (c) both species of *Cx. imitator* and *Cx. rejector* are morphologically similar, especially in the larval stage. We believe that previous records of *Cx. imitator* in Mexico has been confused with *Cx. rejector*, and the original record of Knight and Stone (1977) of *Cx. imitator* corresponds to *Cx. rejector*. Considering the previous arguments, *Cx. imitator* is here removed from the Mexican mosquito fauna checklist. Therefore, the subgenus *Microculex* is now only represented by *Cx. daumastocampa* and *Cx. rejector.*

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