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First record of Limatus durhamii Theobald (Diptera: Culicidae) in Campeche, Mexico

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**Limatus** Theobald (Diptera: Culicidae) is a genus of forest mosquito that occurs in Central America, eastern South America, and the West Indies. It is placed in the tribe Sabethini of subfamily Culicinae. Immature stages develop in bamboo cavities, tree holes, fallen bracts, coconut husks, cacao pods, and also in other small water containers such as fallen leaves and spathes, snail shells, rock holes, and a variety of small artificial containers (Lane 1953; Calderón-Arguedas et al. 2009; Campos et al. 2011; Baak-Baak et al. 2014; Mangudo et al. 2017). Currently 9 valid species of **Limatus** Theobald are recognized, all with Neotropical distribution. In Mexico, 2 species have been recorded, **Limatus asulleptus** (Theobald) (Ortega-Morales et al. 2015) and **Limatus durhamii** Theobald (Diaz-Najera & Vargas 1973). **Limatus durhamii** can be found with the synonyms of *Simondella curvirostris* Laveran, *Dendromyia paraensis* Theobald, *Limatus cacophrades* Dyar & Knab, and *Limatus exhibitor* Shannon & Del Ponte, and is a suspected vector of the genus *Orthobunyavirus* (subfamily: Bunyaviridae) (Berger 2016). The genus *Orthobunyavirus* includes about 53 species containing more than 193 viruses, grouped into about 20 serogroups based on antigenic relationships, and the majority of the viruses distributed worldwide that are transmitted by mosquitoes but are not well studied (Elliott & Blakqori 2011; Plyusnin et al. 2012), except those that have medical (e.g., La Crosse and Oropouche viruses) or veterinary importance (e.g., the newly emerged Schmallenberg virus).

In Mexico, *Li. durhamii* has been recorded in the states of Chiapas, Guerrero, Oaxaca, Puebla, San Luis Potosí, and Yucatán (Díaz-Najera & Vargas 1973; Casas-Martínez & Orozco-Bonilla 2006), Quintana Roo (Pletsch 1986; Ortega-Morales et al. 2010), Tabasco, and Veracruz (Heinemann & Belkin 1977). Immature stages were collected in 4 municipalities of the state (Campeche, Escárcega, Hecelchakán, and Tenabo) from natural breeding sites outside houses, and all water sources were checked from Jan to Dec 2015. Mosquito larvae were collected each mo for 3 consecutive d in the morning, for a total collection effort of 36 days. The larvae were transported alive in plastic bags to the Public Health Laboratory of Campeche State. The collections were conducted in both the dry and rainy seasons. Entomological capture is an activity of the epidemiologic surveillance developed by the Secretary of Health of Mexico.

Taxonomic determinations of immature mosquitoes were based on morphological characteristics of fourth instar larvae using taxonomic keys (Carpenter & LaCaiss 1955; Ibáñez-Bernal & Martinez-Campos 1994) at the Secretary of Health of Campeche, Mexico, followed by confirmation from the Institute for Diagnostic and Epidemiological Reference. A voucher collection of mosquito larvae was deposited in the Public Health Laboratory of Campeche State.

A total of 194 specimens were collected (160 larvae, 34 pupae) representing 6 species belonging to 4 genera (*Aedes aegypti* (L.), *Ae. scapularis* (Rondan), *Culex coronator* Dyar & Knab, *Cx. nigripalus* Theobald, *Haemagogus anastasionis* Dyar, and *Li. durhamii*). A total of 18 mosquito larvae of *Li. durhamii* (9.28%) were collected in artificial and natural breeding sites in the municipalities of Campeche (3: 19.87434°N, 90.47324°W), Escárcega (6: 18.61466°N, 90.73309°W, and 19.00915°N, 91.28392°W), Hecelchakán (6: 20.12974°N, 90.18111°W, and 20.17465°N, 91.43910°W), and Tenabo (3: 20.0344°N, 90.22798°W) for the first time in the state (Fig. 1). Species collected during the study, and the places where they were found, are listed below (Table 1).

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Currently, 50 mosquito species have been recorded in Campeche State. This study adds *Limatus durhamii* to the mosquito fauna record of Campeche with collections in 4 municipalities of the state. Diseases transmitted by arthropods have shown recent changes in dissemination, either by the intercontinental movement of different strains of etiologic agents, the introduction of vectors and exotic reservoirs, or by the susceptible human population that migrates towards endemic areas (Rueda & Hernández 2008). Faunistic studies are necessary to gain information not only of the vector and host species present in the zone, but to recognize their breeding sites, and the environmental factors that determine their presence in the different ecosystems and seasons. Mosquito studies are important for adopting appropriate health measures to control the diseases they transmit, in accordance with the vector species, their abundance, and the time of year favoring the transmission of pathogenic agents. These studies also allow detection of exotic species in a given region (Keesing 2010).

Ochoa-Gómez et al. (2012) mention that distribution of mosquitoes can change due to occupation of new habitats following anthropogenic activities that generate disturbances in the environment. This new record of *Li. durhamii* in municipalities for the state of Campeche possibly affirms the comment of Berti (2012), who mentioned that there are many factors that can accelerate the emergence of vector-borne diseases, including environmental changes, habitat modifications, variations of human and animal demography, deterioration of strategies of vector control, or changes

### Table 1. Record number of associated specimens to *Limatus durhamii* in collection localities.

<table>
<thead>
<tr>
<th>Localities</th>
<th>Ae. aegypti</th>
<th>Ae. scapularis</th>
<th>Cx. coronator</th>
<th>Cx. nigripalpus</th>
<th>Ha. anastasionis</th>
<th>Li. durhamii</th>
<th>Aedes spp.</th>
<th>Culex spp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imi</td>
<td>14</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Colonia Procesadora</td>
<td>14</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Colonia Benito Juárez</td>
<td>33</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Colonia San Francisco</td>
<td>34</td>
<td></td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Colonia 10 de mayo</td>
<td>20</td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Colonia Fátima</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>127</td>
<td>3</td>
<td>9</td>
<td>1</td>
<td>2</td>
<td>18</td>
<td>20</td>
<td>14</td>
</tr>
</tbody>
</table>
in pathogen genetics. These factors contribute to the depletion of
the abundance and distribution of many species, whereas others
have increased explosively to become pests (Peña & Neyra 1998).

The main focus of the surveillance of culcid mosquitoes has been
on the genera Aedes, Anopheles, and Culex, with emphasis on
genetic distribution and other aspects relevant to the imple-
mentation of control activities (Rodríguez & De La Hoz 2005) due
to the importance of these species on public health. However, there
has been less research on other genera, possibly due to their lower
epidemiological impact (Barreto et al. 1996) and transmission of
arboviruses (Gubler 2002), as is the case of the mosquitoes in the
genus Limatus.

Honório et al. (2006) and Talaga et al. (2017) mentioned that
species of Limatus have been found with a high rate of prevalence
in artificial water containers along with mosquitoes of Aedes, and
reported an interspecific competition with native species for food.
Likewise, Ortega-Morales et al. (2010) mentioned that Li. durhamii
immatures were observed preying on Ae. aegypti larvae. These
mosquito species larvae are saprophagous, and in the absence of
decaying matter they can behave like facultative predators of other
mosquito species (Lopes 1999). In a study conducted in Costa Rica,
Li. durhamii was reported living with Ae. aegypti in the same arti-
ficial containers (Marín et al. 2009). Berger (2016) mentioned that
mosquitoes of the genus Limatus are potential vectors of Orthobu-
ynaviruses, and Berti et al. (2015) mention that they are potential
vectors of arbovirus.

This study documents for the first time the occurrence of Lima-
tus durhamii in the state of Campeche. Further studies are neces-
sary to investigate the establishment of Li. durhamii elsewhere in
the country and its potential to transmit arboviruses.

We are grateful to the National Council of Science of Technology
(Mexico) for project 1072 of Catedras-CONACYT, and to the Ph.D.
candidate Sergio Padilla from CEDESU-UAC-Campeche for making
the maps.

**Summary**

A total of 194 specimens were collected (160 larvae, 34 pupae)
representing 6 species from 4 genera (Aedes aegypti, Ae. scapularis,
Culex coronator, Cx. nigripalpus, Haemagogus anastasiosis, and Lima-
tus durhamii). In the study, a total of 18 larvae of Li. durhamii (9.28%)
were collected in natural and artificial breeding sites in the munici-
palities of Campeche (3), Escárcega (6), Hecelchakán (6), and Tenabo
(3). We report here the first collection record of Li. durhamii for the
state of Campeche in southern Mexico. Further studies are necessary
to investigate the geographic distribution of Li. durhamii throughout
the country.

Key Words: Mosquitoes, Limatus, Orthobunyavirus

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