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Urban Mosquito Fauna in Mérida City, México: Immatures Collected from Containers and Storm-water Drains/Catch Basins

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Abstract

We examined the species composition and temporal occurrence of immature mosquitoes in containers and storm-water drains/catch basins from November 2011 to June 2013 in Mérida City, México. A wide range of urban settings were examined, including residential premises, vacant lots, parking lots, and streets or sidewalks with storm-water drains/catch basins. In total, 111,776 specimens of 15 species were recorded. The most commonly collected species were *Aedes (Stegomyia) aegypti* (L.) (n = 60,961) and *Culex quinquefasciatus* Say (45,702), which together accounted for 95.4% of the immatures collected. These species were commonly encountered during both rainy and dry seasons, whereas most other mosquito species were collected primarily during the rainy season. Other species collected were *Aedes (Howardina) cozumelensis* Diaz Najera, *Aedes (Ochlerotatus) taeniorhynchus* (Wiedemann), *Aedes (Ochlerotatus) trivittatus* (Coquillett), *Culex coronator* Dyar and Knab, *Culex interrogator* Dyar and Knab, *Culex lactator* Dyar and Knab, *Culex nigripalpus* Theobald, *Culex salinarius* Coquillett, *Culex tarsalis* Coquillett, *Culex thriambus* Dyar, *Haemagogus equinus* Theobald, *Limatus durhamii* Theobald, and *Toxorhynchites rutilus* (Coquillett). The greatest number of species was recorded from vacant lots (n = 11), followed by storm-water drains/catch basins (nine) and residential premises (six). Our study demonstrated that the heterogeneous urban environment in Mérida City supports a wide range of mosquito species, many of which are nuisance biters of humans and/or capable of serving as vectors of pathogens affecting humans or domestic animals. We also briefly reviewed the medical importance of the encountered mosquito species.

Introduction

Mosquito-borne dengue is a major health problem in the Yucatán Peninsula of México (Loroño-Pino et al. 1993, 2004, 2013; García-Rejón et al. 2008). Several studies reported on the immature or adult stage of the primary local vector mosquito, *Aedes (Stegomyia) aegypti*

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(L.), for dengue virus. The studies reported on containers and seasonal patterns of abundance for immatures (Lloyd et al. 1992; Winch et al. 1992; Manrique-Saide et al. 2008, 2012, 2013; García-Rejón et al. 2011a; Arana-Guardia et al. 2014; Baak-Baak et al. 2014) and examined different indoor environments for adults (García-Rejón et al. 2008, 2011b). Additional studies have reported more broadly on the mosquito fauna of the Yucatán Peninsula (Najera-Vazquez et al. 2004, Zapata-Peniche et al. 2007, Ortega-Morales et al. 2010, García-Rejón et al. 2012).

During studies from November 2011 to June 2013 in Mérida City, the major urban center in Yucatán State, to assess the presence of *Ae. aegypti* immatures in containers and other water-holding structures in a range of urban environments (Arana-Guardia et al. 2014, Baak-Baak et al. 2014), we encountered numerous other mosquito species. Previous studies recorded 29 mosquito species from Mérida City: *Ae. aegypti*, *Aedes (Ochlerotatus) scapularis* (Rondani), *Aedes (Ochlerotatus) sollicitans* (Walker), *Aedes (Ochlerotatus) taeniorhynchus* (Wiedemann), *Aedes (Ochlerotatus) trivittatus* (Coquillett), *Aedes (Ochlerotatus) fulvus pallens* (Ross), *Anopheles albimanus* Wiedemann, *Anopheles crucians* Wiedemann, *Anopheles vestitipennis* Dyar and Knab, *Anopheles pseudopunctipennis* Theobald, *Culex bidens* Dyar and Knab, *Culex coronator* Dyar and Knab, *Culex interrogator* Dyar and Knab, *Culex lactator* Dyar and Knab, *Culex nigripalpus* Theobald, *Culex quinquefasciatus* Say, *Culex salinarius* Coquillett, *Culex tarsalis* Coquillett, *Culex thriambus* Dyar, *Toxorhynchites theobaldi* (Dyar and Knab), *Hemagogus mesodentatus* Komp and Kumm, *Mansonia titillans* (Walker), *Uranotaenia lowii* Theobald, *Psorophora cyanescens* (Coquillett), *Psorophora albipes* (Theobald), *Psorophora ciliata* (Fabricius), *Psorophora confinnis* (Lynch-Arribalzaga), *Psorophora ferox* (Von Humboldt), and *Psorophora howardii* Coquillett (Lloyd et al. 1992; Winch et al. 1992; Najera-Vazquez et al. 2004; Zapata-Peniche et al. 2007; García-Rejón et al. 2008, 2011a,b, 2012; Farfan-Ale et al. 2009, 2010; Manrique-Saide et al. 2008, 2012, 2013).

To improve knowledge of urban mosquito fauna, including species of medical or veterinary importance, it is important to survey a broad range of settings (Ibañez-Bernal and Martínez-Campos 1994, McIntyre 2000). The results reported herein not only expand the previous list of mosquito species recorded from Mérida City but also provide data for their occurrence during dry and rainy seasons and in different kinds of urban environments, including residential premises, vacant lots, and streets or sidewalks with storm-water drains/catch basins.

Materials and Methods

The study area was in Mérida City (population ~ 800,000) in the Yucatán Peninsula of southeastern México. The flat and low Yucatán Peninsula (elevation 0-250 m above sea level) has bedrock of limestone and a subtropical climate. Mean monthly maximum temperatures in Mérida City range from 29°C in December to 34°C in July, and most rainfall occurs from May to October, with peak from June to September (based on data from a weather station operated by Comisión Nacional del Agua at the Mérida airport). Monthly rainfall data for the study period are presented in Table 1.

Immature mosquitoes, primarily from different kinds of containers and storm-water drains/catch basins, were collected from November 2011 to June 2013 in different parts of Mérida City. Urban environments examined were individual residential premises (n = 52), streets or sidewalks with storm-water drains/catch basins (110), vacant lots (36), parking lots (eight), cemeteries (two), and a prison(one) (Table 1). Most sites (n = 167) were examined on a single occasion but some (eight residential premises, 26 streets/sidewalks with storm-water drains/catch basins, six vacant lots, and two parking lots) were examined on two or more dates, for a total number of site visits of 209. As defined in this study, vacant lots did not have buildings but often had abundant vegetation and substantial accumulations of trash (Silva de Mendonça et al. 2011).

Surveys for immatures and classification of container types were as described in previous studies (Najera-Vazquez et al. 2004, García-Rejón et al. 2011a) and included inspection of potential development sites for immatures in homes and their patios and yards, on streets/sidewalks - primarily in storm-water drains/catch basins - and in the other targeted settings (Fig. 1). Nets, turkey basters, or pipettes were used to collect immatures from water-holding containers or other structures. For storm-water drains/catch basins, we used long-handled zooplankton nets (20 × 10 cm, 100-µm mesh). More detailed descriptions of the survey methodology were given by Arana-Guardia et al. (2014) for storm-water drains/catch basins and Baak-Baak et al. (2014) for the other urban environments.

Larvae and pupae were placed in plastic containers, labeled with date and sample number, and transported to the Laboratorio de Arbovirología at Universidad Autónoma de Yucatán. Early instar larvae were reared in a laboratory (28 ± 1°C water temperature and a photoperiod of 12:12 light:dark hours) to fourth instar for more accurate identification of species. Pupae were allowed to emerge as adults, and the adults were identified to species. Stereomicroscopes and keys by Carpenter and LaCasse (1955), Ibañez-Bernal and Martínez-Campos (1994), and Darsie and Ward (2005) were used to identify species.

Statistical analyses were performed using the IBM SPSS Statistics version 19 software (IBM Corporation, Armonk, NY), and results were considered significant when $P < 0.05$. Data were log₁₀-transformed to meet the assumptions of normality and homogeneity of variances. A one-way analysis of variance (ANOVA) test was used to compare number of mosquito immatures by urban environment class (restricted to residential premises, streets/sidewalks, vacant lots, and parking lots). Significant ANOVA results were followed by a post-hoc Tukey test for multiple comparisons of means. Margalef's index for species richness was calculated for each sampling month using EstimateS Statistics Version 9.1.0 software (Colwell 2014):

$$Ma = \frac{(S - 1)}{\ln N}$$

where Ma = Margalef's index, S = total number of species, and N = total number of individuals. This index is based on the assumption that there is a functional relationship between the number of species and the total number of individuals.

Results

We collected a total of 111,776 mosquito immatures of 15 species (Table 2). The most commonly collected species were *Ae. aegypti* (n = 60,961) and *Cx. quinquefasciatus* (45,702), followed by *Cx. lactator* (1,261), *Cx. interrogator* (1,157), *Cx. thriambus* (1,157), *Cx. coronator* (977), *Cx. salinarius* (289), *Cx. nigripalpus* (172), *Limatus durhamii* Theobald (35), *Toxorhynchites rutilus* (Coquillett) (30), *Ae. trivittatus* (18), *Haemagogus equinus* Theobald (seven), *Cx. tarsalis* (five), *Aedes (Howardina) cozumelensis* Diaz Najera (four), and *Ae. taeniorhynchus* (one). New species records for Mérida City were *Ae. cozumelensis*, *Hg. equinus*, *Lim. durhamii*, and *Tx. rutilus*.

Aedes aegypti were collected during all months of the year, and *Cx. quinquefasciatus* during all but two months, with the most frequent collections during the rainy season (April/May to November/December) (Table 2). Several other species were collected in three or more months of the year, most commonly during the rainy season: *Ae. trivittatus*, *Cx. coronator*, *Cx. lactator*, *Cx. salinarius*, *Cx. thriambus*, and *Tx. rutilus*. Additional species were encountered in two months (*Cx. interrogator* in April and June, *Hg. equinus* in July and August, and *Lim. durhamii* in September and December) or a single month (*Cx. tarsalis* in March, *Cx. nigripalpus* in May, *Ae. cozumelensis* in June, and *Ae. taeniorhynchus* in July). Species richness, estimated with Margalef's index, was highest in the rainy months of the year, peaking (Ma = 0.77) in July 2012 when eight different species were recorded.

When collections were grouped by urban environment class, the abundance of mosquito immatures (log₁₀-transformed data) differed significantly between classes ($F = 20.524$, $df = 311$, $P < 0.001$). Specifically, mosquito immatures were more abundant in parking lots and on streets/sidewalks with storm-water drains/catch basins as compared with on vacant lots or residential premises. In contrast, the greatest number of species was collected from vacant lots (n = 11), followed by streets/sidewalks with storm-water drains/catch basins (nine) and residential premises (six) (Table 3). *Aedes aegypti* and *Cx. quinquefasciatus* were collected in all types of environments studied, and *Cx. thriambus* in all but the cemeteries and prison. The non-residential sites (vacant lots, parking lots, and streets/sidewalks with storm-water drains/catch basins) yielded several additional *Culex* species (*Cx. coronator*, *Cx. interrogator*, *Cx. lactator*, *Cx. nigripalpus*, *Cx. tarsalis*, and *Cx. salinarius*) as well as *Ae. cozumelensis*, *Ae. taeniorhynchus*, and *Ae. trivittatus*. *Limatus durhamii* and *Tx. rutilus* were collected from residential premises and vacant lots, whereas *Hg. equinus* was collected only from residential premises. Across the different urban environments, disposable containers, tires, and storm-water drains/catch basins each yielded nine different species.

Collections of mosquito species with potential to serve as vectors of pathogens affecting humans or domestic animals are summarized in Table 4 for the four urban environments most commonly examined: residential premises, vacant lots, streets or sidewalks with storm-water drains/catch basins, and parking lots. Notably, numerous species with potential to serve as arbovirus vectors occur across multiple urban environments in Mérida City.

Discussion

Twenty-nine mosquito species previously were recorded from Mérida City. The current study adds another four species: *Ae. cozumelensis*, *Hg. equinus*, *Lim. durhamii*, and *Tx. rutilus*. *Ae. cozumelensis*, *Hg. equinus*, and *Lim. durhamii* were recorded previously in the Yucatán Peninsula (Najera-Vazquez et al. 2004, Ortega-Morales et al. 2010, García-Rejón et al. 2012) but we present the first records of these species from Mérida City. Previous records from the Yucatán Peninsula for *Toxorhynchites* are restricted to *Tx. theobaldi* (Zapata-Peniche et al. 2007, Ortega-Morales et al. 2010); to the best of our knowledge *Tx. rutilus* is a new record for this part of México. In México, *Tx. rutilus* was previously recorded from Ciudad Valles in San Luis Potosi State (Eads and Campos 1963) and recently from three localities in Nuevo Leon State and one locality in Tamaulipas State (Ortega-Morales 2010). *Haemagogus anastasionis* Dyar may occur within Mérida City in larval habitats not examined by us (e.g., oxidation ponds or naturally occurring small bodies of water) (Najera-Vazquez et al. 2004). A notably absent species is the arbovirus vector *Aedes* (*Stegomyia*) *albopictus* (Skuse), recently recorded for the first time in the Yucatán Peninsula (Salomón-Grajales et al. 2012) but not yet found in Mérida City.

Both the urban environment and time of year impacted the mosquitoes collected. In accordance with previous studies from Yucatán State, *Ae. aegypti* and *Cx. quinquefasciatus* occurred throughout the year and across the full range of urban environments and types of containers or structures (Najera-Vazquez et al. 2004; Zapata-Peniche et al. 2007; García-Rejón et al. 2008, 2011a,b, 2012; Manrique-Saide et al. 2008, 2012, 2013). Peak numbers of *Ae. aegypti* during the rainy season have been reported previously from Mérida (García-Rejón et al. 2008, 2011a) and likely resulted from an increase in abundance of water-filled containers. Another notable result is the wide range of species and great numbers of mosquitoes collected from disposable trash containers, tires, and storm-water drains/catch basins. This agrees with results of previous studies from Mérida (García-Rejón et al. 2008, 2011a; Manrique-Saide et al. 2008, 2012, 2013) and underscores the importance of controlling mosquitoes in larval habitats. High diversity of species in tires also was reported from Argentina (Rubio et al. 2011). In addition to containers on residential premises and storm-water drains/catch basins along streets/ sidewalks, our data indicated that containers in vacant lots are productive mosquito habitats in Mérida City. Similar to studies in other parts of the Americas that highlighted the importance of non-residential areas for production of *Ae. aegypti* (Morrison et al. 2006, Silva de Mendonça et al. 2011), we found non-residential areas such as vacant lots, storm-water drains/catch basins on streets/ sidewalks, and parking lots important sources for a wide range of mosquito species.

Several species reported here are important vectors of pathogens affecting humans in the Americas. *Aedes aegypti* is the primary urban vector of dengue and yellow fever viruses and an important vector of chikungunya virus which is a major emerging threat (Gratz 1999, Gubler 2004, Pialoux et al. 2007, Halstead 2008, Morrison et al. 2008, San Martín et al. 2010, Tapia-Conyer et al. 2012). In Mérida City, dengue virus has been detected from *Ae. aegypti* females in homes and schools (García-Rejón et al. 2008, 2011b; Loroño-Pino et al. 2013). *Culex quinquefasciatus*, *Cx. nigripalpus*, and *Cx. tarsalis* are capable of transmitting important arboviruses that occur in the Americas, including St. Louis encephalitis virus and

West Nile virus (Day 2001, Goddard et al. 2005, Turell et al. 2005, Mores et al. 2007). Although neither virus has yet been detected from the mosquitoes in Mérida City, West Nile virus was detected from *Cx. quinquefasciatus* in northern México (Elizondo-Quiroga et al. 2005) and *Cx. nigripalpus* in Chiapas State in southern México (Ulloa et al. 2009). Recent studies of *Cx. quinquefasciatus* from Mérida City revealed the novel T'Ho virus with still unknown pathogenicity for humans (Farfan-Ale et al. 2009). *Culex salinarius* and *Cx. thriambus* are vectors of West Nile virus (Turell et al. 2005, Reisen et al. 2006), and the virus was recorded from field-collected *Cx. interrogator* in Chiapas State (Ulloa et al. 2009). The mosquito fauna of Mérida City includes at least six *Culex* species that can transmit West Nile virus.

Other records of infection by the mosquito species from Mérida City with pathogens affecting humans or domestic animals include St. Louis encephalitis virus from *Cx. tarsalis* in Durango in the northwest (Sudia et al. 1975), Venezuelan equine encephalomyelitis virus from *Cx. coronator* in Veracruz State (Scherer et al. 1971), and heartworm, *Dirofilaria immitis*, from *Ae. taeniorhynchus* in the Yucatán Peninsula (Manrique-Saide et al. 2010). The typical larval habitat of *Ae. taeniorhynchus* is saltmarsh and mangrove swamp, but we recorded this species in a storm-water drain. *Haemagogus equinus* is a vector of yellow fever virus and St. Louis encephalitis virus and has been found naturally infected with yellow fever virus in Central America (Waddell and Taylor 1945, 1947; Waddell 1949; de Rodaniche and Galindo 1957; de Rodaniche et al. 1957; Hayes et al. 1991).

Toxorhynchites rutilus is of interest because the larval stage is predaceous on other mosquitoes and aquatic organisms that inhabit containers, and therefore might be used as a biological control agent to reduce *Ae. aegypti* and *Cx. quinquefasciatus* in Mérida City (Focks 2007). Tikasingh (1992) reported that *Tx. moctezuma* Dyar and Knab prevented *Ae. aegypti* emergence for 16 weeks in water-filled drums.

Our study demonstrated that the heterogeneous urban environment in Mérida City supported a wide range of mosquito species, many of which are nuisance biters and/or capable of being vectors of pathogens. There is much still to be learned about the urban mosquito fauna, particularly *Culex* species and their associated arboviruses, in Mérida City.

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Storm-water drains/catch basins

Vacant lots

Residential premises

Fig 1.
Examples of streets with storm-water drains/catch basins and vacant lots or residential premises with water-filled containers.

Table 1

Rainfall and Number of Sites Examined by Month from November 2011 to June 2013 in Mérida City

	2011			2012										2013						
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Rainfall (mm)	60	15	60	5	2	112	52	187	100	135	235	138	16	14	47	1	27	63	113	186
<u>Number of sites examined:</u>																				
Residential premises	2	1	4	3	1	2	8	5	5	8	2	3	2	3	1	0	0	0	1	1
Vacant lots	0	8	0	3	0	2	5	6	2	1	2	2	0	0	0	0	0	0	0	5
Streets/sidewalks ^a	0	3	0	1	20	16	14	10	12	0	4	6	14	7	0	2	1	0	0	0
Parking lots	0	0	0	0	0	2	2	1	2	0	0	0	0	0	0	0	0	0	0	1
Cemeteries	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prison	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Total	2	12	4	7	22	23	29	23	21	9	8	11	16	10	1	2	1	0	1	7

^aIncluding storm-water drains/catch basins.

Table 2

Summary of Mosquitoes Collected by Month from November 2011 to June 2013 in Mérida City

Species ^a	2011					2012					2013				
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
<i>Ae. aegypti</i>	87	1,842	694	2,257	4,026	6,768	11,968	6,211	2,985	2,867	1,445	9,848	4,232	2,216	17
<i>Ae. cozymelensis</i>	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
<i>Ae. taeniorhynchus</i>	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
<i>Ae. trivittatus</i>	0	0	0	0	0	0	9	0	2	0	0	0	0	0	0
<i>Cx. coronator</i>	0	0	0	12	38	0	14	2	23	0	0	0	872	0	0
<i>Cx. interrogator</i>	0	0	0	0	0	42	0	0	0	0	0	0	0	0	0
<i>Cx. lactator</i>	0	0	0	0	0	29	0	363	831	0	38	0	0	0	0
<i>Cx. nigripalpus</i>	0	0	0	0	0	0	172	0	0	0	0	0	0	0	0
<i>Cx. quinquefasciatus</i>	3	451	0	68	7,673	10,055	6,485	5,114	4,798	0	2,995	3,350	3,895	355	0
<i>Cx. salinarius</i>	0	0	0	0	0	9	278	0	2	0	0	0	0	0	0
<i>Cx. tarsalis</i>	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
<i>Cx. thriambus</i>	0	0	0	0	0	7	0	576	21	379	43	0	12	0	0
<i>Hg. equinus</i>	0	0	0	0	0	0	0	0	2	5	0	0	0	0	0
<i>Lim. durhamii</i>	0	27	0	0	0	0	0	0	0	0	8	0	0	0	0
<i>Tx. rutilus</i>	1	4	0	6	0	0	0	18	0	0	1	0	0	0	0
Margalef's Index	0.44	0.39	0	0.39	0.32	0.51	0.51	0.53	0.77	0.37	0.59	0.11	0.22	0.13	0.3
															0

^a Ae., Aedes; Cx., Culex; Hg., Haemagogus; Lim., Limatus; Tx., Toxorhynchites.^b No collections were attempted in April 2013.

Table 3

Numbers of Mosquito Immatures Collected by Urban Environment and Container Habitat, from November 2011 to June 2013 in Mérida City

Urban environment and species	Type of container or other structure								
	Disposable container	Tire	Animal water bowl	Bucket	Discarded toilet	Flower pot	Vase	Storm-water drain/catch basin	Other
Residential premises:									
<i>Aedes aegypti</i>	46	7	6	10	1	7	13	0	1 ^b
<i>Culex quinquefasciatus</i>	6	8	0	0	0	2	1	0	0
<i>Culex thriambus</i>	2	0	0	0	0	1	0	0	0
<i>Haemagogus equinus</i>	2	0	0	0	0	0	0	0	0
<i>Limatus durhamii</i>	1	0	0	0	0	0	0	0	0
<i>Toxorhynchites rutilus</i>	2	0	0	0	0	0	0	0	0
Vacant lots									
<i>Aedes aegypti</i>	31	40	0	3	6	0	0	0	2 ^c
<i>Aedes cozumelensis</i>	1	0	0	0	0	0	0	0	0
<i>Aedes trivittatus</i>	1	2	0	0	1	0	0	0	0
<i>Culex coronator</i>	0	1	0	1	0	0	0	0	0
<i>Culex interrogator</i>	0	3	0	0	0	0	0	0	0
<i>Culex lactator</i>	0	2	0	0	0	0	0	0	0
<i>Culex quinquefasciatus</i>	5	13	0	1	0	0	0	0	1 ^c
<i>Culex salinarius</i>	1	1	0	0	0	0	0	0	0
<i>Culex thriambus</i>	1	6	0	0	0	0	0	0	0
<i>Limatus durhamii</i>	4	0	0	0	1	0	0	0	0
<i>Toxorhynchites rutilus</i>	1	5	0	0	0	0	0	0	0
Streets/sidewalks with storm-water drains/catch basins:									
<i>Aedes aegypti</i>	1	4	0	4	1	0	0	115	1 ^d
<i>Aedes taeniorhynchus</i>	0	0	0	0	0	0	0	1	0
<i>Culex coronator</i>	0	0	0	0	0	0	0	10	0
<i>Culex interrogator</i>	0	0	0	0	0	0	0	1	0
<i>Culex lactator</i>	0	0	0	0	0	0	0	5	0
<i>Culex quinquefasciatus</i>	0	2	0	1	0	0	0	103	0

Urban environment and species	Type of container or other structure								
	Disposable container	Tire	Animal water bowl	Bucket	Discarded toilet	Flower pot	Vase	Storm-water drain/catch basin	Other
<i>Culex salinarius</i>	0	0	0	0	0	0	0	2	0
<i>Culex tarsalis</i>	0	0	0	0	0	0	0	1	0
<i>Culex thriambus</i>	0	0	0	0	0	0	0	4	0
<u>Parking lots:</u>									
<i>Aedes aegypti</i>	3	1	0	3	0	4	0	0	0
<i>Culex nigripalpus</i>	0	0	0	0	0	1	0	0	0
<i>Culex quinquefasciatus</i>	2	0	0	0	0	3	0	0	0
<i>Culex thriambus</i>	0	0	0	0	0	1	0	0	0
<u>Other sites^d:</u>									
<i>Aedes aegypti</i>	2	1	0	0	0	0	4	0	0
<i>Culex quinquefasciatus</i>	0	0	0	0	0	0	2	0	0

^a Cemeteries and prison.

^b Fruit shell.

^c Large diverse containers.

^d Hole in a wall.

Table 4

Numbers of Mosquito Immatures of Species with Potential to Serve as Vectors of Pathogens that Affect Humans or Domestic Animals Collected in Mérida City from November 2011 to June 2013

Species	Number collected by urban environment				Vector potential ^b
	Residential premises	Vacant lots	Streets/sidewalks ^a	Parking lots	
<i>Aedes aegypti</i>	10,330	18,534	24,791	6,958	DENV, YFV, CHIKV
<i>Aedes taeniorhynchus</i>	0	0	1	0	DI, EEEV, VEEV
<i>Aedes trivittatus</i>	0	18	0	0	TVTV
<i>Culex coronator</i>	0	14	963	0	VEEV
<i>Culex interrogator</i>	0	1,115	42	0	WNV ^c
<i>Culex nigripalpus</i>	0	0	0	172	EEEV, SLEV, WNV
<i>Culex quinquefasciatus</i>	1,610	2,948	39,465	776	SLEV, WNV
<i>Culex salinarius</i>	0	278	11	0	EEEV, SLEV, WNV
<i>Culex tarsalis</i>	0	0	5	0	WEEV, SLEV, WNV
<i>Culex thriambus</i>	379	713	58	7	WNV
<i>Haemagogus equinus</i>	7	0	0	0	YFV, SLEV

^aIncluding storm-water drains/catch basins.

^bDENV, dengue virus; YFV, yellow fever virus; CHIKV, chikungunya virus; DI, *Dirofilaria immitis* parasitic roundworm; EEEV, eastern equine encephalomyelitis virus; VEEV, Venezuelan equine encephalomyelitis virus; TVTV, trivittatus virus; WNV, West Nile virus; SLEV, St. Louis encephalitis virus; WEEV, western equine encephalomyelitis virus.

^cRecord of natural infection in México, experimental vector competence studies still pending.