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First Report of *Aedes* (*Stegomyia*) *albopictus* (Skuse) (Diptera: Culicidae), the Asian Tiger Mosquito, in Ecuador

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Abstract

Aedes (Stegomyia) albopictus (Skuse), (Diptera: Culicidae), the Asian tiger mosquito, is one of the most widespread invasive vector-borne disease insect in tropical and temperate zones. This species has invaded the Americas over the past 3 decades and has spread to six countries. We report *Ae. albopictus* in Guayaquil city, the first time it has been identified in Ecuador. Outdoor BG-Sentinel traps without lures collected a total of 21 *Ae. albopictus*.

Key words: Aedes albopictus, invasive species, BG-Sentinel, Ecuador, mosquito

The mosquito *Aedes (Stegomyia) albopictus* (Skuse), (Diptera: Culicidae), known as the 'Asian Tiger Mosquito', has been incriminated as a vector of Chikungunya virus (CHKV), Dengue virus (DENV), and potential vector of Zika virus (ZIKV), Eastern equine encephalitis virus (EEEV), La Crosse virus (LACV), Venezuelan equine encephalitis virus (VEEV), Japanese encephalitis virus (JEV), St. Louis encephalitis, West Nile virus (WNV), and Yellow fever virus (YFV) (Medlock et al. 2012, Wong et al. 2013, Amraoui et al. 2016). *Ae. albopictus* has also been identified as a vector of filarial parasites (Cancrini et al. 2003).

Ae. albopictus, that may have tropical and subtropical origin (Shaikevich and Talbalaghi 2013), has spread to temperate and tropical areas of the Americas, Europe, Middle East, the Pacific islands, Australia, and Africa (Benedict et al. 2007). *Ae. albopictus* was first reported in the Americas 3 decades ago and has been identified in Brazil, Bolivia, Colombia, Argentina, Uruguay, and Venezuela (Bonizzoni et al. 2013, Kraemer et al. 2015).

In Ecuador, *Aedes aegypti* has been the most important disease-carrying vectors of the past century. It is the only vector in the country known to transmit dengue, chikungunya and Zika viruses (MSP 2017). Since 2012, the National Institute of Research for Public Health (INSPI) has conducted routine surveillance of mosquitoes of medical importance in order to identify potential new disease vectors. This case report describes the first known detection of *Ae. albopictus* in Ecuador.

Guayaquil is the most populated city of Ecuador and is located on the Pacific coast. It has the main seaport of the country where more than 80% of the country's imports are handled. This fact makes the city vulnerable to invasive species.

This case report describes the first detection of *Ae. albopictus* in Ecuador. *Ae. albopictus* was first identified in South America in the state of São Paulo, Brazil in 1986 (Forattini, 1986) and subsequently in Colombia in Leticia, Amazonas, in 1998. In 2001, the species was recorded in Buenaventura, Colombia, and in 2007 in Cali-Valle del Cauca (2001) (Suárez, 2001), approximately 500 km from the northern border of Ecuador. Vector sampling in Ecuador along the northern border with Colombia over recent months has not detected *Ae. albopictus* in that area.

In 1 March 2017, BG-Sentinel (BGS) traps without lures were set in three urban areas of Guayaquil city, as part of the national surveillance program to detect exotic invasive mosquito species. The mosquito sampling is a continuous program that began in 2012. Four indoor home traps were utilized, two in the northern area of the city and two in the southern area. An additional four outdoor traps were placed at INSPI laboratories, located in the central part of the city. These outdoor traps were placed in locations protected from wind and rain. Traps ran 24 hr a day for 4 d per week.

Samples from the traps were collected daily at 0800 hours and at 1630 hours. All mosquito samples collected were taken to the vector laboratory of INSPI in Quito and identified using taxonomic keys (Rueda, 2004). All voucher specimens were then deposited in the INSPI collection in Quito, Ecuador.

The indoor traps placed in the north collected only one *Aedes aegypti* and one *Culex* sp. Indoor traps placed in the south did not collect any mosquitoes. Outdoor traps at INSPI laboratories (2°9′51.664″S; 79°53′33.295″W) collected a total of 21 *Ae. albopictus* (16 females, five males). The outdoor traps also collected 108 *Culex* spp. (102 females, six males) and 17 *Ae. aegypti* (13 females, four males) (Table 1).

Table 1. Mosquito species and number of specimens collected in BGS traps without bait in Guayaquil city (March 2017)

Species	Outdoor traps (no. 4)	Indoor traps (no.4)
Aedes albopictus	21 (16 females, 5 males)	
Aedes aegypti	17 (13 females, 4 males)	1 female
Culex spp.	108 (102 females, 6 males)	1 female

Over 80% (17) of the *Ae. albopictus* specimens (12 females and five males) were collected at 0800 hours, which indicates that these mosquitoes were active between 1630 hours and 0800 hours. None of the females collected had recently fed.

These *Ae. albopictus* specimens were collected in an urban and highly populated area of Guayaquil. The INSPI laboratories are located on a four-hectare property with buildings surrounded by gardens containing bushes, mango, banana, purple mombin, and guava trees. *Ae albopictus* has been previously described not only as an inhabitant of outdoor domesticated areas, but also in forested areas (Simmons, 1931). Some data suggests that *Ae. albopictus* is less urban than *A. aegypti* and prefers forests close to human habitation (Barraud 1923, Mattingly 1952).

According to Hawley (1987), *Ae. albopictus* shows a bimodal pattern of activity, one at sunrise and a major peak in the afternoon. These peaks of activity may explain why the majority of specimens were collected at 0800 hours. Although the traps did not have lure, they collected a significant number of mosquitoes and may serve as a viable tool for a national surveillance program. Farajollahi et al. (2009) demonstrated that BGS traps with or without lure are efficient collecting *Ae. albopictus*.

Now that *Ae. albopictus* has been identified in Ecuador, it is imperative to establish its geographic distribution in the country. It is known that this species can survive in temperate areas, so it may be able to invade low-altitude valleys in the highlands and in the Amazon basin. In the Amazon basin, mosquito vectors are known to transmit dengue, chikungunya and Zika viruses, and they can potentially transmit yellow fever (Johnson et al. 2002, Amraoui et al. 2016).

The presence of *Ae. albopictus* in Guayaquil poses a challenge to surveillance and control of the dengue, Zika, and chikungunya viruses endemic to that region. The use of low cost methods, such as ovitraps, may help to have better coverage in the surveillance program. Further research is necessary to determine the interaction between *Ae. albopictus* and *Ae. aegypti*, which is widely distributed in Guayaquil. This interaction should also be monitored over time since *Ae. albopictus* may potentially outcompete *Ae. aegypti* (O'Meara et al. 1995).

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