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Aedes albopictus (Skuse) dispersion in Havana City, Cuba, 1995–2018

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ABSTRACT

Various arboviruses are transmitted to humans by mosquitoes, particularly *Aedes aegypti* and *Aedes albopictus*, two invasive and frequently sympatric species. The objective of this study was to evaluate the dispersion and the behavior of *Ae. albopictus* in relation to houses and its association with other mosquitoes in the province of Havana, Cuba. All water-containing deposits in the houses or vacant lots in urban and peri-urban municipalities of the province of Havana were sampled during the two study periods: 1995–1999 and 2010–2018. The following patterns in the presence of *Ae. albopictus* in the study area were observed: a persistent absence of *Ae. albopictus* in one of the municipalities; a rapid dispersion in the second period, staring from the absence of vector in the first period, in tow other municipalities; and a sustained decrease in the dispersion of *Ae.albopictus* in two other municipalities. The peripheral municipalities noted the highest presence of *Ae. albopictus*, but few associations with other mosquitoes. However, overall, we found an increase in this association when comparing the period 2010–2018 with the first period. *Ae. albopictus* was present in 8% (2016) to 21.5% (2013) inside the houses with an average of 15%, which evidences an initial domiciliation of the species. The results obtained in this work show an initiation of domiciliation of *Ae. albopictus* in the urban area of the province of Havana. This is important to alert the National Control Program to strengthen the entomological monitoring of *Ae. albopictus*, and not only *Ae. aegypti*. The follow-up of this domiciliation is important to guide control efforts, knowing its role as a vector of different arboviruses.

1. Introduction

The different arboviruses, dengue, chikungunya, Zika and yellow fever are primarily transmitted to humans by mosquitoes, particularly *Aedes aegypti* (Linnaeus, 1762) and *Aedes albopictus* (Skuse, 1894), two invasive and frequently sympatric species. *Ae albopictus* is often considered as a secondary vector, especially for dengue, based on its lower capacity to transmit pathogens to humans, but its potential to sustain transmission and provoke outbreaks is real (Paupy et al., 2009; Grard et al., 2014).

Aedes albopictus presence was registered for the first time in Cuba in 1995, namely in La Lisa municipality in the province of Havana (Broche and Borja, 1999). It gradually spread, so that nowadays it is distributed throughout the entire Cuban territory. The latest scientific report of this species informed, indeed, about its presence up to the province of Santiago de Cuba located in the eastern side of the country (Castillo et al., 2014).

There are few studies on the ecology of *Ae. albopictus* in Cuba, among them the one that reports on the preferred breeding sites (Marquetti et al., 2001) which showed that larvitraps were the most positive container types followed by cans, with a preference for breeding outside the houses (Valdés et al., 2009). On the other hand, this species was also found breeding in used car tires, mainly in the rainy season, pointing out an allopatric distribution with respect to *Ae. aegypti* (Marquetti et al., 2008). In Pinar del Río situated in western Cuba, the gradual dispersion of *Ae. albopictus* occurred between 2003 and 2008 with preference to breed in larvitraps, cans and water storage containers (Marquetti et al., 2014).

In Havana, *Ae. albopictus* abundance is mainly present in the peripheral municipalities where there is abundant vegetation, and not in the center of town, where there is even a municipality that never reported the presence of this species up to now (Marquetti et al., 2008;

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Valdés et al., 2009; Pérez et al., 2014). The above indicates that in Cuba, as in other parts of the world, *Ae. albopictus* is typically more common in areas with presence of vegetation or in transitory environments with relatively low presence of vegetation and is coexisting with *Ae. aegypti* (Honorio et al., 2009; Camara et al., 2016; Bisset et al., 2017).

Ae. albopictus was restricted, until the beginning of this century, to the eastern hemisphere: the Indian subcontinent, Southeast Asia, China, Japan, Indonesia, and the islands in the Indian Ocean (Braks et al., 2004). *Ae. albopictus* spread from Asia by transcontinental shipping is largely a 20–21st century phenomenon (Benedict et al., 2007).

Several studies indicate that *Ae. albopictus* and *Ae. aegypti* can share the same habitat (Marquetti et al., 2008; Valdes et al. 2009), where invasion processes have led to sympatry of these species and competitive displacement of *Ae. aegypti* by *Ae. albopictus* (Nasci et al., 1989; O Meara et al., 1995; Kaplan et al., 2010) resulting in a patchy distribution (Braks et al., 2004; Rey et al., 2006; Higa et al., 2010). The geographic distribution of both species coincided in some areas in Asia, and West Africa, but was very different in areas such as Europe, East Africa, United States, and Australia. *Ae. aegypti* showed a markedly broader distributional potential across tropical and subtropical regions than *Ae. albopictus* (Kamal et al., 2008). *Ae. albopictus* abundance in its native range decreased in cities but not in rural areas upon the establishment of *Ae. aegypti* (Chan et al., 1971; Hawley 1988; Kay et al., 1995).

Conversely, the observations on the dispersion of *Ae. albopictus* in the southern coastal states of the United States indicates that its expansion seems to occur at the expense of *Ae. aegypti*; and it has been observed that *Ae. albopictus* introduction has been accompanied by a drastic and rapid decline in *Ae. aegypti* populations (Hornby et al., 1994; O'Meara et al., 1995; Juliano et al., 2004). Coexistence between *Ae. albopictus, Ae. aegypti* and *Culex quinquefasciatus*, and an evident displacement of *Aedes mediovittatus* by *Ae. albopictus* in the breeding sites has been demonstrated in a study in Havana (Marquetti et al., 2015).

Despite several probable explanations, both phenomena (coexistence and displacement) of competitive substitutions of *Aedes spp*. in several parts of the world still represent an ecological enigma. This knowledge about abundance and interspecific relationship between these species is essential, to be able to predict the role of each in the transmission of arboviruses. In this study we want to evaluate the dispersion and the behavior of *Ae. albopictus* in relation to houses and its association with other culicids in the province of Havana. It's an important piece of evidence to understand the epidemiology and transmission dynamics of the arboviruses.

2. Materials and methods

2.1. Study area

Havana is located in the 22°58′/ 23°10′ north latitude and 82°30′/ 82°06 west longitude, and belongs to the western region of Cuba. The hydrography is composed by the Almendares, Martín Pérez, Quibú, Cojímar and Bacuranao rivers, among other aquifer reservoirs. The climate of the city is tropical, as is the rest of the island, and there are two seasons: a rainy season between May and October and a dry season between November and April, with some possibility of rain due to the presence of cold fronts coming from the north. The province of Havana is administratively divided into 15 municipalities: Plaza de la Revolución, Habana Vieja, Centro Habana, Diez de Octubre, Cerro, Arroyo Naranjo, Boyeros, Playa, Marianao, La Lisa, Guanabacoa, Regla, Habana del Este, San Miguel del Padrón and Cotorro (Fig. 1).The city has a population of 2.1 million inhabitants (National Statistics Office of Cuba, 2011; Official Census, 2012).

2.2. Municipality classification

According to the urbanization characteristics and the geographical location in the province, the municipalities were categorized in three groups: the *peri-urban* group, which are the peripheral or peri-urban municipalities Guanabacoa, Arroyo Naranjo, Boyeros and Cotorro characterized by having borders with other provinces and a concentrated urbanization in one specific area of the municipality; a *mixed* group, which are the municipalities Playa, La Lisa and Habana del Este which have borders with other provinces but with a scattered urbanization throughout the municipality; and an *urban* group, which are the municipalities of San Miguel del Padrón, Regla, Plaza de la Revolución, Marianao, Habana Vieja, 10 de Octubre, Centro Habana and Cerro which have a high population concentration in their territory and are concentrated in the center and north (seaside) of the province surrounded by the municipalities of the other two groups. From now on, we refer to these three groups as 'urbanization groups'.

2.3. Entomological sampling

The routine *Aedes* control program in the province of Havana inspects all houses and all vacant lots on a monthly basis in the period 2010–2018, and on average, twice a month in the period 1995–1999. During these surveys, all water containing deposits are inspected for the

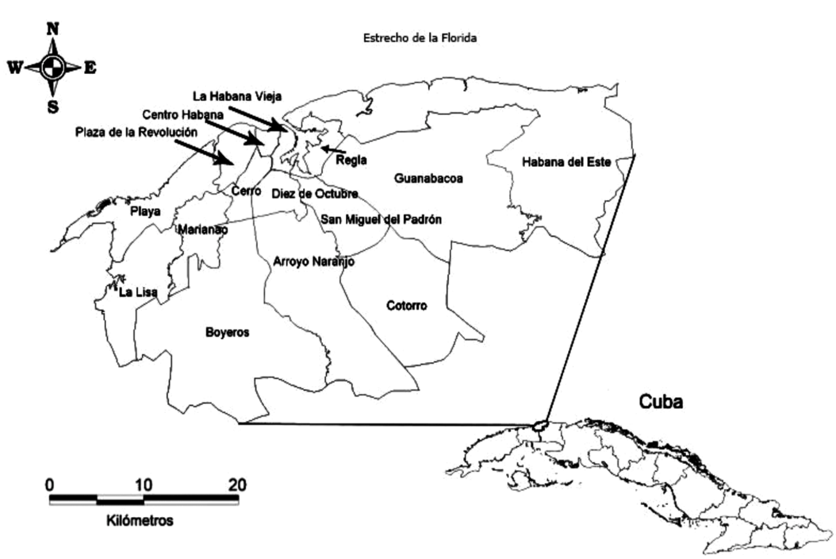

Fig. 1. Map of the municipalities in the province of Havana, Cuba.

presence of immature stages of the *Aedes* mosquito. Of every container positive for *Aedes*, larvae are collected and transported to the laboratory for species identification (dissociating *Culex, Ae. albopictus, Ae. aegypti*). For this study, we retrieved the data from these routine entomological surveys during two periods: the first period corresponded to 1995 – 1999 and the second to 2010–2018. The personnel from the national *Ae. aegypti* and *Ae. albopictus* control program in Cuba, carried out the sampling which forms part of their routine activities. House-level sampling methodology was used as recommended by the Cuban national program (Armada and Trigo 1981; MINSAP, 2012) and consisted in starting at the entry point of a house-block and continuing house after house so that each house is visited; upon arriving in the house, once the permission for sampling has been granted, starting in the yard in front of the house, to continue with the rooms, always keeping right and from the entry forward up to the back of the house. In case one cannot inspect a room, or a house is closed, this is duly noted and a re-visit is scheduled on another day. The data are collected in the established form of the program. The sampling effort is always the same, and did not differ over the two periods, except during outbreak periods when visits are on a more regular basis (up to twice a month-especially the case for the first period). The methodology didn't change between 1995 and 2018. It is part of the routine activities of the vector control teams of the national vector control program, where time is dedicated to entomological surveillance and vector sampling in all houses of the city on a monthly basis.

All types of deposits are reviewed (water storage recipients such as groundlevel tanks, buckets, elevated tanks, cisterns; small miscellaneous artificial deposits such as cans, knobs, bottles, animal drinkers, plastic cups; used car tires; drains and sewage pits, water registers; natural breeding such as tree holes, puddles, coconut shells). In Cuba, larvitraps (Valdés et al., 2018) are used for surveillance of *Ae. aegypti* and *Ae. albopictus* in all municipalities, except during periods of intensive chemical treatment carried out in reaction to increasing *Ae. aegypti* infestation.

2.4. Mosquito samples identification

Within the routine entomological surveillance activities, a sample is taken from each container being positive for mosquito larvae. This larval sample is placed in a vial with a label containing the necessary information about its location, and is subsequently identified using morphological keys for culicids (Pérez Vigueras, 1956; González, 2006). These samples are first identified in the laboratories at the municipal level and subsequently sent to the provincial laboratory for quality control of the morphological identification of mosquito species. Specimens collected and identified remain in this laboratory. The place in the domestic area, being inside or outside the house, was only recorded for *Ae. albopictus* in the period 2013 – 2018. A deposit was considered inside the house when it was located from the door inwards (living room, bedroom, kitchen, bathroom, dining room, etc.) and an exterior deposit was when it was located in the country yard, garden, vacant land, etc. The location of the containers with *Ae. albopictus* were known to be outside the houses (Valdés et al., 2009) and hence this information was not reported on the routinely used forms. During 2010–2013 no data are available on *Ae. albopictus* from the program.

2.5. Statistical analysis

The number of breeding sites where *Ae. albopictus* was detected was mapped over the two study periods. Of all *Ae. albopictus* breeding sites per study period, the relative importance per urbanization group was calculated. A descriptive analysis over time was done of the *Ae. albopictus* breeding sites on co-existence or not with other species, including the most important species with whom it was found to be associated. To evaluate the determinants of the presence of *Ae. albopictus* breeding sites, we constructed a generalized linear random effect regression model with a negative binomial link function. This model considered the nature of the data (repeated measurements in municipalities). We evaluated the effect of belonging to one of the two periods and belonging to a certain urbanization group on the yearly municipal number of *Ae. albopictus* breeding sites. For the periods separately, we also estimated the association between the number of *Ae. albopictus* breeding sites and the year (as a covariate) and urbanization group (as a factor). IBM SPSS statistics version 25 was used.

3. Results

The number of *Ae. albopictus* breeding sites per municipality and per year is shown in Fig. 2 and Table 1, where an increase in the number of *Ae. albopictus* positive municipalities and the number of *Ae.albopictus* sites over the years can be observed. Over the first five year after its introduction on the island, being 1995, *Ae. albopictus* was present in 10 of the 15 municipalities of the province of Havana. The yearly number of *Ae. albopictus* breeding sites in both periods is shown in Table 1. In this first period 1995–1999, besides the geographical expansion, we also see a statistically significant increase in the number of *Ae. albopictus* breeding sites over the years (adjusted OR of 2.05, with 95% CI (1.54–2.73)) and a dependance on the urbanization group: in comparison to the urban group, the mixed group had twice the risk of infestation (adjusted OR of 2.12, 95% CI (0.83–5.41)), and the peri-urban group a risk of five (adjusted OR of 5.65, 95% CI (1.92–16.64)). In the second period 2010–2018 the presence of *Ae. albopictus* increased up to 14 of the 15 municipalities, but the presence of breeding sites did not depend on the years (adjusted OR of 0.98, 95% CI (0.88–1.08)), but were more importantly associated with the urbanization groups: in comparison to the urban group, the mixed group had almost four times higher risk of infestation (adjusted OR of 3.74, 95% CI (1.15–12.20), and the peri-urban group a thirteen times higher risk (adjusted OR of 13.63, 95% CI (4.69–39.57)). *Ae. albopictus* was not detected in Centro Habana municipality during the two study periods.

Proportional (taking the total number of *Ae. albopictus* breeding sites in the entire municipality over each period as a denominator), the peri-urban group takes a bigger proportion of *Ae. albopictus* breeding sites in period two in comparison to period 1. In both other groups, there is a proportional decline over time (Fig. 3).

In the multivariable analysis, evaluating the risk factors associated with the annual numbers of Ae. albopictus breeding sites detected, the peri-urban municipalities have a 10 times higher risk of infestation than the urban ones, and there is also a clear increased risk in the second period in comparison to the first period (Table 2).

Aedes albopictus breeding sites can be divided into sites with exclusive *Ae. albopictus* and sites where a mix of culicids can be found. In Fig. 4 (Fig. 4), one can observe the heterogeneity of this co-breeding over municipalities in the second study period. In the multivariable model, we found a statistically significant association between exclusive *Ae. albopictus* breeding sites and the second period (adjusted OR 1.64, 95%CI (1.09–2.46)) and with the mixed urbanization group (adjusted OR 2.28, 95% CI (1.43–3.63).

In the mixed breeding sites, we see an increased association of *Ae. albopictus* with *Ae. aegypti* in the second period that was accompanied by a decrease in the association with *Ae. mediovittatus* (Fig. 5). In general, an increase in the association between *Ae. albopictus* and *Ae. aegypti* in the period 2010–2020 reached a greater association in the urban area. On the contrary, in the first period a greater association with *Ae. mediovittatus* in the suburban area and a lower association in the urban area was observed. The association with *Cx. quinquefasicatus* and the group of other species did not show considerable changes. This increase of association with *Ae. aegypti* is a general phenomenon and has an increasing trend over the years (Fig. 5). *Culex nigripalpus, Ochlerottatus scapularis, Psorophora confinnis, Culex corniger* and *Anopheles albimanus* were the species found associated with *Ae. albopictus* in the category of other associations.

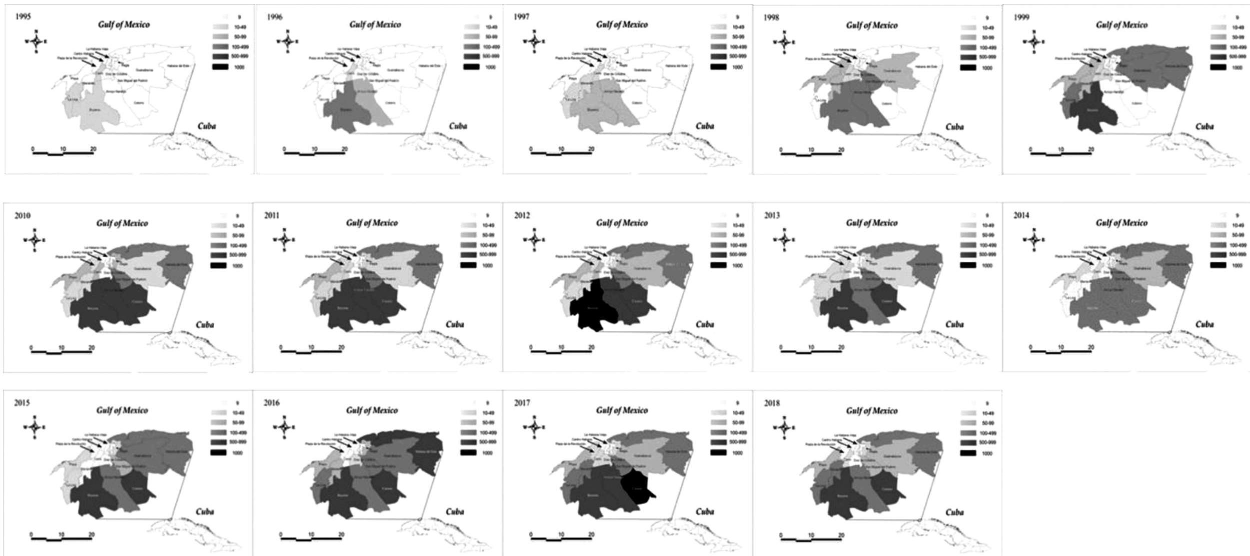

Fig. 2. Annual number of *Ae. albopictus* breeding sites detected per municipality, province of Havana, 1995–1999 and 2010–2018.

Table 1
Total number of breeding sites detected with *Ae. albopictus* presence in the province of Havana, Cuba, study periods 1995–1999 and 2010–2018.

Years	Total of Breeding sites	*Ae. albopictus* breeding site types			
		Water storage containers	Small artificial containers	Naturals	Larvitraps
1995	93	17	69	2	5
1996	260	15	221	18	6
1997	203	20	157	16	10
1998	984	115	602	36	231
1999	1 699	166	1 168	12	353
Subtotal Period 1995–1999	**3 239**	**333**	**2217**	**84**	**605**
2010	3 194	603	1 706	26	859
2011	3 134	667	1 813	34	620
2012	3 466	849	1 917	14	686
2013	1 993	446	1 039	7	501
2014	1 912	470	992	32	418
2015	2 032	552	1 095	6	379
2016	3 332	839	1 801	9	683
2017	3 599	1 004	1 749	32	814
2018	2 821	849	1 385	12	575
Subtotal Period 2010–2018	**25 483**	**6 279**	**13 497**	**172**	**5 535**
TOTAL	28 722	6 612	15 714	256	6 140

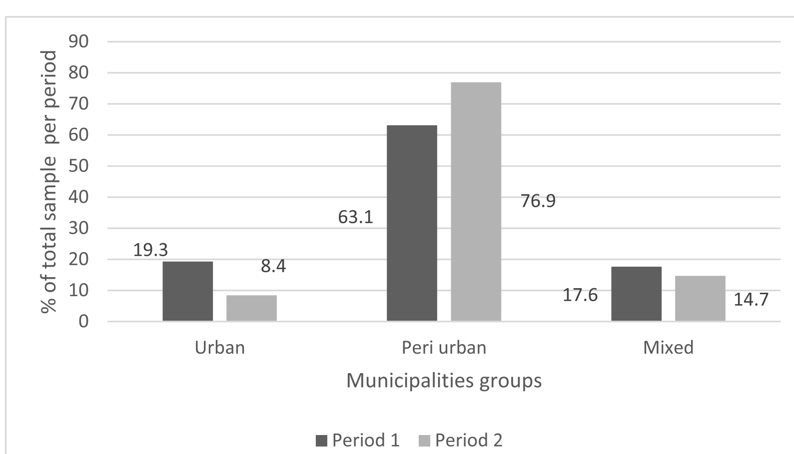

Fig. 3. Proportion of total *Ae. albopictus* breeding sites detected per urbanization group, per study period 1995–1999 (1) and 2010–2018 (2), province of Havana, Cuba,.

Table 2
Factors associated with *Ae. albopictus* breeding sites, province of Havana, study periods 1995–1999 and 2010–2018.

Factors	Adjusted OR (95% CI)
Urbanization group	
Urban (reference)	1
Mixed	3.18 (1.24–8.13)
Peri-urban	10.32 (4.17–25.56)
Study Periods	
Period 1 (reference)	1
Period 2	3.08 (2.02–4.70)

The number of *Ae. albopictus* breeding sites inspected during 2013–2018 were categorized to be inside or outside the house/premise (Fig. 6). In this period, there is an important proportion, ranging from 8% to 21.5%, of *Ae. albopictus* breeding sites that can be found inside the houses, while there was only a report of outside breeding sites in the first period. The containers with *Ae. albopictus* presence inside the house belonged to water storage tanks and artificial containers used in the kitchen such as buckets and basins. The outside/inside proportion remains relatively stable over the second study period, which evidences an initial domiciliation of the species.

4. Discussion

This study represents an analysis of *Ae. albopictus* behavior from its first registration in Havana, 1995, up to 2018. It highlights results on its dispersion and initial evidence of their domiciliation in the last years. There is a sustained increase in the number of *Ae. albopictus* breeding sites shared/mixed with *Ae. aegypti*, known dominant species in the urban ecosystem in the province of Havana (Bisset et al., 2017).

A limitation of this study is that surveillance data from the routine *Ae. aegypti* and *Ae. albopictus* Control Program were used. This program carried out control measures such as the use of Temephos (Abate) and Bactivec® (*Bacillus thuringiensis* H-14) permanently in water containers detected by vector control teams during their monthly inspection of homes, workplaces and vacant lots. The inspection frequency is generally monthly but sometimes the frequency is increased up to 11-days surveys in case of high *Ae. aegypti* infestation or epidemiological alerts. These variations are the same for all municipalities; hence no differential impact is expected.

Aedes albopictus expanded geographically from 2010 to 2018 to 14 of the 15 municipalities of the province of Havana, which shows, in addition to its introduction, its dispersal power. It should be noted that in the first years of its introduction (1995–1997) an attempt was made to eliminate *Ae. albopictus* mainly through chemical measures, but the objective was, obviously, not achieved. This could be due to various factors such as those of an operational nature in the control carried out (being more targeted to indoor spaces, where the main *Ae. aegypti* breeding sites are localized) or due to ignorance about *Ae. albopictus* insecticide susceptibility and/or resistance status (Marquetti et al., 2015). On the other hand, different authors argue that the control of *Ae. albopictus*, in particular, is excessively difficult by living often far from the dwellings which implies a more extensive coverage needed than for *Ae. aegypti* (Jardina, 1990).

The scanty presence of *Ae. albopictus* in the municipalities Habana Vieja and Diez de Octubre and their absence during the study period in Centro Habana can be explained by the lack of areas with abundant vegetation in these urban municipalities. The presence of vegetation is important for this mosquito, since it has been shown that it is rarely found in rural areas where vegetation is eliminated (Braks et al., 2003).

However, research on the presence of *Ae. aegypti* and *Ae. albopictus* in urban areas has shown the dispersion capacity of these species by mark-release-recapture techniques. These studies demonstrated that on the contrary to the existing dispersion concepts, both species showed high flight ranges (Muir et al. 1998; Vavassori et al., al.,2019), where A*e. albopictus* females and males may actually fly beyond 1 km (Maciel de Freitas et al., 2006; Medeiros et al., 2017). Flight performance experiments under laboratory conditions found that well-nourished females even fly as far as 8.6 km without taking another sugar- or blood meal (Kaplan et al., 2010). These aspects (flight range and search for host food sources) could have favored the dispersal of this species in the strata sampled in the province of Havana.

The effect of the increased urbanization over the study period was not taken into account due to lack of standardized information. It is known that *Ae. aegypti* is abundant in urban areas and *Ae. albopictus* in

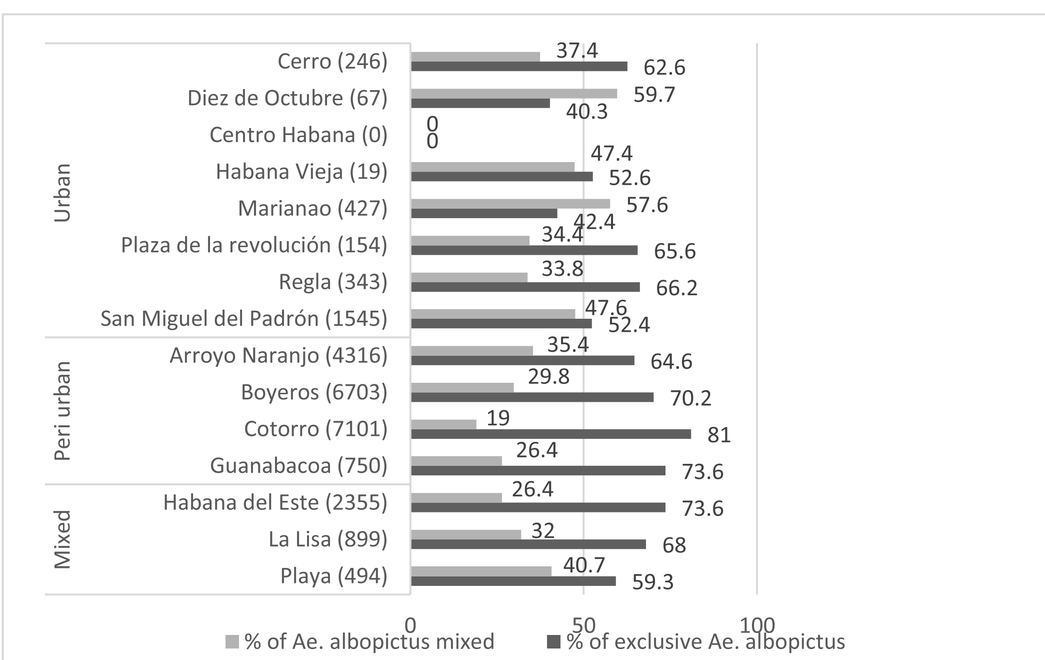

Fig. 4. Percentage of exclusive and mixed - with other culicids - *Ae. albopictus* breeding sites by municipality, province of Havana, 2010–2018 (total number of *Ae. albopictus* breeding sites per municipality as denominator in each line).

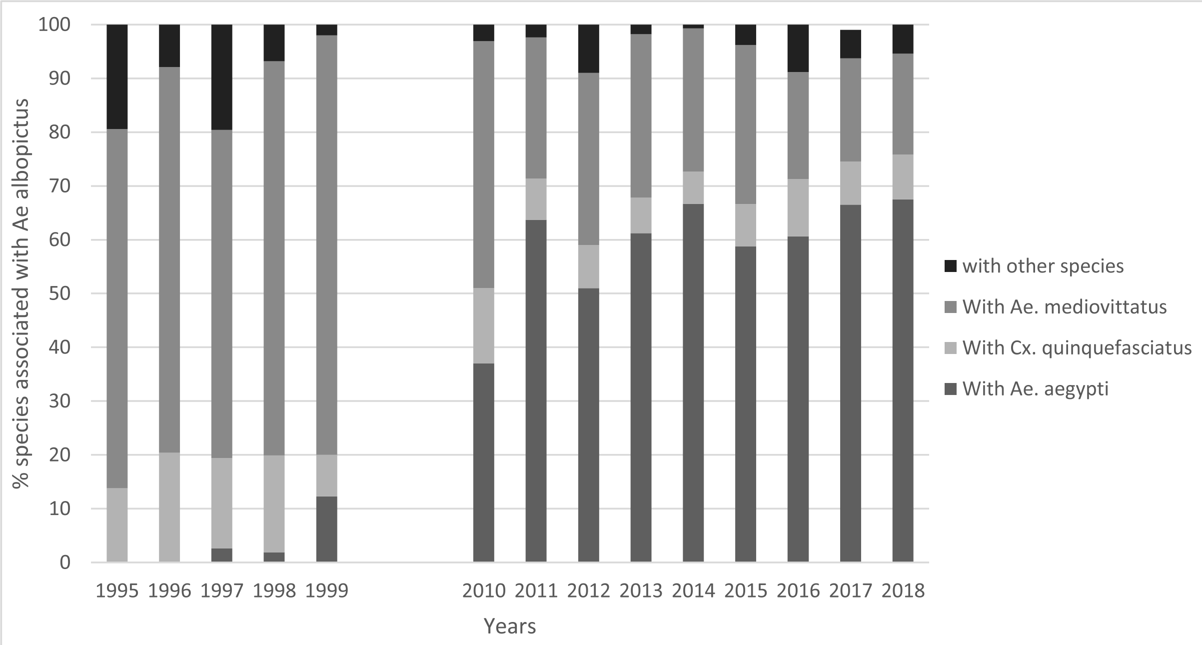

Fig. 5. Species association in the mixed *Ae. albopictus* breeding sites per year, province of Havana, study period 1995–1999 and 2010–2018.

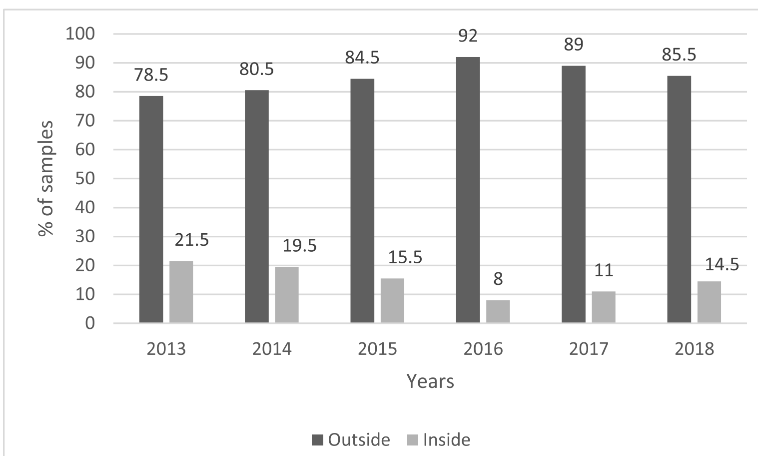

Fig. 6. Proportion of *Ae. albopictus* breeding sites outside and inside the premises, province of Havana, 2013–2018.

rural areas, but that both can coexist in semi-urban areas (Marquetti et al., 2008), breeding in artificial and natural breeding sites. They can even be found in slightly polluted waters (Nguyen and Chow, 1974) – a preferred breeding site of *Cx. quinquefasciatus* – or in used car tires (Valdés et al., 2009; Burke et al., 2010; Utomo and Triwibowo et al., 2016; Allgood and Yee, 2017).

Ae. mediovittatus the other species with one of the highest associated percentages is mainly present in the Caribbean area with preference for rearing in tree holes (González, 2006; Barrera et al., 2012). During the intensive phase of vector control in Cuba in 1981– heavily dependent on insecticides -, the presence of *Ae. aegypti* was drastically reduced in the urban ecosystem which favored an increase in the presence of *Ae. mediovittatus* (Castillo et al., 2014; Bisset et al., 2017), subject to strong pressure and where in recent years it has been displaced by *Ae. albopictus* (Marquetti et al., 2015).

No similar patterns were found regarding the number of exclusive *Ae. albopictus* breeding sites in the province, mostly found in the peri-urban municipalities (Boyeros, Cotorro, Guanabacoa and Arroyo Naranjo) followed by Habana del Este and La Lisa belonging to mixed urbanization group, while the urban municipalities presented the highest number of mixed *Ae. albopictus* breeding sites with other culicids.

Studies conducted with *Ae. aegypti* and *Ae. albopictus* showed that the last one has a greater longevity in adult phase at different temperatures and humidity, which determined the influence of these climatic factors on the geographical species distribution (Schmidt et al., 2018). Such parameters favor the occurrence of microclimates in certain areas of the province of Havana, such as areas with greater vegetation in peri-urban and vegetative patches mainly within urban areas creating appropriate conditions for a greater presence of *Ae. albopictus* exclusively or in coexistence with other species.

Coexistence between *Ae. aegypti* and *Ae. albopictus* could also be favored under the Cuban conditions of strong insecticide pressure, to which the *Ae. aegypti* populations are subjected from 1981 up to today in Havana (Bisset and Marquetti, 1983; Bisset et al., 2017). The finding of *Ae. albopictus* in breeding sites inside the houses, although in an incipient but stable way, indicate towards an initiation of the domiciliation of the species.

It is known that there is satyrization between both species where the male of *Ae. albopictus* mates with the female *Ae. aegypti* resulting in a descendant of permanent sterilization in females resulting from this crossing and influencing the displacement of one species by another (Bargielowski and Lounibos, 2016; Honório et al., 2018), However, a 15-year study in Rio de Janeiro, Brazil (Ayllon et al., 2018) suggested that the two species can achieve relative coexistence in the absence of strong competitive displacement by *Ae. albopictus* males for mating with *Ae. aegypti* females suggesting the low potential of satyrization and the lack of displacement between both species for these reasons (Honorio et al., 2009). On the other hand, another Brazilian study showed that even with high seasonal densities the effects of interspecific competition with *Ae. aegypti* was not enough to displace *Ae. albopictus* (Camara et al., 2016).

In Cuba, there is only evidence of satyrization between *Ae. aegypti* and *Ae. albopictus* at the laboratory level (Martínez et al., 2014). At the field level, it was determined that until 2012 only one coexistence between both species could be demonstrated (Marquetti et al., 2015), a result that we continue to support in this study until 2018. We do not doubt that the Cuban populations of these species exhibit the same behavior, as observed in Brazil in terms of satyrization, although in the Cuban situation there is an important difference of an influencing condition, namely the maintained chemical control with the use of Temephos in the water-holding containers in the houses. This last indication whose objective is to control *Ae. aegypti* populations in Havana until now has not avoided that this species continuing to be the dominant species in the urban ecosystem of this province in Cuba.

The results obtained in this work show, however, an initiation of domiciliation of *Ae albopictus* in the province of Havana endorsed by the increase in breeding sites shared with *Ae. aegypti* over time and by the relatively stable trend of the indoor presence of this mosquito.

These findings together with results obtained by other authors about the ability of *Ae. albopictus* gravid females to disperse at least 800 m (Honorio et al., 2003; Lourenço de Oliveira et al., 2004; Marquetti et al., 2019), in addition to easily moving from areas with abundant vegetation to the urban area and the finding of this species in urban area (Lourenço de Oliveira et al., 2004; De Oliveira et al., 2019), we consider it important to alert the National Control Program to strengthen the entomological monitoring of *Ae. albopictus*. The follow-up of this domiciliation is important to guide control efforts, knowing its role as a vector of different arboviruses (MINSAP, 2019).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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