SHORT REPORT: APPLICATION OF AN ALTERNATIVE AEDES SPECIES (DIPTERA: CULICIDAE) SURVEILLANCE METHOD IN BOTUCATU CITY, SÃO PAULO, BRAZIL

LETÍCIA A. NOGUEIRA, LETÍCIA T. GUSHI, JOÃO E. MIRANDA, NEWTON G. MADEIRA, AND PAULO E. M. RIBOLLA*

Laboratório de Entomologia Molecular, Departamento de Parasitologia, Instituto de Biociências, Universidade Estadual Paulista, Botucatu, São Paulo, Brazil; Equipe de Controle de Zoonoses, Secretaria Municipal de Saúde, Botucatu, São Paulo, Brazil

Abstract. One of the main problems with dengue is the control of *Aedes aegypti*, its major vector. In Brazil, the current control program for *Ae. aegypti* and *Aedes albopictus* populations includes larval density surveys. An interesting alternative is the use of a distinct index, the Premise Condition Index (PCI). This tool relates conditions of property, such as houses and yards, and the degree of shade with the occurrence of *Aedes* sp. oviposition, and is calculated as scores from 3 to 9. The lowest score indicates property in good condition and an unfavorable breeding environment, while the highest score indicates property at high risk for infestation by *Aedes* sp. The present study is based on the application of the PCI in an urban area of Botucatu, Brazil to confirm its effectiveness.

Dengue is the most important vector-borne viral disease in tropical countries, with at least 100 million cases reported each year. In Brazil, infection by the dengue virus has increased significantly in the last two decades after the introduction of mosquito vector *Aedes* (Stegomyia) aegypti (L.). Sympatric presence of *Ae. aegypti* and *Aedes* (Stegomyia) albopictus (Skuse) generates a new problem for dengue epidemiology. *Aedes albopictus* was first observed in Brazil in 1986, in the states of Espírito Santo, Minas Gerais, Rio de Janeiro, and São Paulo. Currently, this species is found in several states in this country. In some municipalities of Minas Gerais that reported *Ae. aegypti* in previous years, health workers have observed that *Ae. albopictus* is now the principal mosquito species. *Aedes albopictus* dissemination is due mainly to the international shipping trade of used tires, which provides an ideal mechanism for passive dispersion of immature stages.

The presence of *Ae. albopictus* is a serious public health problem. First, it plays an important role in the transmission of several arboviruses and its susceptibility to these viruses is higher than that of *Ae. aegypti*. Second, the species maintains the possibility of vertically transmitting serotypes 2 and 3 of the dengue virus naturally. Additionally, the mosquito shows aggressive anthropophilic behavior and a great adaptability to different habitats. This success is perhaps due to extreme variation in its adaptive traits, such as diapause and hardiness to cold temperatures.

Epidemiologic surveillance associated with vector control remains the only way to prevent dengue outbreaks since an effective vaccine is not available. Surveillance is conducted by the determination of different indices that take into account the number of immature and mature forms of the mosquito. In Brazil, the current control program applied by the National Health Foundation/Ministry for Health for *Ae. albopictus* and *Ae. aegypti* populations is a set of concomitant and integrated epidemiologic surveillance, vector elimination, and social, environmental, and medical assistance. There are many problems that compromise the reliability of entomologic surveys. To obtain these indices, it is necessary to enter houses. In localities with ≥ 5,000 houses, 10% need to be surveyed (National Health Foundation, 2001). These methodologies require time, money, and trained personnel. However, it is occasionally difficult to enter houses, which decreases the significance of the index.

An interesting alternative is the use of a distinct index known as the Premise Condition Index (PCI). This tool relates the condition of property, such as the house and the yard, and the degree of shade, to the occurrence of *Aedes* sp. oviposition. The calculation of the PCI is achieved by the association of the three property variables (house, yard, and shade) calculated in scores from 3 to 9. The lowest score indicates property in good condition and an unfavorable breeding environment, while the highest score indicates property at high risk for infestation with *Aedes* sp. The present study tested this instrument in an urban area of Botucatu, Brazil to confirm its effectiveness.

With the assistance of the Municipal Secretary for Health of Botucatu, we divided the city into 105 quadrants that covered its entire area. Houses (one per quadrant) were randomly chosen at the time of the visit. House conditions were recorded according to data from the PCI. This tool relates the condition of property, such as the house and the yard, and the degree of shade, to the occurrence of *Aedes* sp. oviposition. The PCI is calculated as the association of the three property variables (house, yard, and shade) calculated in scores from 3 to 9. The lowest score indicates property in good condition and an unfavorable breeding environment, while the highest score indicates property at high risk for infestation with *Aedes* sp. The present study tested this instrument in an urban area of Botucatu, Brazil to confirm its effectiveness.

* Address correspondence to Paulo E. M. Ribolla, Departamento de Parasitologia, Instituto de Biociências, Universidade Estadual Paulista, Botucatu, São Paulo, Brazil. E-mail: pribolla@ibb.unesp.br

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was a positive correlation (r = 0.9684, P < 0.01) between house condition and percentage of positive houses, which clearly showed the usefulness of this method.

This preliminary analysis has demonstrated the accuracy of the PCI method, since most of the *Aedes* sp. were observed in properties with the highest PCT scores. Larval surveys conducted inside the same houses at the time of the PCT survey showed that 72% of the larva-positive houses were also positive for eggs. Only 4% of the houses had positive results in the larval survey, but were negative for the presence of eggs.

Ovitraps have been successfully used for detection of *Aedes* sp. in many countries. In Brazil, superior performance has been shown in comparison to larval surveys. Braga and others showed that that in 2,944 houses inspected, 7.5% were positive by larval survey while 25.1% were positive by ovitraps. Thus, to determine the degree of infestation of this vector in the city, the trap method was used in our study. Unexpectedly, the predominant mosquito was *Ae. albopictus*, not *Ae. aegypti*.

*Aedes albopictus* was found all over the city, including the downtown (urban) area. This is an important finding for municipal epidemiology because *Ae. albopictus* has been shown to maintain a dengue epidemic. Although it is not considered important in virus transmission to humans, this species is able to sustain the virus in nature due to high rates of transovarian transmission.

This reinforces other hypotheses that the virus in semi-rural, rural, and forest areas could be sustained by a vector more efficient than *Ae. aegypti* by combining transovarian transmission and periodic presence in human and primate populations.

The present study showed the effectiveness of the PCI because worse conditions in houses showed a higher correlation with the presence of *Aedes* mosquitoes than in well-maintained houses. However, further studies should be undertaken to improve the technique, essentially to obtain a clearer distinction between intermediate and high PCI scores. Gómez and others also tested the PCI and showed its accuracy with other factors related to mosquito breeding. This does not mean that if sufficient resources are available, houses with lower PCI scores should be neglected. However, it does provide guidelines for locating houses that have been shown to contain most of the eggs. The major advantage of the PCI is that it offers a rapid assessment method for selecting houses for survey. Conversely, the PCI method requires specific training of health workers, since estimation of index properties is reasonably subjective. In the case of dengue outbreaks, by having all representative house indices of the region, it will be much easier and less expensive to control the epidemic.

### Table 1

<table>
<thead>
<tr>
<th>House condition*</th>
<th>Number of houses surveyed</th>
<th>Positive houses (egg presence)</th>
<th>Positive houses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>21</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td>Good</td>
<td>13</td>
<td>5</td>
<td>38</td>
</tr>
<tr>
<td>Regular</td>
<td>19</td>
<td>10</td>
<td>52</td>
</tr>
<tr>
<td>Bad</td>
<td>18</td>
<td>11</td>
<td>61</td>
</tr>
<tr>
<td>Worst</td>
<td>34</td>
<td>22</td>
<td>65</td>
</tr>
</tbody>
</table>

* Houses were grouped conforming their premise condition index (PCI): excellent (PCI = 3 and 4); good (PCI = 5); regular (PCI = 6); bad (PCI = 7); worst (PCI = 8 and 9).

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Authors’ addresses: Leticia A. Nogueira, Leticia T. Gushi, Newton G. Madeira, and Paulo E. M. Ribolla, Laboratório de Entomologia Molecular, Departamento de Parasitologia, Instituto de Biociências, Universidade Estadual Paulista, PQ Box 510, 18618-000, Botucatu, São Paulo, Brazil; João E. Miranda, Equipe de Controle de Zoonoses, Secretaria Municipal de Saúde, Rua Major Matheus, 07 Vila dos Lavradores, 18609-083, Botucatu, São Paulo, Brazil.

Reprint requests: Paulo E. M. Ribolla, Departamento de Parasitologia, Instituto de Biociências, Universidade Estadual Paulista, Botucatu, São Paulo, Brazil. Telephone: 55-14-3811-6239, Fax: 55-14-3811-6239. E-mail: pribolla@ibb.unesp.br.

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