

Twenty-eight years of *Aedes albopictus* in Brazil: a rationale to maintain active entomological and epidemiological surveillance

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ABSTRACT

Introduction: *Aedes albopictus* was first detected in Brazil in 1986. This mosquito species presents a major threat to public health because Brazilian populations have shown substantial vector competence for arboviruses such as dengue and chikungunya. **Methods:** We updated the records of *Ae. albopictus* in several States of Brazil, focusing on areas in which its presence had been reported after 2002. **Results:** Twenty-eight years after its arrival in Brazil, *Ae. albopictus* has been detected in 24 of 27 States. **Conclusions:** The rapid spread of this species and its high vector competence demonstrate the danger of *Ae. albopictus* in Brazil.

Keywords: *Aedes albopictus*. Update. Brazil.

Aedes albopictus (Skuse 1894) originated in Southeast Asia, where it is implicated in the transmission of the dengue virus in several countries⁽¹⁾. The spread of *Ae. albopictus* to Europe, Africa, and the Americas has raised major public health concerns as this species is not only an important vector for the dengue virus, but may also transmit other arboviral infections, such as yellow fever, chikungunya, and several encephalitides⁽²⁾. *Aedes albopictus* has a broad distribution in tropical as well as temperate countries⁽¹⁾, even more so than *Aedes aegypti* (Linnaeus 1762).

In Brazil, *Ae. albopictus* has not yet been incriminated as a dengue vector, although it has been shown, under artificial conditions, that Brazilian populations of this species are capable of being infected with the dengue virus, and successfully transmitting it⁽³⁾. Recently, under laboratory conditions, Brazilian populations of *Ae. albopictus* have also shown high vector competence for the chikungunya virus, reinforcing the importance of entomological and epidemiological surveillance of this mosquito species in Brazil⁽⁴⁾.

Aedes albopictus was first recorded in Brazil in 1986. It occurred in the southeast of Brazil, in the State of Rio de Janeiro, with 6 females and 5 males of this species confirmed from specimens collected at Rodovia Rio-São Paulo, Km 47⁽⁵⁾. In the same year, 3 larvae of *Ae. albopictus* were identified in the

State of São Paulo, in the Areias municipality⁽⁶⁾. Within a few years, *Ae. albopictus* had been recorded in all four southeastern States of Brazil⁽¹⁾.

The first record of *Ae. albopictus* in southern Brazil occurred in the State of Paraná in 1996⁽⁷⁾. Females of this mosquito species were captured in the City of Curitiba using human bait⁽⁷⁾.

In December 1997, during the routine activities of the Brazilian Dengue Control Program in Mato Grosso do Sul in west-central Brazil, fourth stage larvae (n = 3) and pupae (n = 5) of *Ae. albopictus* were collected from a tree hole in the municipality of Douradina⁽⁸⁾.

In April 2002, employees of the Brazilian Dengue Control Program detected *Ae. albopictus* larvae in larvitrap in the municipality of Medicilândia, Pará, in northern Brazil. This was the first record of *Ae. albopictus* in the State of Pará. One month later, 42 adult (23 males and 19 females) *Ae. albopictus* were captured with human bait during the morning hours⁽⁹⁾.

The distribution of *Ae. albopictus* in Brazil was described in 2003, where 7 of its 27 states had not registered the presence of this mosquito species: Acre, Amapá, Ceará, Piauí, Roraima, Sergipe, and Tocantins⁽¹⁰⁾. Slightly more than 10 years later, this situation has changed: *Ae. albopictus* has now also been detected in Ceará, Tocantins, Roraima, and Piauí (**Figure 1** and **Table 1**).

Between January and July 2005, the Brazilian Dengue Control Program of the State of Ceará, in northeastern Brazil, collected *Aedes* eggs during routine field activities. After eclosion, the immature mosquitoes were raised in the laboratory to the adult stage. In one neighborhood of the City of Fortaleza, Montese, 13 *Ae. albopictus* adults were reared from eggs collected in domestic and peridomestic areas - the first report of this species in Ceará⁽¹¹⁾. It is important to note that in the

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FIGURE 1 - Brazilian States that recorded *Aedes albopictus* during 1986-1990 (light grey: Rio de Janeiro, São Paulo, Minas Gerais, and Espírito Santo), 1991-2002 (dark grey: Amazonas, Rondônia, Pará, Goiás, Distrito Federal, Mato Grosso do Sul, Maranhão, Paraíba, Rio Grande do Norte, Pernambuco, Alagoas, Bahia, Paraná, Santa Catarina, and Rio Grande do Sul), 2003-2014 (black: Ceará, Tocantins, Roraima, and Piauí), and those with no record (white: Acre, Amapá, and Sergipe).

same city, serotypes DENV-2 and DENV-3 were recently isolated from pools containing *Ae. albopictus* females deprived of having a blood meal; this demonstrates the occurrence of vertical transmission of the dengue virus among this population⁽¹²⁾.

Aedes albopictus was found for the first time in the State of Tocantins, in northern Brazil, between January and February of 2006, during entomological surveillance for *Ae. aegypti* in the municipality of Mateiros. One larva and three *Ae. albopictus* pupae were identified⁽¹³⁾.

In June 2006, *Ae. albopictus* was found for the first time in the State of Roraima, in the capital Boa Vista, where two pupae of *Ae. albopictus* were collected during the Brazilian Dengue Control Program. In November of the same year, another pupa was collected, and in May 2007, 10 larvae of this species were collected in 3 neighborhoods of Boa Vista: Araceli Souto Maior, Cinturão Verde, and Pricumã⁽¹⁴⁾.

Aedes albopictus was detected in the State of Piauí during annual larval surveys conducted during 2007-2014. Data were collected using a house-to-house larval survey (Larval Index) and the "Rapid Assessment of Infestation by *Aedes aegypti*" (LIRaA)⁽¹⁵⁾.

The rapid geographical spread of *Ae. albopictus* in different continents was thought to have only minimal consequences for humans, because this mosquito species has been considered

TABLE 1 - First record of *Aedes albopictus* in eight of Brazil's States.

State	Year	Stage of life cycle
Rio de Janeiro ⁽⁵⁾	1986	adult
São Paulo ⁽⁶⁾	1986	larvae
Paraná ⁽⁷⁾	1996	adult
Mato Grosso do Sul ⁽⁸⁾	1997	larvae and pupae
Pará ⁽⁹⁾	2002	larvae and adult
Ceará ⁽¹¹⁾	2005	eggs
Tocantins ⁽¹³⁾	2006	larvae and pupae
Roraima ⁽¹⁴⁾	2006	larvae and pupae

to have a relatively low capacity to transmit pathogens. *Aedes albopictus* is considered exophilic, exophagic, and common in rural and vegetated suburban areas in Brazil⁽¹⁾. Nevertheless, it can bloodfeed on different vertebrate hosts besides humans and, owing to its opportunistic feeding behavior, may serve as a bridge vector for the transmission of emerging viruses, such as yellow fever, between wild and domestic animals and humans⁽¹⁰⁾.

The dengue and chikungunya arboviruses are commonly transmitted by the same mosquito vectors: *Ae. aegypti* and *Ae. albopictus*. The latter species rapidly spread through Brazil, such that only three States have not yet registered its presence. The rapid spread of *Ae. albopictus*, in conjunction with the high vector competence of Brazilian populations of this species to the dengue and chikungunya arboviruses⁽³⁾⁽⁴⁾ confirm its threat to the population of Brazil.

It is important to note that most records of *Ae. albopictus* in Brazilian states occurred during entomological surveillance, which involves the regular monitoring of existent, or potential, mosquito vectors of human disease. Therefore, it is extremely important to maintain entomological and epidemiological surveillance and/or control of *Ae. albopictus* in all municipalities of all Brazilian States, in order to minimize future arbovirus outbreaks.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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