

Editorial

The Contradictory Slogan of the Ministry of Health against *Aedes aegypti* in Brazil: How a Mosquito can “Bite” an Entire Country?

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Facing epidemics of dengue, chikungunya and now the feared zika virus, the Ministry of Health in Brazil launched the campaign “a mosquito cannot be stronger than an entire country”. The campaign aims to draw population’s attention to avoid leaving stagnant water, where *Aedes aegypti*, vector of these arboviruses, may lay eggs. However, the slogan does not correspond to Brazil’s reality, since the country has registered more than 100,000 cases of dengue this year. Furthermore, cases of zika fever have been reported in 21 of the 26 states of the Brazilian Federation [1]. These numbers reveal how vulnerable the country can be for diseases transmitted by *Aedes aegypti* and emphasize the inefficiency of the mosquito control in the country.

Recently, the government announced the release of about US\$ 550 million to control *Aedes aegypti* [2]. Currently, the mosquitoes’ control strategy relies mainly in chemicals, such as larvicidae, ovicidal and adulticide, and mechanical/environmental control, which aim the larval habitat elimination [3]. Nevertheless, other techniques like transgenic mosquitoes, Sterile Insect Technique (SIT) [4] and biological control [5] are being employed or quoted to be used as alternatives for control. Referring to genetically modified mosquitoes, the male containing a lethal gene are produced in lab and released in field. In copulating with wild females, the males transmit the gene to the offspring, which precludes the development of the females. In the case of SIT, males are sterilized through radiation and then, released in field. As in mosquitoes’ life cycle, females copulating only once, as for, wild females that copulate with the sterile male will be unable to produce offspring. In ideal conditions both techniques could lead to a decrease in *Aedes aegypti* populations. The biolarvicidal *Bacillus thuringiensis israelensis* also has been used, mainly in locations with recipients that have potential to accumulate water. This bacterium produces toxins that are lethal to the mosquitoes’ larvae. Currently, the trend is the integration of all these methods to potencialize the efficiency during control. What can explain, that despite all these efforts, mosquito population is still increasing?

An important aspect to be considered as successful for the establishment of *Aedes aegypti* in Brazil is the mosquito biology itself.

The oviposition is an example about how the mosquito adapts to environment. In the first place, females of this species spread their eggs in several spots, raising the chances of the offspring’s viability. The eggs are laid in the walls of artificial recipients and undergo mandatory diapauses and they are resistant to dryness. When the eggs get in contact with water, the immature hatch and develop, going through four larval and a pupal stage until the adult emerge. After the egg hatching, in favorable environmental conditions, the development of mosquitoes into the adult stage may take a period of 10 days. The capacity of mosquito to use artificial recipients in oviposition is intrinsically linked to the adaptability of *Aedes aegypti* to urban environment and raises an important issue in the country: the recycling collection and disposal in Brazil.

Presently, Brazil has a Law No. 12.305, of August 2nd, 2010, establishing the National Solid Waste Police (PNRS), which determines that all municipalities of the country should submit a plan for solid waste management. However, 209,280 tons of waste that is produced daily, only 58.26% get to the appropriate destination [6]. Speaking about recycling, approximately 60% of the counties present some kind of recycling initiative. Annually, Brazil discards about 17 million tires, which are suitable breeding for *Aedes aegypti* [7]. What would be the destiny of all this litter and recycling? Most end up in open dumps, vacant lots, or frequently in the streets, which means, potential larval habitats for mosquitoes. The problem is not limited only by the inability of the government in the garbage and recycling management, but also by the lack of conscious and knowledge of the population. Day-after-day, cans, all kinds of plastic bags, plastic bottles, glass bottles, are dumped in the streets. Although the main larval habitats of the *Aedes aegypti* are in large water reservoirs, such as water tanks, gallons and barrels, it is undeniable that small recipients are also important for the mosquito’s life cycle.

Therefore, it is not enough to invest only in modern and new technologies to control *Aedes aegypti*, if the country fails in providing basic infrastructure. In order to improve mosquitoes’ control, Brazil also requires massive investments in sanitation, recycling, garbage destination, adequate housing, among others. If this does not happen, the mosquito will definitely remain stronger than the country and the solution for diseases as dengue fever, chikungunya and zika will depend on the vaccine development, and not of the mosquito control.

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