



***Aedes aegypti* and the Zika virus: Symptoms of a wider problem**

The Entomological Society of America (ESA) and Sociedade Entomológica do Brasil (SEB) held a Summit in Maceió, Alagoas, Brazil on 13 March 2016 to discuss the research and implementation knowledge gaps in current approaches to managing the *Aedes aegypti* (*Ae. aegypti*) crisis in the Americas. The one-day meeting brought together more than 60 researchers, public health officials, entomologists, vector control experts, and representatives from nongovernmental organizations (NGOs) and other agencies for a day of plenary talks, breakout sessions, panel discussions, and other presentations on the topic of establishing a sustainable and effective level of control for *Ae. aegypti*, which is known to carry dengue, chikungunya, yellow fever, and more recently the Zika virus. **The primary objective of the Summit was to convene many of the major knowledge leaders involved in the research and control of this insect and identify immediate steps needed to create long-term and sustainable solutions.**

The key findings are:

Connecting science to communities:

While critical gaps unarguably exist, the magnitude of the public health threat presented by this mosquito species and the basic knowledge needed to control it are well understood. The real issue is that there are barriers to implementation of control programs that are difficult to overcome, as they involve political, educational, social and economic issues rather than purely scientific issues.

Vector-borne diseases are often symptomatic of wider societal problems. The biology of *Ae. aegypti* is well understood. We know that it feeds almost exclusively on humans throughout its range and that its larvae can complete development in less than a teaspoon of water. Increasing urbanization throughout Latin America and the Caribbean has dramatically expanded its available habitat, putting additional millions of people at risk of contracting the diseases it transmits. Many communities in the disease zones have pools of standing water (*e.g.*, open drains, uncovered cisterns) and inadequate sanitation (*e.g.*, trash piles of discarded containers, open sewers) that provide ideal breeding and feeding grounds for *Ae. aegypti*. Although some communities have mounted successful management campaigns with limited resources, in general, few cities support best practices in mosquito management and often haphazardly and/or incompletely control mosquitoes. Moreover, the individual behavior of people in

these urban areas often promotes mosquito population development in and around their homes, which typically have areas inaccessible to mosquito abatement authorities.

More of a challenge than learning how to control the mosquito is engaging the residents of the affected areas to modify their behavior so as to reduce the availability of breeding sites and reduce the likelihood of disease transmission. Effective, integrated campaigns of habitat reduction, targeted control measures, and ongoing monitoring can lead to dramatic drop-offs in mosquito populations, in some cases reductions approaching 95%.

We must recognize that there is no “magic bullet” to stop this mosquito. We need to develop management systems that are sustainable over many decades as well as outreach programs that enlist individuals in every community at risk to engage in management efforts.

Recommended actions:

- Develop community education and communication efforts, tailored for each country, to gain the support of affected communities to support management of *Ae. aegypti* and provide instructions on specific actions individuals should take to control the mosquito and protect themselves;
- Create and support methods of sharing accurate information with affected communities on the science that supports management efforts, dispelling rumors and misinformation (often spread by social media) that can engender fear and panic and delay or prevent effective responses.

Critical research needs:

Scientists around the world are racing to develop vaccines, diagnostic tests, and treatments for Zika, chikungunya, and dengue. Federal government agencies throughout the Americas are appropriating resources to combat these diseases. However, developing tests and treatments for these specific viral diseases will not protect us against new emerging or re-emerging viral diseases that can be carried by *Ae. aegypti*.

Mayaro virus disease and Oropouche fever, for example, are diseases that very few people other than tropical medicine professionals or mosquito biologists have heard of today, and yet both are potentially carried by *Ae. aegypti*. With history as a guide, we can expect that in the foreseeable future they may well follow the same tragically explosive growth path of Zika and other diseases carried by this mosquito.

In a sense, these diseases are not the main problem. They can be viewed as the catastrophic consequences of the failure to focus on vector control. When we collectively focus our attention on one disease at a time, we are ignoring at our peril the real drivers of these public health crises—the spread of mosquito vectors of these diseases.

Recently, many nations have declared states of emergency to combat Zika, as have some counties in the United States. The Obama administration requested \$1.8 billion in funding from Congress to combat Zika, and yet relatively little of this emergency funding would be directed toward controlling vectors in afflicted areas or sustaining vector management after the current crisis is resolved. While clinical research is indisputably and urgently needed, vector control is still a neglected tool. Ultimately, if there are fewer mosquitoes, there will be fewer infected individuals, which will enhance the success of clinical efforts as well.

Sustained efforts to initiate, maintain, and upgrade mosquito management programs as well as to incorporate new research into the development of novel approaches to mosquito surveillance and management are critically needed.

Recommended actions:

- Carry out research on the most effective ways to integrate current and new technologies for reduction of disease transmission by *Ae. aegypti*;
- Improve collection and dissemination of data on mosquito population dynamics and on efficacy of control measures, insecticide resistance management, sampling methods, threshold determination, monitoring efforts, and population modeling;
- Support rapid and robust funding of critically needed research on *Ae. aegypti* and other mosquito vector species.

Speaking with a united voice:

A common theme throughout the Summit was the need for a unified voice for the value of vector control. Most government and NGO efforts focus on the immediate challenges of an individual disease, with a primary focus on clinical research aimed at developing new diagnostic tests, vaccines, and treatments. Those are indeed important elements of the overall effort; however, vector control is often poorly integrated or overlooked entirely in these efforts. Multi-institution efforts, when they have occurred in the past, have been limited to the duration of the funding.

There is a need to unify the voices and influence of organizations related to vector control to speak globally and locally about the critical importance of vector control research and implementation. This unified voice can advocate more effectively for this often under-utilized yet utterly essential component of any effort to manage diseases transmitted by *Ae. aegypti*.

Recommended action:

- Immediately form a steering committee to create a coalition of vector-control-related organizations to advocate for vector control as a critical element of the campaign against *Ae. aegypti*-borne diseases;
- Begin building relationships with government agencies, NGOs, and other organizations to develop the connections needed for the coalition to be effective in its advocacy.