

**18th FKMCD-Oxitec
Public Educational Webinar:
Mosquitoes & Public Health
Tuesday, June 28th 2022**



Introductions – Panelists With You Today



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FKMCD-Oxitec Public Educational Webinar Series

Introduction to our Webinar Series

FKMCD and Oxitec are hosting a series of public educational webinars to share information with residents of the Florida Keys and provide forums to answer questions.

- Webinars are **open to everyone**.
- Webinars are **recorded and made available for everyone (published online)** after the event.
- **Questions relating to the webinar topic(s)** will be answered during a Q&A session at the end.
- If time runs out, **we accept questions in writing** via florida@oxitec.com.
- **All questions and answers will be treated anonymously.**
- **Questions and answers may be published after the event** with external or related online resources/references.

FKMCD & Oxitec Public Educational Webinars

Welcome to Webinar #18!

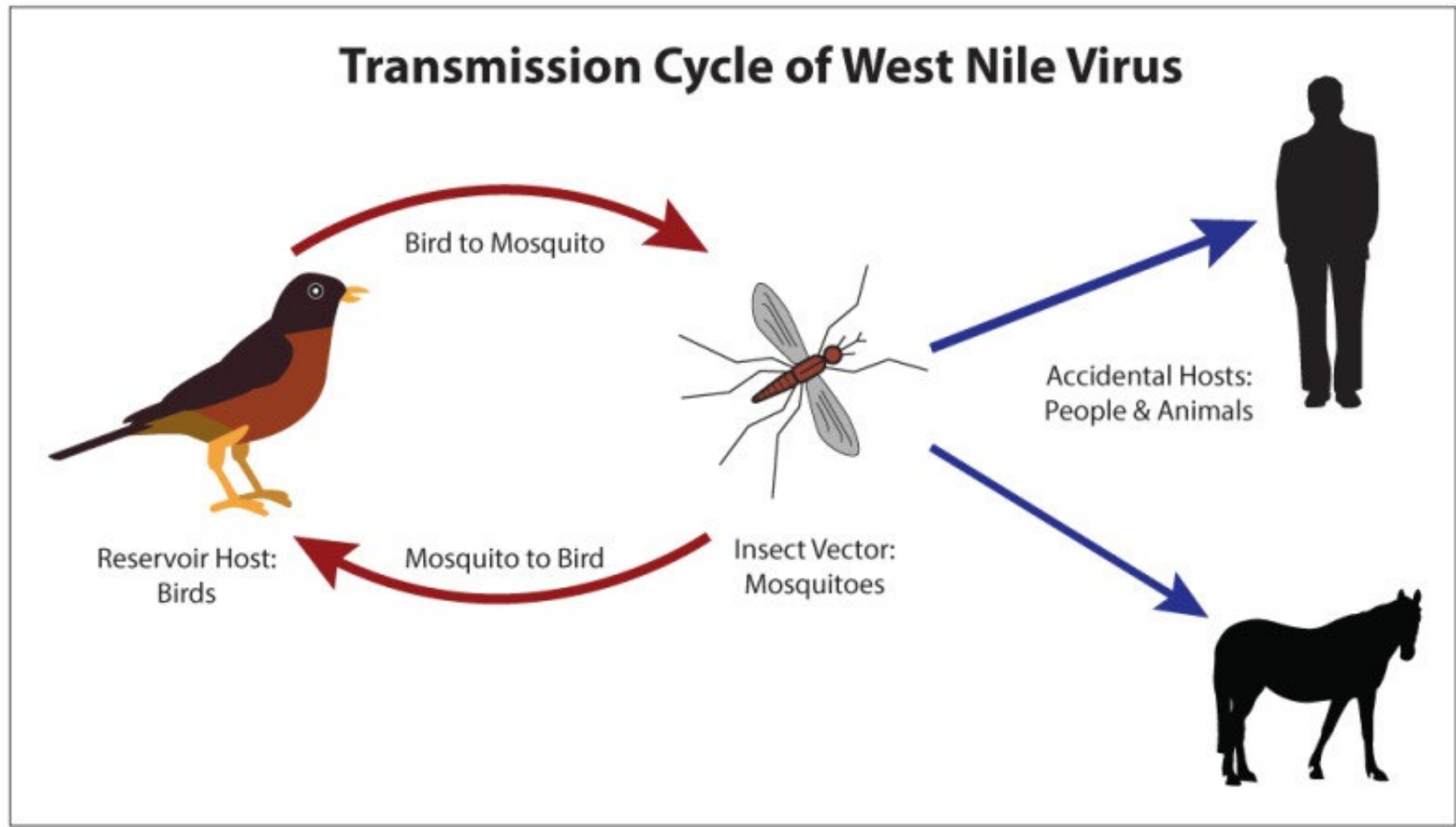
Today's Agenda:

- Presentation on Mosquitoes as disease vectors and the challenges to public health.
- Your Questions, Answered.

Documentation, resources, references, and other information are available at keysmosquitoproject.com

What is a *Vector*?

A *vector* is an organism that transmits a pathogen from one host to another. Examples of vectors include ticks, fleas, and mosquitoes.



There Are Over 3,500 Species of Mosquitoes

There are only 3,400 species of snakes!



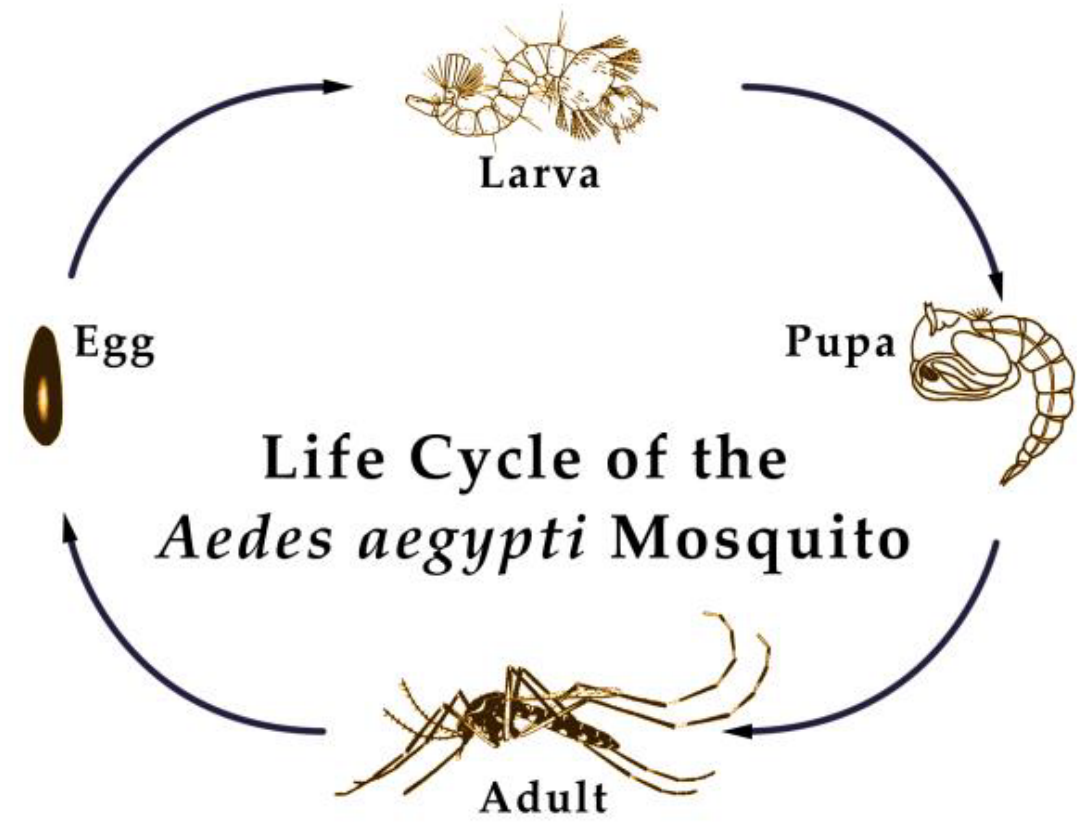
What Pathogens Do Mosquitoes Transmit?

Most mosquitoes are not a public health concern as they do not transmit pathogens to humans, but a small number of species are indeed deadly. In fact, these few species kill more people than any other creature on earth!

Mosquito	Disease	Disease Agent
<i>Aedes aegypti</i>	Dengue	Virus
<i>Aedes aegypti</i>	Yellow Fever	Virus
<i>Aedes aegypti</i>	Chikungunya	Virus
<i>Aedes aegypti</i>	Zika	Virus
Other <i>Aedes</i> species	Eastern Equine Encephalitis	Virus
<i>Culex</i> species	West Nile Fever	Virus
<i>Culex</i> species	Saint Louis Encephalitis	Virus
<i>Anopheles</i> species	Malaria	Protozoa

Mosquito Life Cycle

Females of almost all mosquito species feed once in a gonotrophic cycle – except for *Aedes aegypti*, which feeds multiple times.



Why and How do Female Mosquitoes Feed on Blood?

Female mosquitoes feed on blood to mature their eggs.



Different Female Mosquitoes Feed on Particular Hosts

Aedes aegypti feeds almost exclusively on people.



Some mosquito species are *generalists*. They feed on what's available. Others are *specialists* and show a preference for one animal over another.

Why is *Aedes aegypti* Such a Good Vector?

Aedes aegypti is the most important global vector of yellow fever, dengue, Zika, and chikungunya.

REMEMBER - ONLY FEMALES BITE AND SPREAD DISEASE!

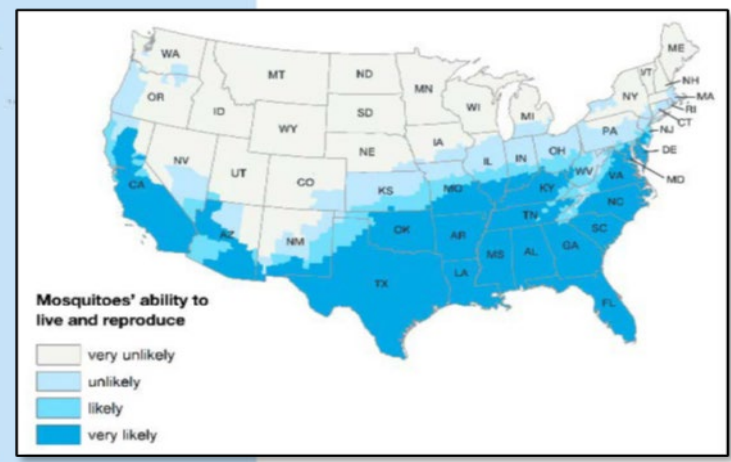
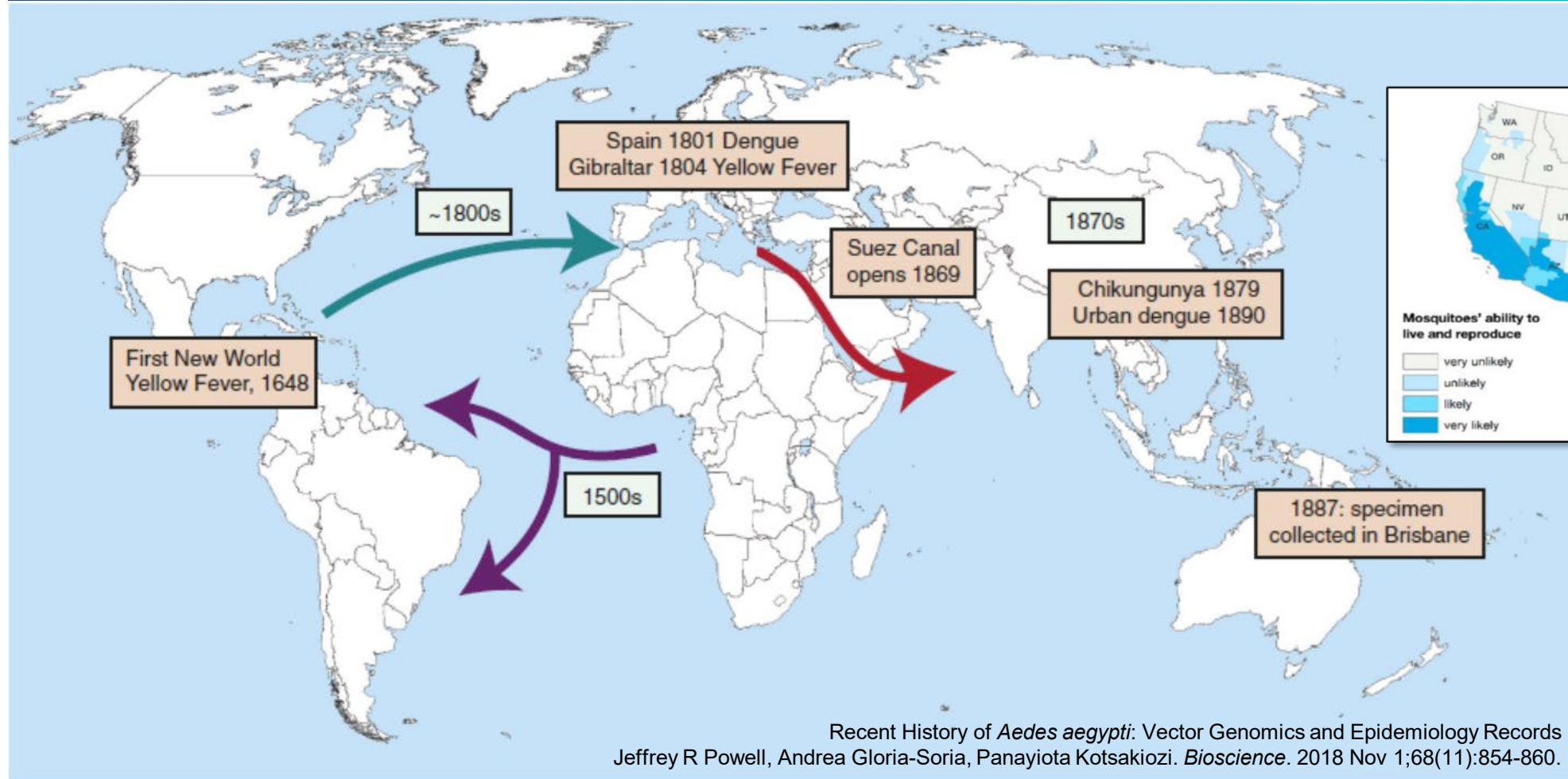
- *Aedes aegypti* feeds almost exclusively on people, so the "next bite" is on another person, not a dead-end host like a bird or dog.
- *Aedes aegypti* feeds multiple times and on multiple hosts, increasing the number of infective bites.
- *Aedes aegypti* feeds and breeds in or near human homes, increasing the risk of transmission from an infective person to an uninfected person.
- This species gets infected and stays infected, transmitting viruses in saliva when the female bites another host. **It has a high vector competence.**
- The association of *Aedes aegypti* with humans means that it is readily transported around the world and readily adapts to new environments – **it is highly invasive!**



Female *Aedes aegypti* often lay their eggs in the saucers at the base of potted plants.

The *Aedes aegypti* Mosquito: An Invasive Species in Florida

Aedes aegypti is not native to the Americas. It was likely transported from Africa in the 16th century, bringing viral diseases with it.



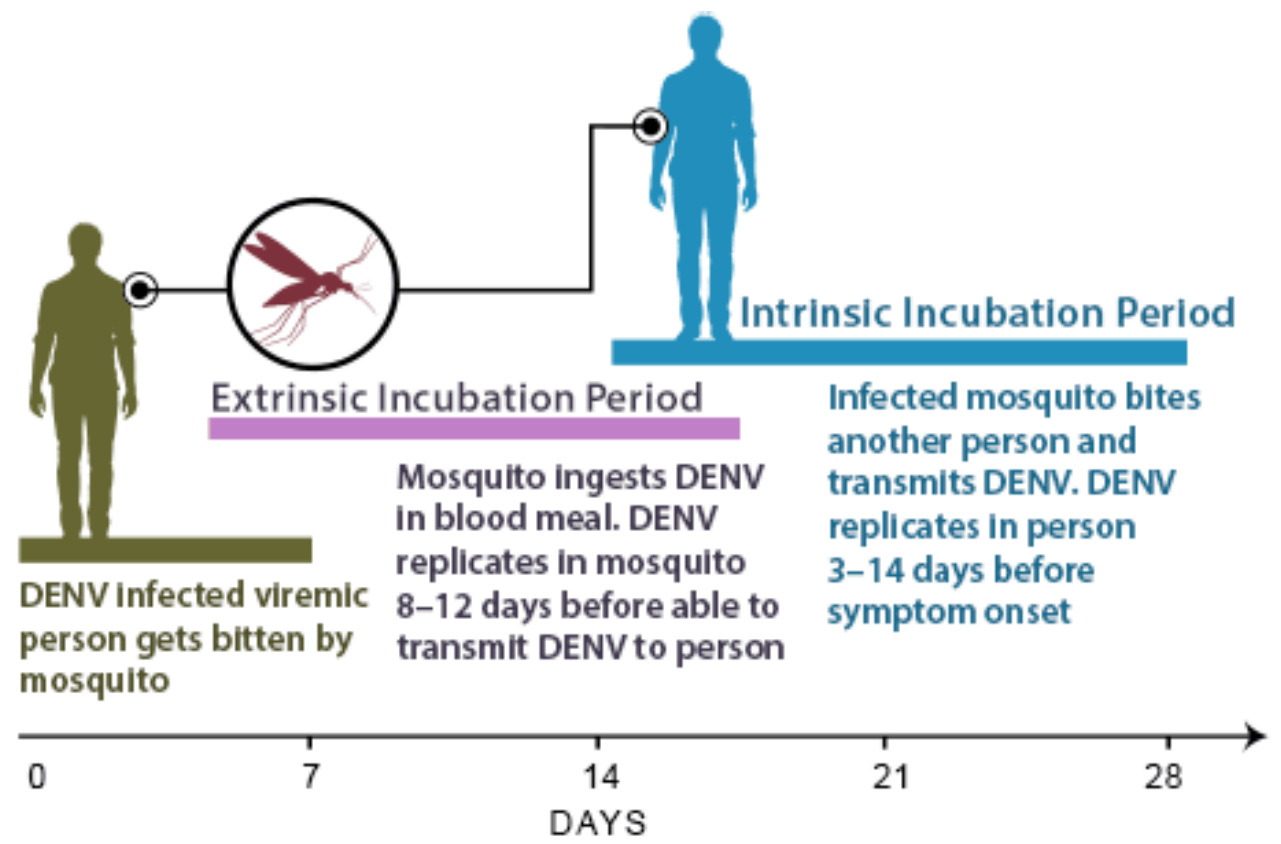
The potential for *Aedes aegypti* in Florida and surrounding U.S. states.

Recent History of *Aedes aegypti*: Vector Genomics and Epidemiology Records
 Jeffrey R Powell, Andrea Gloria-Soria, Panayiota Kotsakiozi. *Bioscience*. 2018 Nov 1;68(11):854-860.

Dengue

Dengue is the most common mosquito-borne disease in the world.

- About **half the world's population** is at risk for dengue.
- 100-400 million infections occur each year, but **>80% of them are *asymptomatic***.
- Dengue is found in tropical and subtropical climates worldwide and is a **leading cause of death in some Asian and Latin American countries**.
- Dengue fever, dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS)
- No widely available vaccine, no therapeutic medicine (treatment).
- **Vector management remains the most effective prevention.**

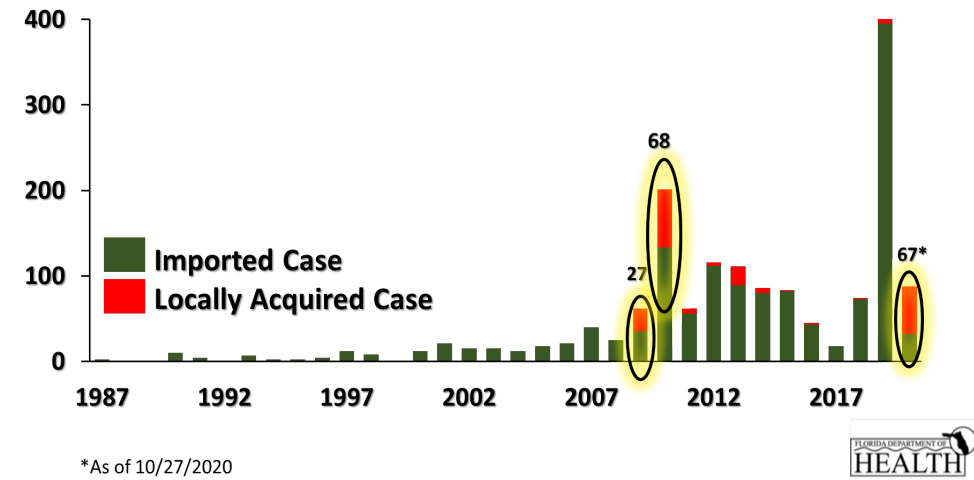


Dengue in the Florida Keys

Virus transmission, pyrethroid resistance, and challenges unique to *Aedes aegypti*.

- **Dengue is an ongoing challenge** with 72 confirmed, locally-acquired cases in Monroe County in 2020.
- Potential risk of **Zika, chikungunya, and yellow fever**.
- **Pyrethroid resistance** in *Ae. aegypti* in Florida is widespread.
- **Inherent challenges to *Ae. aegypti* control.** Cryptic harborages, oviposition & larval sites, diurnal behavior.
- **Need more tools** in our toolbox.
- **Environmental impact** a key consideration in the Keys.
- Nine national & state agencies concluded **Oxitec male *Ae. aegypti* pose no risk to human or environmental health.**

Dengue Cases in Florida Since 1987



Quantification of permethrin resistance and *kdr* alleles in Florida strains of *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse)

Alden S. Estep^{1*}, Neil D. Sanscrainte², Christy M. Waits¹, Sarah J. Bernard¹, Aaron M. Lloyd³, Keira J. Lucas⁴, Eva A. Buckner⁵, Rajeev Vaidyanathan⁶, Rachel Morreale⁷, Lisa A. Conti⁸, James J. Becnel²

Yellow Fever

The common name of *Aedes aegypti* is the "yellow fever mosquito."

- Yellow fever is an **acute hemorrhagic disease**.
- The "yellow" refers to jaundice of the skin and eyes.
- Endemic to parts of Africa and Central and South America.
- Resulted in thousands of deaths in the U.S. in the 1700 and 1800s. As far north as Philadelphia and Boston!
- **Effective vaccine available** and supportive treatment.



Chikungunya

"Chikungunya" comes from a Nilotic language and means "that which bends up," in reference to the painful arthritis.

- Symptoms include high fever and severe muscle and joint pain.
- **No vaccine, no specific treatment.**

First Chikungunya case acquired in the United States reported in Florida

Press Release

For Immediate Release: Thursday, July 17, 2014

US chikungunya cases jump to 74 in 23 states

Filed Under: **Chikungunya**

Robert Roos | News Editor | CIDRAP News | Jun 25, 2014

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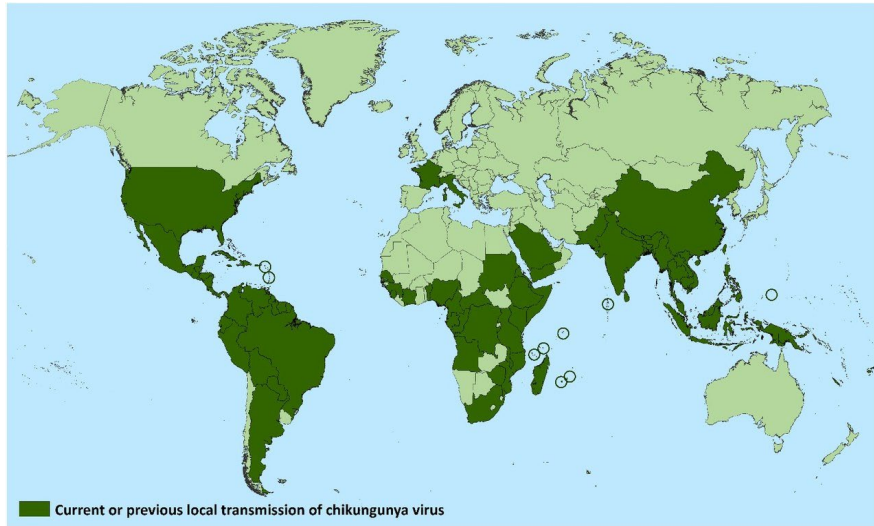
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The chikungunya epidemic in the Caribbean is continuing to spill over into the United States, with federal and state officials reporting at least 74 cases in 23 states yesterday.



Dark green denotes countries with current or previous local transmission of CHIKV, per CDC as of Sept 17, 2019.

Zika

First found in monkeys at the Zika Forest Preserve in Uganda in 1947.

- In 2016 became the **first ever vector-borne WHO Public Health Emergency of International Concern**
- Mild symptoms may include fever, rash, and headache.
- Zika virus infection **during pregnancy can result in microcephaly** and other birth defects.
- Zika virus can result in neurological complications.
- **No vaccine, no specific treatment.**

CDC issues historic travel warning over Miami Zika outbreak

By Sandee LaMotte, CNN

Updated 12:00 PM EDT, Wed August 3, 2016



Traditional Mosquito Control

Aedes aegypti is most active during the day near people's homes, and female *Ae. aegypti* lay their eggs in cryptic containers.

Strategy	Challenges
Larval source reduction (tip & toss)	<ul style="list-style-type: none"> • Finding the natural & artificial containers is a challenge! • Female <i>Ae. aegypti</i> lay their eggs in natural & artificial containers, including bromeliads, trash, buckets, toys, and bases of potted plants.
Chemical or biological control of larvae (larvicide)	<ul style="list-style-type: none"> • Same as for tip & toss. • Application constraints – e.g., many water sources are in backyards, where backpack & truck-mounted sprays cannot penetrate.
Chemical control of adult mosquitoes (adulticide)	<ul style="list-style-type: none"> • <i>Aedes aegypti</i> is a day-biting, day-active species. Adulticides can be applied before sunrise and after sundown. • This species is often in our homes and hides under foliage, where aerosol sprays might not reach. • Another increasing challenge is widespread mosquito resistance to pyrethroids. Many current products are ineffective.

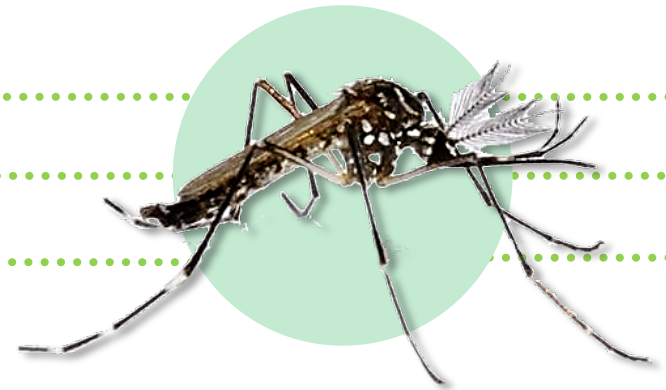
Biological Control using Oxitec *Aedes aegypti* Males

Oxitec male mosquitoes mate with invasive female *Aedes aegypti*, and only the male offspring of these encounters survive.

✓ TARGETED SUPPRESSION

✓ SAFE, NON-TOXIC, NON-ALLERGENIC

✓ PROVEN EFFECTIVE



MALE-ONLY RELEASES ✓
(male mosquitoes do not bite!)

TRACEABLE IN THE FIELD ✓

SELF-LIMITING IN THE ENVIRONMENT ✓

Question and Answers

Any and all questions on this evening's topics are welcome!

(If we run out of time tonight, email florida@oxitec.com and we will attempt to answer your question if it isn't included in the growing FAQ or post-event summary we publish online at oxitec.com/florida and keysmosquitoproject.com)

THANK YOU!

A summary of this event, as well as more Q&As, resources, facts, and background materials will be made available at oxitec.com/florida and keysmosquitoproject.com