Mosquito Vectors of Zika Virus and Their Control

Chris Evans, MS, PhD
Public Health Entomologist

South Carolina Department of Health and Environmental Control
Promoting and Protecting the Health of the Public and the Environment
Acquires virus

mosquito incubation period 7-10 days

virus in bloodstream

Transmits virus

human incubation period 2-7 days

virus in bloodstream

Symptom Onset

Human 1

illness 2 - 7 days

Human 2

illness 2 - 7 days

Symptom Onset
Mosquito Vectors of Zika Virus
Ten *Aedes* Species in Africa & the South Pacific

- **Stegomyia** group
  - *Ae. aegypti*, *Ae. africanus*, *Ae. albopictus*, *Ae. apicoargenteus*, *Ae. hensilli*, *Ae. luteocephalus*, and *Ae. polynesiensis*

- **Aedimorphus** group
  - *Ae. vittatus*

- **Diceromyia** group
  - *Ae. furcifer*, *Ae. taylori*
Aedes aegypti
Yellow Fever Mosquito

Feeds almost exclusively on people
Breeds and rests indoors and outdoors
Near human habitation
Due to being out-competed by *Aedes albopictus*, *Aedes aegypti* is now limited to coastal regions of the southeastern United States.
Aedes aegypti Outdoor Breeding
Urban Areas Near Human Habitation

Cemetery Vase
Water Storage

Waste Containers
Bird Baths
Discarded Tires
Aedes aegypti Indoor Breeding

Bathroom Container

Water Fountain
Aedes albopictus
Asian Tiger Mosquito

Opportunistic blood feeder, mostly mammals
Breeds and rests outdoors
Near human habitation or rural, wooded areas
Aedes albopictus
U.S. Range
Aedes albopictus Outdoor Breeding Sites
Urban or Rural Areas

- Containers
  - Metal, glass, stone, earthenware, plastic, wood, or rubber
- Natural containers
  - Treeholes
  - Leaf axils (not common)
- Human-made containers
  - Flower pots
  - Cans
  - Buckets
  - Ornamental ponds
  - Birdbaths
  - Old tires
  - Cemetery vases
  - Clogged rain gutters
  - Pet watering dishes
Eliminate Mosquito Vectors and Avoid Exposure
Controlling Mosquito Larvae

*Main Focus of Mosquito Control*

- Mosquito larvae are
  - Confined to water and are easier to treat than adults
  - More vulnerable to control measures than the adults
Source Reduction
Removing sources of water that breed mosquitoes
Think Tall

Think Small
Recycling Waste Tires

Eliminates the need to use expensive EPA-registered insecticides
Community Involvement in Source Reduction

“Man breeds his own *Aedes aegypti* and sits back either in ignorance or in the hope that someone else will do the tidying up.”

J.D. Gillett

**Educational Challenges**

- Link larvae – “wrigglers” – with adult mosquitoes that might cause illness
- Stop dependence on government or other institutions to sustain source reduction activities
Larviciding

Process of killing mosquitoes by applying natural agents or commercial products to control larvae and pupae
**Mosquito Control At Home**

*Bacillus thuringiensis israelensis – Bti*

Bacterial toxins paralyzes the midgut of mosquito larvae
Mosquito Control at Home

Methoprene, an Insect Growth Regulator

Methoprene mimics juvenile hormone & prevents larvae from molting into pupae.
Mosquito Repellents

EPA-Registered Active Ingredients

- DEET
- Picaridin
- IR3535
- Oil of Lemon Eucalyptus
Adult Mosquito Control – Adulticiding

- Source reduction or larviciding fails to control mosquitoes OR
- Outbreak already in progress
Ultra-Low Volume (ULV) Spraying
Use of nozzles to atomize the insecticide
Thermal Fogging
Use of heat to atomize the insecticide

Vehicle-mounted, Handheld, or Backpack versions available
Barrier Spray
Residual Insecticides on External Walls of Houses & Vegetation
Establishing a Mosquito Control Program

ASTHO’s Recommendations

- **Level 1 (Minimal)**
  - *Minimal or no resources*. Emphasize education, community participation, and personal responsibility.

- **Level 2 (Intermediate)**
  - *Little to moderate resources*. Combine resources with other jurisdiction. Add increased source reduction and adulticide. Map habitats. Monitor larval & adult populations.

- **Level 3 (Comprehensive)**
  - *Moderate to full resources*. Procure equipment and insecticides. Expand data collection. Build risk maps and assign priorities to areas.

Mosquito Control Program Support Levels

Level 1: Minimal or No Resources
Level 2: Little to Moderate Resources
Level 3: Moderate to Full Resources

South Carolina Mosquito Control Program Support Levels

66 Mosquito Control Programs
16 County Level
45 City/Town Level
2 Home Owner’s Association
3 Lake Shorelines

Mosquito Control Program Support Levels
Level 1: Minimal or No Resources
Level 2: Little to Moderate Resources
Level 3: Moderate to Full Resources

Program Office - Lake Mgt. Locations
⭐ Level 3 - County Office
⭐ Level 2 - County Office
⭐ Level 2 - City/Town Office - Within boundaries
⭐ Level 2 - Lake Greenwood Shoreline
⭐ Level 3 - Duke/Santee-Cooper Lakes Shoreline

Mosquito Control Program Coverage Areas
Level 1 - No City/County Resources
Level 2 - City/Town Program
Level 2 - Community Program
Level 2 - County or Lake Mgt. Program
Level 3 - County or Lake Mgt. Program

May 2016
When to Notify Mosquito Control Programs of Zika-Virus Positive Events

Patient is infectious (viremic) to mosquitoes while in South Carolina

YES

Lab Result: Presumptive or Equivocal or Confirmed

YES

Mosquito Control Program Exists in the Jurisdiction

YES

Mosquito Control is Notified

NO

County Emergency Manager is Notified