

Quarter 3 (10/1/2019 – 12/31/2019) Report

Florida Department of Health Contract CODQJ

Improving our understanding of domestic mosquito control of *Aedes aegypti*, *Ae. albopictus*,  
and *Culex quinquefasciatus* through assessments of insecticide susceptibility

Prepared by:

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13 January 2020

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## Task List

1. Deploy traps each quarter to collect a minimum of 100 eggs from adult *Aedes* and *Culex* mosquitoes or collect 100 *Aedes* and *Culex* larvae from within a minimum of three sites or collect eggs from adult *Aedes* and *Culex* mosquitoes hatched from previously collected eggs from identified sites that were reared to adulthood and allowed to blood feed and lay eggs. Document the number of eggs and larvae collected and the number and the species of adult mosquitoes that hatched from collected eggs in the Quarterly Report.
2. Conduct insecticide resistance testing on mosquitoes collected as eggs (parental generation) or successive generations (within two generations of parental generation) of mosquitoes within 60 days of collection and hatching of eggs. Document the insecticide resistance testing and results in the Quarterly Report.
3. Conduct CDC bottle bioassay testing on mosquitoes from a minimum of three identified sites against one pyrethroid and one organophosphate each quarter. Document the bioassay testing and results in the Quarterly Report and post the CDC bottle bioassay results to Provider's reporting website, <https://fmel.ifas.ufl.edu/>.
4. Map the distribution of where *Aedes* and *Culex* eggs or larvae are collected and used in CDC bottle bioassays each quarter. Document the mapped distribution in the Quarterly Report.
5. Distribute the results of the CDC bottle bioassay testing to the Florida Mosquito Control Program managers in the counties of a minimum of the three identified sites each quarter. Document the distribution of the results in the Quarterly Report.
6. Prepare a Quarterly Report, post it on Provider's reporting website, and submit it to the Contract Manager within 15 days following the end of each quarter, but no later than invoice submission. At a minimum, include the following information in the report:
  - a. The number of eggs and larvae from adult mosquitoes collected and hatched;
  - b. The number of eggs and larvae from adult mosquitoes in which insecticide testing was conducted;
  - c. Documentation of mapping of egg collection results including species identification and location of collection;
  - d. Documentation of results of CDC bottle bioassay testing of mosquitoes for insecticide resistance; and
  - e. Documentation of CDC bottle bioassay testing results distribution to Florida Mosquito Control Program Managers.
7. Identify the methods for distributing information on resistance to tested insecticide active ingredients. Prepare an Annual Report, including the identified methods, and submit it to the Contract Manager within 45 days from the end of the contract term, but no later than submission of the final invoice. At a minimum, include the following in the report:

- a. The method for informing Florida Mosquito Control Programs, the Department, and the general public on the regions of Florida that are most likely to have populations of Zika, Dengue, Chikungunya, and West Nile Virus mosquito vectors;
- b. The method for informing Florida Mosquito Control Programs and the Department on the efficacy of the insecticides that are currently being used in their programs (i.e., whether the chemicals are working as they should to reduce the mosquito populations); and
- c. The method for informing Florida Mosquito Control Program managers on the relationship between the CDC bottle bioassay (a lab assay) and the efficacy of spraying mosquitoes at the insecticide label rates.

## Tasks Progress

1. Traps were deployed this quarter, and 20,497 *Aedes* eggs and 47 *Culex quinquefasciatus* rafts were collected from the traps. Of the 20,497 *Aedes* eggs collected, there was  $\approx$  a 51% hatch rate, resulting in 10,392 *Aedes* adults emerging. The *Culex quinquefasciatus* larvae collected had a  $\approx$  79% survivorship rate, resulting in 3,397 *Culex quinquefasciatus* adults emerging. The species identification for the resulting *Aedes* adult mosquitoes was *Aedes aegypti*, *Ae. albopictus*, and *Ae. triseriatus*.

The *Aedes* eggs processed this quarter came from (county followed by site name):

- a. Brevard
  - i. Satellite High
  - ii. Viera
- b. Escambia
  - i. Extension Office
  - ii. Pine Forest Road
  - iii. Pond
  - iv. Tire Refurb
- c. Hernando
  - i. CDC-7
  - ii. Gupton
  - iii. Jackson
- d. Miami-Dade
  - i. Flagler Cemetery
  - ii. Homestead
  - iii. Little River
  - iv. Miami Beach
  - v. Wynwood
- e. Monroe
  - i. Overseas
- f. Pasco
  - i. Holiday
  - ii. Port Richey
- g. Santa Rosa
  - i. Rustic Trail
- h. South Walton
  - i. Golf Club
  - ii. County Highway

The *Culex quinquefasciatus* rafts and larvae processed this quarter came from (county followed by site name):

- a. Bay
    - i. Cox Grade
  - b. Palm Beach
    - i. Sysco
  - c. Seminole County
    - i. 2<sup>nd</sup> Street
    - ii. Center Street
    - iii. Halsey
    - iv. Lake Mary
    - v. Lazy Acres
2. Since the end of the previous quarter, 3 populations of *Aedes aegypti* and 4 populations of *Ae. albopictus* and 2 populations of *Culex quinquefasciatus*, respectively, have been tested using the CDC bottle bioassay. Based on the mortality observed at a diagnostic time, the mosquito populations were classified as susceptible, developing resistance, or resistant to the various active ingredients. These results were incorporated into maps and can be found on pages 8 - 25 of this report.
3. CDC bottle bioassay testing was performed on mosquitoes from 9 sites against at least one pyrethroid (permethrin) and one organophosphate (malathion) active ingredient (AI). The total number of active ingredients that each mosquito population was tested against can be found in the table below. The CDC bottle bioassay results for each active ingredient can be found at <https://fmel.ifas.ufl.edu/>.

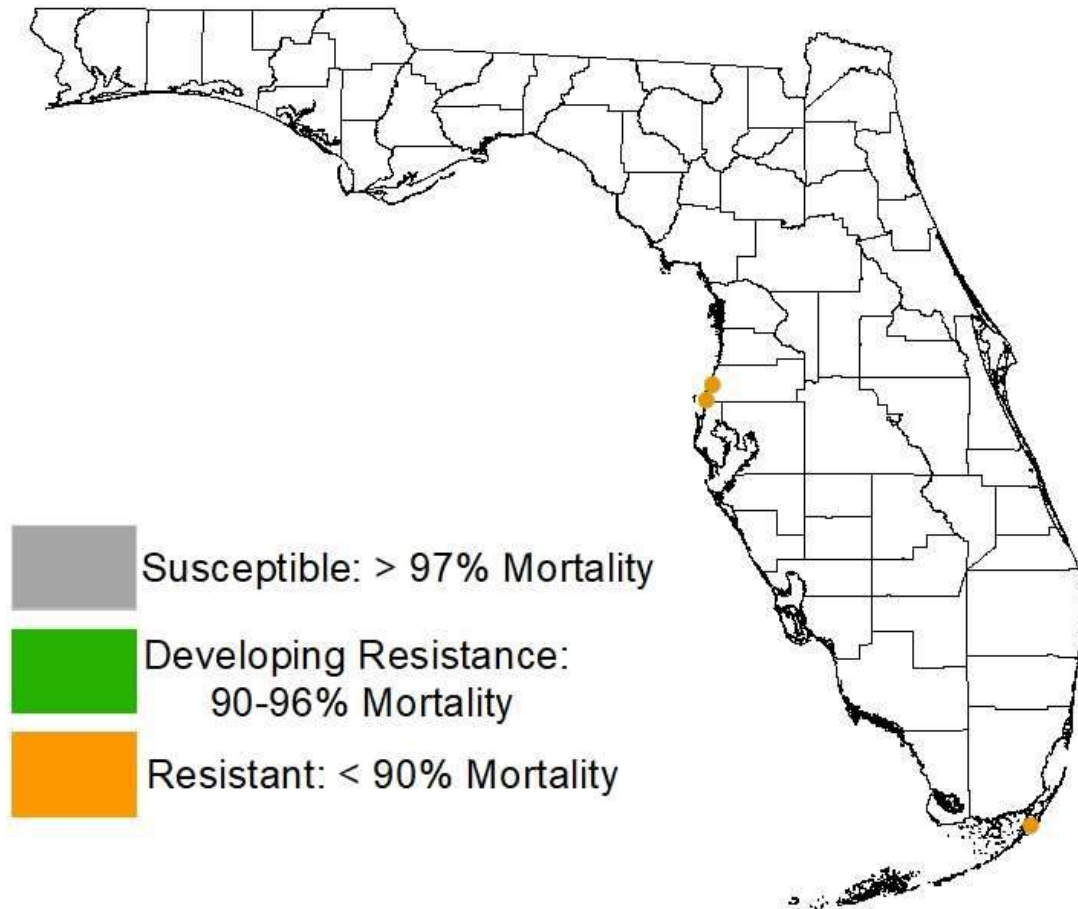
Species Tested	County	Site	# of AIs Tested
<i>Aedes aegypti</i>	Monroe	Overseas	6
<i>Aedes aegypti</i>	Pasco	Holiday	6
<i>Aedes aegypti</i>	Pasco	Port Richey	3
<i>Aedes albopictus</i>	Brevard	Viera	6
<i>Aedes albopictus</i>	Hernando	CDC7	3
<i>Aedes albopictus</i>	Hernando	Gupton	6
<i>Aedes albopictus</i>	Hernando	Jackson	5
<i>Culex quinquefasciatus</i>	Bay	Cox Grade	6
<i>Culex quinquefasciatus</i>	Seminole	Center Street	6

4. The locations of where *Aedes* and *Culex* eggs or larvae were collected from were mapped and can be found on page 26-27 of this report. The distribution map can also be found at <https://fmel.ifas.ufl.edu/>.
5. Results of the CDC bottle bioassay testing were distributed as reports by email to Florida Mosquito Control Program managers in Bay, Hernando, and Seminole Counties for the

sites Cox Grade, Gupton, and Center Street, respectively, this quarter. An example report can be found on pages 28-29.

6. This Quarterly Report in combination with the information posted on the Reporting website at <https://fmeal.ifas.ufl.edu/> satisfies this task.
7. All necessary information will be provided in the Final Annual Report.

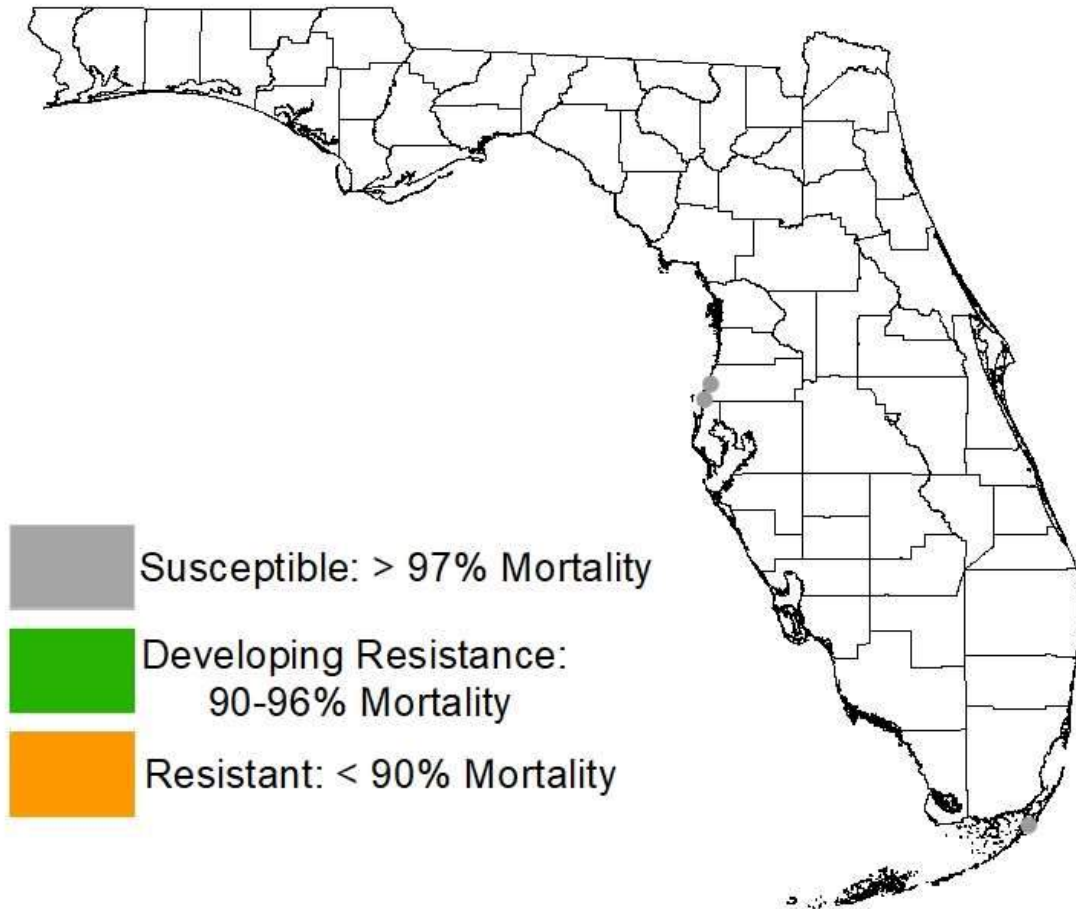
**Species: *Aedes aegypti***  
**Active Ingredient: permethrin**



Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
Updated December 31 2019

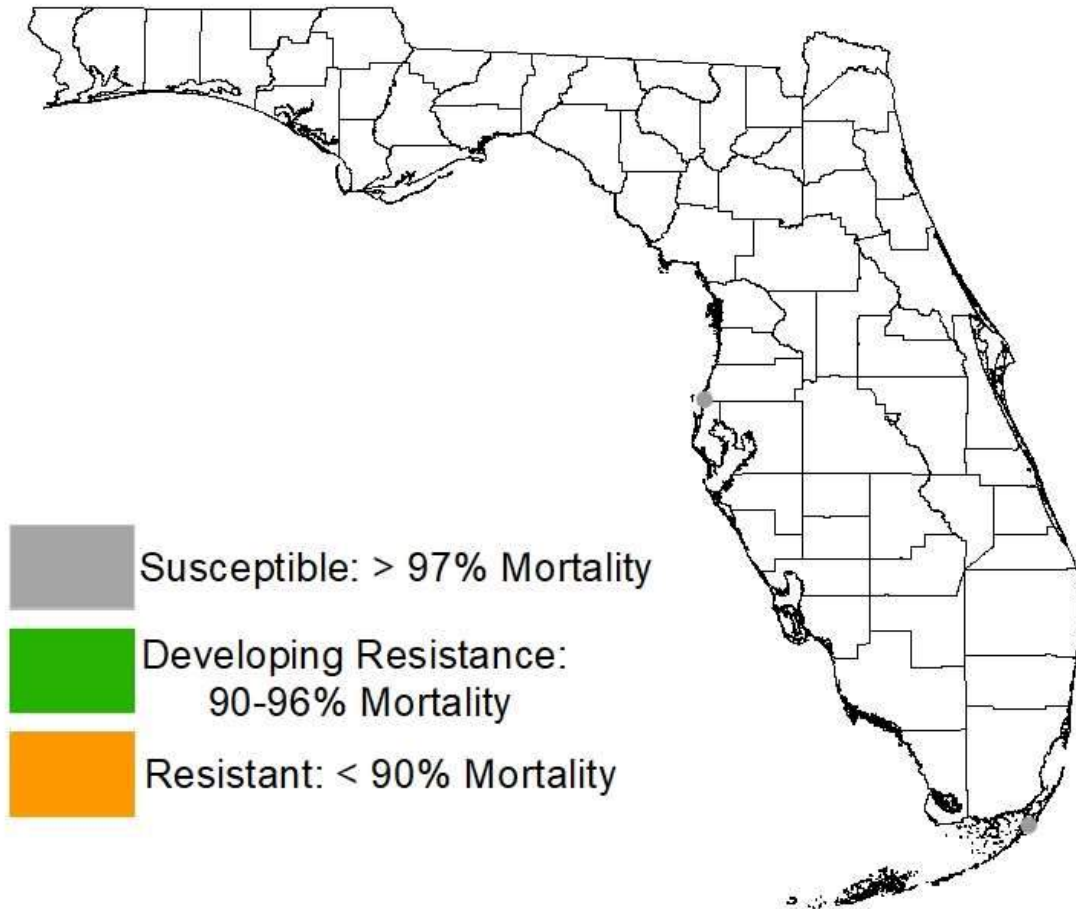


**Species: *Aedes aegypti***  
**Active Ingredient: malathion**



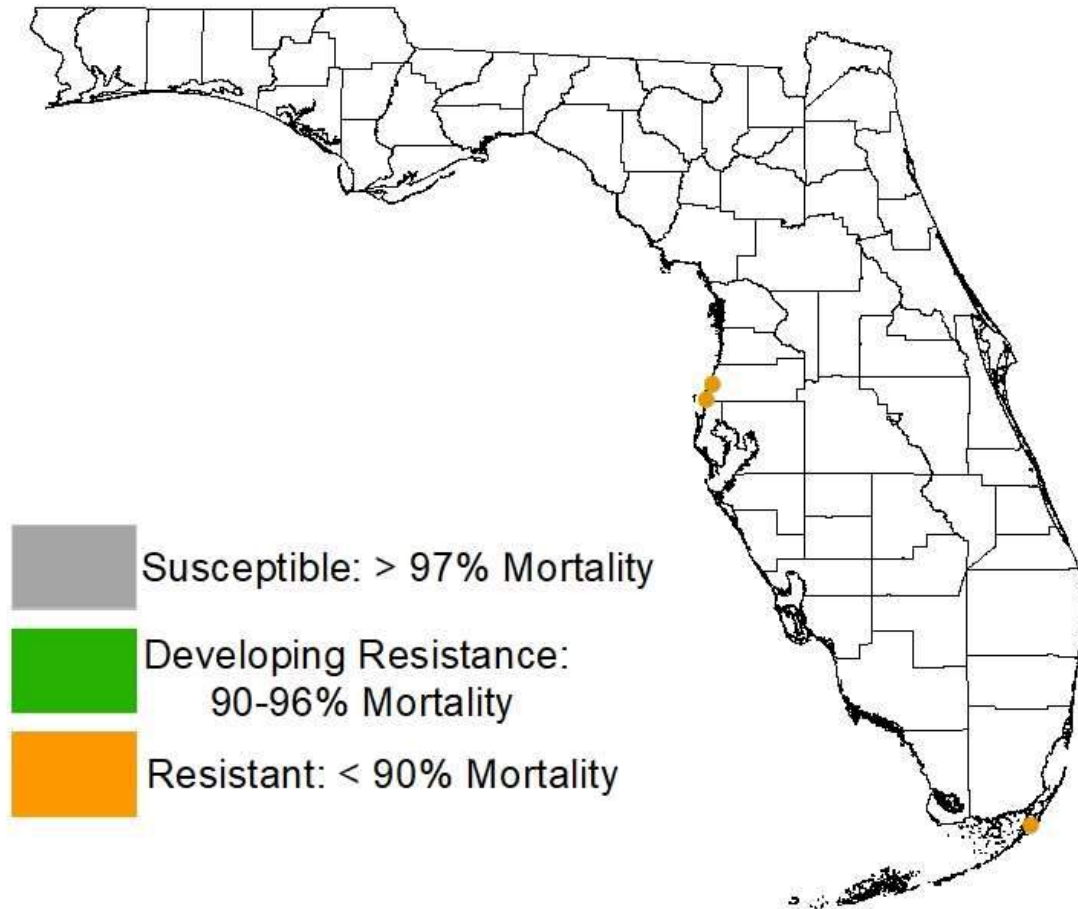
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
Updated December 31 2019

**Species: *Aedes aegypti***  
**Active Ingredient: naled**



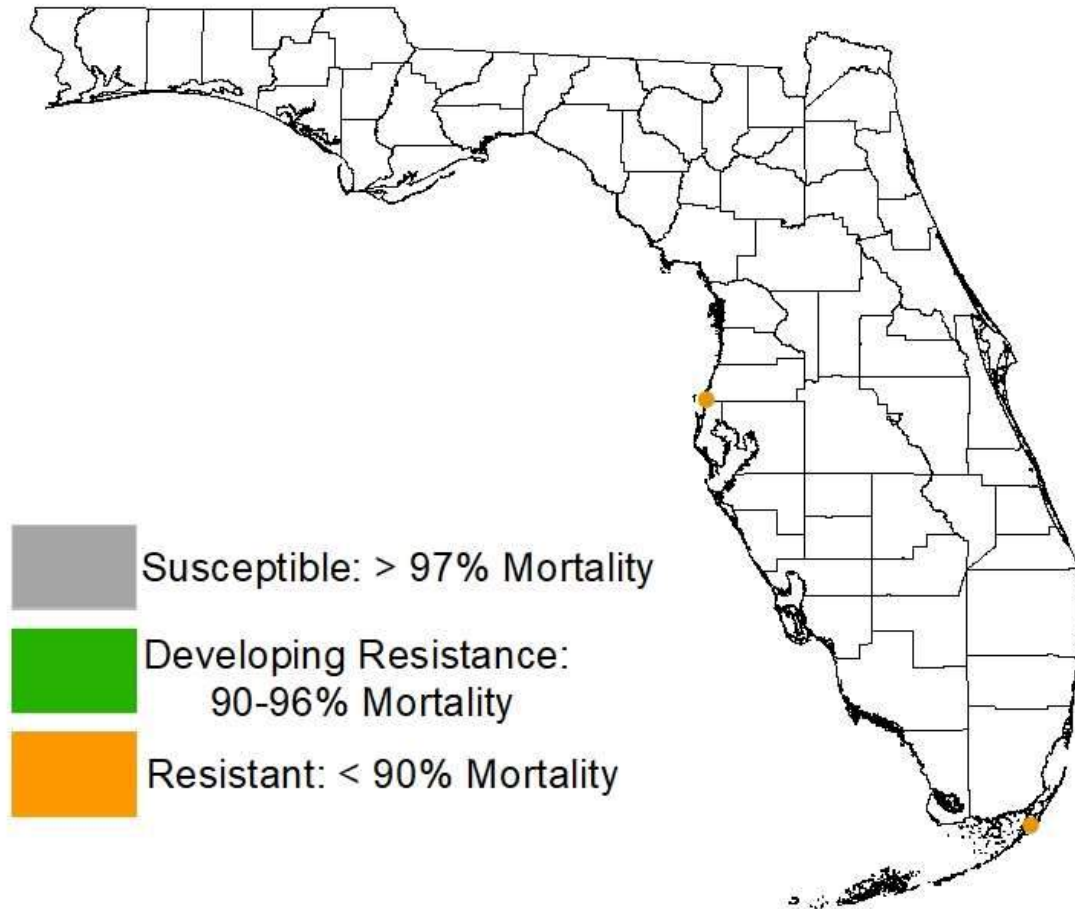
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
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**Species: *Aedes aegypti***  
**Active Ingredient: deltamethrin**



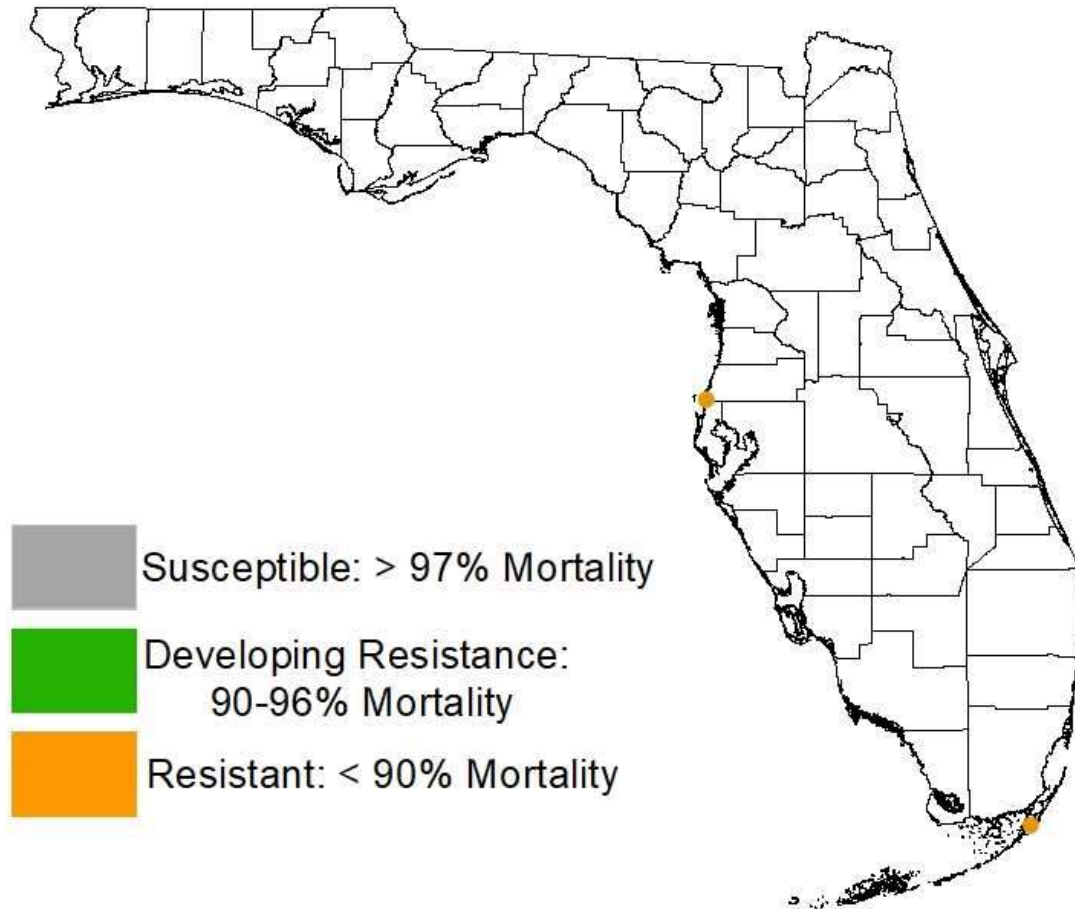
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
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**Species: *Aedes aegypti***  
**Active Ingredient: etofenprox**



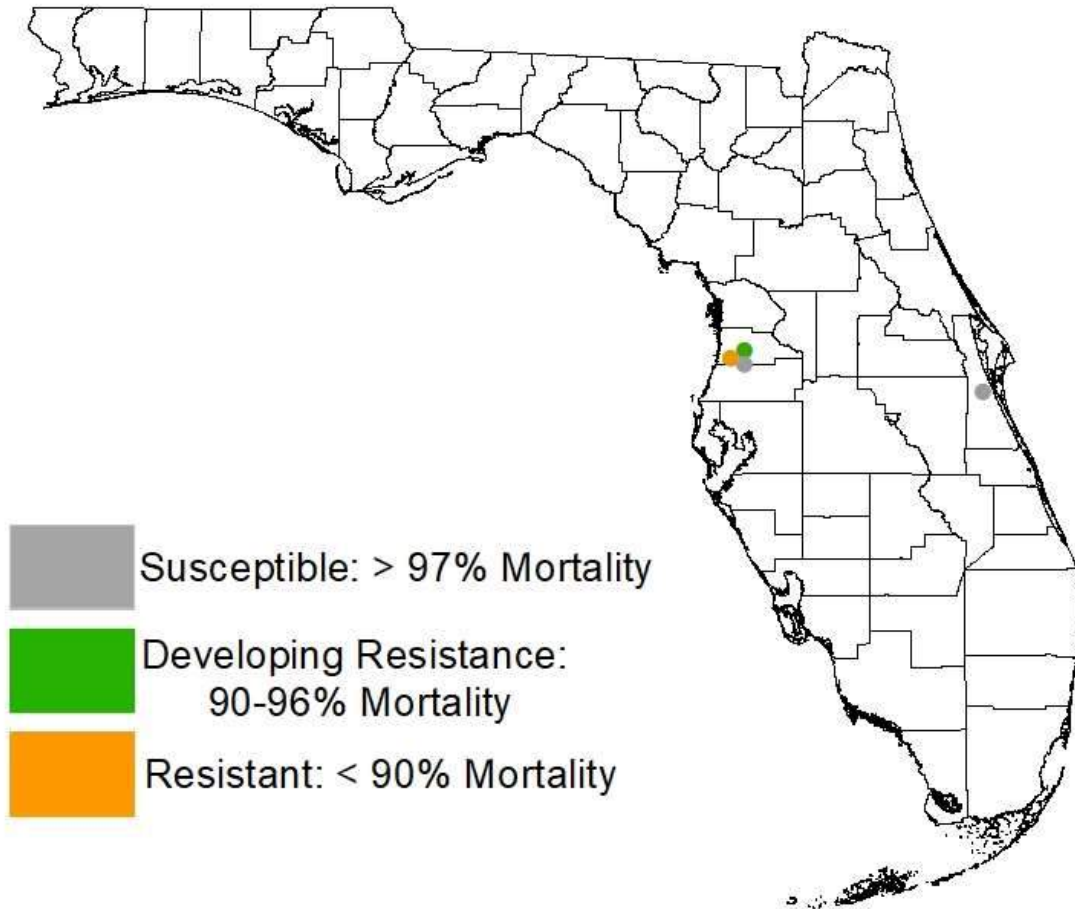
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
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**Species: *Aedes aegypti***  
**Active Ingredient: permethrin**



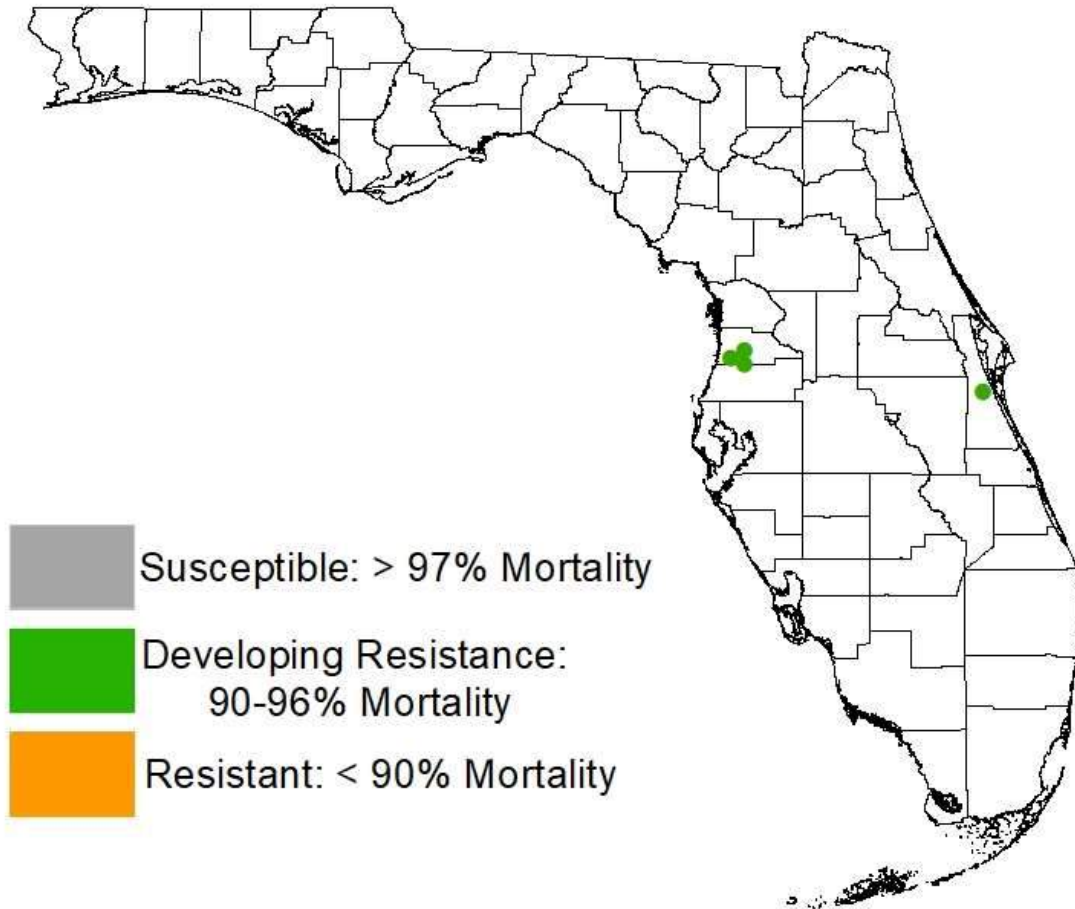
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
Updated December 31 2019

**Species: *Aedes albopictus***  
**Active Ingredient: permethrin**



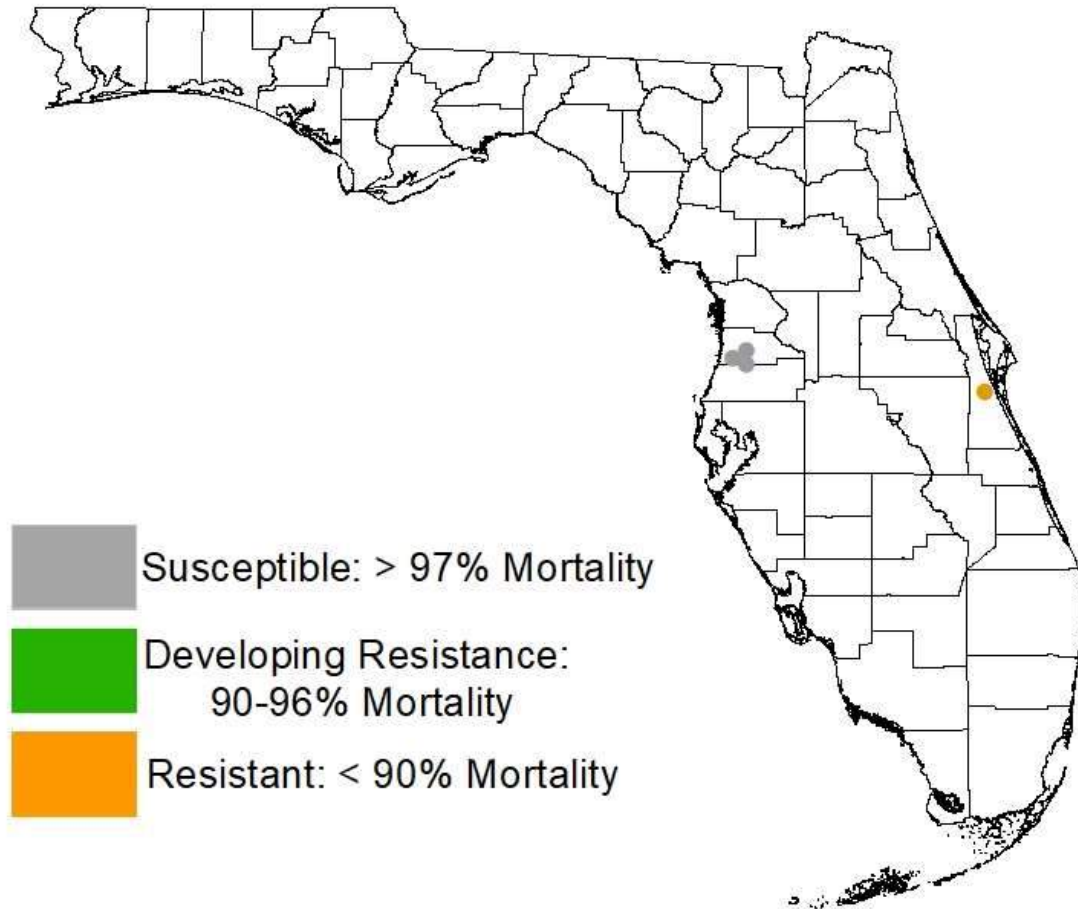
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**Species: *Aedes albopictus***  
**Active Ingredient: malathion**



Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
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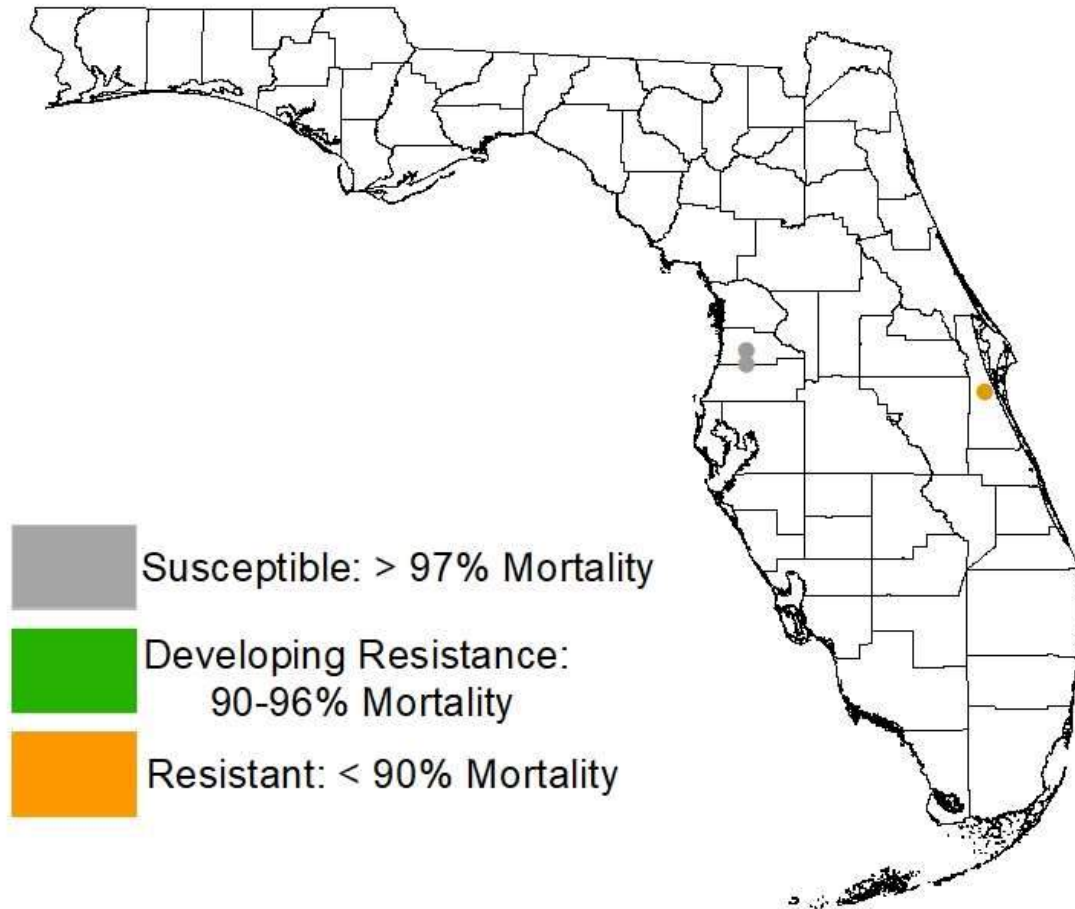
**Species: *Aedes albopictus***  
**Active Ingredient: naled**



Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
Updated December 31 2019

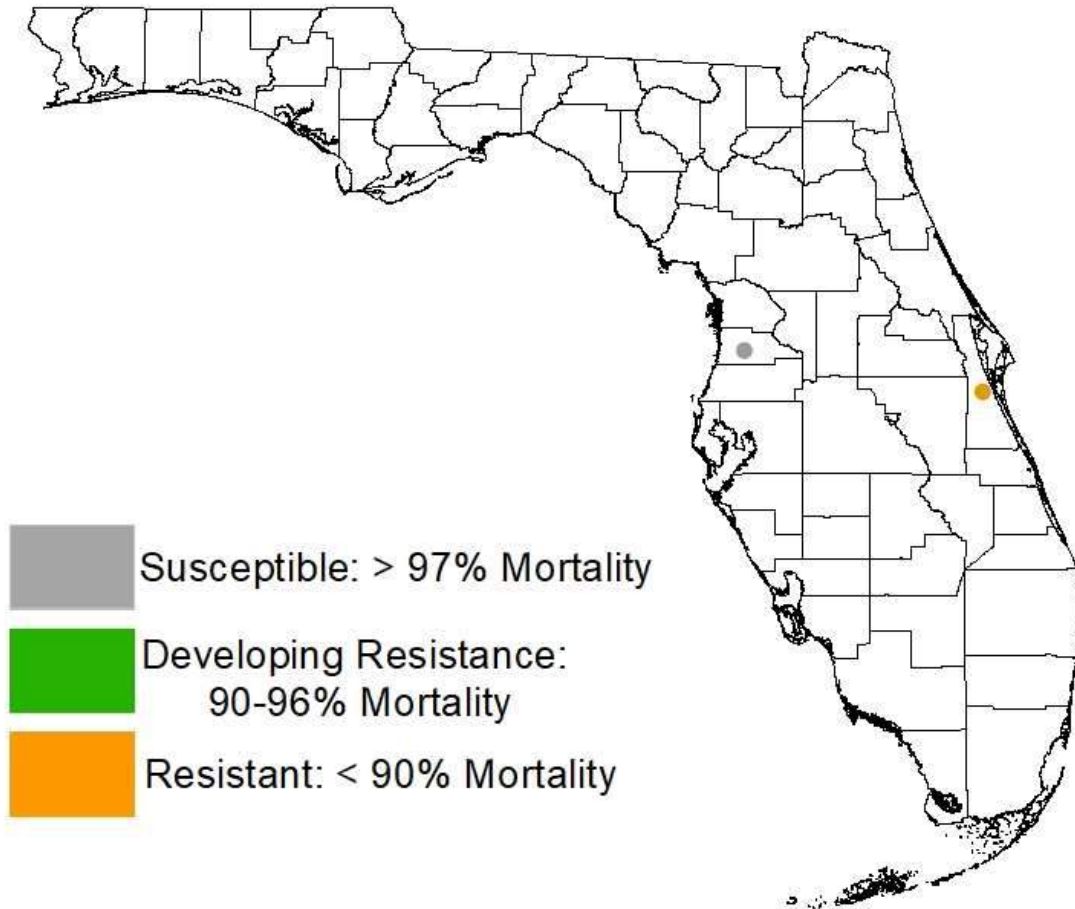


**Species: *Aedes albopictus***  
**Active Ingredient: deltamethrin**



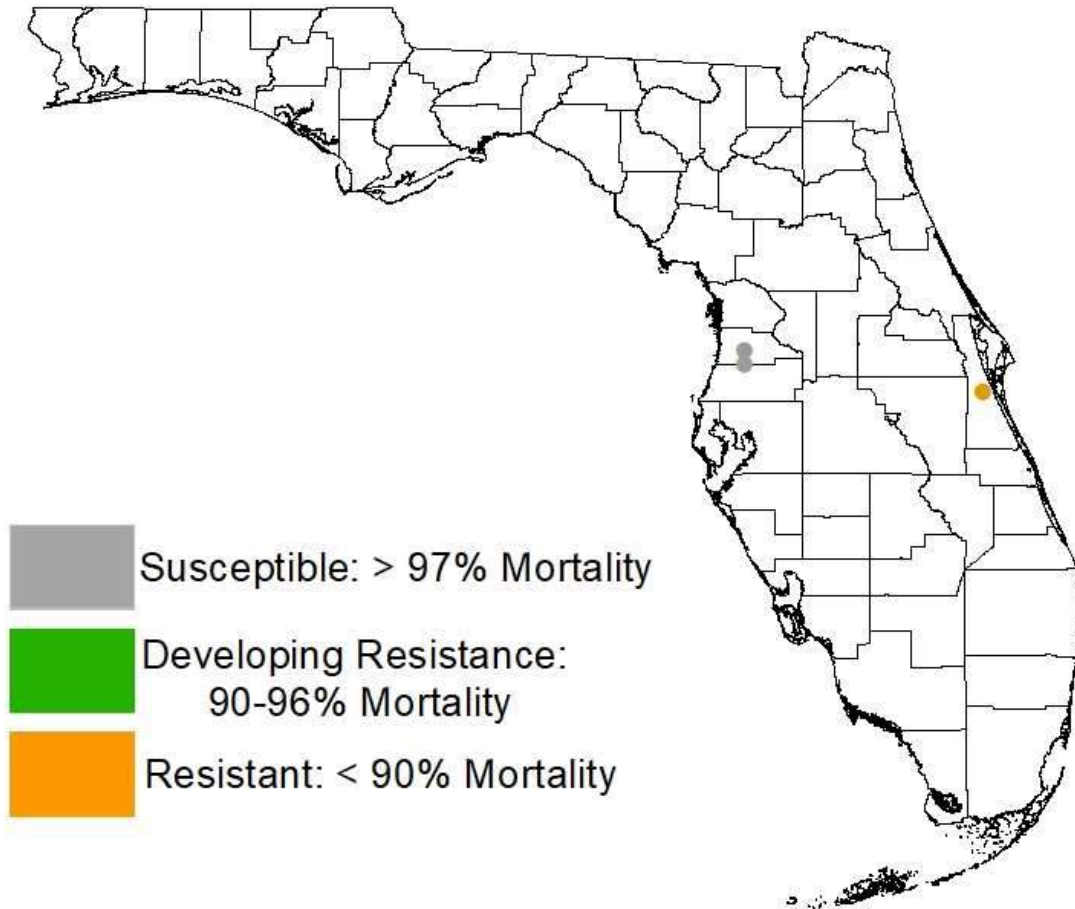
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**Species: *Aedes albopictus***  
**Active Ingredient: etofenprox**



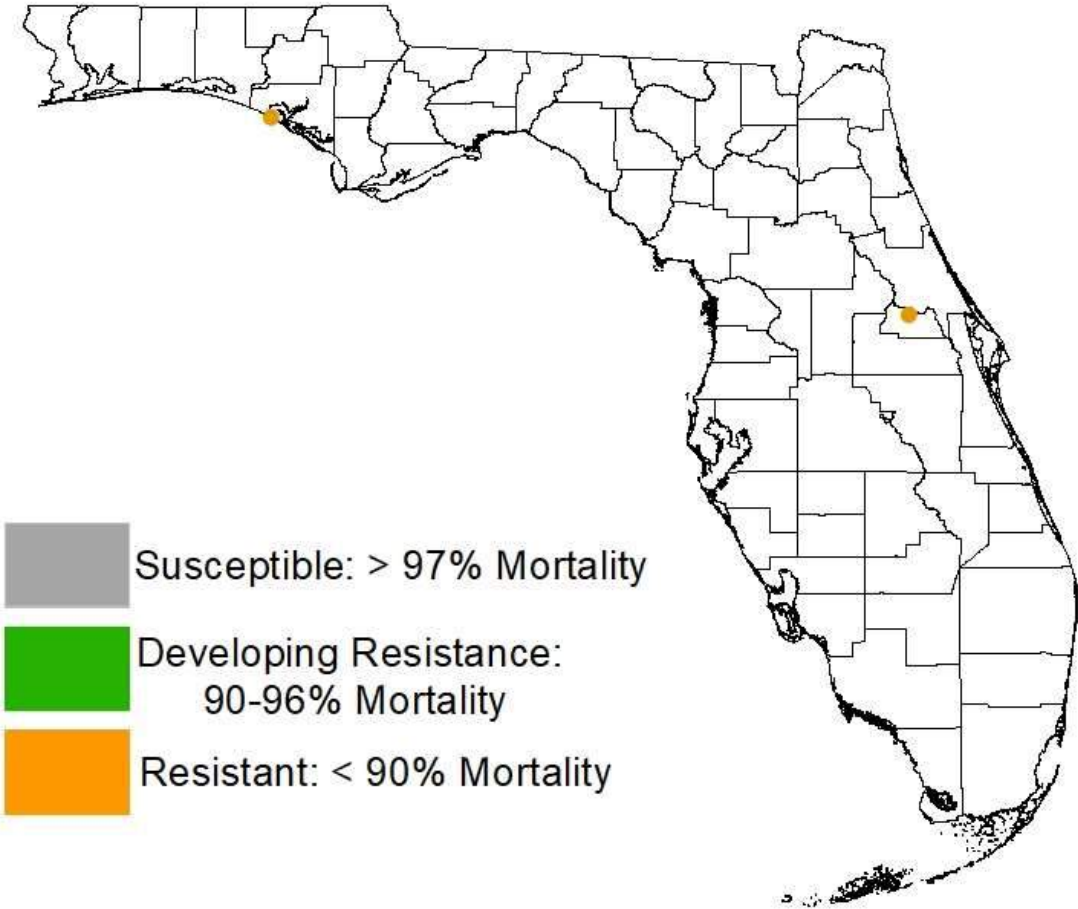
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**Species: *Aedes albopictus***  
**Active Ingredient: sumithrin**



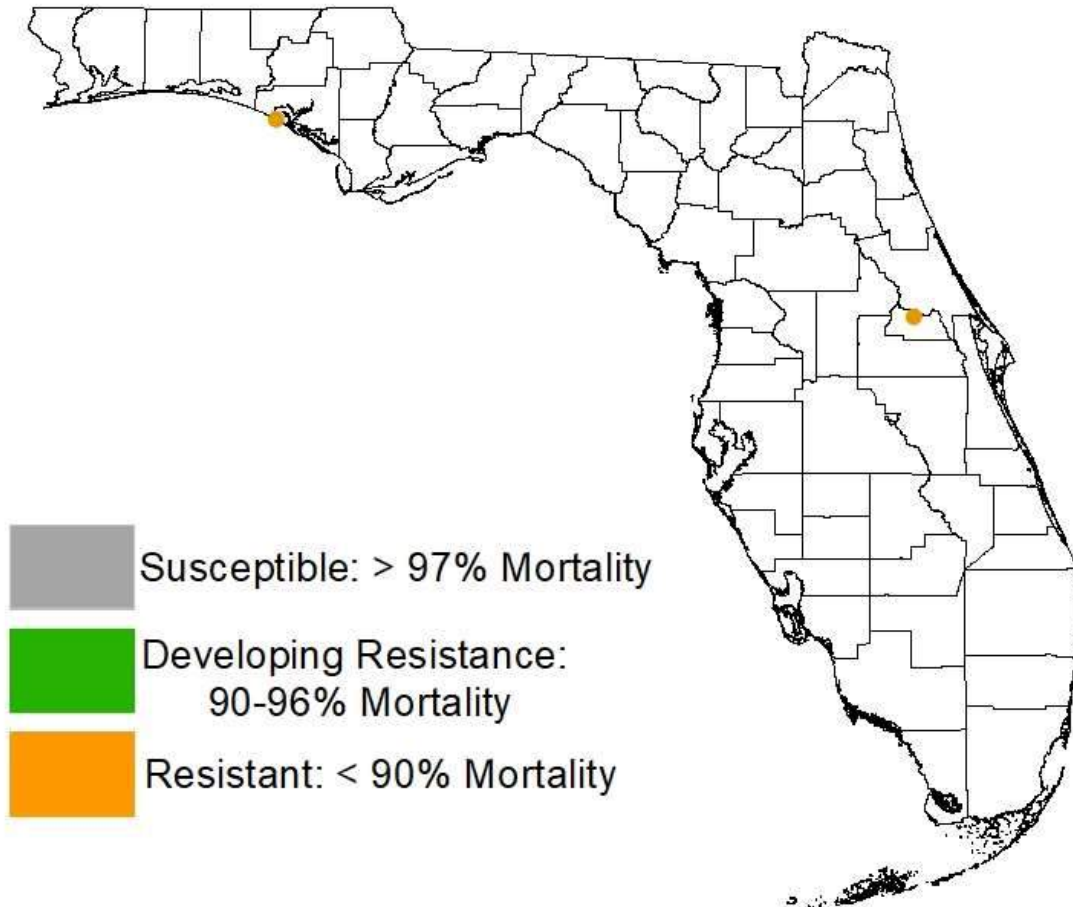
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
Updated December 31 2019

**Species: *Culex quinquefasciatus***  
**Active Ingredient: permethrin**



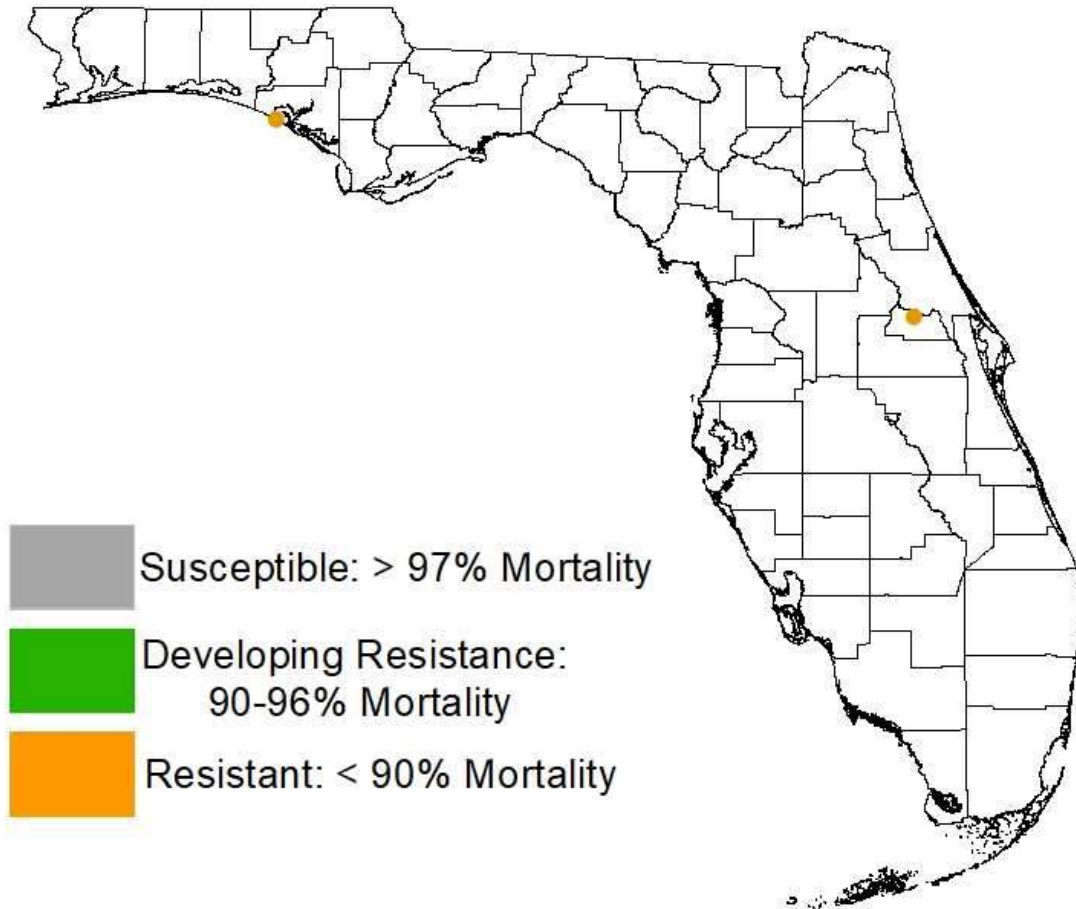
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
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**Species: *Culex quinquefasciatus***  
**Active Ingredient: malathion**



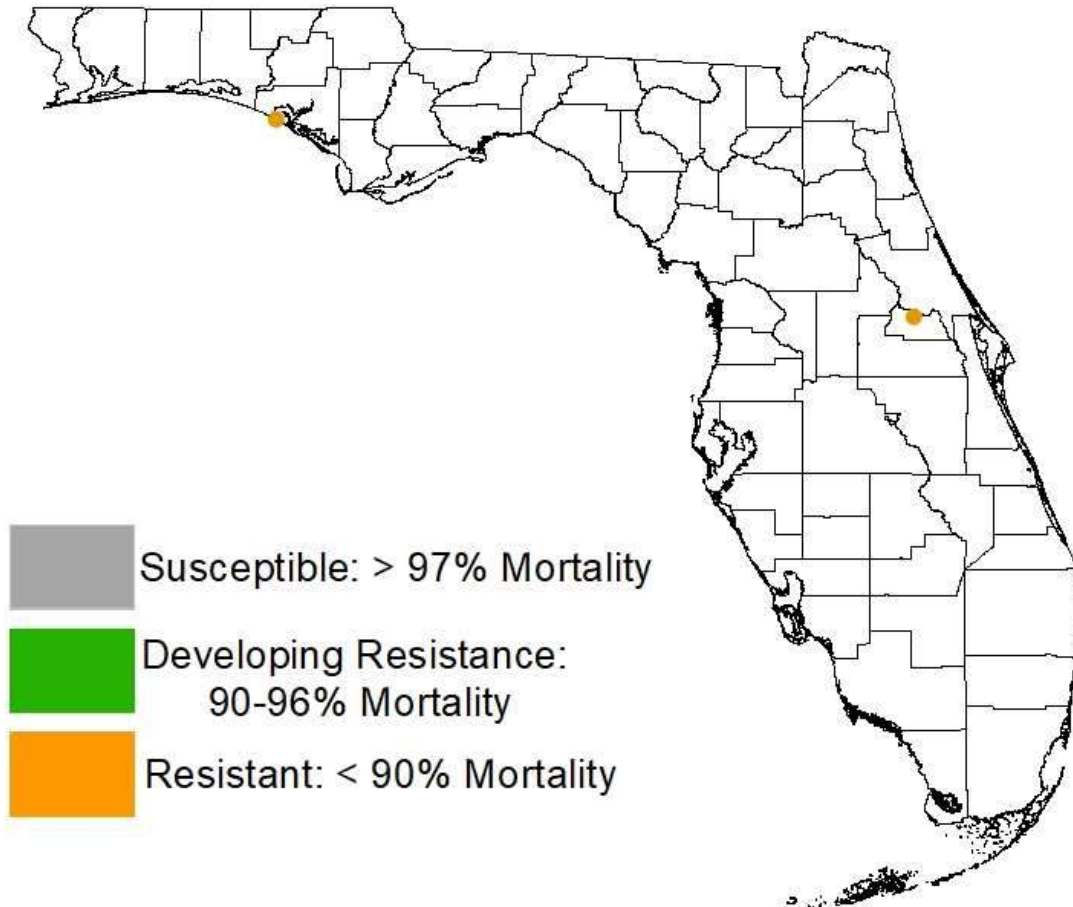
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**Species: *Culex quinquefasciatus***  
**Active Ingredient: naled**



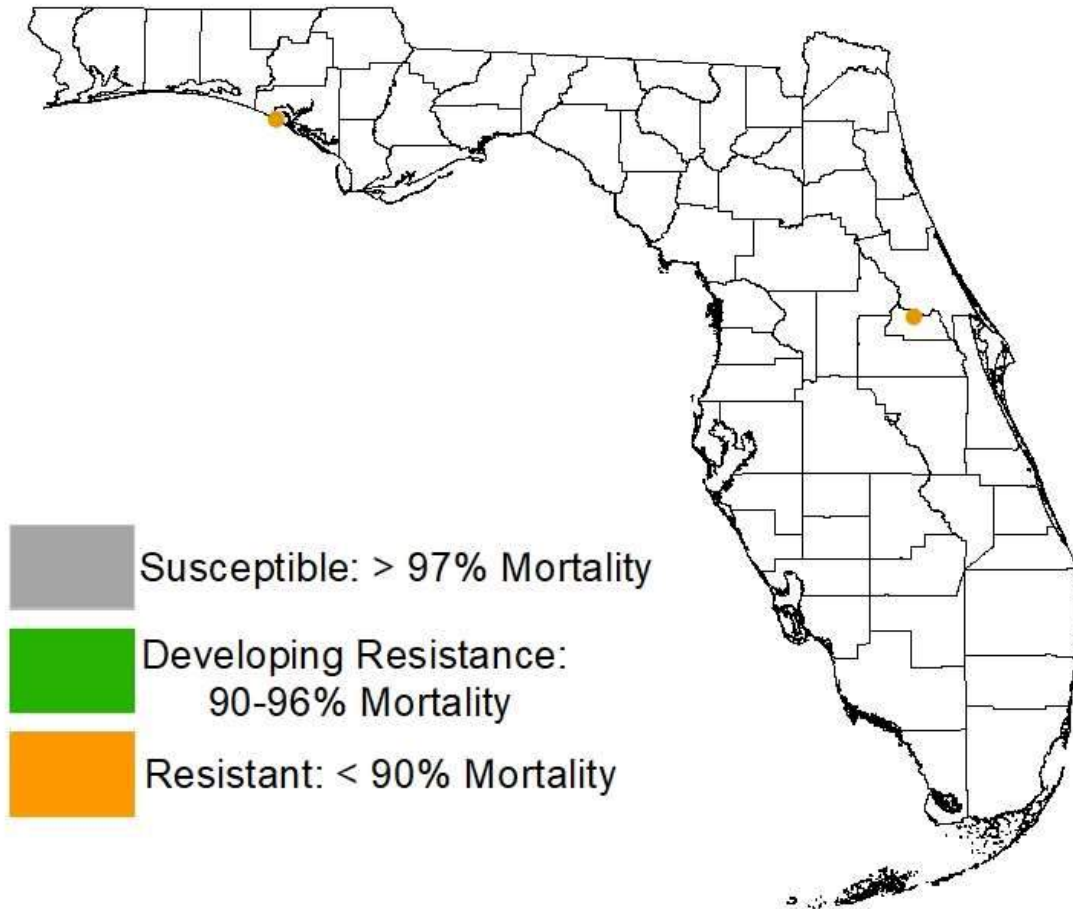
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**Species: *Culex quinquefasciatus***  
**Active Ingredient: deltamethrin**



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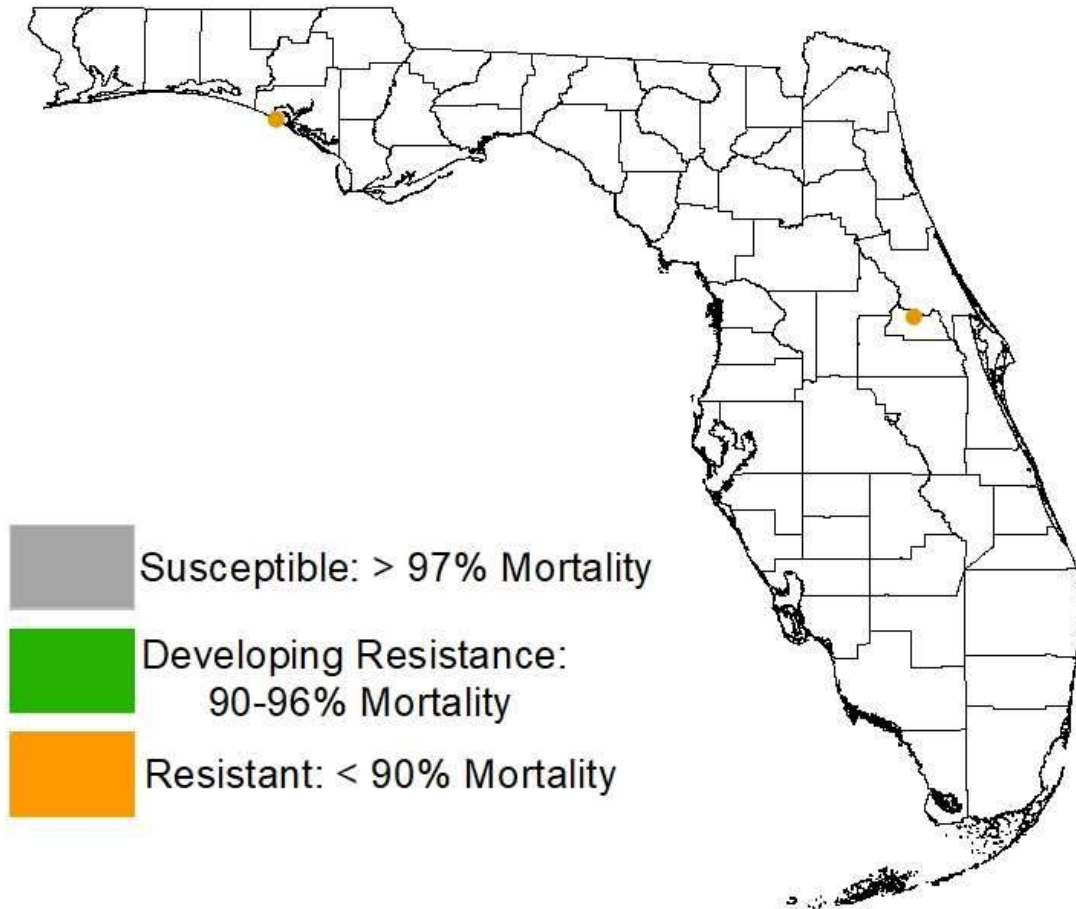
**Species: *Culex quinquefasciatus***  
**Active Ingredient: etofenprox**



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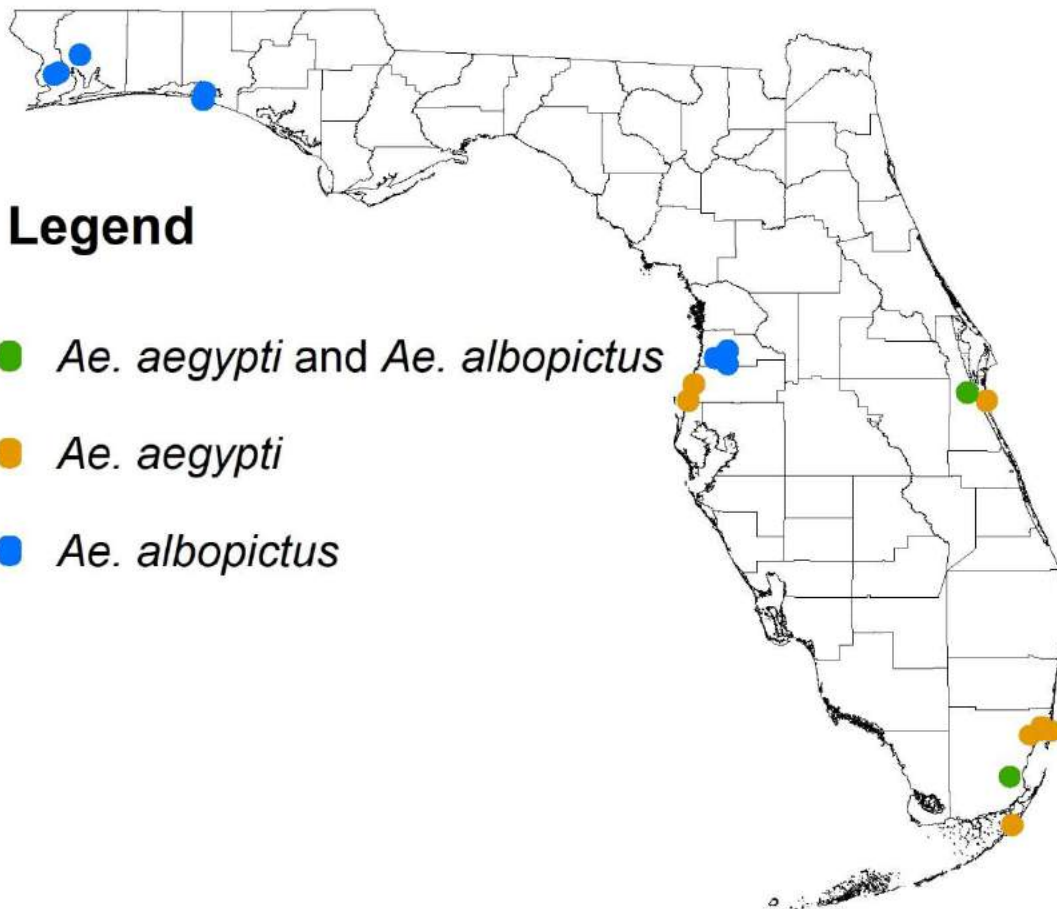


**Species: *Culex quinquefasciatus***  
**Active Ingredient: sumithrin**



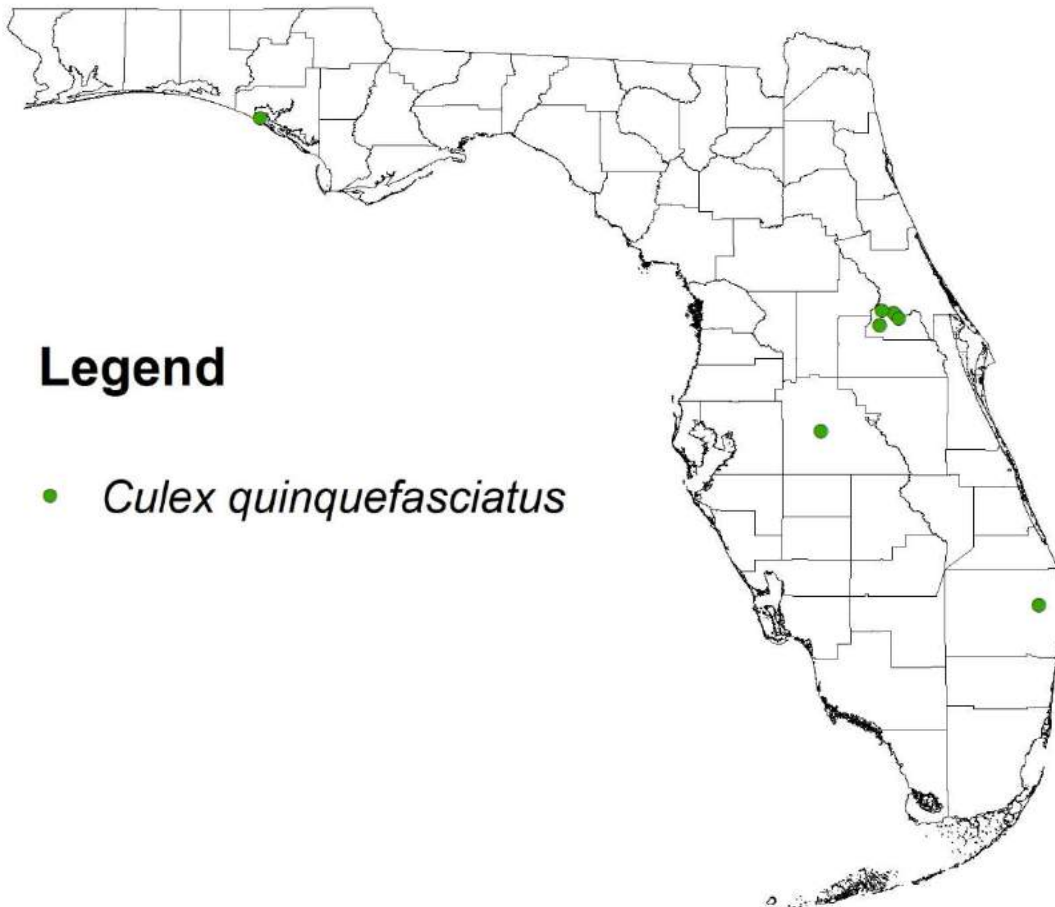
Credit: E. Buckner & D. Ramirez, Florida Medical Entomology Laboratory,  
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Updated December 31 2019

# Distribution of *Aedes aegypti* and *Ae. albopictus* populations collected October – December 2019



Credit: E. Buckner & D. Ramirez Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
Updated December 31, 2019

# Distribution of *Culex quinquefasciatus* populations collected October – December 2019



Credit: E. Buckner & D. Ramirez Florida Medical Entomology Laboratory,  
University of Florida, IFAS  
Updated December 31, 2019

Assay: CDC bottle bioassay  
 Conducted by: UF/IFAS/FMEL – Buckner Lab  
 Species: *Aedes albopictus*  
 Source: Reared from eggs  
 Site: Hernando County (Gupton)  
 Address: 16212 Gupton Street, Brooksville, FL, 34613  
 Coordinates: 28.54562, -82.46238

Date of assay: 12/16/19 - 12/17/19

Following the CDC Guidelines for insecticide resistance monitoring <http://www.cdc.gov/zika/vector/insecticide-resistance.html>, resistance is determined by the percentage of mosquitoes that die (mortality rate) in the diagnostic time.

The data shown below provides:

- Column 1: CDC recommended diagnostic dose (per bottle)
- Column 2: Active ingredient tested
- Column 3: Diagnostic time from FMEL assays using susceptible strain of *Aedes albopictus*
- Column 4: Site specific *Aedes albopictus*; % mortality at the FMEL diagnostic time

1	2	3	4
CDC diagnostic dose (per bottle)	Active ingredient tested	FMEL diagnostic time given using strain of <b>susceptible</b> <i>Aedes albopictus</i>	Gupton <i>Aedes albopictus</i> ; % mortality at the FMEL diagnostic time
43 ug/bottle	Permethrin	15 min	96%
400 ug/bottle	Malathion	30 min	90%
2.25 ug/bottle	Naled	15 min	100%
12.5 ug/bottle	Etofenprox	30 min	100%
0.75 ug/ bottle	Deltamethrin	15 min	97%
20 ug/bottle	Sumithrin	15 min	100%

Using the CDC guidelines (<http://www.cdc.gov/zika/vector/insecticide-resistance.html>) on interpreting the data for management purposes (see page 2 of this document for reference):

The Gupton population of *Aedes albopictus* is developing resistance to Permethrin and Malathion; susceptible to Naled, Etofenprox, Deltamethrin and Sumithrin.

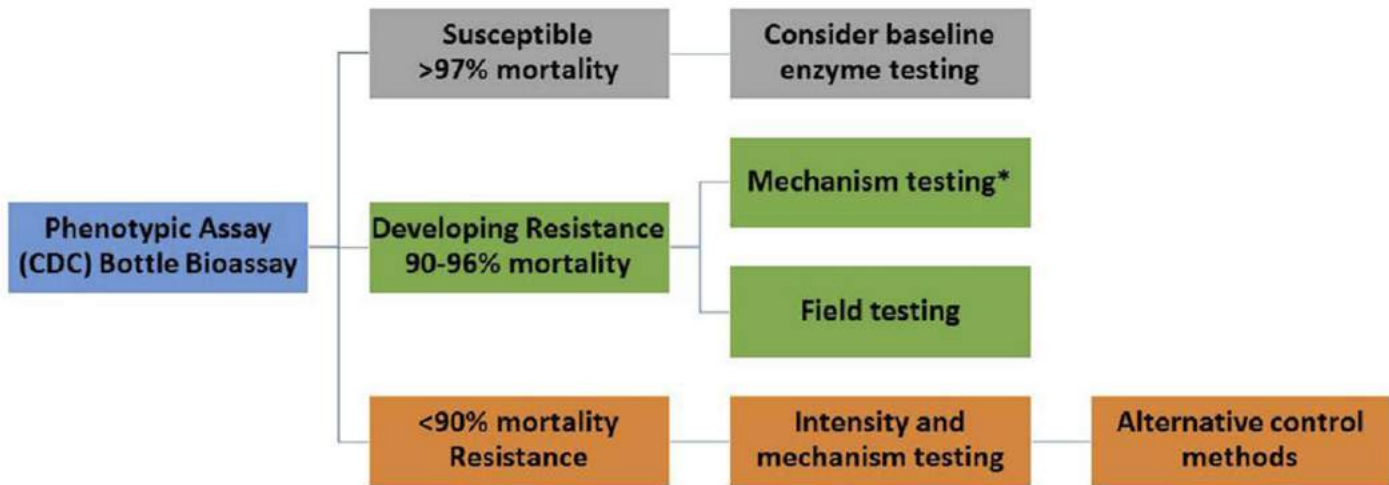
Date: 12/29/19

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## Overview of Insecticide Resistance Testing Algorithm

From: <http://www.cdc.gov/zika/pdfs/guidelines-for-aedes-surveillance-and-insecticide-resistance-testing.pdf>



\*Mechanism testing options: enzymes, molecular assays, bottle bioassay with inhibitors