

Quarter 4 (1/1/2020 – 3/31/2020) 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

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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 identified 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 4,561 *Aedes* eggs and 25 *Culex quinquefasciatus* egg rafts were collected from the traps. Of the 4,561 *Aedes* eggs collected, there was \approx a 79% hatch rate, resulting in 3,603 *Aedes* adults emerging. The *Culex quinquefasciatus* egg rafts collected had a \approx 77% hatch rate, resulting in 2,495 *Culex quinquefasciatus* adults emerging. The resulting *Aedes* adult mosquitoes were identified as *Aedes aegypti* and *Ae. albopictus*. The *Aedes* eggs processed this quarter came from (county followed by site name):
 - a. Miami-Dade
 - i. Brickell
 - ii. King's Bay
 - iii. Little Havana
 - b. Palm Beach
 - i. Mounts
 - ii. Rocky Pines
 - c. Seminole
 - i. Halsey

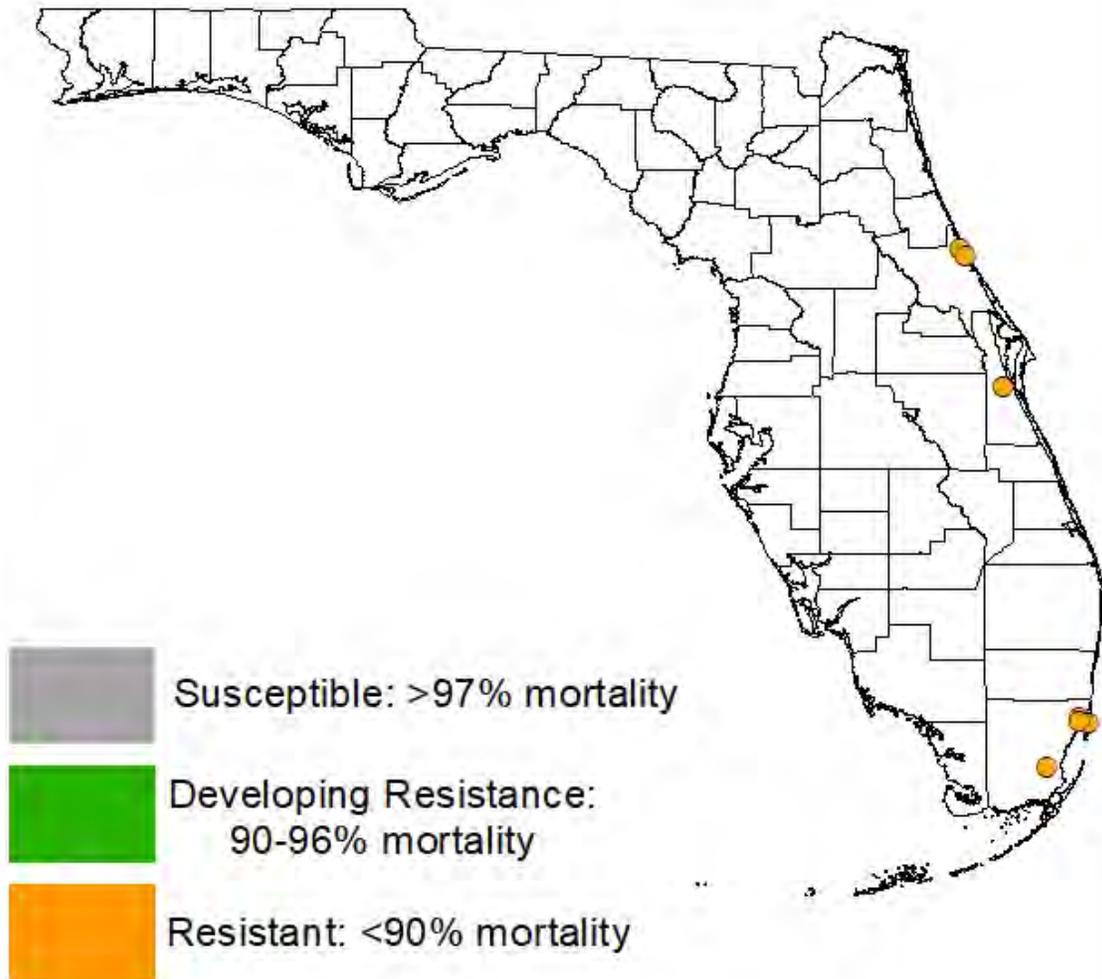
The *Culex quinquefasciatus* egg rafts processed this quarter came from (county followed by site name):

- a. Citrus
 - i. 10th St
 - b. Seminole
 - i. Palm
 - ii. Winding Pines
2. Since the end of the previous quarter, *Aedes aegypti* from 7 sites, *Ae. albopictus* from 1 site, and *Culex quinquefasciatus* from 2 sites, respectively, have been tested for resistance 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 7 - 24 of this report.
 3. CDC bottle bioassay testing was performed on mosquitoes from 10 sites against at least one pyrethroid (permethrin) and one organophosphate (malathion) active ingredient (AI). The total number of active ingredients that the mosquitoes from each site were tested against can be found in the table below. The CDC bottle bioassay results for each active ingredient can also be found at <https://fmel.ifas.ufl.edu/>.

Species Tested	County	Site	# of AIs Tested
<i>Aedes aegypti</i>	Brevard	Viera	6
<i>Aedes aegypti</i>	Miami-Dade	Homestead	6
<i>Aedes aegypti</i>	Miami-Dade	Little River	6
<i>Aedes aegypti</i>	Miami-Dade	Miami Beach	6
<i>Aedes aegypti</i>	Miami-Dade	Wynwood	6
<i>Aedes aegypti</i>	Volusia	Holly Hill	6
<i>Aedes aegypti</i>	Volusia	South Daytona	4
<i>Aedes albopictus</i>	Brevard	EFSC	6
<i>Culex quinquefasciatus</i>	Citrus	10th St	6
<i>Culex quinquefasciatus</i>	Seminole	Winding Pine	6

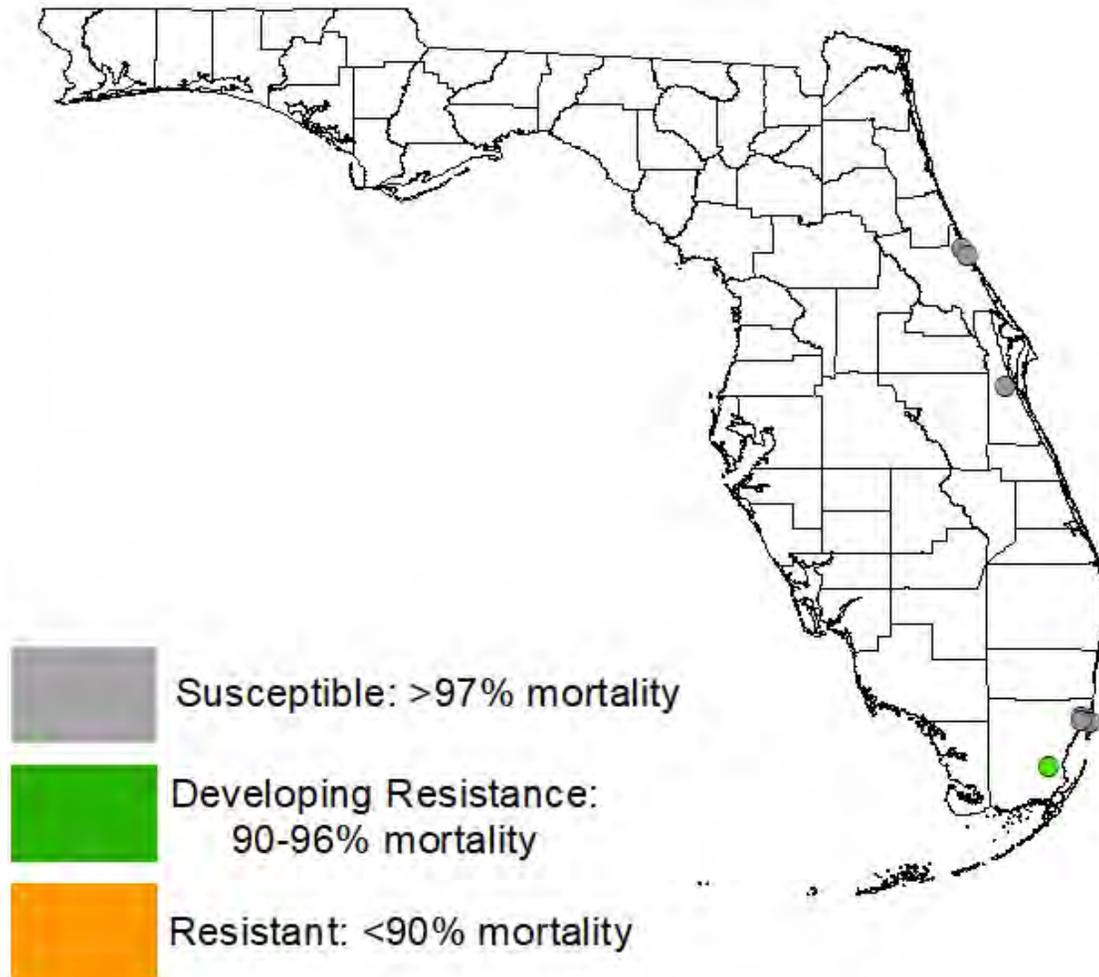
4. The map of sites where *Aedes* eggs and *Culex* egg rafts were collected from and used in CDC bottle bioassay testing this quarter can be found on page 25 of this report. The distribution map can also be found at <https://fmel.ifas.ufl.edu/>.
5. Results of the CDC bottle bioassay testing were distributed as reports by email to Florida mosquito control program managers. Specifically, the results sent to program managers for the Little River, Miami Beach, and Wynwood sites in Miami-Dade County, Viera and EFSC sites in Brevard County, and 10th Street site in Citrus County were forwarded to the Contract Manager. An example report can be found on pages 26-27.
6. This Quarterly Report in combination with the information posted on the Reporting website at <https://fmel.ifas.ufl.edu/> satisfies this task.
7. All necessary information will be provided in the Final Annual Report.

Species: *Aedes aegypti*
Active Ingredient: permethrin



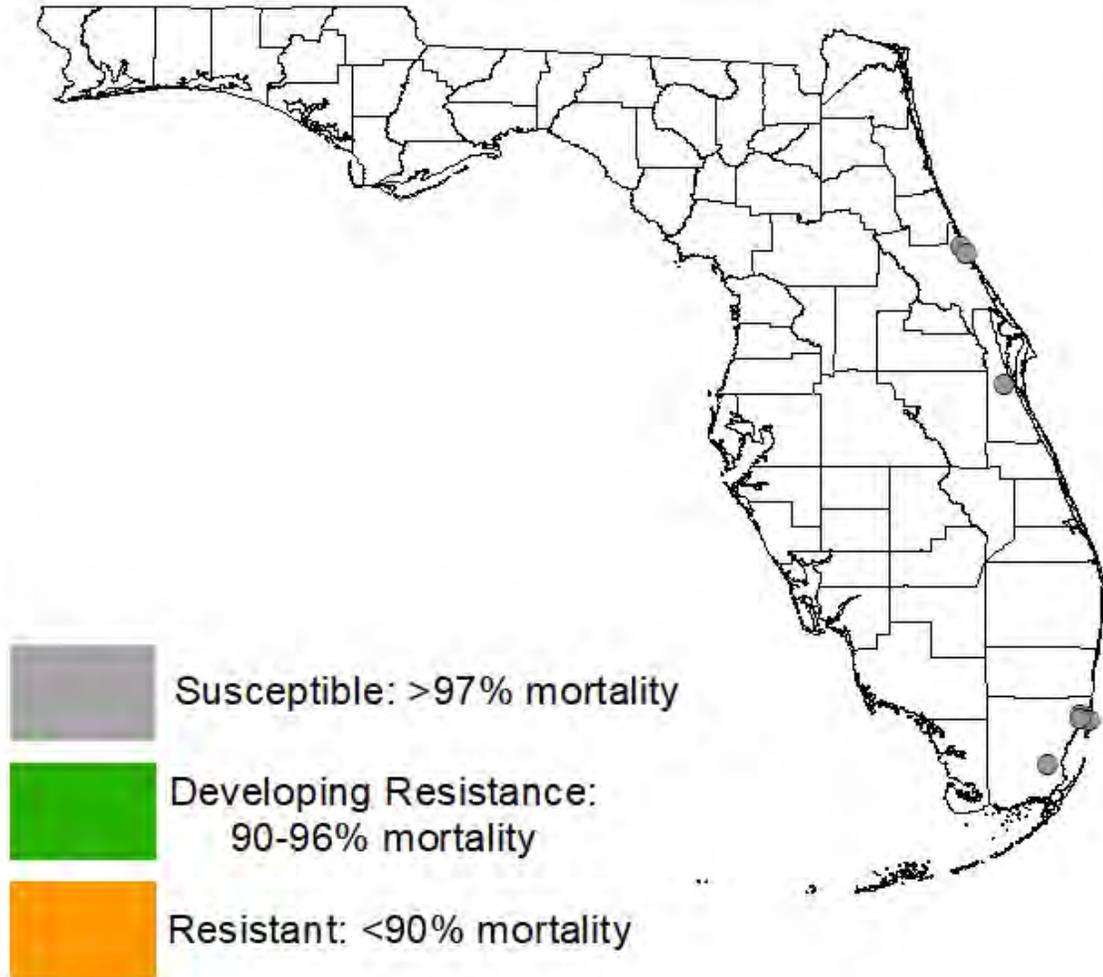
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes aegypti*
Active Ingredient: malathion



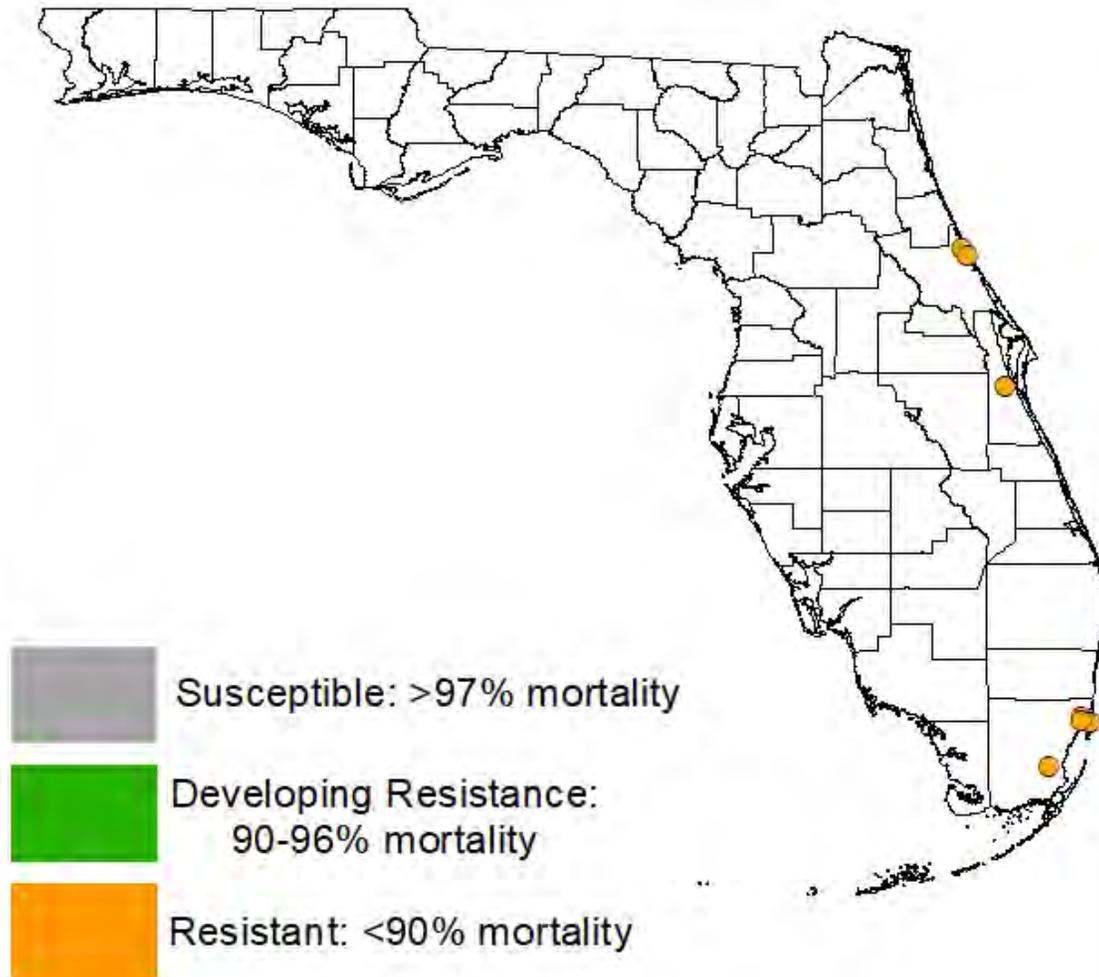
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes aegypti*
Active Ingredient: naled



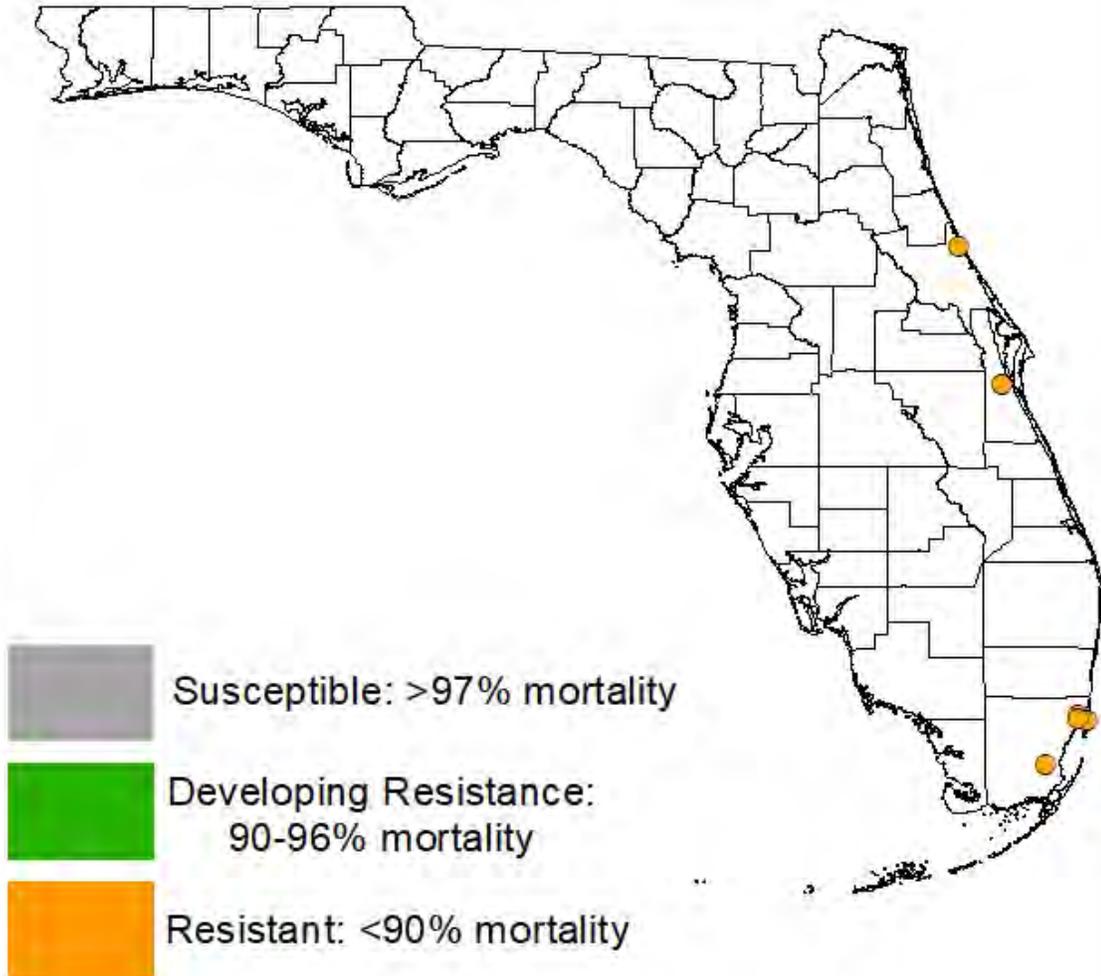
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes aegypti*
Active Ingredient: deltamethrin



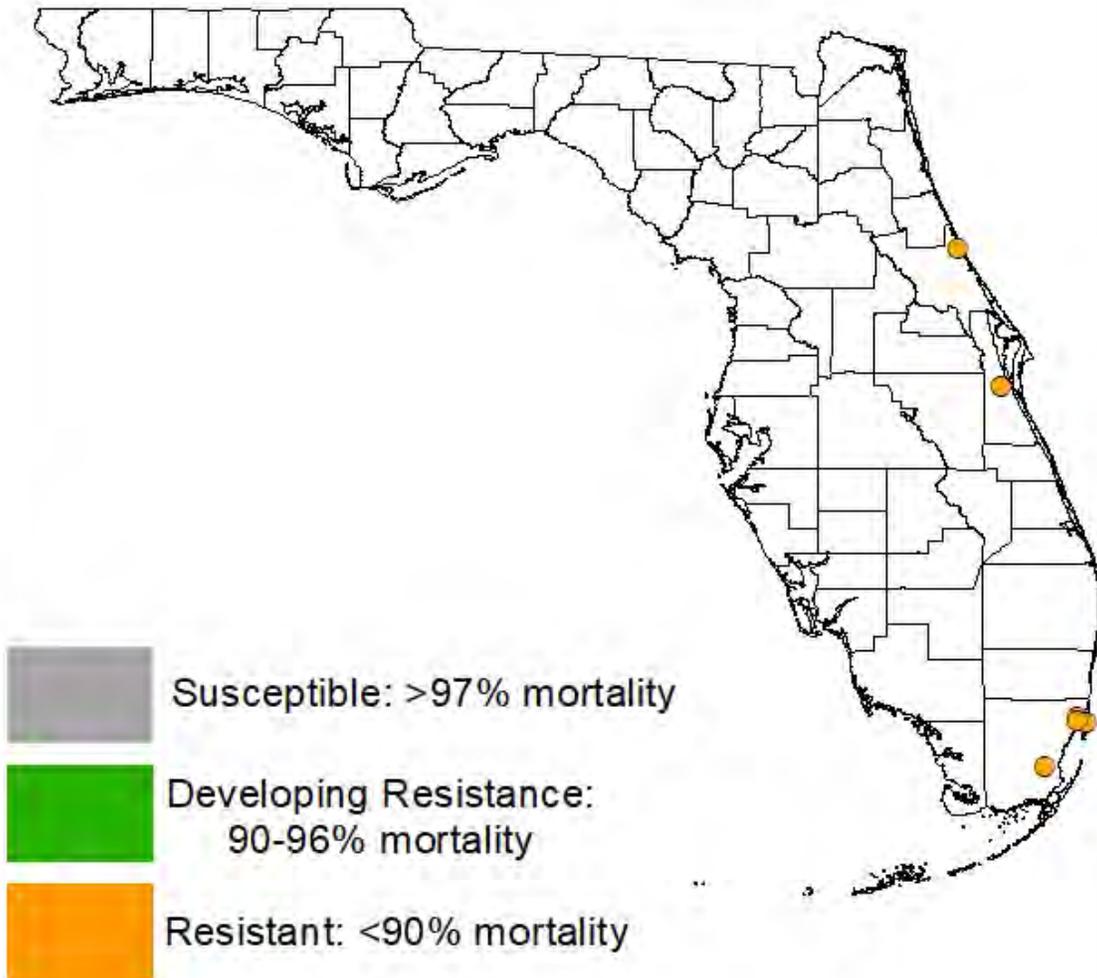
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes aegypti*
Active Ingredient: etofenprox



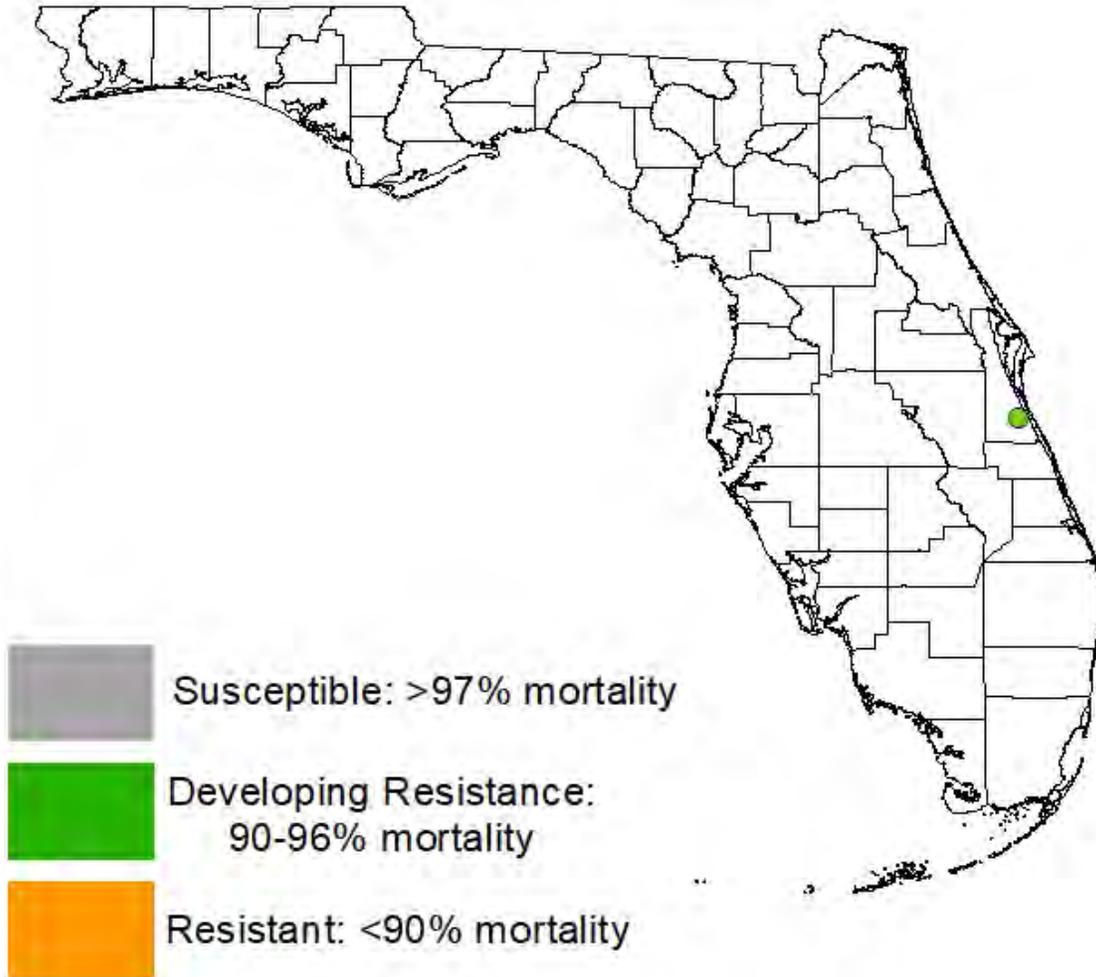
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes aegypti*
Active Ingredient: sumithrin



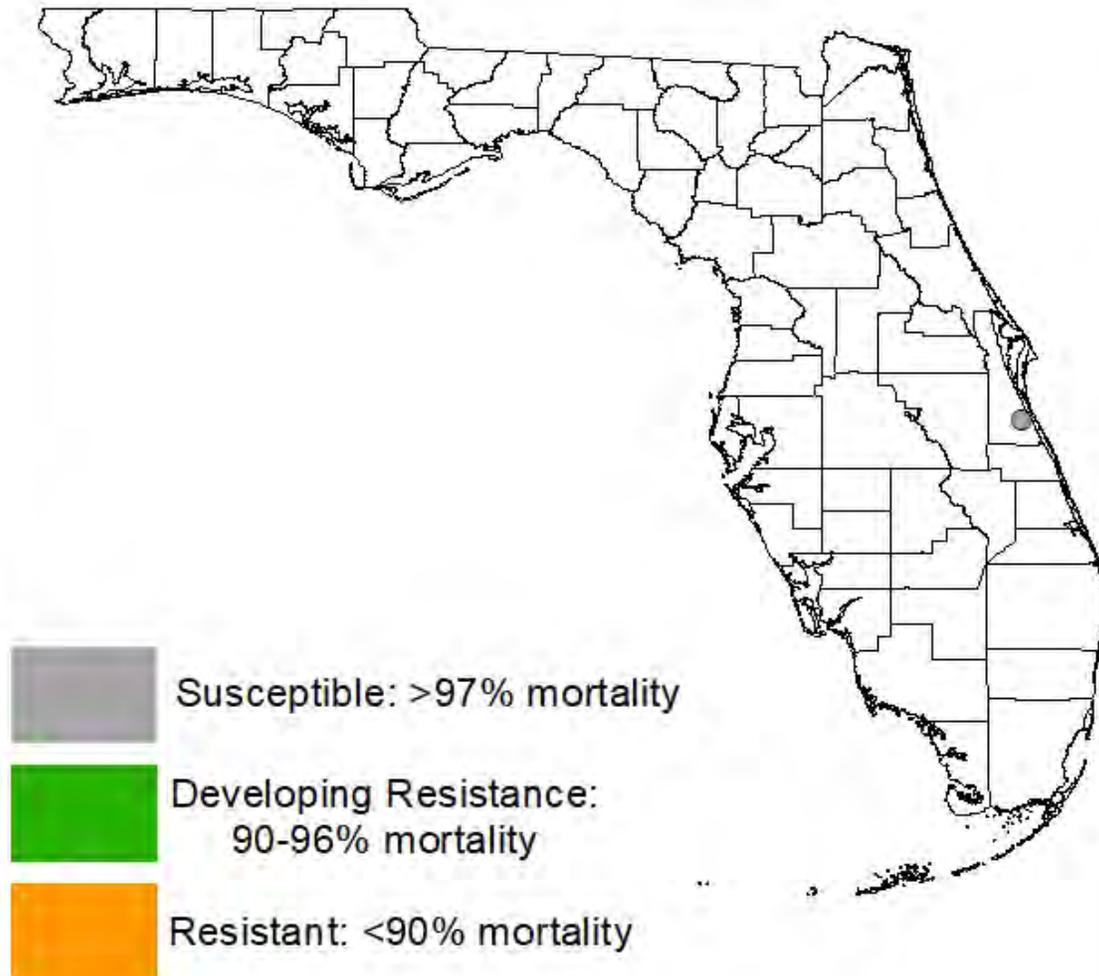
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes albopictus*
Active Ingredient: permethrin



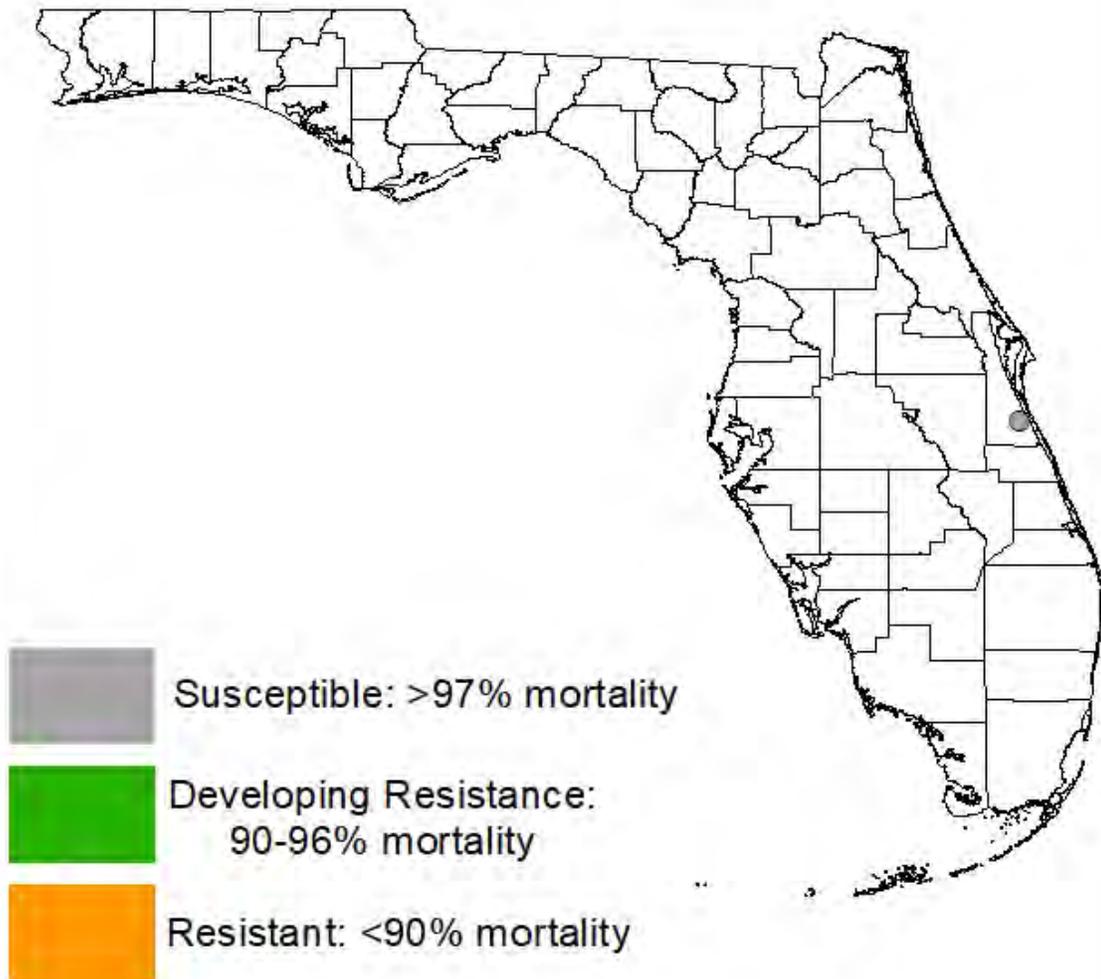
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes albopictus*
Active Ingredient: malathion



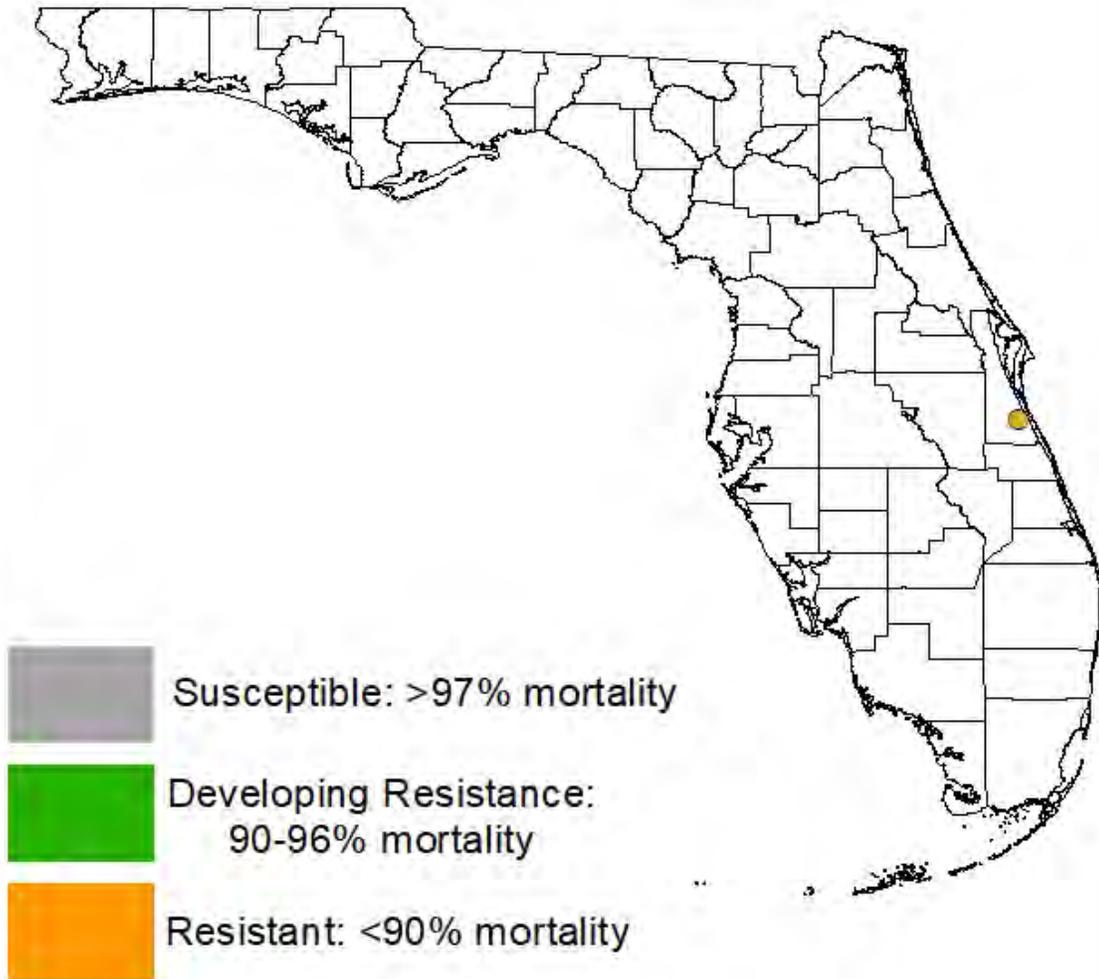
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes albopictus*
Active Ingredient: naled



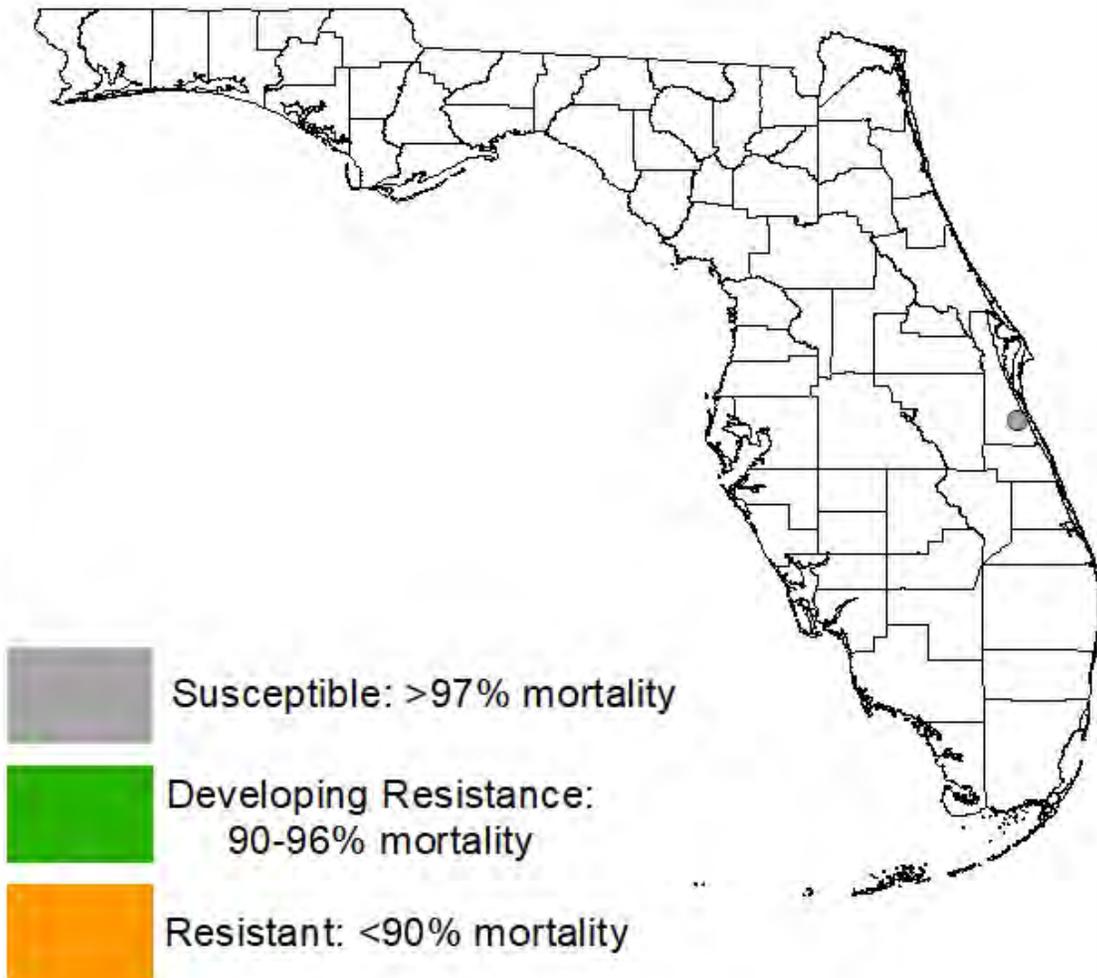
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes albopictus*
Active Ingredient: deltamethrin



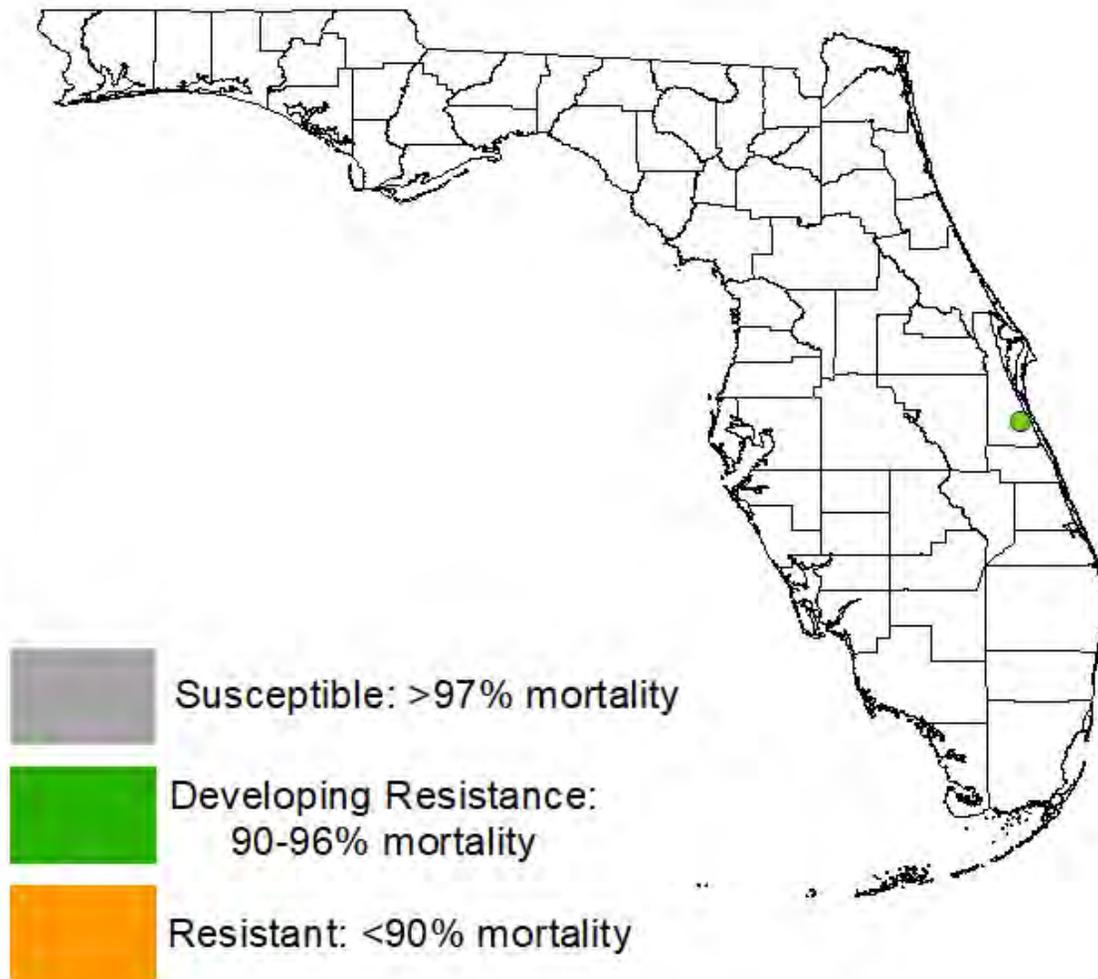
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes albopictus*
Active Ingredient: etofenprox



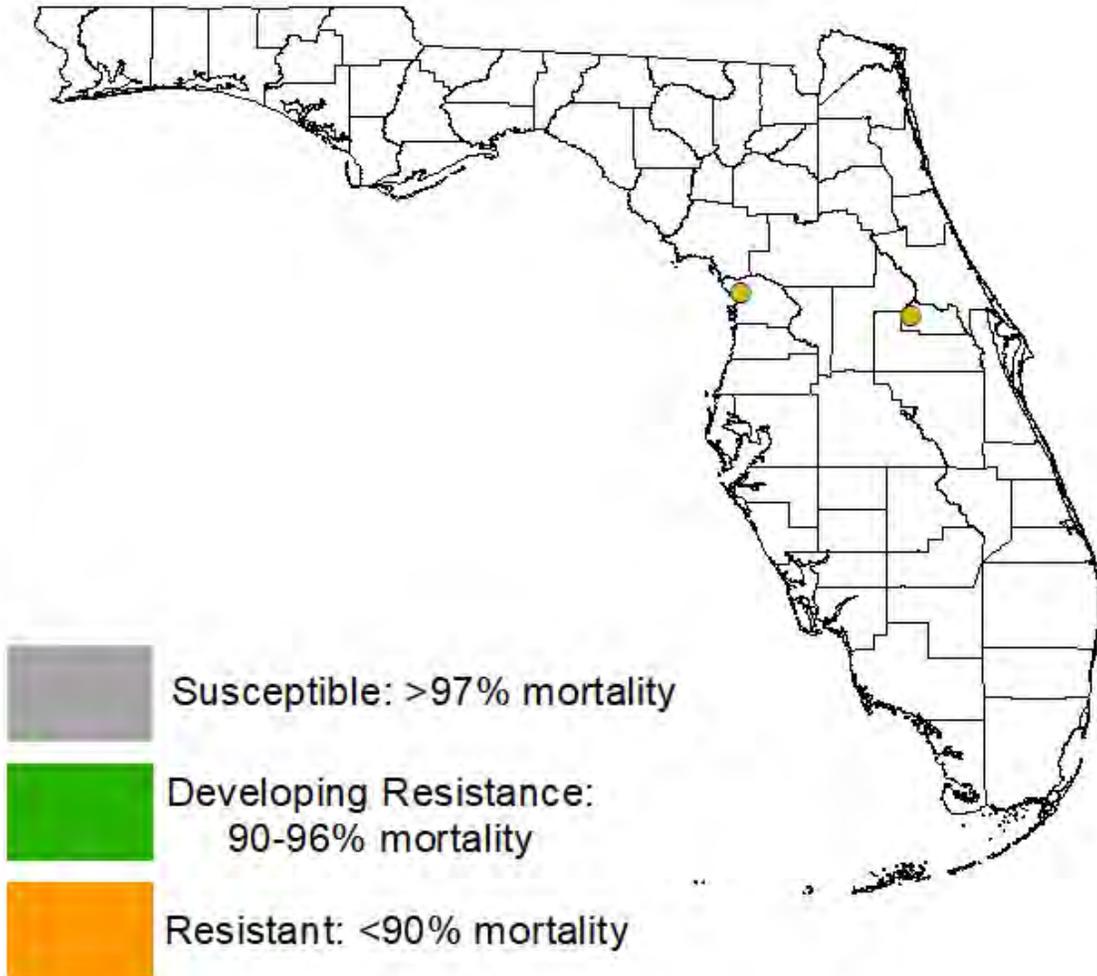
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Aedes albopictus*
Active Ingredient: sumithrin



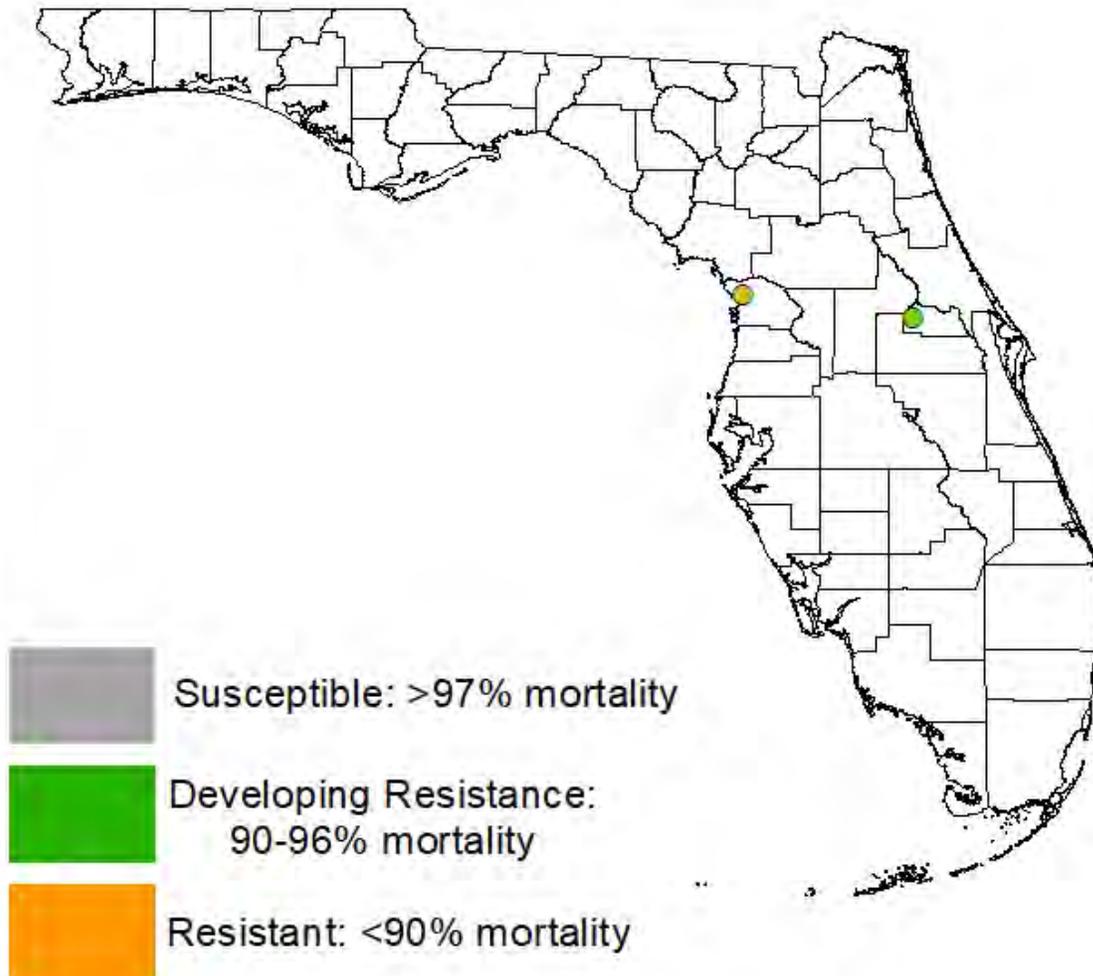
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Culex quinquefasciatus*
Active Ingredient: permethrin



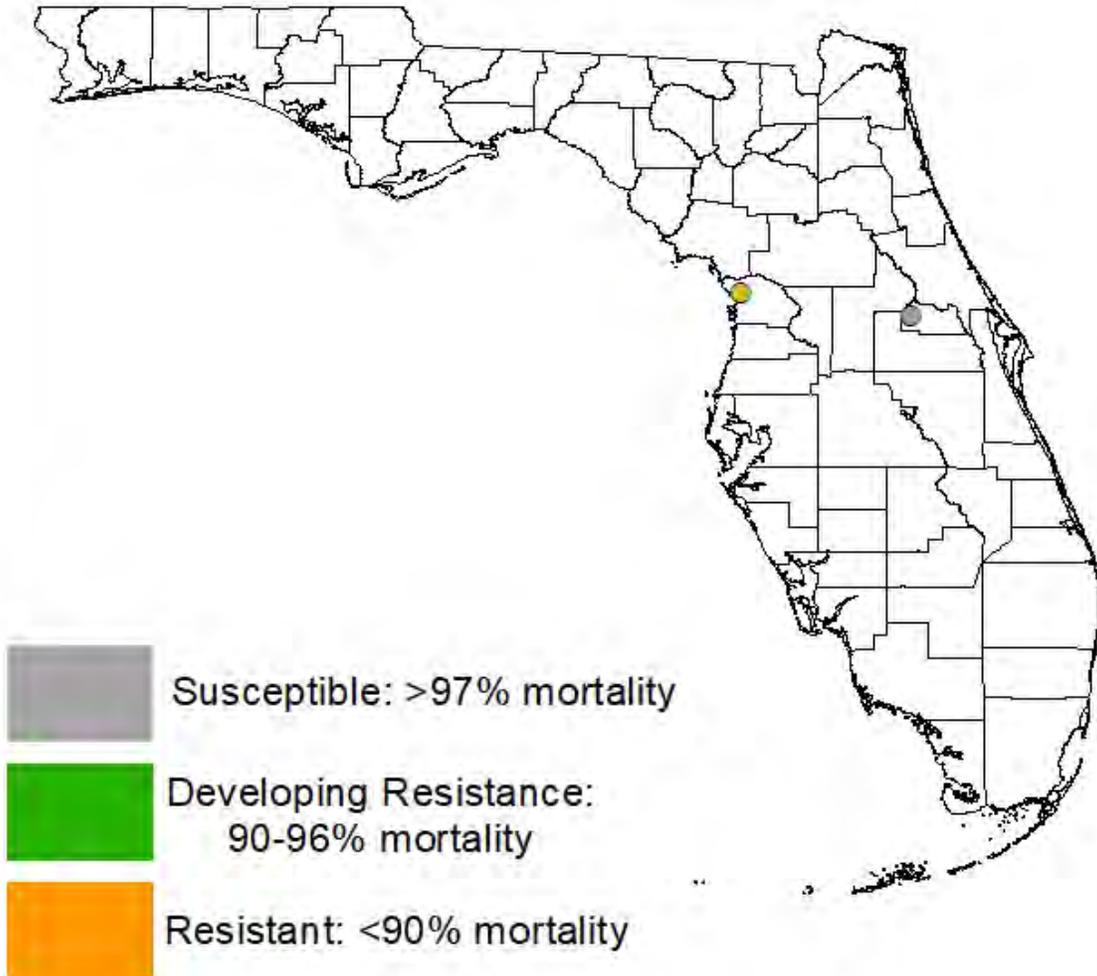
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Culex quinquefasciatus*
Active Ingredient: malathion



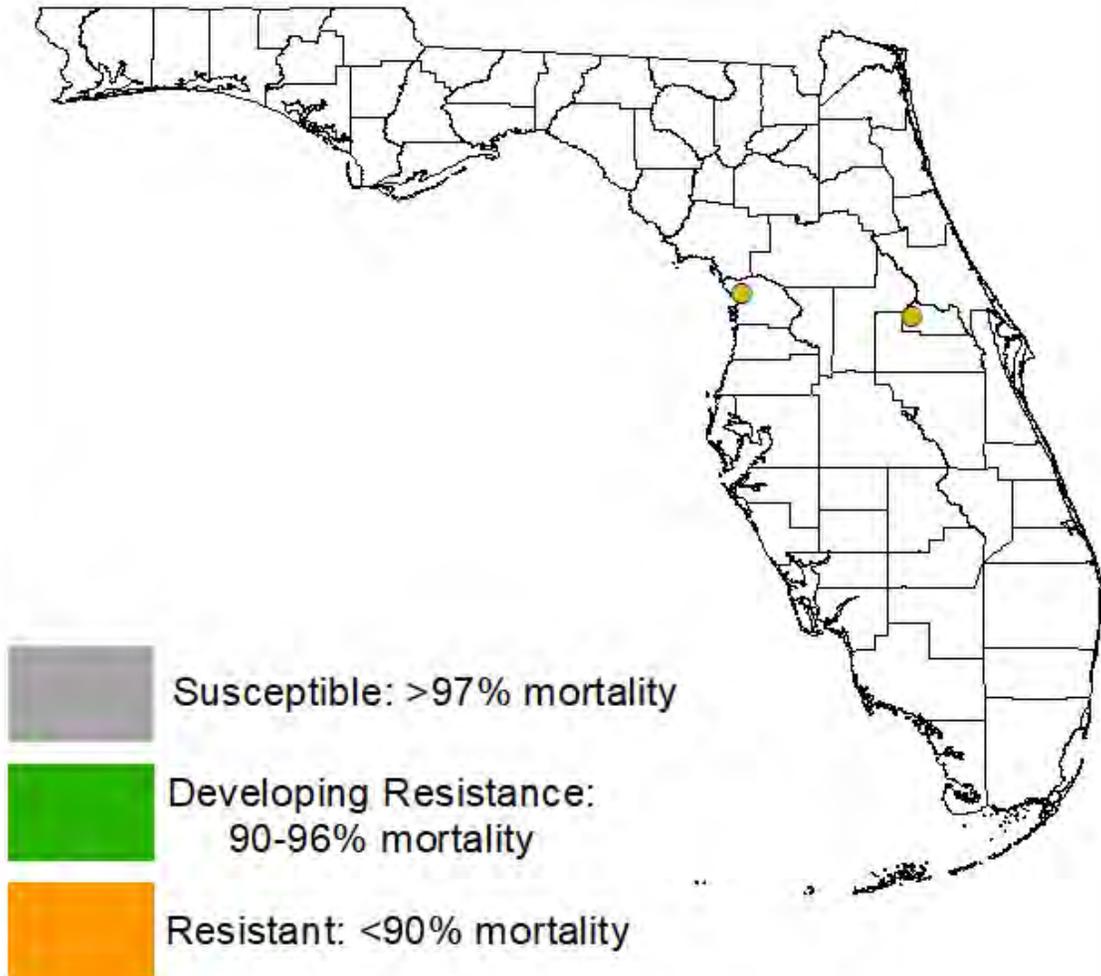
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Culex quinquefasciatus*
Active Ingredient: naled



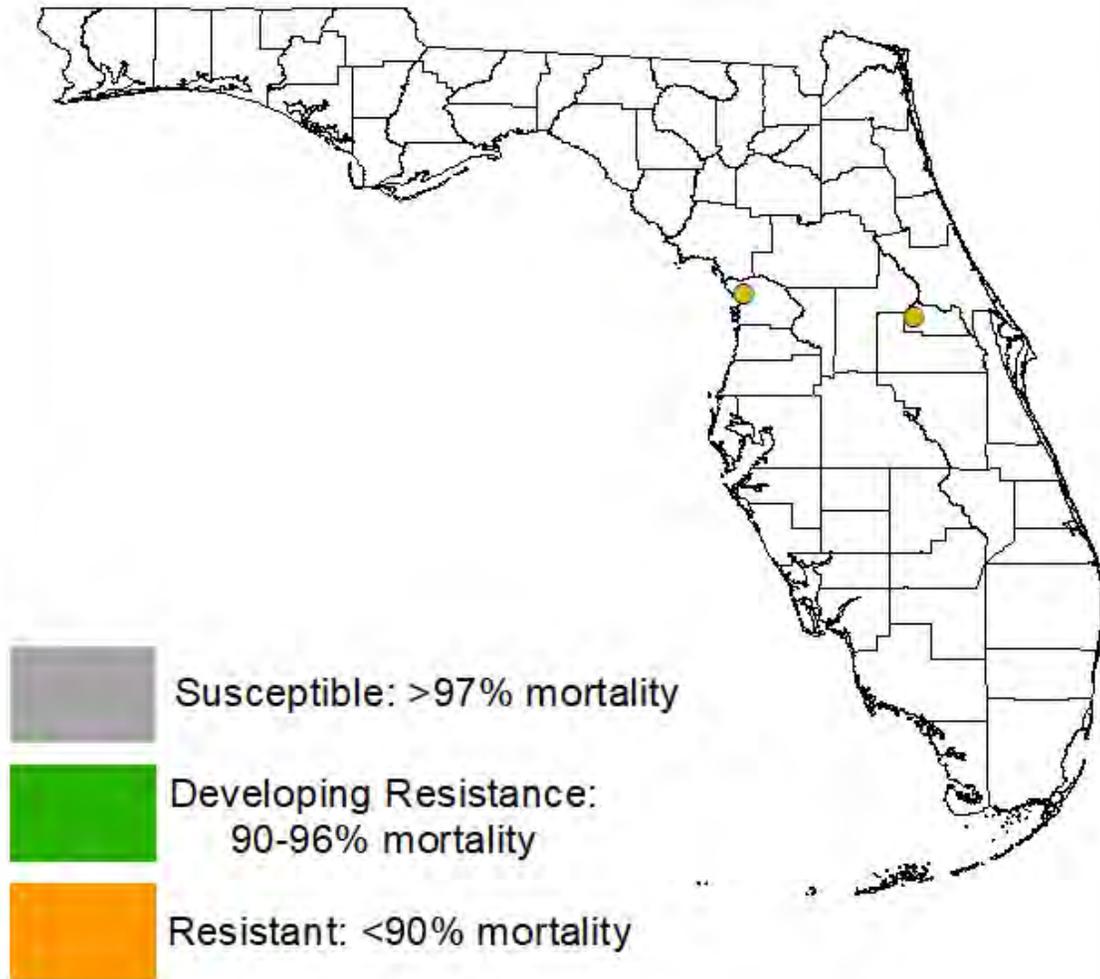
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Culex quinquefasciatus*
Active Ingredient: deltamethrin



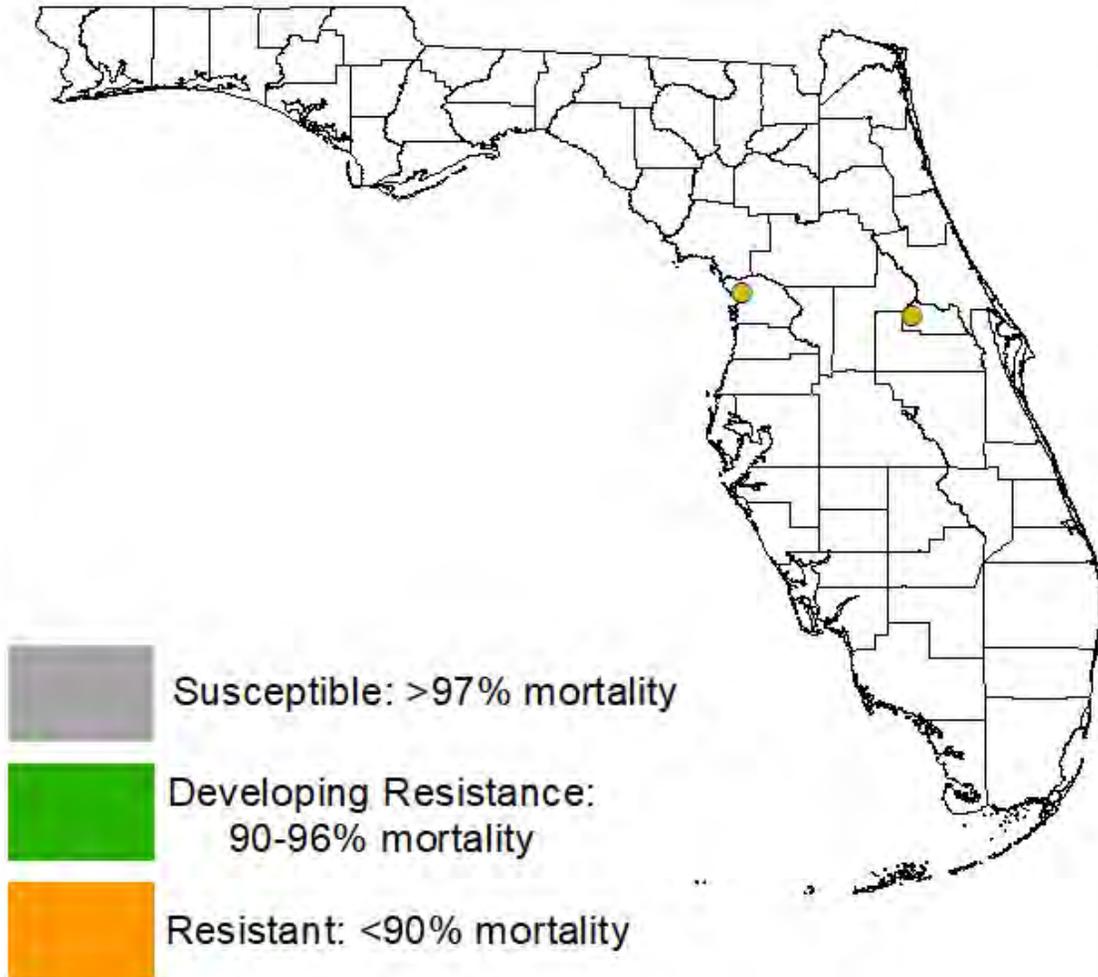
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Culex quinquefasciatus*
Active Ingredient: etofenprox



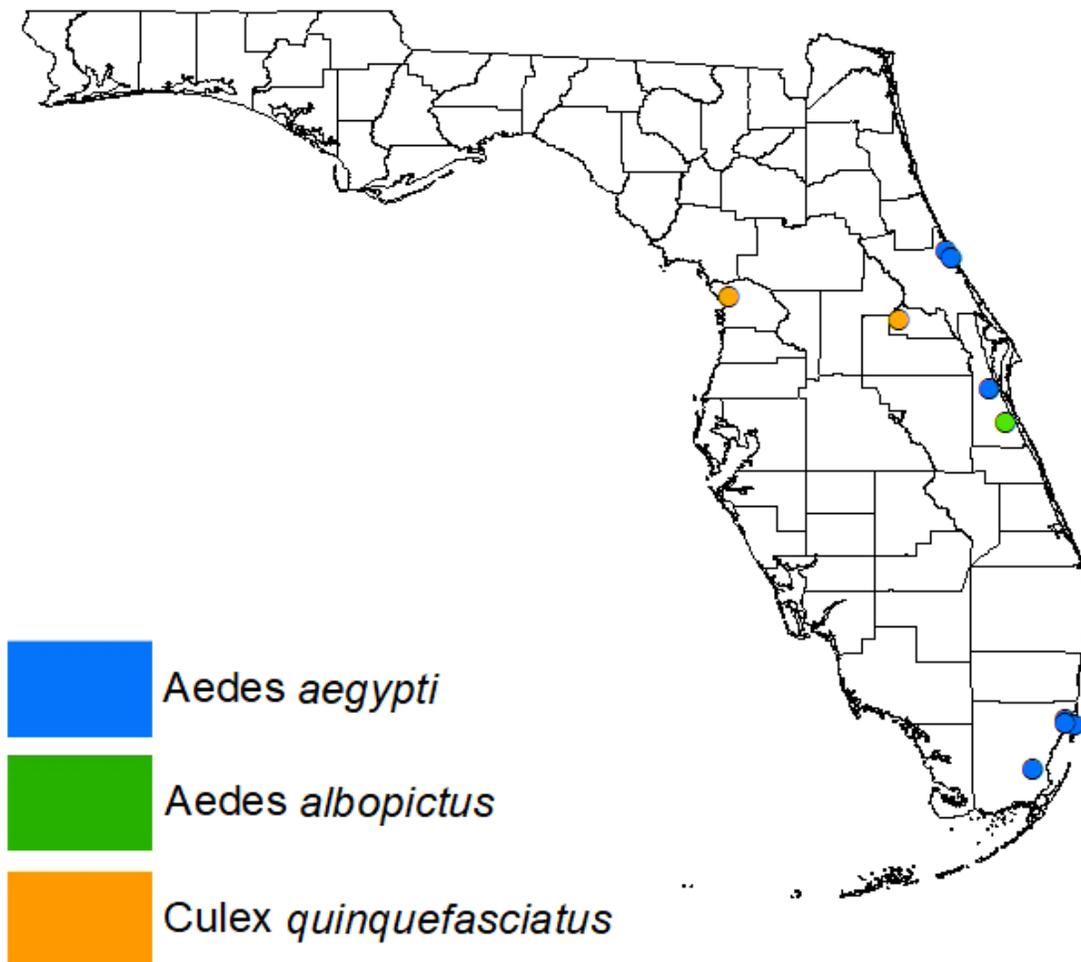
Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Species: *Culex quinquefasciatus*
Active Ingredient: sumithrin



Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Distribution of domestic mosquito populations tested for insecticide resistance January 1 - March 31, 2020



Credit: E. Buckner & D. Ramirez,
UF/IFAS Florida Medical Entomology Laboratory

Assay: CDC bottle bioassay
 Conducted by: UF/IFAS/FMEL – Buckner Lab
 Species: *Aedes albopictus*
 Source: Reared from eggs
 Site: Brevard County (EFSC)
 Address: 250 Community College Parkway Southeast, Palm Bay, Florida 32909
 Coordinates: 27.993386, -80.6302709

Date of assay: 1/21/20 – 1/23/20

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; 100% mortality expected at given time using a strain of susceptible *Aedes albopictus* Column 4: Site specific *Aedes albopictus*; % mortality at the CDC diagnostic time

1	2	3	4
CDC diagnostic dose (per bottle)	Active ingredient tested	CDC diagnostic time; 100% mortality expected at given time using strain of susceptible <i>Aedes albopictus</i>	EFSC <i>Aedes albopictus</i> ; % mortality at the CDC diagnostic time
43 ug/bottle	Permethrin	5 min	96 %
400 ug/bottle	Malathion	30 min	99 %
2.25 ug/bottle	Naled	15 min	98 %
12.5 ug/bottle	Etofenprox	30 min	100 %
0.75 ug/ bottle	Deltamethrin	15 min	75 %
20 ug/bottle	Sumithrin	15 min	95 %

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

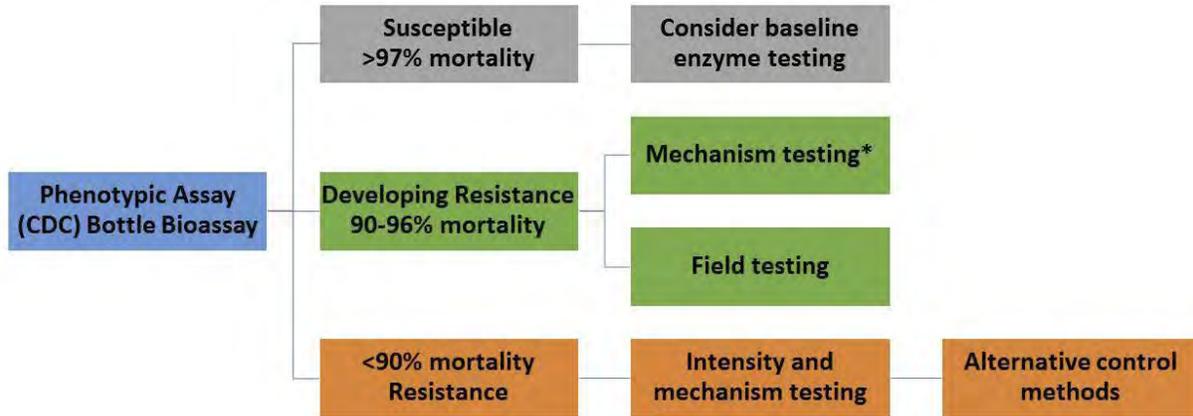
Date: February 6th, 2020

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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