NEVBD Pesticide Resistance Monitoring Program

Establishing a Centralized Network to Increase Regional Capacity for Pesticide Resistance Detection and Monitoring

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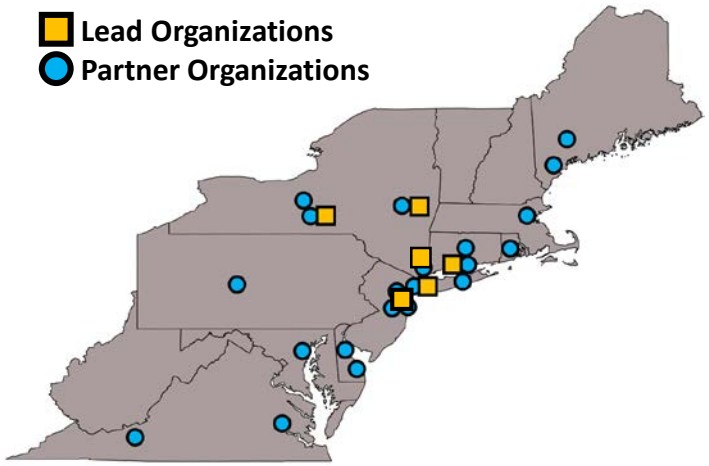
Cornell Department of Entomology
NEVBD

Northeast Regional Center for Excellence in Vector Borne Diseases (NEVBD)

- **Lead Organizations**
  - *Cornell University, College of Agricultural & Life Sciences*
  - *New York State Department of Health*
  - *Columbia University*
  - *Connecticut Agricultural Experiment Station*
  - *Rutgers University*
  - *Fordham University: Louis Calder Center*



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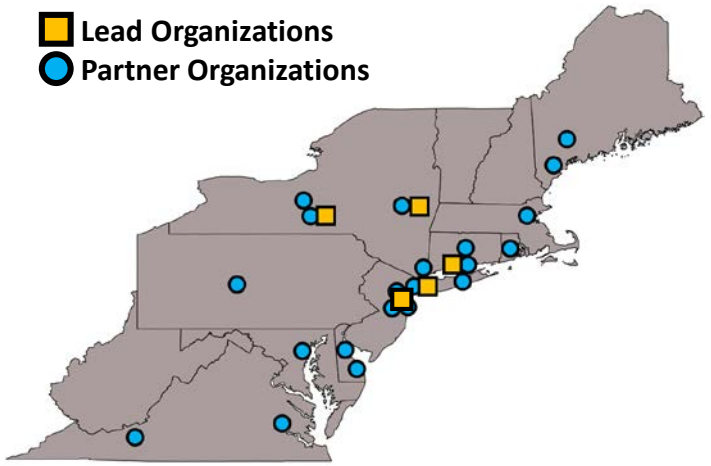
- **Funded by CDC in December <u>2016</u> to address tick- and mosquito-borne disease threats**
  - *Community of practice*
  - *Applied Research*
  - *Training*



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Pesticide Resistance Monitoring Goals

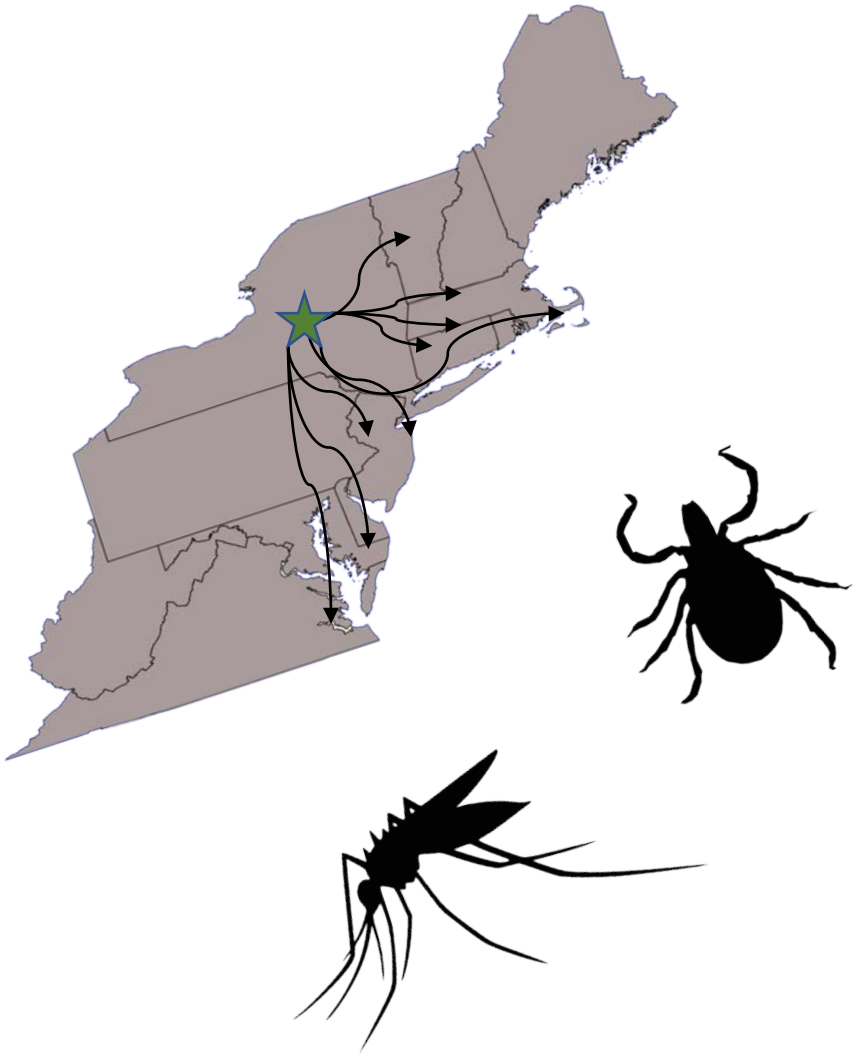
Is resistance monitoring conducted in the Northeast?

1. Address factors limiting regional pesticide resistance monitoring

2. Assist directly in the monitoring of pesticide resistance through specimen submission system

3. Provide educational to the public health community

4. Provide support for efficacy and resistance field trials



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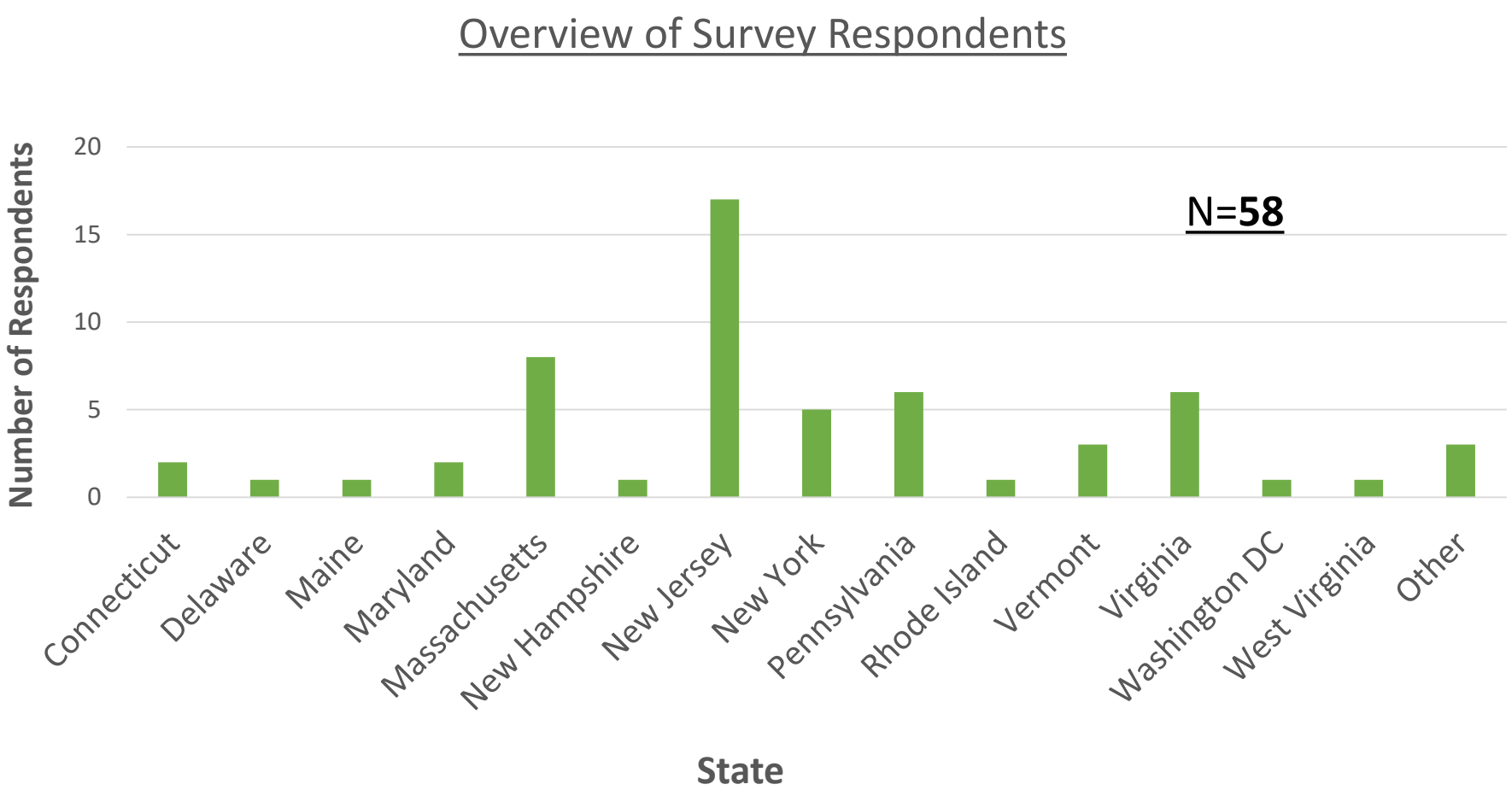
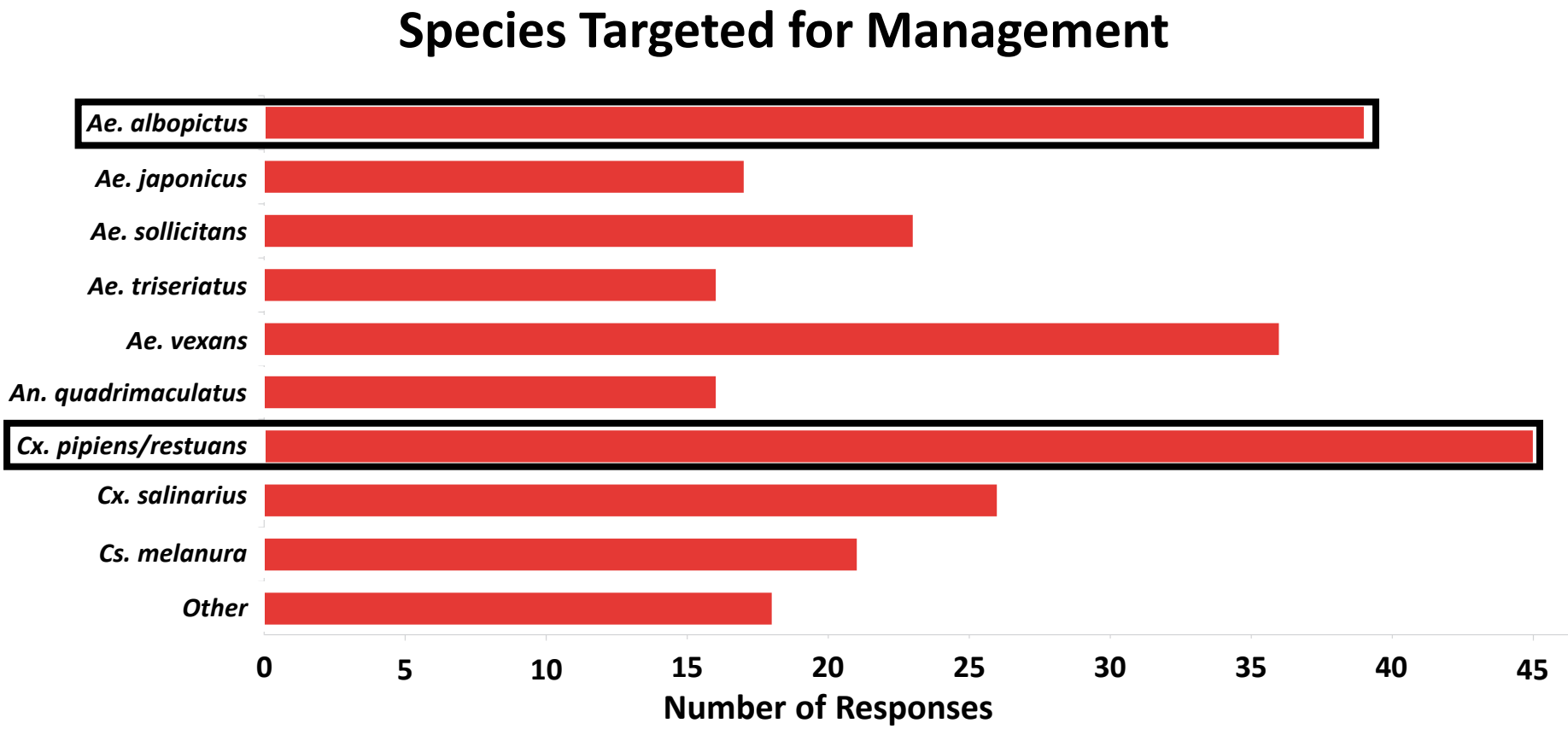
Pesticide Use and Resistance Survey



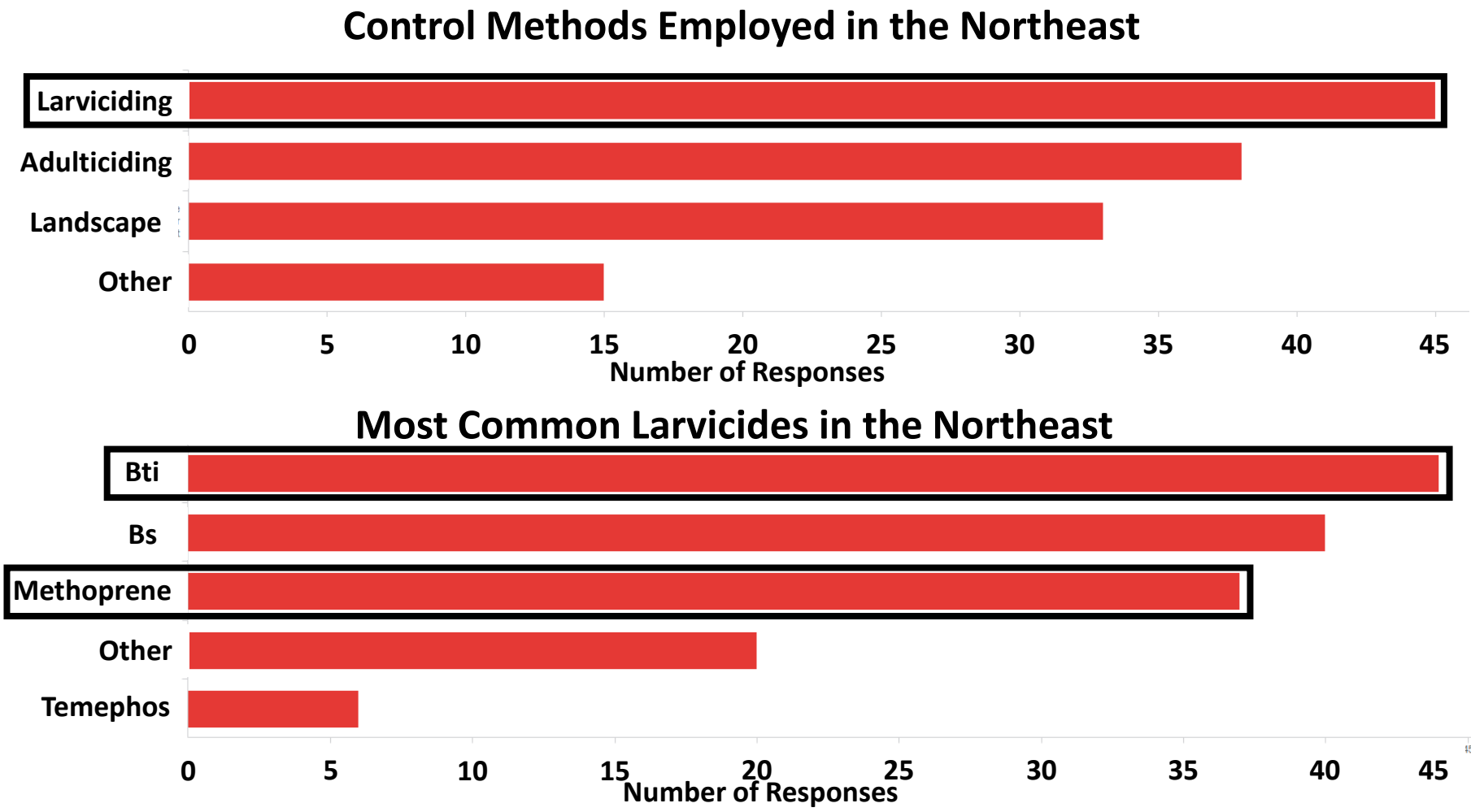
Thank you to everyone who responded!

Pesticide Use and Resistance Survey



- The primary management targets in the northeastern region are *Aedes albopictus* and *Culex pipiens/restuans*
- Resistance detection in other species is often limited by how difficult they can be to maintain in colony

Pesticide Use and Resistance Survey



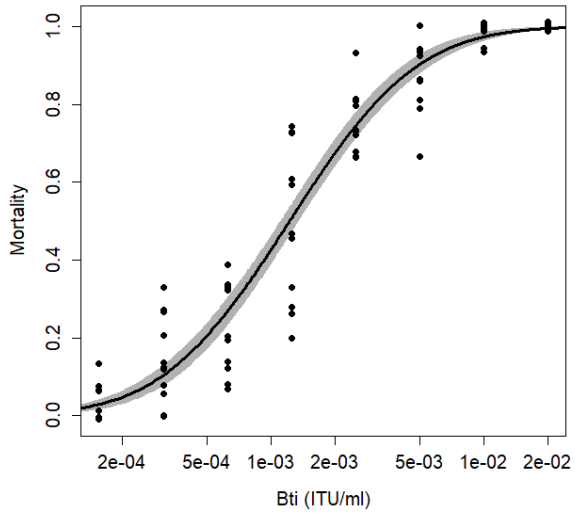
- Larvicides are commonly deployed in our region
- We targeted the most common biopesticide and synthetic pesticide

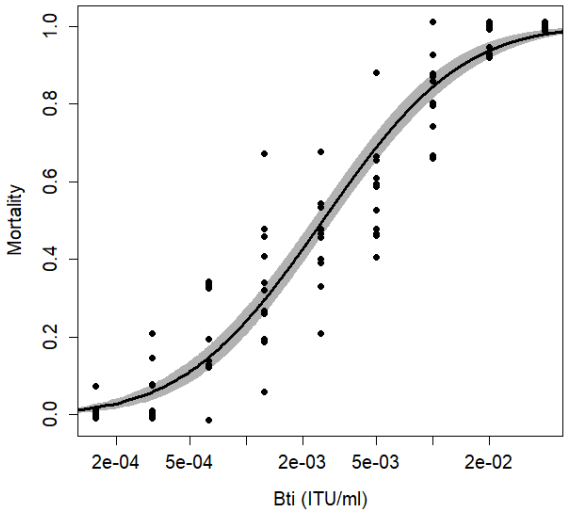
Preparation: Larval Bioassays

- **Established diagnostics for *Ae. albopictus* and *Cx. pipiens* using susceptible colonies**

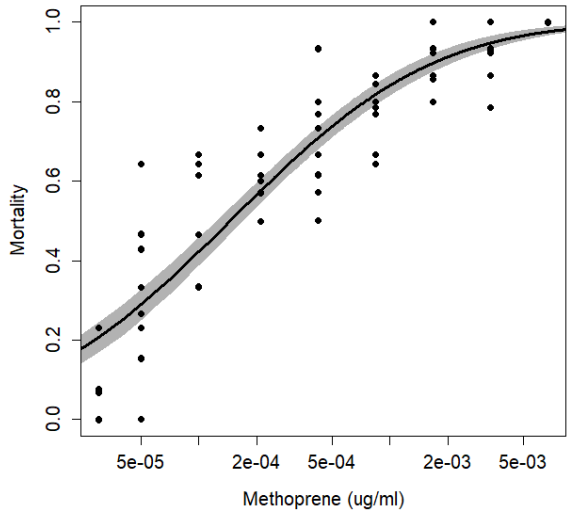
Culex pipiens | ***Aedes albopictus***

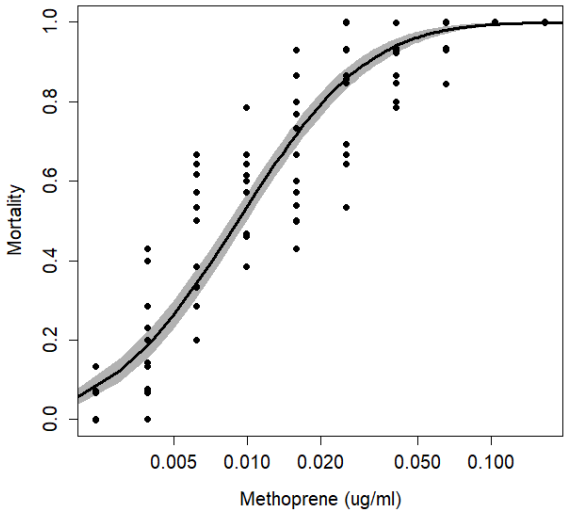
Bti





Methoprene





Preparation: CDC Bottle Bioassay

- Established diagnostics for *Ae. albopictus* and *Cx. pipiens* using susceptible colonies

- **Order Bottle Bioassay kits from CDC**

Preparation: NEVBD Kits

- Established diagnostics for *Ae. albopictus* and *Cx. pipiens* using susceptible colonies
- Coordinated with CDC on using and teaching CDC bottle bioassay
- **Made larvicide resistance kits**

Larvicide Resistance Kit

https://neregionalvectorcenter.com/resistance

Preparation: NEVBD Kits

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- Coordinated with CDC on using and teaching CDC bottle bioassay
- **Made larvicide resistance kits**
- **Made collection kits & Initiated a specimen submission system**

Culex pipiens **Collection Kit**

Aedes albopictus **Collection Kit**

Larvicide Resistance Kit

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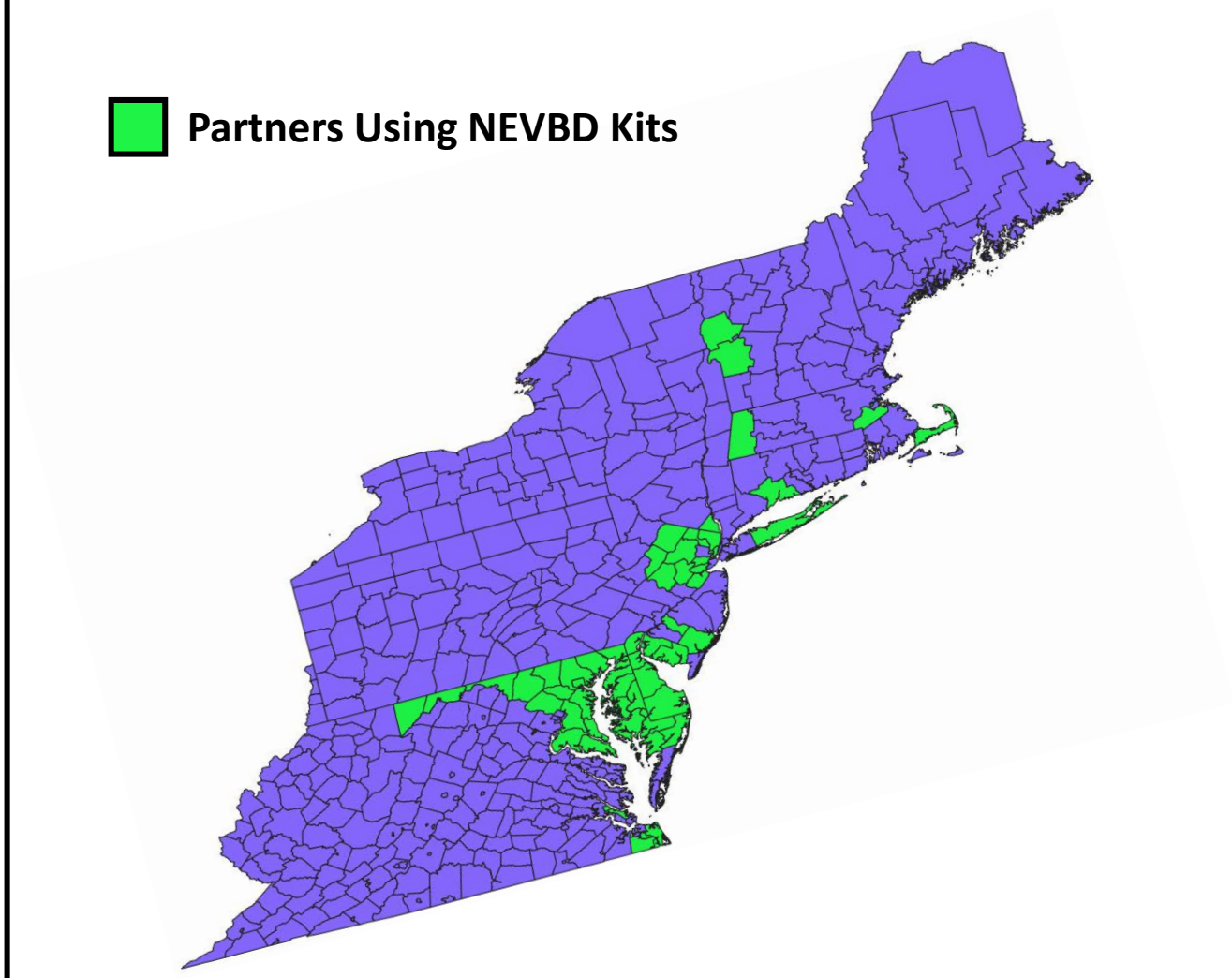
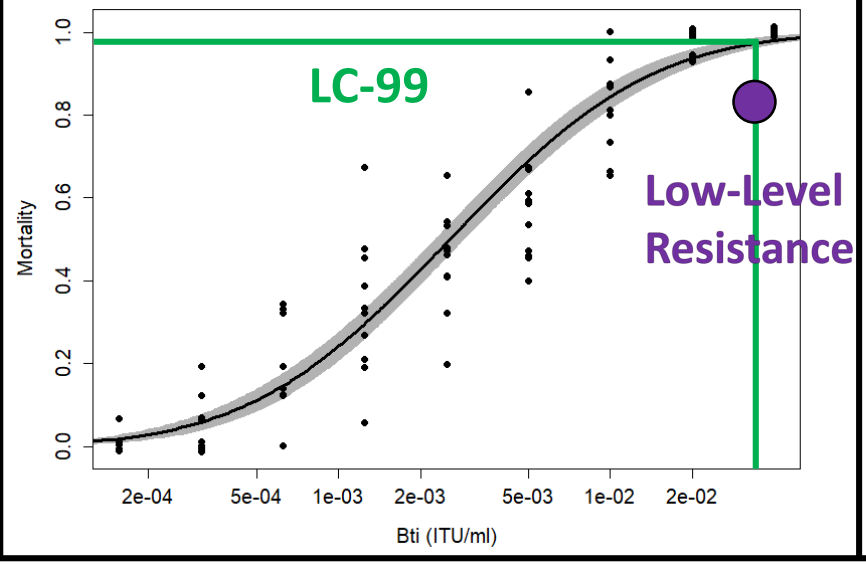
Preparation: NEVBD Kits

- Established diagnostics for *Ae. albopictus* and *Cx. pipiens* using susceptible colonies
- Coordinated with CDC on using and teaching CDC bottle bioassay
- Made larvicide resistance kits
- Made collection kits & Initiated a specimen submission system
- **Distributed materials & educational tools to collaborators**



Methods: Defining Resistance

Larval Bioassays



5x LC-99

Moderate Resistance

Mortality < 90%

10x LC-99

High-Level Resistance

Mortality < 90%

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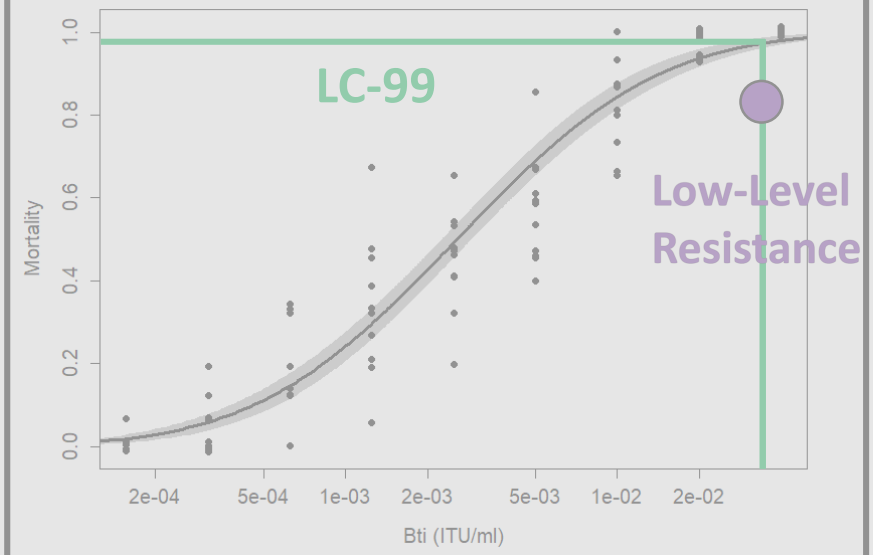

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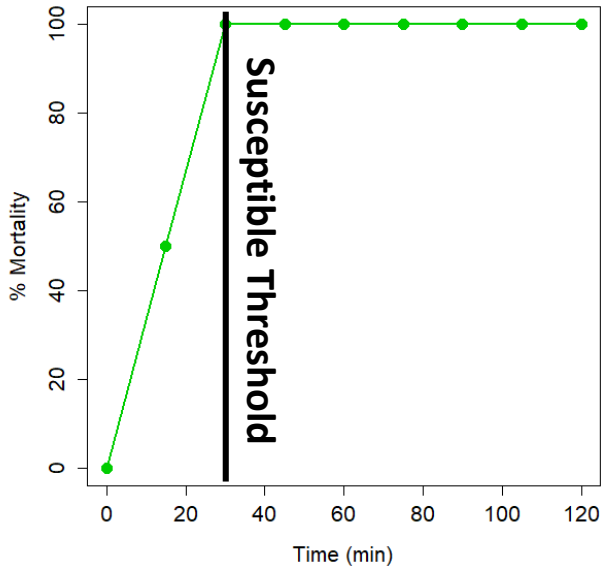
Adult Bioassays



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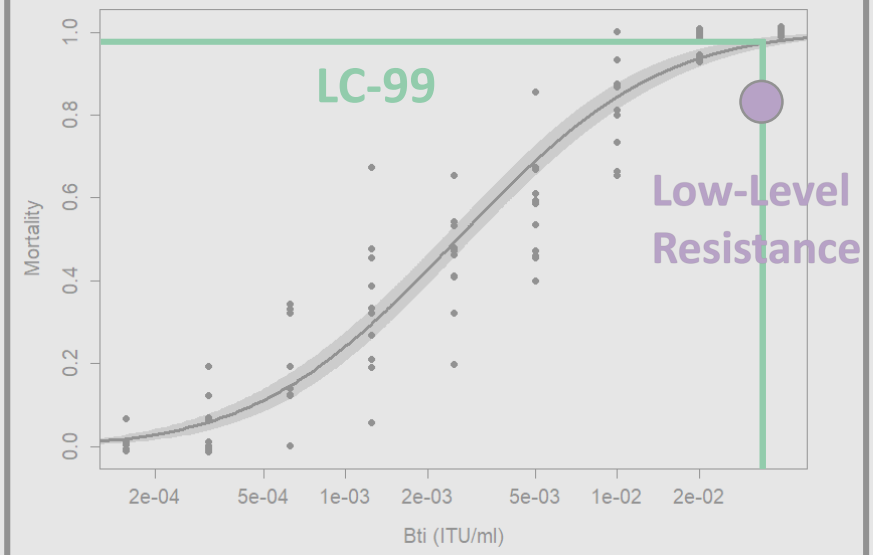

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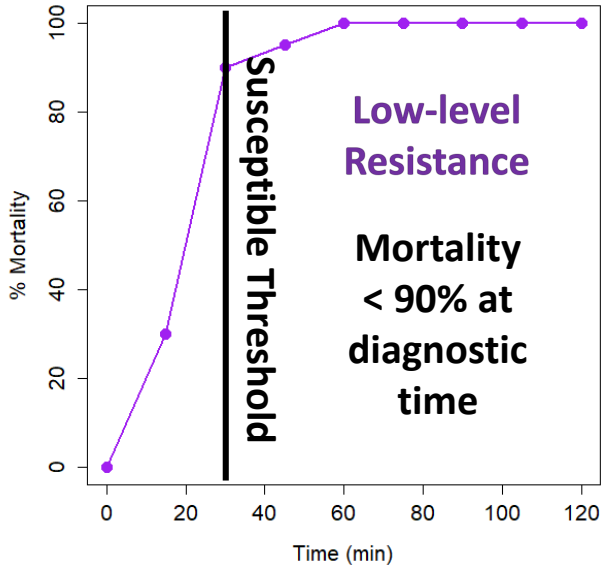
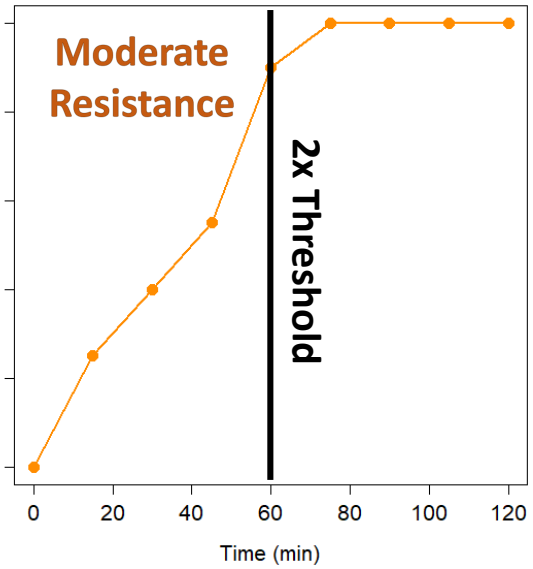
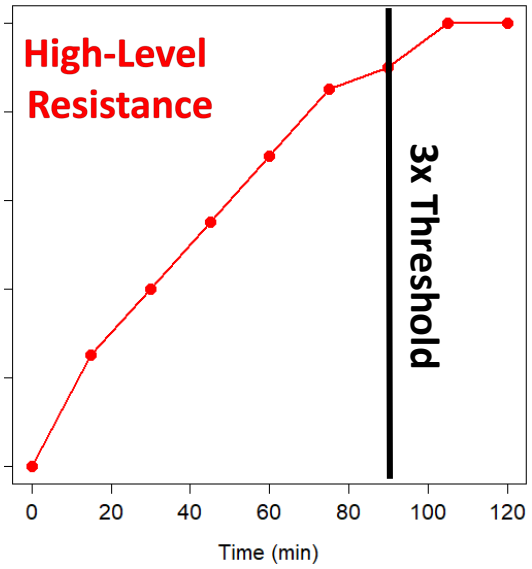
Bottle Bioassays







Methods: Rearing Conditions

- **Larvae were reared at a consistent density, temperature and food supply**

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- **Adults used in CDC bottle bioassays were 2 – 6 day old sugarfed F0 females**

Methods: Bioassay Conditions

- Larvae were reared at a consistent density, temperature and food supply
- Bioassays were conducted in incubators at 28° C and 80% humidity and a 12:12 (L:D) light cycle
- Adults used in CDC bottle bioassays were 2 – 6 day old unfed F0 females
- **All materials were either sterilized or discarded between trials**
- **Pesticides were technical grade and stored at < 4° C**

2019 Results: Larvicide Resistance

Culex pipiens

- **13,200 larvae tested throughout the region**

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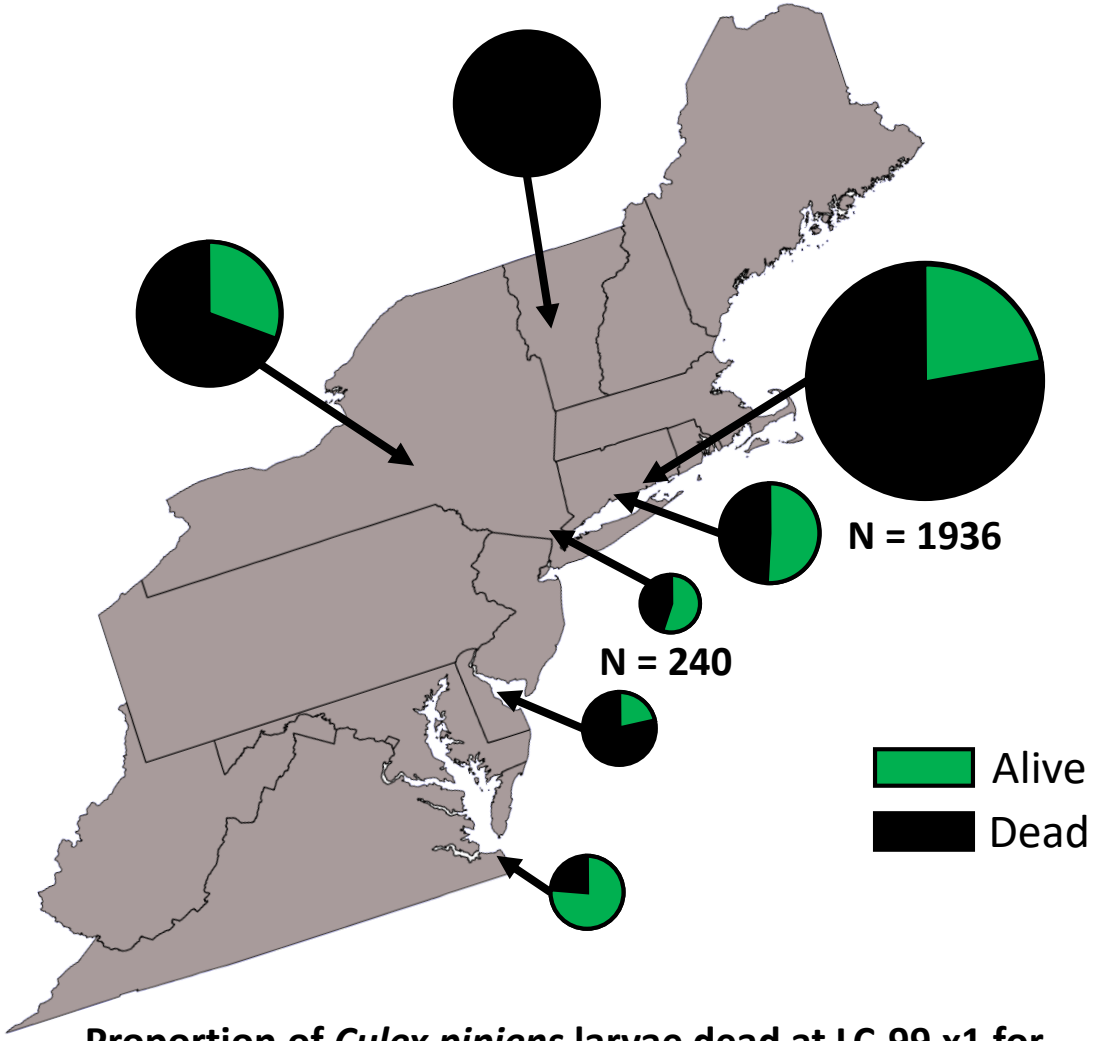
- **Widespread low-level methoprene resistance was detected with moderate resistance in some locations**
- **No Bti or *Bacillus sphaericus* resistance was detected**



Proportion of *Culex pipiens* larvae dead at LC-99 x1 for methoprene. The size of the circles represent the number of specimens tested, which ranges from 240 –to– 1936

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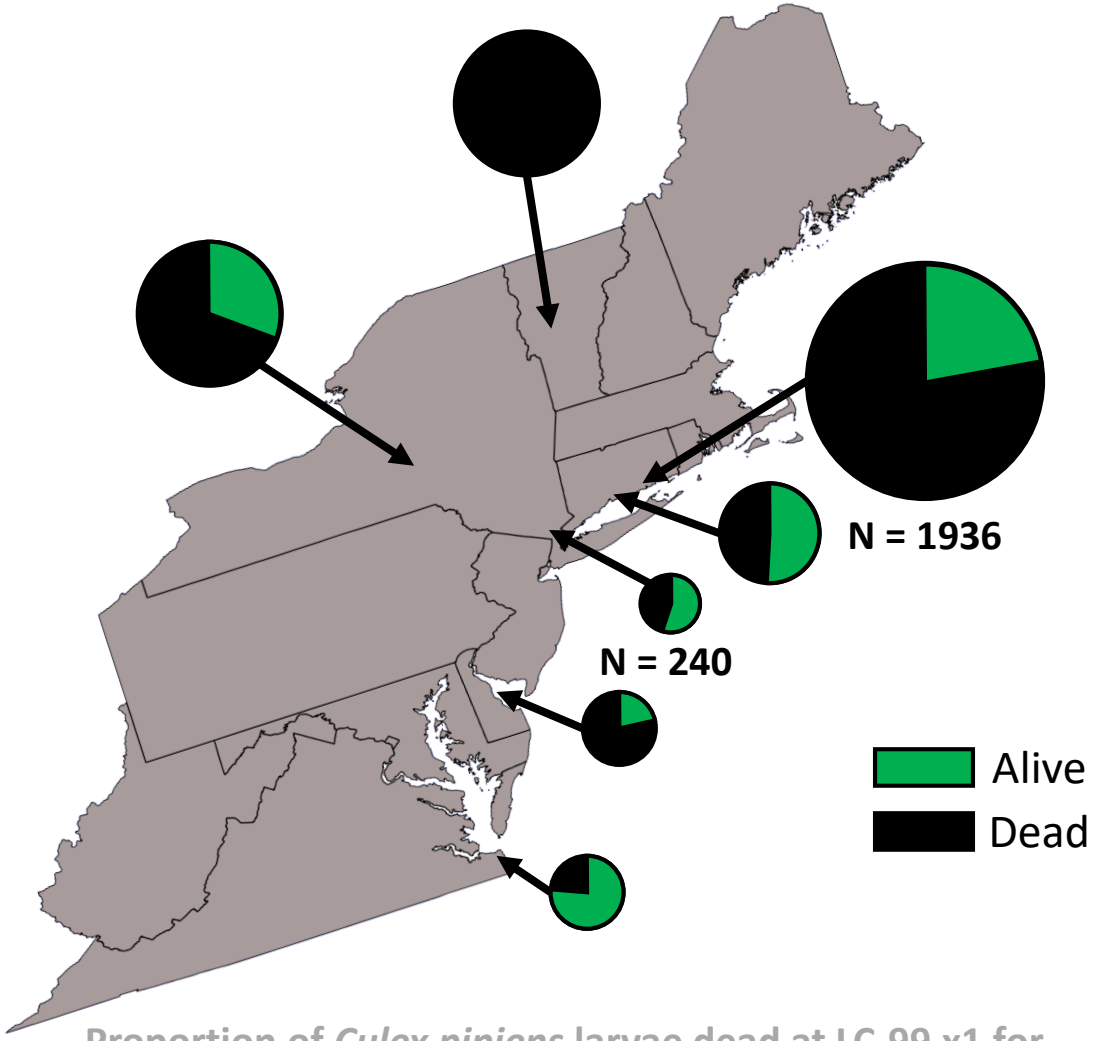
Aedes albopictus

- **1,416 larvae tested throughout the region**
- **No resistance to Bti or methoprene was detected**

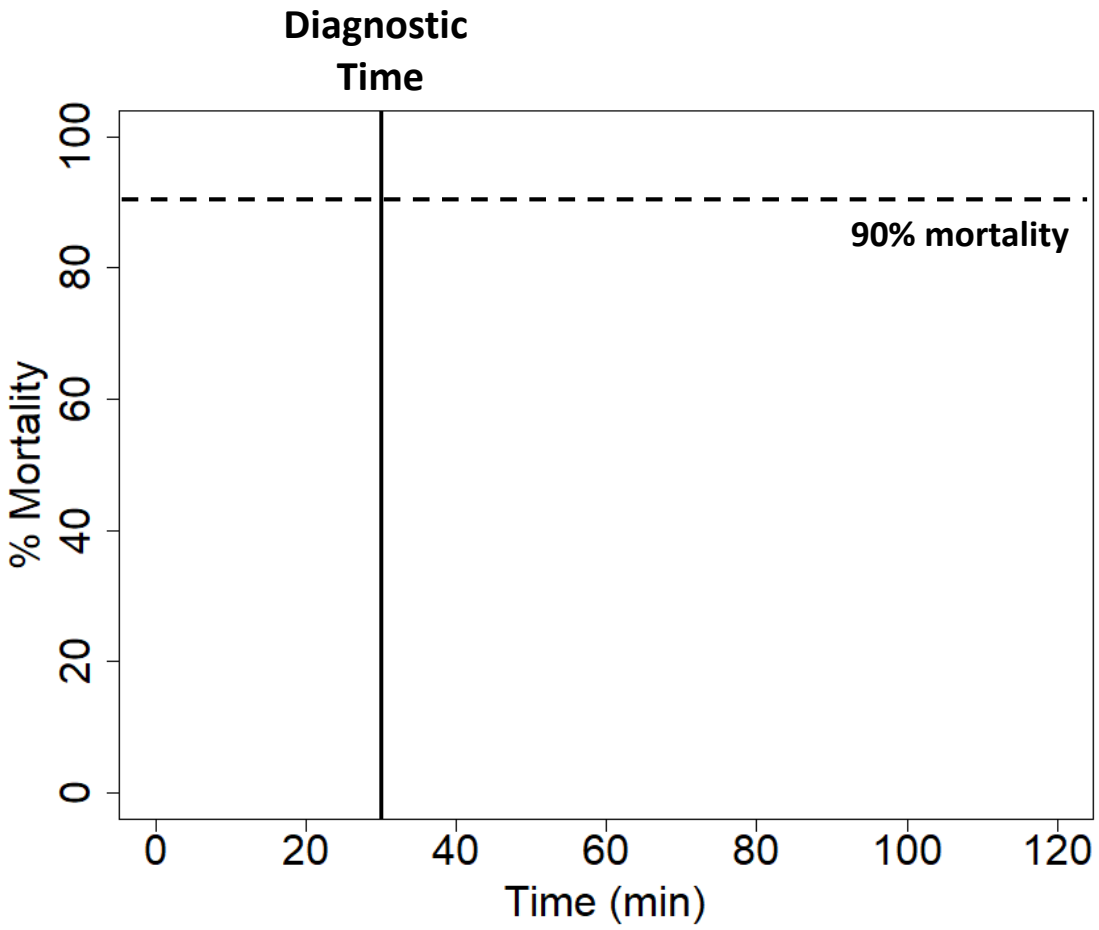


Proportion of *Culex pipiens* larvae dead at LC-99 x1 for methoprene. The size of the circles represent the number of specimens tested, which ranges from 240 –to– 1936

2019 Results: Adulticide Resistance

Culex pipiens

- **3,113 adult females tested throughout the region**
- **Received many pyrethroid requests but few organophosphate requests**
- **Levels of resistance varied**



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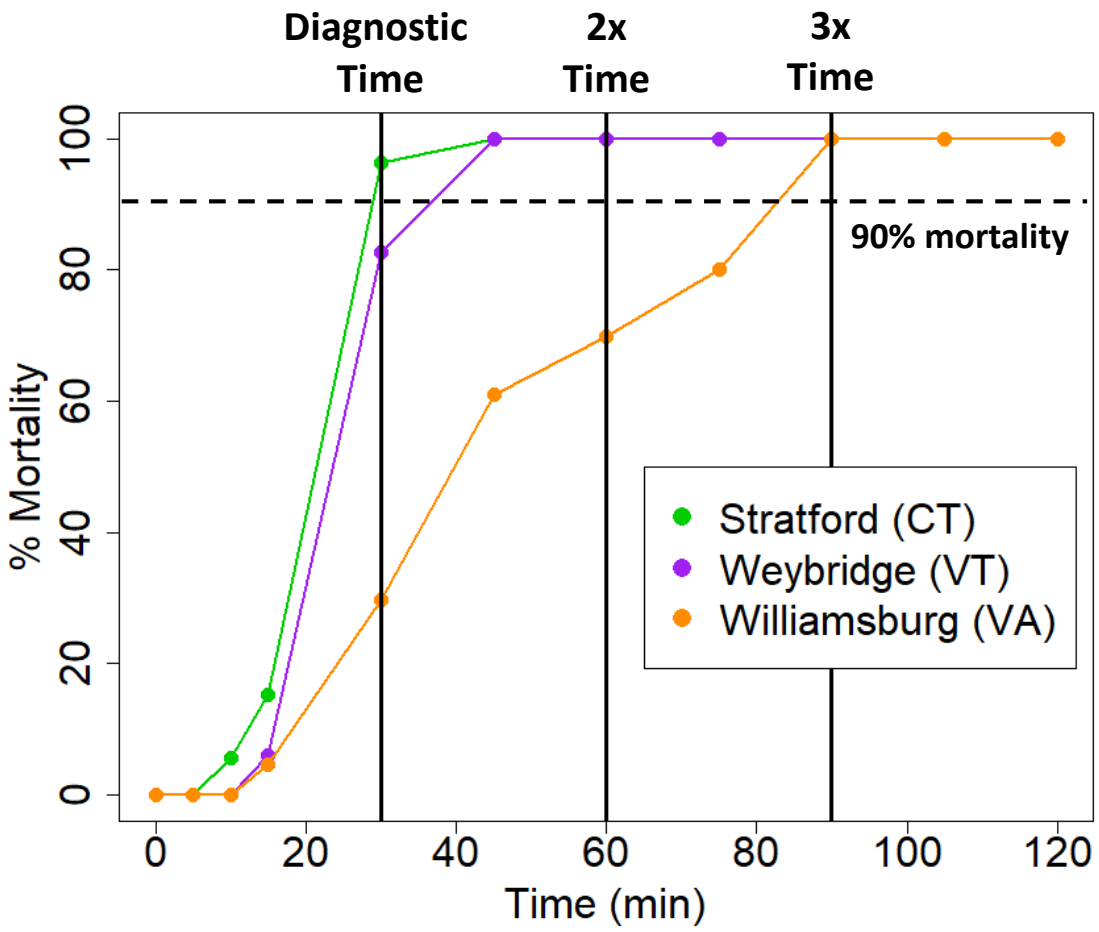

Percentage of *Cx. pipiens* adults dead throughout a CDC bottle bioassay trial testing for sumithrin resistance. A comparison between three locations.

2019 Results: Adulticide Resistance

Culex pipiens

- 3,113 adults tested throughout the region
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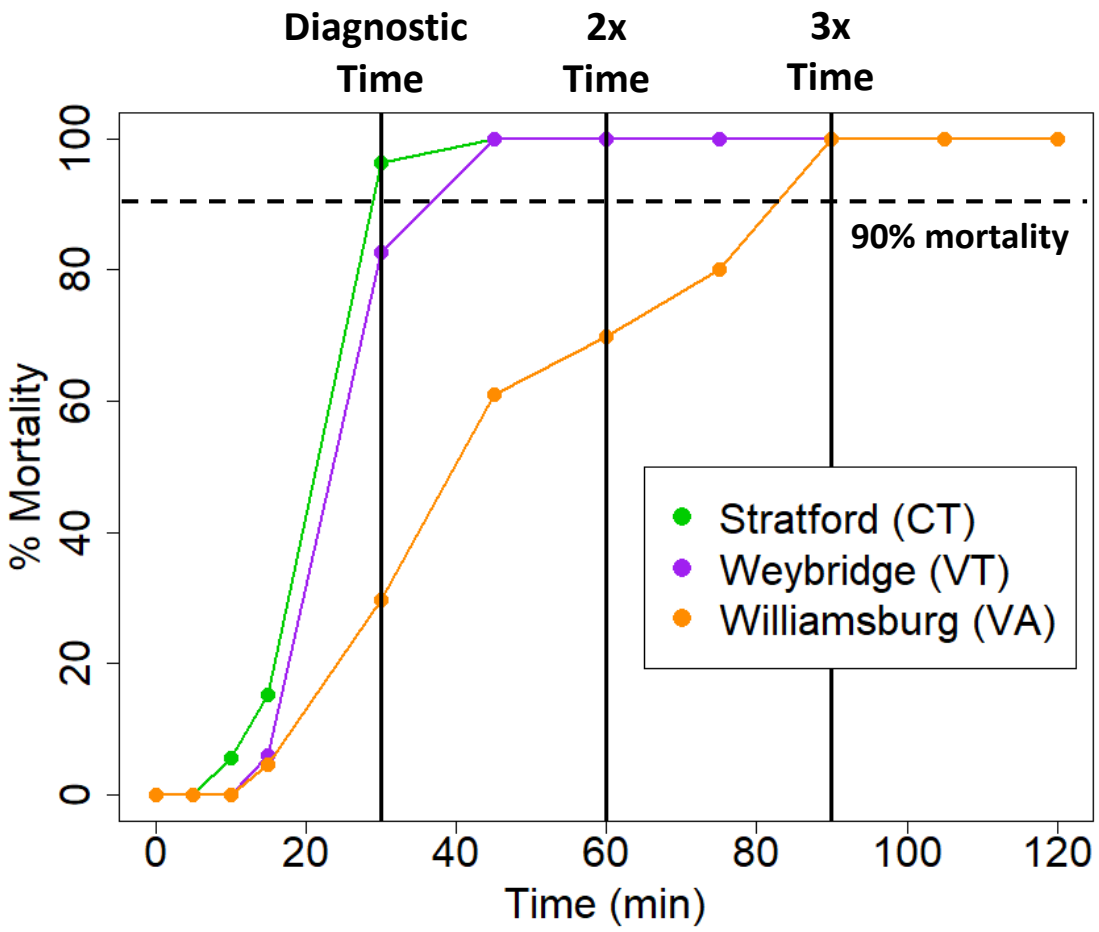
Aedes albopictus

- **910 adults tested throughout the region**
- **Pyrethroid resistance detected, mostly from New Jersey**



Percentage of *Cx. pipiens* adults dead throughout a CDC bottle bioassay trial testing for sumithrin resistance. A comparison between three locations.

Additional Activities

New Jersey Spray Efficacy Trials

- ***Assisted with field trials to compare the efficacy of Buffalo Turbine and A1 Super Duty Blower for larvicidal application***
- ***Field work and spray conducted in NJ by Scott Crans, Nick Indelicato, and Matthew Bickerton***
- ***Laboratory work conducted in Ithaca NY***

Spray Areas in Bergen

Four areas in total were treated, two each in Bergen and Mercer Counties

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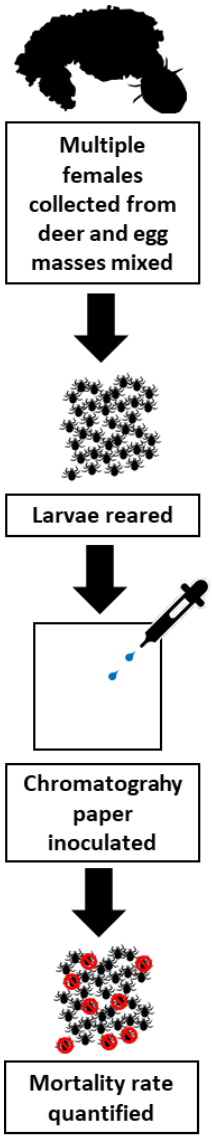
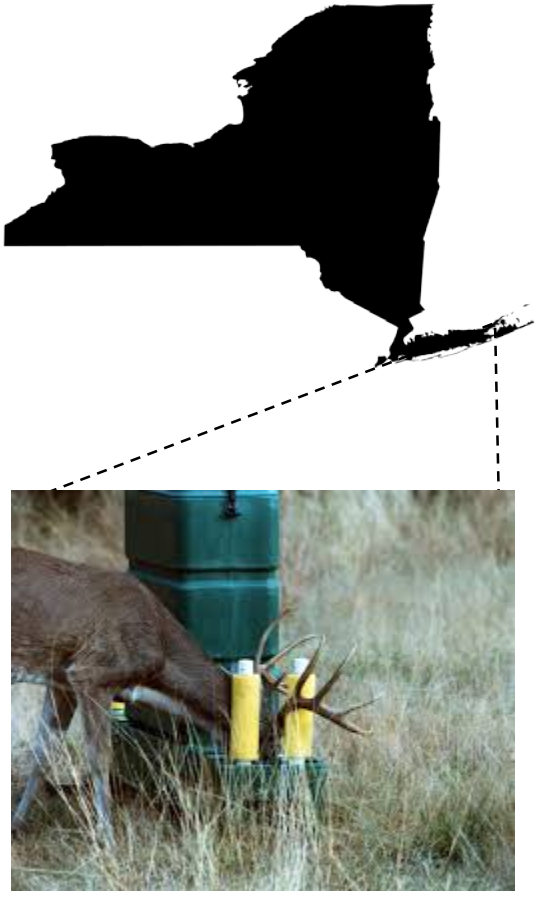
4-Posters and Tick Resistance

- ***Compare permethrin susceptibility of Shelter Island ticks with other populations and laboratory colonies***
- ***Collected ticks from Shelter Island in collaboration with Beau Payne and Dr. Scott Campbell***





4-Poster System

Next Field Season

1. Continue to expand our collaborative network

2. Send out a follow-up survey to feedback

3. Update larvicide curves using the CDC's *Ae. albopictus* and *Cx. pipiens susceptible* colonies

4. Create a *Bacillus sphaericus* curve and diagnostics

5. New efficacy kits and rearing guides!

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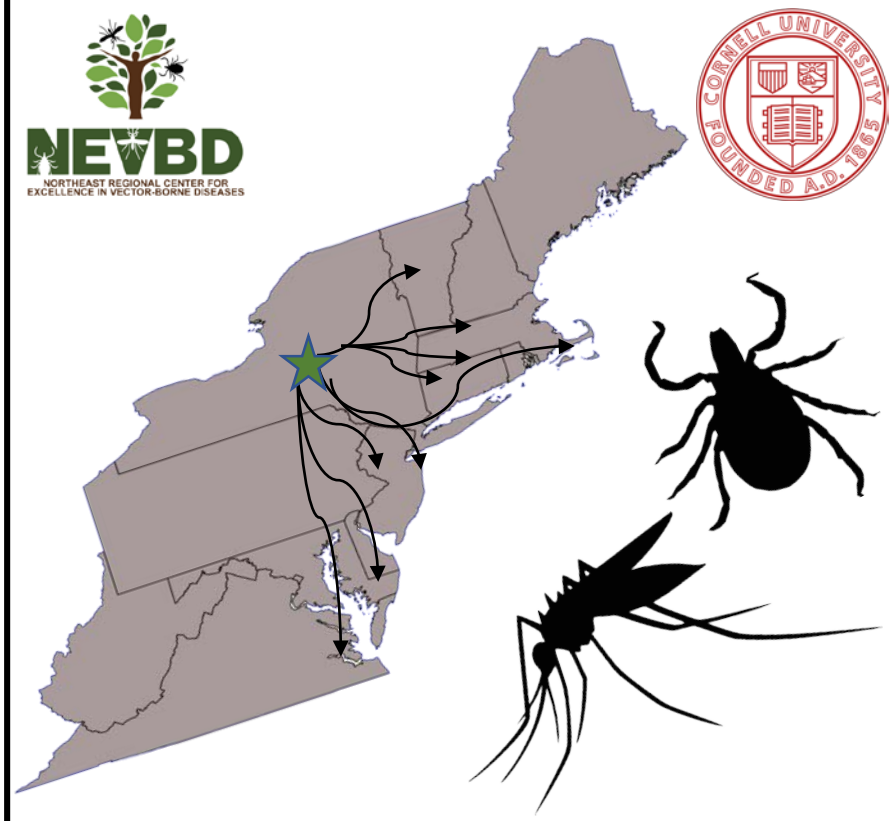

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Acknowledgements

Key Collaborators

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Patti Casey
Scott Crans
Amy Isenberg
Janice Pulver
Kerry White
Craig Zondag
Beau Payne

Contributors

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Steven Su
Gregory Williams
Stacey Giordano
Jack Petersen
Margaret Kawalkowski
Russell Berger
John Betz

Harrington Lab

Please visit the NEVBD for more information
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