NEVBD QUARTERLY DIGEST

CONTENTS

NEVBD

NORTHEAST REGIONAL CENTER FOR EXCELLENCE IN VECTOR-BORNE DISEASES

UPCOMING EVENTS & ANNOUNCEMENTS

- NEVBD currently has two openings in our network! Cornell University is seeking a Lecturer, and Columbia University is seeking a postdoctoral associate. Visit: http://neregionalvectorcenter.com/career to learn more!

- Our lead investigators have been publishing several papers covering their work in the NEVBD. Check out the NCBI Publication Archive featuring the work of our core group of researchers and collaborators. Recent publications include:
  - Use of climate parameters to improve prediction of West Nile virus
  - First recognized human bite of the Asian longhorned tick in the US
  - Lyme disease risk enhancement in New York City

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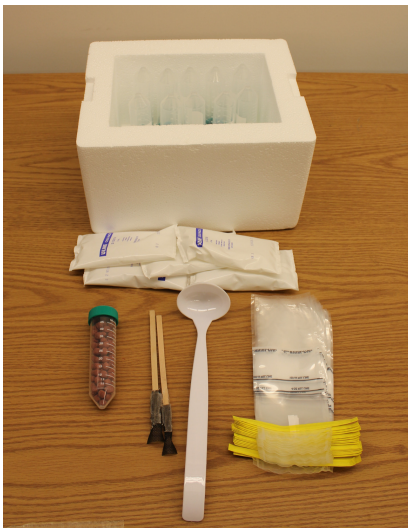
NEVBD PESTICIDE RESISTANCE PROGRAM

NEVBD Pesticide Resistance Facility at Cornell University Now Open!

The NEVBD Pesticide Resistance Program is happy to announce that our pesticide resistance facility at Cornell University went live in June 2019! We are ready to accept *Aedes albopictus* and *Culex pipiens* specimens. We ask that those submitting specimens to our program for testing **follow the submission guidelines on our website - this will ensure that your specimens survive the journey to our facility**. NEVBD also provides optional submission kits to help with this process. NEVBD has also developed a method for detecting resistance to larvicides, which will be used at our testing facility. You can order larvicidal assay kits through our website.



The NEVBD Pesticide Resistance Program is a monitoring network covering the Northeastern region of the US. The goal of this program is to support public health and mosquito control agencies in detecting pesticide resistance in mosquito populations. This effort is led by our postdoctoral associate Dr. James Burtis at Cornell University.

Visit **http://neregionalvectorcenter.com/resistance** to access the submission kits and guidelines for our pesticide resistance facility. Our website features a decision tree to help you find the appropriate resources to support your program needs. If you are interested in receiving updates on the NEVBD Pesticide Resistance Program, sign up for the program-specific mailing list through the NEVBD website.

TRAINING & CAREER RESOURCES

NEVBD Seeking Full-Time Lecturer at Cornell University

The Cornell University Department of Entomology is seeking a full-time lecturer to join the Vector Biology program team and the NEVBD. The Lecturer will play an integral role in the delivery of the NEVBD Master of Science in Entomology degree program, including course instruction, student advising and mentoring, practicum placement, and preparation and completion of program competencies and projects. The successful candidate is also encouraged to conduct some research in an area of their expertise that contributes to the goals of the NEVBD. This is a full time position through 31 May 2020, with renewal contingent on performance and availability of funds.

Visit **https://academicjobsonline.org/ajo/jobs/13770** to learn more about this position and apply!

NEVBD Seeking Postdoctoral Associate at Columbia University

A postdoctoral position is available in Matia Diuk-Wasser's lab at the Department of Ecology, Evolution and Environmental Biology (E3B) at Columbia University. The successful applicant will harness an extensive network of existing and newly acquired surveillance and control datasets to develop diagnostic and predictive models for the presence and abundance of mosquito and tick vectors and their associated pathogens. Areas of emphasis include modeling for optimal deployment of integrated tick management approaches, modeling the population dynamics and spread of mosquito- and tick-borne pathogens, and other modeling platforms to enhance surveillance and institutional response capacity for real-time impact on vector-borne disease management.

Visit **http://blogs.cuit.columbia.edu/mad2256/opportunities/** to learn more about this position and apply!

2019 VECTOR BIOLOGY BOOT CAMP

Second Annual Vector Biology Boot Camp Hosted May 2019

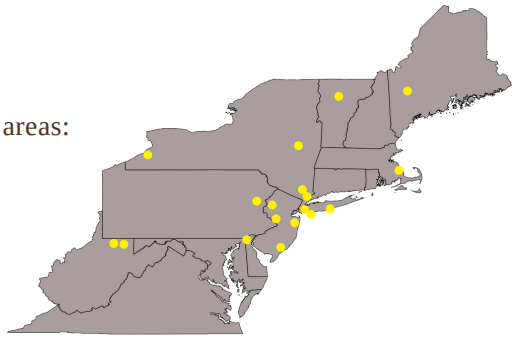
NEVBD hosted its second annual Vector Biology Boot Camp on May 13 - 16, 2019, at Fordham University's Louis Calder Center in Armonk, New York. This program provided hands-on training in key elements of vector surveillance program operations through lectures, lab exercises and field collections. The curriculum focused on tick and mosquito species of medical importance to the Northeastern United States, with content specifically targeted to vector-borne disease professionals working in this region.

This year's program hosted 20 participants from across the Northeast region. The majority of participants worked at a county or city jurisdiction level in a vector control or public health agency. Eighty-percent of our participants perform data collection and entry for surveillance and/or control programs, and directly collect and process vector specimens as part of their regular duties in their current positions.

Program Curriculum and Activities

The 2019 Vector Biology Boot Camp curriculum was divided into 7 competency areas:

- Arthropod Biology & Behavior
- Major Regional Diseases & Emerging Threats
- Taxonomy and Arthropod Identification
- Mosquito & Tick Surveillance
- Control and Resistance Monitoring
- Communication
- Data Collection and Management



Distribution of 2019 Vector Biology Boot Camp participant workplace locations

Participants gained hands-on experience collecting ticks and mosquitoes in the field using multiple methodologies that are available to target different vector species in our region. We also hosted two vector ID lab sessions, where participants learned how to identify mosquito and tick specimens to genus, with insight and assistance provided by our instructional team of regional experts.

A new part of this year's program focused on pesticide resistance monitoring techniques. Participants conducted larvidical resistance assays following the protocol used by the NEVBD Pesticide Resistance program, and also conducted the CDC Bottle Bioassay for testing adult mosquitoes for pesticide resistance.

(from top left to right) Participants practice field techniques for mosquito larval sampling, conduct tick drags, and perform pesticide resistance assays in the lab.

Future Directions and Training Opportunities

NEVBD will host the Vector Biology Boot Camp again next spring, 2020, at the Louis Calder Center. You can expect updates on the curriculum and application in late Fall.

We also recognize that many of the topics covered in the Vector Biology Boot Camp are of interest to professionals working in public health and vector surveillance across the region who may not be able to attend this event. To support the continuing education of our professional community, NEVBD will be partnering with professional society organizations across the region to provide **targeted workshops on specific topics**, such as using open-source software for GIS mapping of surveillance data and effectively communicating with the public on vector-borne disease risk and prevention. NEVBD is also planning **web-based educational programs**, like webinars and instructional videos. These programs will be made available through our website, and will be advertised broadly through our network of collaborators.

NEVBD TEAM MEMBER SPOTLIGHT

Joseph R. McMillan, PhD - Connecticut Agricultural Experiment Station

Joseph R. (JR) McMillan is a postdoctoral associate working with Dr. Philip Armstrong and Dr. Theodore Andreadis at the Connecticut Agricultural Experiment Station (CAES). JR hails from Georgia, where he received his Bachelors of Science from the University of Georgia's Odum School of Ecology (2009) and his PhD in Ecology and Evolution from Emory University (2018). As both a staff scientist (2009 – 2013) and graduate student at Emory, JR researched the wildlife ecology of West Nile virus (WNv) in urban environments in the southern U.S. His dissertation focused on how variability in the composition of mosquito and bird communities impacted WNv transmission and the risk of exposure in humans. While at Emory, JR developed a special interest in how to measure the impact of mosquito control interventions applied in urban environments. This interest led him to CAES, where he is working with the station and NEVBD to **develop protocols that evaluate the ability of current and novel mosquito control interventions to reduce mosquito-borne disease exposure rates in humans** in the northeast U.S.

Joseph (JR) McMillan, PhD

JR McMillan Describes His Work

Motivation for the project:

The mosquito species *Culex pipiens pipiens*, which is the main vector of WNv in the northeast U.S., is strongly associated with urban environments. This species often lays eggs in road-side catch basins, which can retain water during drought conditions. Treating catch basins with **larvicides** is the most common form of **mosquito larval control** in cities; however, these treatments are often inconsistently applied across space and time. This makes it difficult to determine if and when a catch basin larvicidal treatment program successfully reduces the number of *Cx. p. pipiens* in an area, and as a consequence also reduces the prevalence of WNv and risk of human exposure in the local community.

Key Terms:

- **Larvicides** are insecticides applied to bodies of water to kill mosquito larvae.
- **Mosquito larval control** tries to reduce the number of biting adult mosquitoes by reducing the number of mosquito larvae and their habitats.

What we hope to understand:

We are investigating many research questions as a part of this work, including:

1. How is mosquito larval control for WNv applied throughout the region?
2. What are the best methods available for evaluating mosquito larval control practices implemented in cities (mainly, the treatment of catch basins)?
3. How can we not only improve the efficacy of larval control in catch basins, but also of mosquito control overall in cities?

Sampling city catch basins for Culex p. pipiens larvae (left). Adult Culex p. pipiens mosquito (right, image credit M. Thomas, CAES)

How we are doing it:

We are tracking the growth of *Cx. p. pipiens* mosquito populations and the prevalence of WNv infection in mosquitoes in Connecticut communities that use various mosquito larval control practices. We are also developing methods that better measure the effectiveness of larvicides in road-side catch basins.

What the data can tell us:

The first phase of this work is underway and the data will tell us how much adult populations of *Cx. p. pipiens* are reduced when mosquito larval control practices are used. We will also compare adult mosquito populations in areas with larval control practices vs. areas without control. Ultimately, this project will help us understand whether larval control methods reduce the prevalence of WNv in local mosquito populations.

ASIAN LONGHORNED TICK

NEVBD's Collaborative Approach to this Invasive Species

NEVBD Initiates Multi-Institutional Applied Research Program Targeting the Invasive Asian Longhorned Tick

Adult female Asian longhorned tick (Photo credit M. Lejeune, Cornell University)

The Asian longhorned tick (*Haemaphysalis longicornis*) was documented on a farm in New Jersey in 2017. Since that time, this invasive tick species has been detected in 10 states in the Eastern US. The impact this tick will have on human and animal health is not yet known, and key questions remain about how to best study and monitor tick populations in the US. With support from the CDC, NEVBD has initiated a multi-institutional applied research program to answer some of these pressing questions.

The NEVBD research plan will fill essential knowledge gaps about this potentially important new vector in the US. Across the next three years, we will make progress toward:

1. Understanding the distribution and regional expansion of *H. longicornis* using optimized surveillance approaches
2. Identifying important aspects of its ecology, including host feeding preferences, seasonality, overwintering biology, and environmental population drivers
3. Acquiring critical knowledge of the vector potential of this tick for new and emerging human pathogens to assess public health risk

Project Objectives

NEVBD is uniquely positioned to play a leading role in the research and management of the Asian longhorned tick in the Northeast. We have harnessed our regional network to bring together a team of research and public health experts across multiple institutions to conduct targeted investigations on this invasive species. Listed below are our project specific aims:

Optimize Surveillance

We will gather data on what type of drags/flags/sweeps work best for collecting Asian longhorned ticks, and will sample across the Northeast to assess this ticks regional distribution. We will also design and optimize passive traps for this tick.

Habitat, Hosts, & Pathogens

We will develop transects across grass, edge habitat, and interior woods to understand which life stages of this tick can be found in these environments. We will conduct surveys in backyards and neighborhoods to assess risk around residences. We will assess the relative frequency of Asian longhorned ticks feeding on small and medium-sized mammals. Collected ticks will be tested for human and veterinary pathogens.

Phenology Field Studies

Using the optimized surveillance techniques, we will gather data on the annual phenology of this species in several specific field locations. We will also gather data on overwintering triggers and overwintering biology of this tick.

Control Approaches

We will assess the susceptibility of the Asian longhorned tick to standard acaricides, perform resistance monitoring assays, and explore the use of integrated tick management strategies to manage populations.

Lead Institutions

NEVBD lead institutions for this applied research program include: Rutgers University, New York State Department of Health, Columbia University, Connecticut Agricultural Experiment Station, and Cornell University. We are also consistently engaging with regional partners conducting surveillance and control activities for the Asian longhorned tick in their communities.

UNDER THE MICROSCOPE:

Biosketch of a Vector Villain

Woodland Pool Mosquito

Aedes (Och.) canadensis

Aedes canadensis adult female (Photo credit Judy Gallagher)

The Woodland Pool Mosquito (*Aedes canadensis*) is a medium-sized mosquito. It has a reddish-brown thorax with golden-brown scales and broad white bands on its hind legs. Sometimes this mosquito is also referred to as *Ochlerotatus canadensis*.

This mosquito is a serious nuisance biter, and is considered a vector of viruses and parasites that affect humans and pets in the Northern part of the USA, including:

- West Nile virus
- Eastern equine encephalitis
- Jamestown Canyon virus
- Dog heartworm

Where do they live?

The woodland pool mosquito has a large distribution across the United States and Canada. It lives along the Atlantic seaboard, from Canada to Northern Florida, and then across the USA along the Mississippi River basin. It also lives across all of Canada and into Alaska. These mosquitoes live in woodland seasonal flood pools in areas with standing water from snow-melt and spring rains.

Where do they lay eggs?

Woodland pool mosquitoes lay eggs in areas that are seasonally flooded in the spring with snow-melt and rains. Adult mosquitoes lay eggs that can survive the winter (overwinter) and then hatch when the winter thaw starts and forms flood pools. Mosquito larvae are most commonly found in shallow, leaf-lined pools in wooded areas, but they can also be in deep snow pools, roadside ditches, seasonal pools in open fields, along the edges of swamps, and in acid water bogs.

Aedes canadensis distribution (Photo credit RF Darsie and RA Ward, Identification and Geographical Distribution of the Mosquitoes of North America, 2005)

What times of the year are they active?

The woodland pool mosquito is the dominant spring-breeding mosquito in the Northeast USA. Adults usually appear near the end of May or in early June. Populations of these mosquitoes will peak in the spring in the Northeast, but then wane across the summer as the seasonal pools dry out. It is possible that these mosquitoes can appear again in the fall if rains re-fill the woodland pools where eggs have been laid.

Seasonal pool (Photo credit Vermont Center for Ecostudies)

What animals do they bite?

Woodland pool mosquitoes feed on a wide variety of animals, including humans, large and small mammals, birds, and even reptiles. They feed during the daytime, and can be aggressive biters in shaded areas near their breeding grounds, including urban parks, rural areas, and residential neighborhoods.

Tips on how to avoid the Woodland Pool Mosquito:

- Use a CDC-recommended insect repellent, and consider wearing long sleeves and pants to prevent bites when you are near the shady, wooded areas where these mosquitoes lives.

- Andreadis TG, Anderson JG, Armstrong PM, Main AJ. Isolations of Jamestown Canyon Virus (Bunyaviridae: Orthobunyavirus) from Field-Collected Mosquitoes (Diptera: Culicidae) in Connecticut, USA: A Ten-Year Analysis, 1997-2006. *Vector-Borne and Zoonotic Diseases*. 2008;8(2):175-88. doi:10.1089/vbz.2007.0169.
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