1. ***Title:*** *New York State* Tiger Mosquito Education Network (Tiger NET)

2. ***Project Leader(s):*** Laura C. Harrington, lch27@cornell.edu, Professor of Entomology, Cornell University; Talya Shragai, ts676@cornell.edu, graduate student, Entomology, Cornell University

3. ***Cooperator(s):*** Tamson Yeh tsy3@cornell.edu, CCE, Suffolk County; Annie Christian-Reuter, alc44@cornell.edu, Community Horticulture Educator, CCE, Rockland County

4. ***Abstract (no more than 100 words):*** Write a short abstract that could be understood by someone without a scientific background.

The invasive Asian tiger mosquito is a serious pest, yet knowledge about its habitat and abundance across NY State is lacking. This information is essential to implement regional IPM control strategies, especially in light of its role in emerging diseases, such as Zika. Engaging citizens in understanding the risks of contracting disease and personal protection measures is also important. To address these needs, we conducted the 2016 TigerNET project. Master Gardeners built, deployed and collect mosquito eggs from traps, which were used to map mosquito distribution. Follow-up surveys demonstrated increased participant knowledge of mosquito biology and Zika transmission risk.

5. Background and Justification: Summarize pertinent IPM efforts, the need for the project, and clientele interest. Describe how the project addresses community IPM priorities.

The Asian tiger mosquito (*Aedes albopictus)* is a highly invasive species which was introduced to the United States from Asia and Japan in the mid-1980s. Gradually, over several decades, it has invaded much of the Eastern United States. This species is of primary importance, not just as an aggressive nuisance mosquito, but also as a highly efficient vector of multiple pathogens. Many viruses of human health significance can be transmitted by the Asian tiger mosquito including dengue, chikungunya and, more recently, Zika virus. The mosquito has been present in Southern New York State since the early 2000s. Despite its presence recorded from spotty observations and some adult collection data, little is known about its true range within the state and how it may be expanding its range. In addition, little is known about what types of containers may be the key producers of this mosquito. This information is essential as a first step for IPM-based control strategies and for estimating human risk for contracting the many pathogens *Ae. albopictus* can transmit.

Aedes albopictus is a container breeding mosquito. Females lay their eggs in natural and man-made water holding containers. Eggs are pasted to surfaces in containers just above the water line, where they can remain dormant until hatching when flooded by rainwater or manual flooding by humans. Often, it can be very difficult and time consuming to identify all positive containers in surveys. In addition, mounting threats from introduced viruses such as chikungunya and Zika requires greater education of the public on what they can do to minimize mosquito habitat and protect themselves.

Targeting Master Gardeners and children at summer camps, we conducted a citizen science-style educational program that taught these groups about Asian tiger mosquito biology and risk and allowed them to gather critical data on mosquito breeding throughout its range within New York State.

Through the process of this program we sought to achieve many of the goals of the community IPM program including "develop innovative educational materials for Community IPM, to be delivered in multiple media (video, interactive online, etc.) and languages" and "develop, implement and evaluate outreach for integrated mosquito management, especially in light of emerging diseases".

6. Objectives:

A. Develop and deliver an outstanding citizen science educational program (for children and Master Gardeners in NYS). Our objectives were as follows:

- To collect accurate data used to create an occurrence map of *Ae. albopictus* in NY state
- To teach participants about mosquito biology
- To help participants gain a greater understanding of the risks posed by mosquitoes for human beings and how to protect themselves
- To show participants that their engagement in mosquito control and in science makes a difference to their community and to the world at large

B. To administer a pre- and -post project evaluation, via surveys to assess knowledge and practices. We sought increase by 50% knowledge/awareness of ATMs and positive practices to reduce mosquito breeding.

7. Procedures:

A. Citizen Science program

For children as part of summer camp programs in the region:

We developed and administered an interactive lesson about mosquito biology to four different children's camp groups. Our goal was for participants to come away knowing key components of mosquito control, how mosquitoes transmit disease, and what residents can do to reduce mosquitoes and mosquito bites in their communities. Educational modules are provided in an attachment. They include:

- The mosquito life cycle
- Mosquito sensory systems
- Mosquito identification
- Mosquito-borne diseases
- Community based mosquito protection and control

The primary audience targeted were children ages 10 to 14 years of age throughout the Lower Hudson Valley, New York. Participants were reached through summer schools, camps, boy/girl scouts, 4-H, and other youth organizations. Parental/guardian permission for participant involvement in the program was obtained with guidance from camp/organization instructors.

For Master Gardeners: A Master Gardener educational program was developed (materials attached) which included *Aedes albopictus* biology, monitoring and control practices. Prior to administering the program, a survey was conducted to determine the most pressing questions from the group so they could be addressed directly in the presentation.

All groups were provided with a kit containing all the materials and instructions to create a mosquito egg trap and measure basic environmental parameters (materials available on line at http://blogs.cornell.edu/harrington/tigernet/).

B. Pre- and post- project evaluation. A short survey was administered at the beginning of project initiation and again at the end of the project for both citizen science groups.

8. Results and Discussion.

Education. The citizen science education modules were effective and delivered well. Participants were engaged and enthusiastic about the material. Unfortunately, we faced some reluctance by camp organizers to participate in the program. Some cited the inappropriateness of the topic for young girls as a reason. Future programs should investigate more fully the reasons for hesitation and strategies to accommodate the concerns. Unfortunately, none of the participants from the 4 children's camp groups returned eggs. The Master Gardener program was more successful with a total of 70 participants over the summer.

Egg trapping and mapping. Over 50% of the Master Gardeners returned eggs to us at Cornell. We were able to develop a method for identification of eggs by chorionic patterning which streamlined the process, allowing us to forgo hatching and taxonomic identification of larvae. All eggs were identified to species in this way, enumerated and then used to make an occurrence map of the Asian tiger mosquito (http://blogs.cornell.edu/harrington/tigernet/). The occurrence map shows presence of the ATM much farther north in NYS than previously reported. Our results demonstrate that the egg traps can be made and deployed by citizen scientists, the majority of participants understood and followed the instructions, and the majority of traps deployed contained mosquito eggs. Future programs could be expanded to include more participants and a wider range of locales.

Surveys and program evaluation. A pre- and post- survey was designed and deployed for this project. The survey ask respondents about the biology and habitat of ATM, and IPM practices for control (monitoring and source reduction). Results from the pre-survey showed that before the workshop, on a scale from 1-5 with one indicating no knowledge and 5 indicating high knowledge, the average participant ranked a 1.84 on mosquito basic biology, 2.26 on mosquito borne diseases in New York State, 3.00 on mosquito bite prevention. In addition, they scored 3.11 on mosquito prevention in the home. The post survey asked participants to report on their knowledge after the workshop. The average participant ranked their knowledge at 3.9 on mosquito basic biology, a 4.2 on mosquito bite prevention, 4.2 on mosquito prevention in the home, and 3.86 on mosquito borne diseases in New York State. This corresponds to a 106% increase in knowledge on basic mosquito biology, a 40% increase on mosquito bite prevention, a 35% increase on mosquito prevention in the home, and a 71%

increase on mosquito borne disease in New York State. We further tested the increase in knowledge through four test questions, of which 76% of all answers were correct. Unfortunately, participation in the post survey was low (n=14) limiting our ability to make conclusions. Future surveys could be improved by administering knowledge test questions both before and after the workshop. In addition, higher response rates could be achieved by collecting responses in-person directly before and after the workshop.

While impact is difficult to evaluate, we believe our TigerNET 2016 project was successful as a pilot program. Future programs can be conducted that are more expansive. For this pilot, our participants learned basic IPM practices such as population monitoring and source reduction for mosquito control. Overall, we expect that our program will enhance community knowledge and mosquito vector IPM practices for protecting community health.

9. Project location(s):

Workshops were presented in the following counties:

Westchester
Sullivan
Orange
Suffolk

Traps were deployed in the following counties:

Westchester
Rockland
Suffolk
Orange
Sullivan
Duchess
Nassau

10. Samples of resources developed: (if applicable).

Much of our results and our mosquito map is located on our TigerNET website. In addition, we've provided links and attached hard copies for the following:

A. PDF of two activities from the educational presentation for children

..\Citizen Science\Clean up yard spot the difference.pdf
..\Citizen Science\Story of the asian tiger mosquito.pdf

PDF of presentation outline for children

..\Citizen Science\Camp Presentation Modules.docx

PDF of educational presentation for MS gardeners

..\Citizen Science\MasterGardenerPresentationforWebsite.pdf