Northeastern IPM Center – IPM Partnership Grants – 2010

Proposal Type: Regional IPM Publications

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Project Title: Educating School Children and the Public about Container Mosquitoes and their Prevention

Project Description

Project Summary

Container mosquitoes are serious nuisance pests to humans. Because these mosquitoes lay eggs in backyard containers, control of mosquito larvae is often too difficult over large areas. Integrated Pest Management (IPM) of these species relies heavily on public education (brochures, handouts, public service announcements, community events and website) to promote source reduction. However, these practices cannot target everyone and in general, are geared mainly toward adults.

Many mosquito control agencies in the US are developing mosquito-based curricula that can be used to teach school children about the use of IPM to control mosquitoes. This project proposes to produce and distribute mosquito IPM curricula and materials previously developed by the principle investigators to mosquito control agencies in NJ, the Northeast and nationally. In turn these agencies will promote the use of these materials in elementary schools in the areas distributed. By educating school children about mosquitoes and mosquito IPM, we will reach a larger proportion of the general public and thus have a greater impact on container mosquitoes.

Background and Justification

There are at least 14 species of mosquitoes in the northeastern United States (Table 1) that lay their eggs in containers (Carpenter and LaCasse, 1955). Of these species, 9 are cosmopolitan, occurring throughout all of the northeastern states (Darsie and Ward, 2000). These species belong to 5 different genera including *Aedes, Anopheles, Culex, Orthopodomyia,* and *Toxorhynchites.* In addition, there are at least 11 other common mosquito species in the northeast that have been collected from tires (Yee, 2008), although their primary habitats are bogs, swamps, marshes, or ditches.

Of the 14 species in the northeast that lay their eggs in containers, there is a wide variety of natural and artificial containers that are used as larval habitat. Although many species use treeholes as a natural container, the same species are often encountered in backyard containers in both urban and rural habitats. The overwintering sites for many of these container species are unknown. *Aedes triseriatus,* a mosquito that is commonly collected in backyard containers, overwinters as eggs in Northeast (Sims, 1982). This species has been collected in a wide variety of natural and artificial containers, including those in backyard habitats. Container species of

Table 1. Container inhabiting mosquito species in the Northeast

Species	ME	NH	VT	NY	CT	MA	RI	PA	MD	DE	VA	NJ
Aedes albopictus								X	X	X	X	X
Aedes atropalpus	X	X	X	X	X	X	X	X	X	X	X	X
Aedes hendersoni	X	X	X	X	X	X	X	X	X	X	X	X
Aedes japonicus	X	X	X	X	X	X	X	X	X	X	X	X
Aedes triseriatus	X	X	X	X	X	X	X	X	X	X	X	X
Anopheles barberi				X	X	X	X	X	X	X	X	X
Anopheles punctipennis	X	X	X	X	X	X	X	X	X	X	X	X
Culex pipiens	X	X	X	X	X	X	X	X	X	X	X	X
Culex restuans	X	X	X	X	X	X	X	X	X	X	X	X
Culex salinarius	X	X	X	X	X	X	X	X	X	X	X	X
Culex territans	X	X	X	X	X	X	X	X	X	X	X	X
Orthopodomyia alba				X				X	X	X	X	X
Orthopodomyia signifera		X		X	X	X	X	X	X	X	X	X
Toxorhynchites rutilus septentrionalis				X	X			X	X	X	X	X

Culex and *Anopheles* overwinter as adults, and begin laying eggs in containers in late spring and early summer. *Toxorhynchites rutilus septentrionalis* is a predatory mosquito, which as larvae feed on other mosquito larvae. This species is most abundant in treeholes, where it overwinters as larvae. However, during the summer this species is frequently found in backyard containers, such as tires, trashcans, and buckets.

In the Northeast, West Nile virus is maintained in container-inhabiting mosquitoes, such as *Culex pipiens.* This species feeds primarily on birds, but has been found to take bloodmeals from humans and other mammals (Hamer et al, 2008), making it a potential bridge vector of West Nile virus to humans. Not only is this species an important bridge vector, it is also closely associated with humans, laying eggs in septic tanks, storm drains, and artificial containers (Barr, 1965). In New Jersey, anthropophilic container species, such as *Aedes albopictus, Aedes triseriatus,* and *Aedes japonicus* are also found positive for West Nile virus each year. In addition, *Aedes japonicus,* was recently found positive for Eastern Equine Encephalitis (EEE) virus, which is potentially more deadly than West Nile virus. *Aedes japonicus* readily feeds on both avian and mammalian hosts in its native range (Miyagi, 1972), and has been shown to be a competent vector for EEE (Sardelis et al, 2002). Although *Aedes japonicus* was first detected in the United States in 1998, it has rapidly spread into each state in the Northeast. *Aedes albopictus,* another recently introduced species, is limited in distribution by daily winter temperature (Nawrocki and Hawley, 1987), and it is capable of picking up and transmitting EEE virus in the laboratory (Scott et al, 1990). Both *Aedes albopictus* and *Aedes japonicus* readily lay eggs in artificial and natural containers. Therefore, some of the greatest risks of disease transmission from mosquitoes occur from those mosquitoes laying eggs in backyard containers.

In this proposal, we propose to increase community awareness and involvement by educating the public about the IPM strategy of source reduction to manage populations of container mosquitoes without the use pesticides. Specifically we propose to produce (print/duplicate), test

and distribute curricula to elementary school teachers in order to educate students about mosquitoes and source. It is our hope that students completing the curricula will retain the information gained and communicate this information to parents and/or guardians thereby reducing container habitats, local container-inhabiting mosquito populations, and complaint calls to county mosquito control agencies. In 2009, we began our first evaluation of our educational efforts. In our education only site in Monmouth County, we saw a 54.4% reduction in the number of containers from 13.6 $\pm$ 3.4 containers per home before education to an average of 6.2 $\pm$ 1.5 containers per home after education. We saw similar results in Mercer County with a 44.6% reduction in the number of containers per home from 11.75 $\pm$ 2.4 before education to 6.5 $\pm$ 0.9 after education. Our goal is to enhance the materials and distribute the final curricula, brochures, handouts and PSA's to mosquito control agencies on a state, regional and national basis.

Literature Cited

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Objectives

The overall goal of this project is to educate the public on how they can reduce container-inhabiting mosquitoes in their yards by source reduction of backyard containers. This includes the following objectives:

1. To teach the public to adopt this IPM strategy to reduce container-inhabiting mosquitoes by incorporating these concepts into elementary school science curricula,

2. To produce brochures, curricula, handouts and public service announcements regarding container-inhabiting mosquitoes that educate the public to reduce mosquitoes in their back yards using this IPM strategy,

3. To distribute these materials throughout New Jersey, the Northeast and nationally.

Anticipated Impacts

Safeguarding human health and the environment:

Development and use of these materials can safeguard human health and the environment by reducing the number of biting mosquitoes in back yards, reducing potential vectors in back yards, and reducing homeowner use of pesticides to control mosquitoes by teaching source reduction,

This project can help to reduce mosquitoes in large areas, including urban and low income cities, where the container species are of increasing concern, and

By teaching the public to eliminate standing water on their property, there is a greater potential to reduce mosquitoes in large areas without the use of pesticides.

These anticipated impacts can be measured through a comparison of the number of container mosquitoes collected in traps, from homes receiving education, compared to those not receiving education. Impacts can also be measured by comparing the reduction in the number of suitable container habitats in areas receiving education, compared to those not receiving education.

Economic benefits:

Pesticides to control mosquitoes are often warranted due to high nuisance levels or disease concerns. Having the public engaged in source reduction can significantly decrease the number of nuisance and vector mosquitoes, thus reducing the usage of multiple pesticide applications, lowering the costs to those agencies that conduct mosquito control. The economic impacts will be measured through a analysis being conducted by Brandeis University. All costs for the project are being determined. Therefore, a reduction in pesticide use can be determined in areas where the source of the container habitat has been decreased.

Implementation of IPM:

Teaching the public to implement source reduction of mosquitoes can greatly increase the area where container-inhabiting mosquitoes can be reduced. This project will allow us to teach source reduction as a means of reducing mosquitoes in all of the Northeast. We can measure the increase in public awareness and knowledge through, (1) the number of new users going to an

educational website, and (2) number of individuals correctly answering knowledge based questions about container mosquitoes in a survey.

Approach and Procedures

Objective 1 - To teach the public to adopt this IPM strategy to reduce container-inhabiting mosquitoes by incorporating these concepts into elementary school science curricula: The curricula to be produced and distributed by this project is currently being developed and evaluated as part of a larger project. This past year, we pilot tested the curricula in two NJ counties (Monmouth and Mercer) with a known history of container mosquito problems. In each county, three sites (education only, education and mosquito control, and mosquito control only) were selected for testing. A 5-day curriculum was developed to teach elementary school children about mosquitoes. Fifty teachers were given a box of curricula and materials, taught as a group how to use the materials, and were allowed to use and keep the materials in their classrooms. To determine the effects of education, the number of containers, potentially used by container inhabiting mosquitoes, from 50 randomly selected homes in each site was determined and compared using Repeated Measures analysis. Surveys conducted by Brandeis University before and after education allowed us to determine if students were learning specific concepts. In addition, student and teacher evaluations were used to allow us to enhance the materials during the second year of the project. Based on the information received during evaluation of the pilot, we will begin modifying the curriculum to have the greatest impact on education, while satisfying the needs of the elementary schools.

Objective 2 - To produce brochures, curricula, handouts and public service announcements (PSA) regarding container-inhabiting mosquitoes that educate the public to reduce mosquitoes in their back yards using this IPM strategy: The brochures, curricula, handouts and PSA's to be distributed by this project are currently being developed and evaluated as part of a larger project. Brochures and handouts were initially evaluated using a focus group and survey using members of the target audience. Based on these results, we modified the materials to suit the needs of the community. Four brochures were distributed over a 6 month period. Following each brochure distribution, the number of containers in 50 randomly selected homes in each site was determined. A repeated measures analysis will allow us to compare the reduction in containers in similar homes after each brochure distribution. This will allow us to determine which brochures were most effective in educating the public about source reduction. Those brochures that were least effective will be scrutinized and modified. After modification, we will evaluate the brochures again using another focus group or survey. Following any necessary modifications, this project will facilitate the printing of brochures and/or duplication of PSA's for distribution to mosquito control agencies in NJ and the Northeast.

Objective 3 - To distribute these materials throughout New Jersey, the Northeast and nationally: The New Jersey Mosquito Control Association has agreed to distribute all materials produced to mosquito control agencies within NJ (approximately 575 mosquito kits - 25 kits per county). The Northeastern Mosquito Control Association has agreed to facilitate the distribution of all materials to counties in Northeastern states that have organized mosquito control programs (550 kits - 2 per county in NY, PA, DE, MD, WV, RI, ME, NH, VT, MA and the District of Columbia). Once these materials are distributed, both associations have agreed to encourage the

use of these materials by elementary school teachers or county mosquito control staff in counties receiving materials. Finally, to facilitate national distribution, all materials will be made available via a Rutgers University/NJAES website. Availability of these materials will be advertised at the 2010 annual meeting of the American Mosquito Control Association. A compact disc containing the materials will also be made available on request.

Timetable

Objective	Task	2010	2011
Teach the public to adopt IPM strategies to reduce container mosquitoes by incorporating these concepts into school science curricula	Pilot test curricula	X	
	Collect complaint/population data	X	X
	Analyze data, modify curricula	X	X
	Evaluate program		X
Produce brochures, curricula, handouts & PSA's	Print materials	X	
	Assemble materials	X	X
Distribute materials throughout NJ, the NE and nationally	Distribute within NJ	X	
	Distribute within NE		X
	Distribute nationally		X

Evaluation Plans

The use of these materials will be evaluated in two NJ counties. The short-, medium- and long-term impacts will be evaluated as outlined in Appendix A. In each county, a school district that receives and agrees to use the educational materials and one that does not will be compared to evaluate whether or not education of school children reduces number of container habitats as well as mosquito populations, and the number of related complaint calls to associated county mosquito control agencies in each community. In each of the three study areas, 50 homes will be chosen at random. At each of these homes, the number of containers, water filled containers, and larvae/pupae filled containers will be counted. Container counts will be conducted after each educational effort. Container numbers and indices will be compared using a repeated measures analysis. Before and after surveys conducted by Brandeis University will be used to measure a change in the knowledge about mosquitoes and mosquito habitats. Based on the results, modifications to the materials will be made prior to distribution within NJ and the Northeast. At the end of the project, mosquito control agencies in NJ and the Northeast will be surveyed about their use of the educational materials and perceived effectiveness of the materials in communities where the materials were used.

Cooperation and Institutional Units Involved

NJAES Cooperative Extension is the lead organization for this project. It is an educational branch of USDA, Rutgers University, and New Jersey county governments. Its mission is to help people improve the quality of their lives by providing research-based information, and informal educational opportunities focused on individual, family, and community needs.

Rutgers University School of Biological and Environmental Sciences' mission is to promote the mission of Rutgers University, with emphasis on the tripartite land grant mission of academics, research, and extension.

Rutgers University Computer Services maintains and technically supports central UNIX computer servers that will provide Internet access and a website for the project. Staff is available to help with web page design, listserv posting page design and maintenance, online catalog design and development, and trouble shooting of the website, and will provide assistance when videoconferencing is required for meetings.

Key Personnel

Kristen Bartlett – Principle Investigator/Project Director: Manage the day-to-day activities of the project including the production and distribution of all educational materials produced, prepare final reports.

George C. Hamilton – Co-Principle Investigator: Oversee project, provide technical leadership and help prepare final reports.

Appendix A.

SITUATION: Educate children and adults how to reduce backyard mosquitoes by source reduction

PRIORITIES: Reduce potential human health risks from nuisance and vector mosquito species

PROGRAM ACTION- LOGIC MODEL