

*The Navy Entomology Center of Excellence joins
Florida Mosquito Control Districts in the Fight against Mosquitoes
by Aaron Lloyd and LCDR Carl Doud*

Of the Florida mosquito species that feed on humans, the majority are a nuisance, while others pose a disease threat to state residents and visitors. As recently as 100 years ago, Virginia Congressman John Randolph declared Florida uninhabitable due in large part to the legions of mosquitoes ready to bite and potentially spread diseases such as malaria and yellow fever. Today, there are more than 60 mosquito control programs across the Sunshine State that labor year-round to make this once "uninhabitable" region much safer and more hospitable.

Military entomologists focus on vector-borne disease (VBD) prevention to ensure the health and readiness of US troops. Two of the biggest VBD threats, malaria and dengue, are vectored by mosquitoes; therefore, mosquito control is a prime objective of military entomology. The Navy Entomology Center of Excellence (NECE), Jacksonville, FL, is a unique Department of Defense (DoD) command that specializes in VBD to reduce disease risk among US and allied forces. The 34 member staff includes a diverse group of scientists, administrators, and preventive medicine personnel made up of active duty, civilians and contractors. NECE has a long history of close association and partnership with several Florida mosquito control districts. According to CAPT Eric Hoffman, NECE Officer-in-Charge, "for NECE to be successful, we must have access to the most effective surveillance and control tools and techniques. Collaboration with mosquito control districts provides a unique opportunity for

each of us to learn from our collective experience during discussion and training and pool resources to discover workable solutions to common problems. Clearly, these relationships are critical in delivering the best possible support to both our military and civilian customers."

Recent fiscal restrictions at both the state and federal level have served to solidify these relationships/collaborations as organizations strive to meet their missions with less. Here, we highlight just a few recent examples of the partnership between NECE and Florida mosquito control districts.

**FLORIDA KEYS MOSQUITO
CONTROL DISTRICT:
DENGUE - 2009-2010**

In September 2009 dengue virus was confirmed in a New York tourist who recently traveled to Old Town, Key West. During 2009, 22 confirmed cases of locally-acquired dengue fever were identified followed by 66 cases in 2010 including an active duty Navy service member. In response to the 2009 cases, the Florida Keys Mosquito Control District (FKMCD) mounted a targeted campaign to control local *Aedes aegypti* with the use of lethal ovitraps (LOT) (Trap-N-Kill®, SpringStar



Figure 1: LT Tracy Mejeoumov placing a lethal ovitrap (inset) for control of *Aedes aegypti* and *Aedes albopictus* in Key West, FL. Photo by PO 1st Class Jesse Evans, NECE

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Figure 2: Navy Entomology Center of Excellence and Anastasia Mosquito Control District collaborate to apply pyriproxyfen from a truck-mounted sprayer in St. Augustine, FL. Photo by LCDR Carl Doud, NECE

Inc, Woodinville, WA). The LOT is a black cup that contains a bifenthrin impregnated strip that will kill female mosquitoes after oviposition, as well as larvae that hatch in the cup; see Figure 1 inset. It was originally developed by the US Army and is reported to be successful against *Ae aegypti*. The public acceptance of LOTs in combination with low toxicity makes this product an attractive tool for the mosquito management toolbox. However, the deployment, monitoring and maintenance of 7000 LOTs in Key West required a considerable amount of labor making it difficult to conduct daily operations without additional personnel. In response to FKMCD's operational void, NECE provided a team of six officers and Preventive Medicine Technicians (PMT), who assisted during two visits; see Figure 1. By the way, it was not hard to find willing volunteers, even in light of a dengue threat! NECE assisted FKMCD to place and maintain LOTs, dumped small containers of water at residences and helped

to apply larvicide to permanent larval habitats. Valuable information was obtained regarding the LOT units, which was useful for product refinement.

ANASTASIA MOSQUITO CONTROL DISTRICT: PYRIPROXYFEN STUDIES 2010-2012

With the consistent global threat of dengue fever and the potential introduction of other viruses such as chikungunya, there is a need for novel strategies to control *Aedes aegypti* and *Aedes albopictus*, the vectors of these diseases. NECE, Anastasia Mosquito Control District (AMCD) along with The Center for Vector Biology at Rutgers University partnered to evaluate pyriproxyfen use as a novel mosquito control technique. Pyriproxyfen, an insect growth regulator that disrupts mosquito larval development, is a potentially ideal larvicide since it is lethal to mosquito larvae at extremely low concentrations, but is considered safe for humans and other vertebrates.

A series of studies were conducted in the St Augustine area from 2011 to 2012 to test two primary ways of applying and distributing pyriproxyfen: 1) directly by truck-mounted ultra low volume (ULV), see Figure 2; and 2) the concept of autodissemination via adult gravid female mosquitoes. Container inhabiting *Aedes* mosquitoes utilize skip oviposition to maximize offspring survival by laying a few eggs in several locations. When adult female mosquitoes have been exposed to pyriproxyfen, they can potentially contaminate multiple habitats as they oviposit at subsequent larval sites.

Results of these efforts suggest that pyriproxyfen could be applied against *Ae aegypti* larvae at least as far as 75 ft from the spray truck (not measured beyond that distance). Further, adult *Ae albopictus* trap captures suggested that pyriproxyfen affected the population, as the mosquitoes captured averaged 50% fewer than those from the control following treatments. Autodissemination was not observed in the mentioned studies, however; efforts to refine the technique are ongoing among NECE and the Rutgers group through use of an autodissemination station.

JACKSONVILLE MOSQUITO CONTROL DIVISION AND LEE COUNTY MOSQUITO CONTROL DISTRICT

A number of other collaborations between NECE and various Florida mosquito control districts have occurred and are ongoing. NECE personnel have recently worked with the City of Jacksonville Mosquito Control Division (JMCD) to survey rebounding *Ae aegypti* populations in the Jacksonville area; see Figure 3. With the invasion of *Ae albopictus* in the 1980-90s, this species displaced *Ae aegypti* in a number of locations. This trend



Figure 3: LT Ryan Larson evaluates oviposition papers for an *Aedes aegypti* and *Aedes albopictus* surveillance project with Marah Clark, City of Jacksonville Mosquito Control Division. Photo by LT Jen Wright, NECE

seems to be reversing to some extent and was confirmed in the Jacksonville area during this study. JMCD has also assisted NECE in its equipment evaluation mission by field testing various sprayers during their control operations. This collaboration provides valuable information to NECE regarding the durability and reliability of equipment for military application.

NECE also received operational mosquito control exposure and training by participating with Lee County Mosquito Control District (LCMCD). LCMCD is the most hi-tech, extensive and well-funded mosquito control district in the nation. Their fleet of mosquito control vehicles alone gives a clear picture of the magnitude of their operation: eleven helicopters,

three airplanes plus numerous boats, airboats, trucks and various other vehicles. This land, sea and air capability is something a Navy entomologist definitely appreciates! The NECE team who trained with LCMCD received exposure to a wide range of operations, including air and land larval surveillance, sentinel chicken surveillance, airboat surveillance and numerous adult and larval control efforts; see Figure 4.

THE CONTINUED FIGHT

Civilian-Military collaborations have provided valuable information in the fight against pestiferous and disease-carrying mosquitoes. Continued joint-force research, operations and training encourages innovative ideas and facilitates the sharing of mosquito management techniques that provide a competitive edge in the shared fight against mosquitoes.

Disclaimer: The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the US Government.



Figure 4: LT Jen Wright draws blood as part of a sentinel chicken program monitoring West Nile virus run by Lee County Mosquito Control District. Photo by LTJG Matthew Yans, NECE



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