The significant amounts of rainfall in the Florida Keys this year were not from the typical threat of hurricane season the Keys are so accustomed to; but the rain brought a new threat: dengue fever. The Key West dengue outbreak produced 27 confirmed cases in 2009 and 56 confirmed cases so far in 2010.

The Florida Keys Mosquito Control District runs a successful operation. As Director Ed Fussell proudly states, “We are the only program I know of that operates in a national marine sanctuary, conducting Bti larval control in protected wilderness areas.” Fussell attributes this to the District's high level of competence and good control techniques. In addition, the District's extensive surveillance program, comprised of 44 dedicated inspectors, has successfully prevented the Aedes albopictus species from becoming established in the Keys and hopes to similarly control the dengue vector, Aedes aegypti, using all available resources.

However, the dengue outbreak meant that traditional control methods for salt marsh mosquitoes of aerial adulticiding using Dibrom and larviciding using Bti granular products would no longer be sufficient. For the District, protecting the 100 square miles of the Keys from dengue-transmitting Aedes aegypti presented a domestic problem: the mosquitoes breed around citizens' homes looking to feed on humans.

Mikki Coss, Domestic Program Supervisor, explains that the expansion of the District's domestic program was critical in attacking dengue-transmitting mosquitoes. “We added 8 more inspectors this year, so now 23 inspectors go door-to-door, doing their best to get into every property throughout the Keys.” The team inspects artificial containers around homes, tree holes and garbage cans, going through each yard and eliminating any standing water they find. Plus, there are inspectors that focus solely on drains -- with more than 4,000 drains in Key West alone that breed continually. The domestic program is critical, because it's the only control method that reaches mosquitoes inside the homes.

The Florida Keys Mosquito Control District was the only program I know of that operates from our often self-imposed hibernations. As the season winds down for us, we all want to take some time off and rest. Likewise, mosquitoes go into their own form of off-season hibernation. Understanding the various overwintering strategies of various mosquito species can often lead to better control practices in the spring. As we all know, mosquitoes have 4 life stages: egg, larva, pupa, and adult. Depending upon the species and sometimes climate, they can successfully survive the winter in the egg, larval or adult stage.

Mosquito dormancy is prevalent in all temperate climates where the year round climate does not support year-round development. Several factors, especially the latitude, will determine the duration of dormancy. Dormancy is the result of the mosquito entering a state of diapause. Diapause refers to a physiological state of arrested development induced by specific environmental cues, such as decreasing daylight hours and decreasing temperatures.

Species of Aedes, Ochlerotatus, and Culex can overwinter in the larval stage and are able to survive in habitats with frozen surface water. Larval diapause is induced by similar environmental cues as in facultative egg diapause. During the winter months, larval metabolism is greatly reduced; subsequently, larval development is halted. Typically, larval overwintering takes place in the 3rd and 4th instar stages and in breeding sites that do not completely freeze or freeze for only a short time. Therefore, for larval overwintering species, a severely cold winter can cause high mortality rates. Hence, if these species are of concern in your area, a warm winter can lead to more spring larviciding than expected. However, keep in mind that overwintering larvae are largely metabolically inactive and feed only minimally, so early season use of microbials may have limited success.

Anopheles, Culex, Culiseta, and Uranotaenia will often overwinter as adults. When larvae and pupae are exposed to cooler temperatures and shortening light cycles, the resultant adult females will enter a state of reproductive diapause. Shortly upon emerging, they will seek out hibernating shelters (hibernacula) that typically remain free of frost such as caves, stables, rodent burrows, cellars, and sewer systems. The females will almost always mate and use sugar feed to develop internal fat reserves. However, their eggs do not reach the resting stage. Although diapasing Culex will rarely feed on blood prior to entering hibernaculae, Anopheles regularly take blood meals from nearby hosts. Fall and winter surveys can be conducted to locate the primary locations of overwintering mosquitoes. Adulticide treatments can then be made to these structures during the winter or very early spring; thereby, reducing the number of adult mosquitoes emerging with warmer temperatures. For example while in New York City, our program regularly inspected and treated known hibernaculae in Fort Totten, Queens, in an effort to reduce the number of overwintering, WNV-infected Culex.

So while sitting back this winter enjoying the quiet and peace of the off season, it's a good idea to consider the mosquito species present in your area and how they may be overwintering themselves. Getting a jump on them while they’re hibernating can lead to a more effective control program when the weather warms and we all begin to emerge from our often self-imposed hibernations.

Expert Insight

Mosquito Overwintering Strategies
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