SOUTH CAROLINA FAMILY AND COMMUNITY LEADERS
Affiliated with National Volunteer Outreach Network, Country Women's Council, U.S.A., Associated Country Women of the World and in partnership with Clemson University Cooperative Extension Service
SCFCL website: http://www.scfcl.com

Leader Training Guide

Mosquito Control: Reducing Breeding Sites

Objectives:

- Gain a basic understanding of the mosquito life cycle
- Develop insight regarding the important role of water in the mosquito life cycle
- Identify potential locations of water retention to aid in elimination/reduction of mosquito breeding sites

Lesson Overview/Introduction:

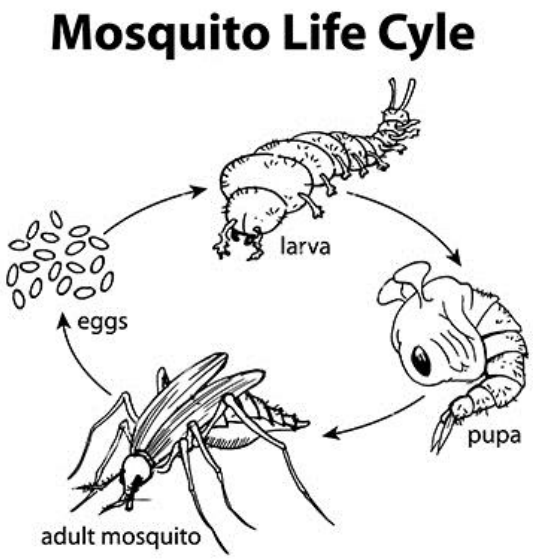
South Carolina is home to over 50 different species of mosquitos. The term mosquito means "little fly" indicating they are a midge-like two-winged insect. Mosquitos are close relatives of flies in the gnat and no-see-um taxa. Like all biological species, mosquitoes undergo a developmental cycle. The mosquito life cycle consists of 4 stages: the egg-larva-pupa-and adult. Availability of standing water to begin the developmental life cycle is highly influential on the overall reproduction numbers of mosquitoes. Areas where water is allowed to stand for 5 or more days can become possible mosquito breeding sites. Areas or containers (man-made or natural) that capture and retain water in a particular location are limitless. When high reproductive success results in elevated population levels, mosquitoes can become a nuisance and often earn the moniker "pest insect". Mosquitoes are most noted for the itchy bite they inflict upon contact, but they are also known to be potential vectors of disease. Common diseases potentially carried by mosquitoes in South Carolina include: West Nile, Eastern Equine Encephalitis, La Crosse encephalitis, St. Louis encephalitis virus, Chikungunya, Dengue, plus dog/cat worm. Recently, Zika virus has been added to the list of potential diseases; however, "no cases of Zika have been identified in South Carolina at this time, and the virus is not currently found in the United States" (DHEC Info Service 10374-DHI-02-24-2016-MOSQ). Zika virus can be potentially vectored by 2 mosquito species in South Carolina, *Aedes aegypti* (Yellow Fever Mosquito) and *Aedes albopictus* (Asian Tiger Mosquito).

The almost limitless availability of standing water for mosquitos to reproduce in combined with their ability to vector potential harmful disease drives the importance of reduction in breeding sites. Steps to reducing mosquito breeding sites are as easy as identifying potential locations for capture and retention of water and eliminating them. However, we often overlook many locations where water can pool and become stagnant. This lesson is designed to generate ideas of common place as well as not so common place locations for retention of water around homes and property that can easily become potential breeding grounds.

Lesson:

Mosquito Biology and the Role of Water

The mosquito life cycle is composed of four developmental stages: egg, larva (referred to as the wriggler stage), pupa (referred to as tumbler stage), and the adult.



The egg, larva and pupa stages require water. Mature female mosquitoes generally require a blood meal prior to producing eggs and can lay masses of 50-200 eggs at a time in or on a water source. There are 2 mosquito egg types: floodwater eggs (require a drying period to become viable) and permanent water eggs (the type focused on in this lesson that require standing water). For the majority of permanent water mosquito species, eggs will hatch in 2-3 days once laid in or on exposed water. Once the egg hatches, a series of larval phases (referred to as instars) will begin evidenced by molting and increase in larval size. For approximately 1 week, larvae (wrigglers) will feed on small pieces of settled organic matter in stagnate water. Larvae will periodically “wriggle” to the surface of the water to breath air at this time. After reaching their final instar, feeding stops and larvae will begin to take on the comma-shaped appearance of the pupae (tumblers). The pupal stage of the life cycle lasts approximately 2 days, but can extend up to a week. The adult mosquito emerges from the pupal case, crawls out of the water, and flies after a short period of time once body parts have hardened. At this time, the adult mosquito is ready to commence mating and complete its life cycle. Female and male mosquitoes use flower nectar as a carbohydrate source for energy. Only female mosquitoes bite because they require protein from a blood meal prior to egg production.

Identifying Possible Water Retention Locations

Evidenced from the mosquito life cycle, water plays an extremely important role in reproduction. Water only needs to remain stagnate for a minimum of 5 days to become a potential breeding site for permanent water eggs. As little as a bottle cap full of water can house enough space to rear even a few mosquitoes; however, standing water can simply be removed from a location once it is identified. The goal of this lesson is to develop skills for identifying water retention areas, then further generate ideas for eliminating or reducing them. It is common practice to leave items, most often larger than a bottle cap, lying fallow around homes and property. Perhaps the first step in identifying water retention locations is to not create them. Proper storage of items in and around the home or property reduces the initial possibly of water retention as well. Turning items over so that water drains rather than fills can become an easy practice. Perform suggested activity 1-Common Items. Participants should be able to list out several common water retention items quickly. Once a list of common items is established, encourage participants to think outside the

box regarding uncommon sources of water retention. Perform suggested activity 2- Uncommon Items. If participants are having difficulty listing items that retain water easily, use the Protect your home against Mosquitoes Poster (print as handout) found in the suggested materials to generate ideas. If the meeting location is suitable, perform the tour recommended in suggested activity 3. If the location doesn't allow for an outside tour, suggest participants search around their own homes and property to identify/eliminate potential mosquito breeding sites.

Lesson Summary:
We often complain about mosquitoes in our surroundings, labeling them as a nuisance to ourselves or those we love. It's easy to say: "It's hard to enjoy the outdoors because there are so many mosquitoes." Instead of relying on chemical control options to solve the problem for us, perhaps we can train ourselves to become better caretakers of our own environment meanwhile reducing the numbers of mosquitoes in the process. The combined knowledge of the mosquito life cycle, the role that water plays in it and the potential for mosquitoes to vector disease produces the need for efficient identification of water capture and retention locations in the environment. This lesson on mosquito control addresses that need. Participants are encouraged to identify common and uncommon items, around homes and property, that capture and retain water and have the potential to become mosquito breeding sites. After identification, discussion is encouraged to generate ideas on how potential mosquito breeding sites can be reduced or eliminated to effectively lower the overall number of mosquitoes in our surroundings.

Suggested Activities:
1: List common items, around homes and property, where water can be retained to produce a potential mosquito breeding site.
Suggestions: flower pots and collection saucers, pet bowls, animal troughs, buckets, barrels/drums, watering cans, old tires & hubcaps, wheel barrow, birdbaths, fountains, children's toys, wagons, trash cans, unmaintained swimming pools, low lying areas that create puddles, tire ruts, woodpiles, coolers, etc.

2: List uncommon items, around homes and property, where water can be retained to produce a potential mosquito breeding site.
Suggestions: cans/cups, bottles and caps, outdoor vases (cemeteries), plant cuttings rooting in water, leaf axils of plants (bromeliads), wading pools, garden ponds, rain barrels, clogged gutters & downspouts, boats & canoes, junk cars, discarded appliances, plastic sheeting & tarps, pool covers, tree & stump holes, root holes at the base of trees, leaf piles, cut open ended bamboo used in landscaping, metal fire pits, bbq pits, bricks or cement blocks with holes, unused extension pipes, dysfunctional drain ditches/basins/cisterns, leaky pipes that pool, storm drains, air conditioner drain areas, flat roofs in the shade, old shoes/boots, garden tools, etc.

3: Take a short tour outdoors of the surrounding property to identify potential water retention breeding sites from suggested activities 1 & 2, or possibly new found sites. Discuss ways to manage, reduce or eliminate these water retention locations or items (water drainage vs. water fill, proper storage, removal/disposal, secure coverings/tarps tightly, use sand, dirt or cement to fill voids).

Suggested Materials:
Protect your home against Mosquitoes Poster http://www.scdhec.gov/Library/ML-012031.pdf

Mosquito Vectors of Zika Virus and Their Control: Chris Evans (DHEC Public Health Entomologist)
http://www.scdhec.gov/Health/docs/Zika/Pres/Mosquito%20Vectors%20of%20Zika%20Virus%20by%20Dr.%20Chris%20Evans.pdf (good photos for water retention visualizations if unable to tour outdoors)

SCDHEC YouTube Channel: Mosquito Bite Prevention (30-Second PSA)
https://www.youtube.com/watch?v=1m79FSV5RBQ&feature=youtu.be

Centers for Disease Control and Prevention (CDC) Help Control Mosquitoes that Spread Dengue, Chikungunya, and Zika Viruses Poster
http://www.cdc.gov/zika/pdfs/control_mosquitoes_chikv_denv_zika.pdf

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Sources/References:
Centers for Disease Control and Prevention (CDC) Controlling Mosquitoes at Home
http://www.cdc.gov/zika/prevention/controlling-mosquitoes-at-home.html

Clemson Cooperative Extension: Entomology Insect Information Series:
-Asian Tiger Mosquito http://media.clemson.edu/public/esps/pdfs/mv12.pdf
-Mosquito Control In and Around the Home http://media.clemson.edu/public/esps/pdfs/hs7.pdf

South Carolina Department of Health and Environmental Control (SCDHEC):
-DHEC Info Service 10374-DHI-02-24-2016-MOSQ: Take Steps Now to Control Mosquitoes
http://www.scdhec.gov/Health/docs/HAN/10374-DHI-02-24-2016-MOSQ.pdf
-DHEC observing National Mosquito Control Awareness Week
http://www.scdhec.gov/Agency/NewsReleases/2012/nr20120621-01/
-Mosquitoes http://www.scdhec.gov/HomeAndEnvironment/Insects/Mosquitoes/
-Mosquito Vectors of Zika Virus and Their Control: Chris Evans (DHEC Public Health Entomologist)
http://www.scdhec.gov/Health/docs/Zika/Pres/Mosquito%20Vectors%20of%20Zika%20Virus%20by%20Dr.%20Chris%20Evans.pdf
-Protecting Yourself from Mosquitoes
http://www.scdhec.gov/HomeAndEnvironment/Insects/Mosquitoes/EliminateBreedingAreas/

University of Florida IFAS Extension: Mosquito Information Website: Mosquito Biology
http://mosquito.ifas.ufl.edu/Mosquito_Biology.htm

US Environmental Protection Agency (EPA) Mosquito Life Cycle
https://www.epa.gov/mosquitocontrol/mosquito-life-cycle