

## Mosquitoes

Mosquitoes (order *Diptera*) are important pests. They annoy and bite humans and animals. The bite can be painful, as well as annoying, resulting in loss of property values and production efficiency of animals.

Adult mosquitoes are familiar insects, but we seldom observe them closely. They are true flies, with a single pair of narrow wings that have a fringe of scales on the margins and veins. They have three pairs of long, slender legs. Most mosquitoes are small, ranging from 3/16 inch upwards to « inch in length. Mouthparts are an elongate beak.

Several species are capable of transmitting potentially fatal human diseases such as encephalitis and malaria. Yellow fever and malaria are two of the devastating diseases that mosquitoes transmit worldwide. In Delaware, mosquitoes may help transmit the viruses that cause encephalitis, in humans and horses, and heartworm in dogs. In both diseases, other organisms such as birds, squirrels, and small mammals are also involved in the life cycle.

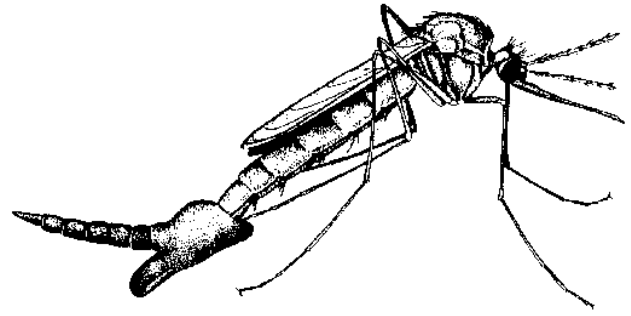
### Life Cycle

Water is essential for development of mosquitoes, which go through four life stages. The egg, the first stage, is laid by the adult female directly on the water surface or on a solid substrate that is subject to flooding. Eggs laid on solid substrates will not hatch until flooded; they can remain viable for several years waiting for water. In Delaware, two major pest mosquitoes that lay eggs on solid substrate are the salt marsh mosquito (*Aedes sollicitans*) and the fresh water swamp mosquito (*Aedes vexans*).

The second life stage is the larva. Larvae always live in water and cannot survive long out of it. The larva is an active stage that feeds while floating at the water surface. They get air at the water surface through a snorkel-like device. When disturbed, larva actively move in an s-shape motion which gives them their common name "wiggler." They can swim down from the surface but need to return to it shortly in order to breathe. Larva are filter feeders, eating organic matter in the water, which they collect by using their bristle-like mouthparts.

The third life stage is the pupa. Pupae are comma-shaped and stay at the water surface. If disturbed, they tumble downward to escape. Pupae do not feed. This stage lasts only for two or three days. Both larvae and pupae are subject to heavy predation. Typically, the 100-400 eggs laid by a female only result in a few adults developing successfully.

The adult stage appears in as little as 7-10 days in some mosquitoes. Adult behaviors vary depending upon the species. Some breed and live near water, which may be fresh or brackish. Other species may fly considerable distances from a breeding site to seek food sources. Some species are only active at dusk, while others seek blood meals during daylight hours. Some species prefer to bite birds and mammals; others seek reptiles and amphibians. Only the females seek blood, which they need as a protein source to produce eggs. Males as well as females feed on flower nectar or plant juices for energy.



## Breeding Sites Around the Home

There are many places mosquitoes can breed around homes. They need water for larval and pupal development and eggs must have water to hatch. Some common breeding sites around the home are:

- a. Containers that hold water such as paint buckets, tin cans, tires, yard debris, little-used equipment, etc.
- b. Cesspools or septic tanks that have openings allowing females to enter and lay their eggs.
- c. Storm sewer catch basins, roof gutters that drain poorly, rain barrels, etc.
- d. Bird baths or fish pools.
- e. Rot holes in trees and stumps.
- f. Swimming or wading pools.
- g. Areas where standing water accumulates such as below down spouts, drainage ditches, crawl spaces, and in sump pump holes.

## Control

The most effective way to reduce mosquito bites is to employ a multi-faceted control strategy. There is little that can be done about the species that are able to fly several miles from their breeding site except to rely on public agencies for control of these species. Delaware State Mosquito Control Section, which is part of Delaware Natural Resources and Environmental Control Agency (DNREC), has an active control program. Contact that agency if you have a problem that doesn't respond to personal control efforts.

## Elimination of Breeding Sites

One of the easiest and surest ways to control mosquitoes around the home is to eliminate standing water breeding sites, which breaks the life cycle. For standing-water containers like wading pools, bird baths, or around watering tanks, flush the container weekly with clean water. Filtering systems of swimming pools should keep a swimming pool free from immature

mosquitoes. Seal openings to standing water sources like septic tanks or rainwater barrels. Water the lawn and garden only at recommended levels.

Search for and eliminate standing-water sources. Old tires or discarded containers of most any sort can collect water and the female mosquito can find these sites for her egg laying. Drainage ditches, pools with lots of vegetation, and sites like roof gutters and storm drains, which occasionally hold water, are more difficult to detect but they too need attention. Areas that contain fish and other natural enemies of mosquito larvae, like amphibians and insects, are not effective breeding sites because these animals eat the larvae. If waterways are clogged with vegetation, mosquitoes can survive, however. Check natural sites like holes in trees or stumps where water can accumulate, and fill or exclude entry for adult mosquitoes.

Mosquitoes that fly long distances may be the source of annoyance. Simple elimination of water sources will not work in these instances. If you are a large landowner or have property bordering public areas, you may not be able to effectively manage the source of the problem yourself. Adult mosquito control provides only limited, temporary relief from biting activity. You still can:

- a. Maintain functioning screens over doors and windows (16x16/14x15 mesh).
- b. Stay inside, particularly at dusk when mosquitoes are more active.
- c. Wear protective clothing - long sleeves and pants and head cover
- d. Use insect repellents containing DEET.
- e. Reduce outside lights - use yellow bulbs when possible.
- f. Hang bug zappers away from areas to be protected.

When flooding (such as periodic high tides or heavier than normal rains) has resulted in a hatch of mosquito eggs, you can expect an influx of adult mosquitoes in a couple of weeks. You need to avoid becoming a target for such a mosquito 'bloom'. This larger population will probably last for only a couple of weeks.

## **Natural Enemies**

A large number of organisms eat mosquitoes. Birds such as purple martins may eat a few mosquitoes but are not effective in eliminating them. Bats may also sometimes feed on mosquitoes, but making nest or roost areas for these predators is not advisable for mosquito reduction.

Wigglers are highly prized by fish and a large number of other aquatic predators. Gambusia and guppies are two fish that will readily eat mosquito larvae. You can purchase them for stocking ponds or pools. If the water source is stagnant, fish will not survive, but the mosquitoes will.

## **Mechanical Control**

Several types of traps which claim mosquito control are available. Most are not effective. Ultraviolet (purple) lights with electric grids (bug zappers) are widely used. These attract few mosquito species, so they should not be used for mosquito reduction. Ultrasonic devices do

not meet advertisers claims for their products. Other types of traps are effective survey tools for mosquitoes but will not provide adequate control.

## Indoor Control

Sprays or aerosol "bombs" containing pyrethrins and piperonyl butoxide can help eliminate mosquitoes inside a closed area. Mosquito coils, candles, and other repellents may provide limited repellency while in use but have no lasting effect. If mosquitoes have a means of readily gaining access to your home, no indoor control will be economically effective or have any long-term effect.

Easy-to-use insecticide strips can be used for adult mosquito control. Do not use in kitchens, restaurants, or areas where food is prepared or served. Do not use strips in nurseries or rooms where infants or aged persons are confined.

**Repellents** - A great deal of research has gone into finding and developing effective insect repellents. Some compounds that were once recommended have been removed from the market because of possible side effects upon humans. Only repellents containing DEET (N,N diethyl metatoluamide) are now permitted. This chemical remains an effective repellent for use on clothing and skin to ward off mosquitoes and other biting insects.

The length of effectiveness varies from one to several hours. The material is formulated as sprays, sticks, lotions, and creams, and comes in concentrations from 15-85 percent. Some people show allergic sensitivity to DEET, particularly to higher concentration products, and under intense heat and perspiration. Before using a repellent, check your personal sensitivity. Be very careful not to use DEET repellents around the eyes, nose, or mouth.

Repellents containing natural products such as clove oil, citronella, peppermint, or combinations of these and other odors may provide some temporary repellency in a localized area. Products of sprays, air wicks, or candles that burn slowly contain such compounds. The real efficacy of these materials have not been rigorously tested, and claims of effectiveness should be determined for the individual situation. Such repellents work only in confined areas and only while circulating in the air; they have no residual effect.

## Outdoor sprays

Mosquitoes are drawn to an area because they detect a food source or a white light. Temporary relief may be possible by fogging an area immediately before use with an approved insecticide. There are some community-based fogging programs. Mosquitoes may land and rest on vegetation when they come to an area, and spraying the area may provide some temporary relief.

Aerosol sprays that may provide relief inside are not effective outside. Likewise the repellent compounds in coils, candles, or as air wicks are not as effective when used outdoors.

The easiest way to control mosquitoes is to take away their water breeding sites. If you are not able to remove the standing water, you may be able to treat it with an insecticide, with an oil that covers the surface, or with the biological insecticide *Bacillus thuringiensis*, which kills the

larvae. Several formulations of such compounds are available. Additionally, pyrethrins or the insect growth regulator methoprene are available in easy-to-use packaging for placement in water breeding sites to reduce the development of wigglers.