Mosquito Information
(Tom Floore, American Mosquito Control Association, 2000)

Introduction

Mosquitoes are insects belonging to the order Diptera, the True Flies. Like all True Flies, they have two wings, but unlike other flies, their wings have scales and their mouthparts (in female mosquitoes) form a long piercing-sucking proboscis. Males differ from females by having feathery antennae and mouthparts not suitable for piercing skin. Nectar is their principal food source.

There are over 2500 different species of mosquitoes throughout the world, of which 150 species occur in the United States and 73 species occur in Florida. Each of the species has a Latin scientific name, such as Culex tarsalis. Culex is the "generic" name of a group of closely related mosquitoes and tarsalis is the "species" name which represents a group of individuals that are similar in structure and physiology and capable of interbreeding. These names are used in a descriptive manner so that the name tells something about this particular mosquito. Some species have what are called "common names" as well as scientific names, such as Aedes sollicitans, the "Black salt marsh mosquito."

The Name "Mosquito"

The Spanish called the mosquitoes, "musketas," and the native Hispanic Americans called them "zancudos." "Mosquito" is a Spanish or Portuguese word meaning "little fly" while "zancudos," a Spanish word, means "long-legged." The use of the word "mosquito" is apparently of North American origin and dates back to about 1583. In Europe, mosquitoes were called "gnats" by the English, "Les moucherons" or "Les cousins" by French writers, and the Germans used the name "Stechmucken" or "Schnacke." In Scandinavian countries mosquitoes were called by a variety of names including "myg" and "myyga" while the Greeks called them "konopus." In 300 B.C., Aristotle referred to mosquitoes as "emvis" in his "Historia Animalium" where he documented their life cycle and metamorphic abilities. Modern writers used the name Culex and it is retained today as the name of a mosquito genus. What is the correct plural form of the word mosquito? In Spanish it would be "mosquitos", but in English "mosquitoes" (with the "e") is correct.

Mosquitoes can be an annoying, serious problem in man's domain. They interfere with work and spoil hours of leisure time. Their attacks on farm animals can cause loss of weight and decreased milk production. Some mosquitoes are capable of transmitting diseases such as malaria, yellow fever, dengue, filariasis and encephalitis (SLE, WEE, LAC, JE, EEE and West Nile virus (WNV)) to humans and animals.
Mosquito Life Cycle

The mosquito goes through four separate and distinct stages of its life cycle: Egg, Larva, Pupa, and Adult. Each of these stages can be easily recognized by its special appearance.

**Egg**: Eggs are laid one at a time and they float on the surface of the water. In the case of Culex and Culiseta species, the eggs are stuck together in rafts of 200 or more. Anopheles and Aedes species do not make egg rafts but lay their eggs separately. Culex, Culiseta, and Anopheles lay their eggs on water while Aedes lay their eggs on damp soil that will be flooded by water. Most eggs hatch into larvae within 48 hours. Water is a necessary part of their habitat.

**Larva**: The larva (larvae - plural) lives in the water and comes to the surface to breathe. Larvae shed (molt) their skins four times, growing larger after each molting. Most larvae have siphon tubes for breathing and hang from the water surface. Anopheles larvae do not have a siphon and lay parallel to the water surface to get a supply of oxygen through a breathing opening. The larvae feed on micro-organisms and organic matter in the water. On the fourth molt the larva changes into a pupa.

**Pupa**: The pupal stage is a resting, non-feeding stage. This is the time the mosquito turns into an adult. It takes about two days before the adult is fully developed. When development is complete, the pupal skin splits and the mosquito emerges as an adult.

**Adult**: The newly emerged adult rests on the surface of the water for a short time to allow itself to dry and all its body parts to harden. The wings have to spread out and dry properly before it can fly.
The egg, larva and pupa stages depend on temperature and species characteristics to determine how long they take for development. For instance, Culex tarsalis, a common California, USA mosquito, might go through its life cycle in 14 days at 70 F and take only 10 days at 80 F. Also, some species have naturally adapted to go through their entire life cycle in as little as four days or as long as one month.

The following pages show a typical mosquito egg raft, larva, pupa, and adult, and explain more about each stage.

Mosquito Egg Raft

Culex mosquitoes lay their eggs on the surface of fresh or stagnant water. The water may be in tin cans, barrels, horse troughs, ornamental ponds, swimming pools, puddles, creeks, ditches, or marshy areas. Mosquitoes prefer water sheltered from the wind by grass and weeds.

Culex mosquitoes usually lay their eggs at night. A female mosquito may lay a raft of eggs every third night during its life span.

Culex mosquitoes lay their eggs one at a time, sticking them together to form a raft of from 200 to 300 eggs. A raft of eggs looks like a speck of soot floating on the water and is about 1/4 inch long and 1/8 inch wide.

Tiny mosquito larvae emerge from the eggs within 24 hours.

NOTE: Anopheles mosquitoes lay their eggs singly on the water, not in rafts. Aedes mosquitoes lay their eggs singly on damp soil. Aedes eggs hatch only when flooded with water (salt water high tides, irrigated pastures, treeholes, flooded stream bottoms).
Mosquito Larva

Mosquito larvae, commonly called "wigglers", must live in water from 7 to 14 days depending on water temperature.

Larvae must come to the surface at frequent intervals to obtain oxygen through a breathing tube called a siphon. The larvae eat algae and small organisms which live in the water.

During growth, the larva molts (sheds its skin) four times. The stages between molts are called instars. At the 4th instar, the larva reaches a length of almost 1/2 inch.

When the 4th instar larva molts, it becomes a pupa.

Mosquito Pupa

Mosquito pupae, commonly called "tumblers," must live in water from 1 to 4 days, depending upon species and temperature.
The pupa is lighter than water and therefore floats at the surface. It takes oxygen through two breathing tubes called "trumpets." When it is disturbed it dives in a jerking, tumbling motion and then floats back to the surface. The pupa does not eat.

The metamorphosis of the mosquito into an adult is completed within the pupal case.

The adult mosquito splits the pupal case and emerges to the surface of the water where it rests until its body can dry and harden.

**Mosquito Adult**

Only female mosquitoes bite animals and require a blood meal. Male mosquitoes do not bite, but feed on the nectar of flowers.

**Aedes** mosquitoes are painful and persistent biters. They search for a blood meal early in the morning, at dusk (crepusular feeders) and into the evening. Some are diurnal (daytime biters) especially on cloudy days and in shaded areas. They usually do not enter dwellings, and they prefer to bite mammals like humans. Aedes mosquitoes are strong fliers and are known to fly many miles from their breeding sources.

**Culex** mosquitoes are painful and persistent biters also, but prefer to attack at dusk and after dark, and readily enter dwellings for blood meals. Domestic and wild birds usually are preferred over man, cows, and horses. Culex nigripalpus is known to transmit St. Louis encephalitis to man in Florida. Culex mosquitoes are generally weak fliers and do not move far from home, although they have been known to fly up to two miles. Culex usually live only a few weeks during the warm summer months. Those females which emerge in late summer search for sheltered areas where they "hibernate" until spring. Warm weather brings them out again in search of water on which to lay their eggs.
**Culiseta** mosquitoes are moderately aggressive biters, attacking in the evening hours or in the shade during the day. Psorophora, Coquillettidia and Mansonia mosquitoes are becoming more pestiferous as their natural habitats are invaded by an ever expanding human population. Anopheles mosquitoes are the only mosquito which transmits malaria to man.

**MOSQUITO CONTROL**

Mosquito control can be divided into two areas of responsibility: individual and public. Chemical control of mosquitoes around the home may be accomplished with the use of repellents or space sprays. Repellents are substances that make a mosquito avoid biting people. Several repellents are effective against mosquitoes. All insect repellents must have the active ingredient appear on the label; examples are DEET and pyrethroids. Check the label before buying.

Oil of citronella is another type of mosquito repellent for space repelling. Oil of citronella is the active ingredient in many of the candles, torches, or coils which may be burned to produce a smoke which repels mosquitoes. These are useful outdoors only under windless conditions. Their effectiveness is somewhat less than repellents applied to the body or clothing.

Space sprays may be used to kill mosquitoes present at the time of treatment. The major advantage of space treatment is immediate knockdown, quick application, and relatively small amounts of materials required for treatment. Space sprays are most effective indoors. Outdoors, the insecticide particles disperse rapidly and may not kill many mosquitoes. The major disadvantage of space spraying is that it will not manage insects for long periods of time.

Mosquitoes can be killed inside the house by using a flit gun or a household aerosol space spray containing synergized pyrethrum or synthetic pyrethroids (allethrin, resmethrin, etc.). Only insecticides labeled for flying insect management should be sprayed into the air. Best results are obtained if doors and windows are kept closed during spraying and for 5-10 minutes after spraying. Always follow directions on the label.

Homeowners may use hand-held foggers or fogging attachments on tractors or lawn mowers for temporary relief from flying mosquitoes. Pyrethrins or 5% malathion can be fogged outdoors. Follow instructions on fogging attachments for application procedure.

Most of the mosquito problems that trouble homeowners and the general population cannot be eliminated through individual efforts, but instead, must be managed through an organized effort. Many states have some sort of organized mosquito control, either at the State, County or city level. Some residential communities organize to control their mosquito problems. These management
measures include permanent and temporary measures. Permanent measures include impounding water and ditching, and draining swampy mosquito breeding areas. Temporary measures include treating breeding areas to kill larvae and aerosol spraying by ground or aerial equipment to kill adult mosquitoes. If you live within an organized mosquito management district, support it in its control efforts. Organized mosquito management can accomplish much more than individual efforts. If you are not sure about whether your community has a mosquito control district, contact the local division of health officials.

**Premises Control**

The most effective way to control mosquitoes is to find and eliminate their breeding sites. Eliminating large breeding areas such as swamps or sluggishly moving streams or ditches may require community-wide effort. This is a task for your organized mosquito control program. Homeowners, however, can take the following steps to prevent mosquito breeding on their own property:

1. Destroy or dispose of tin cans, old tires, buckets, unused plastic swimming pools or other containers that collect and hold water. Do not allow water to accumulate at the base of flower pots or in pet dishes for more than 2 days.

2. Clean debris from rain gutters and remove any standing water under or around structures, or on flat roofs. Check around faucets and air conditioner units and repair leaks or puddles that remain for several days.

3. Change water in bird baths and wading pools at least once a week and stock ornamental pools with top feeding predacious minnows. Known as mosquito fish, these minnows are about 1 - 1-1/2 inches in length and can be purchased or seined from streams and creeks. Ornamental pools may be treated with biological larvicides (Bacillus thuringiensis subsp.israelensis) under some circumstances.

4. Fill or drain puddles, ditches and swampy areas, and either remove, drain or fill tree holes and stumps with mortar.

5. Eliminate seepage from cisterns, cesspools, and septic tanks.

6. Eliminate standing water around animal watering troughs.

7. Irrigate lawns and gardens carefully to prevent water from standing for several days.
Adult Mosquito Control

Some adult mosquitoes can fly long distances, therefore, it is often necessary to supplement larval control on your premises with control measures directed against mosquito adults.

Mechanical Barriers

Mosquitoes can be kept out of the home by keeping windows, doors and porches tightly screened (16-18 mesh). Those insects that do get into structures can be eliminated with a fly swatter or an aerosol space spray containing synergized pyrethrin.

Repellents

Persons working or playing in mosquito-infested areas will find repellents very helpful in preventing mosquito bites. Use repellents containing ingredients such as diethyl phthalate, diethyl carbate, N, N-Diethyl-3-Methylbenzamide (DEET), and ethyl hexanediol. For more than 40 years, DEET has been the standard in mosquito repellents. Check the label for these active ingredients. The area of skin to be protected should be covered evenly, because mosquitoes will find and bite untreated spots. It is often helpful to use spray repellents on outer clothing as well as the skin. Repellents are formulated and sold as aerosols, creams, solids (sticks) and liquids. You should keep repellents away from eyes, nostrils and lips. Protection generally may be expected up to 6 hours following application.

Vegetation Management

Adult mosquitoes prefer to rest on weeds and other vegetation. Homeowners can reduce the number of areas where adult mosquitoes can find shelter by cutting down weeds adjacent to the house foundation and in their yards, and mowing the lawn regularly. To further reduce adult mosquitoes harboring in vegetation, insecticides may be applied to the lower limbs of shade trees, shrubs and other vegetation. Products containing allethrin, malathion or carbaryl have proven effective. Paying particular attention to shaded areas, apply the insecticides as coarse sprays onto vegetation, walls and other potential mosquito resting areas using a compressed air sprayer. Always read and follow label directions before using any pesticide.
Insect Electrocutors

Numerous devices are available for purchase which claim to attract, repel or kill outdoor infestations of mosquitoes. Most of these devices are ineffective and they should be thoroughly researched before being purchased. Insect electocutors (bug zappers) utilizing ultraviolet light as an attractant have been shown to be ineffective in reducing outdoor populations of mosquitoes or their biting activity.

Mosquito-borne Diseases

Mosquitoes cause more human suffering than any other organism with over one million people dying from mosquito-borne diseases every year. Mosquito vectored diseases include protozoan diseases, i.e. malaria, filarial diseases such as dog heartworm and viruses such as dengue, encephalitis and yellow fever. In Asia more than 50,000 cases of Japanese encephalitis (JE) are reported annually. Yellow fever, dengue and malaria once were prevalent in the United States, but now they are rare. During 1997 and 1998 CDC reported 143 cases of laboratory diagnosed dengue in the US and less than 1200 malaria cases were reported. More recently, West Nile virus (WNV) was the causative agent in 7 deaths among 62 infections in New York City in 1999. This was the first reported case in North America of predominantly African, Middle East and Southeast Asia flavivirus. No human cases have been reported thus far in 2000, however several birds, mainly crows, have tested positive for the virus.