

MOSQUITOES: BIOLOGY AND CONTROL

Purpose: To prevent the spread of encephalitis, West Nile Virus and to reduce the nuisance from biting mosquitoes.

Description: Trapping, surveillance, and control of disease carrying and nuisance mosquitoes.

MOSQUITO LIFE CYCLE

There are a wide variety of types and species, of mosquitoes in Greene County. Despite this large variety, all mosquito species have a similar life cycle that depends on water.

Mosquito species have evolved to seek out and lay their eggs in various locations and different conditions. In general, mosquitoes of the genus *Anopheles* lay single eggs that float on the water's surface. *Aedes* mosquitoes also lay single eggs; however, their eggs are laid just above the water line and dry out. As the water level rises during flooding events, these eggs hatch. Other mosquitoes, such as *Culex* species, will lay clusters of eggs, often called egg rafts. Larvae hatch from these eggs and filter-feed on decaying plant matter. Mosquito larvae are very active in their aquatic environments and have been called "wrigglers" because of their almost constant wriggling movements. Larvae breathe at the water's surface through a specialized tube or siphon and are constantly moving up to breathe, and down to the bottom to feed. Within a few days to several months, they grow and pass through four stages. Colder water temperatures will slow larval development dramatically.

The final, non-feeding larval stage is called the pupa. Pupae are less mobile than larvae; however, they are often seen "tumbling" at the water's surface.

While in the pupal stage, the mosquito larva is changing or metamorphosing into the adult form, a process requiring several days to complete. The adult mosquito emerges from the pupal case at the water's surface and immediately rests for several days to harden its outer cuticle or "skin".

After emerging, males and females will mate over a 2 to 3 day period. Within a week, the adult females begin searching for suitable hosts to bite for a bloodmeal. This bloodmeal gives her all the proteins and nutrients required to produce 100 to 300 eggs. After feeding, female mosquitoes will find a cool resting spot in which to convert the bloodmeal into eggs. Between blood-meals, the females (similar to males) feed on nectar from flowers for sustenance. The females seek successive blood-meals about every 2 weeks throughout their life which lasts for several weeks to several months, depending upon environmental conditions.

MOSQUITOES AND DISEASE

Mosquitoes are responsible for causing more human suffering than any other animal. Mosquito-borne infections include protozoan diseases (malaria), filarial diseases (heartworm) and viral diseases (yellow fever, dengue fever, encephalitis and West Nile Virus). Within the United States, the encephalitis and West Nile Virus are the most commonly reported mosquito-borne diseases in humans.

Mosquitoes are called vectors because they transmit disease-causing pathogens from one animal to another. Often, the host bird or animal is not affected by the disease and serves as a reservoir allowing the pathogens to thrive. The pathogen must be highly concentrated in the host's blood

for the mosquito to acquire it during its bloodmeal. When a mosquito bites an infected bird or animal, the pathogen must be ingested, penetrate the mosquito's midgut, enter its body cavity, multiply, and invade the salivary glands. When a mosquito bites its next victim, its saliva is injected and the pathogen is then transmitted. Some pathogens cannot survive this process and therefore are not transmissible by mosquitoes. Some mosquitoes bite only birds, allowing the disease to be amplified within a bird-mosquito cycle. At some point, mosquitoes that bite birds and mammals have a good chance of biting an infected bird and transmitting the pathogen to a non-infected animal or human host. Monitoring bird populations for infection can give mosquito agencies a forewarning of the disease's threat to human health.

MOSQUITO CONTROL AROUND THE HOME

An effective strategy for mosquito control is to deny them a place to breed. In short, if there is no still water, there will be no mosquitoes breeding in the area. There are many things that each homeowner can do to reduce the mosquitoes found in their backyard and neighborhood.

- All standing water should be eliminated. Avoid over watering lawns.
- Dispose of all useless containers and those that are saved should be turned upside down. Tires, especially, can readily breed thousands of mosquitoes.
- Recycling containers should have holes drilled into their bottom to allow for drainage of rainwater or have tight-fitting lids.
- Roof gutters and drainage ditches should be maintained and cleared of debris.
- Fish will readily eat mosquitoes and, therefore, should be placed in ornamental ponds.
- The water in birdbaths and troughs should be changed weekly.
- Swimming pools and wading pools should be emptied or covered when not in use so water cannot collect in them (or the cover).
- Canoes and other boats should be covered or turned over for storage.
- Properly screening windows and doors will help keep mosquitoes and other biting insects outside—away from you, your family and your pets.
- Properly grade property and smooth out tire ruts to allow for water drainage.

ROADSIDE DITCHES AND CATCH BASINS

Ditches and basins that hold water for extended periods of time can breed large numbers of mosquitoes. These areas are suitable habitat for many species of *Culex* mosquitoes, for example *Culex pipiens* and *Culex restuans*. These mosquitoes lay their eggs directly on the water's surface and the larvae thrive in these areas.

HARDWOOD AND CONIFEROUS FRESHWATER SWAMPS

These swamps can serve to breed a variety of mosquito species. In particular, they are a primary breeding habitat for the mosquito *Culiseta melanura*, the natural or enzootic vector of EEE virus between birds. *Culiseta* larvae live deep within the recesses of the root cavities of large trees. Controlling these mosquitoes in such a difficult to reach habitat makes management of this mosquito nearly impossible.

FRESHWATER MARSHES

The mosquito *Coquilletidia perturbans* can be extremely prolific in cattail marshes as well as areas with other emergent freshwater vegetation. The larvae attach themselves to the stems and roots of the emergent vegetation to obtain oxygen. Therefore, they do not need to swim up and down in the water column to feed and breath. Because of this adaptation, control of this species can be very difficult.

TEMPORARY WOODLAND POOLS AND FRESH FLOODWATER

Shallow, temporary pools are common in woodland areas during the spring and wet summers. A variety of mosquito species will breed in these areas. Some of the most common are *Aedes canadensis*, *Aedes excrucians* and *Aedes vexans*. These mosquitoes lay their eggs along the edges of the pool and rely on rainwater or melting snow to hatch the larvae.

FRESHWATER PONDS

The larvae *Anopheles* are found primarily in small ponds among emergent vegetation. Typically, ponds clogged with vegetative growth and lacking natural predators can breed huge numbers of these mosquitoes. These areas should be maintained to keep vegetative growth to a minimum. Also, they can be stocked with a tiny predatory fish, such as *Gambusia affinis*.

RUNNING WATER

Streams with running water produce few, if any, mosquitoes. Mosquitoes need still or standing water to lay their eggs on or near.

ARTIFICIAL CONTAINERS

Containers such as tires, bottles and buckets provide excellent, predator free mosquito-breeding habitat. Many mosquitoes that prefer natural containers (treeholes) have adapted to using these man-made mosquito nurseries. In such instances, the abundance of litter and other debris can allow for the proliferation of millions of mosquitoes during a season. *Aedes albopictus* and *Culex pipiens*, notorious for transmitting several disease agents, have capitalized on breeding in tires and other artificial containers. To control these mosquitoes, all items collecting rainwater should be tipped over, removed or cleaned regularly.

TREE HOLES

Tree holes and other natural containers, such as pitcher plants, serve as a good spot for breeding mosquitoes. *Aedes triseriatus*, known to transmit several disease agents including dog heartworm filaria, prefers tree holes and can be a very common mosquito in wooded areas. Frequent rainfalls will maintain standing water in these containers and breed mosquitoes throughout an entire summer.

MISTAKEN IDENTITIES

Non-biting Midges

The Chironomidae, non-biting midges, are small flies that closely resemble mosquitoes. Despite not being able to pierce the skin or bite, midges can still be a serious nuisance problem in urban areas, particularly along lake front communities. During peak emergence, massive thick swarms of these midges can blanket houses, cars, and other structures in the vicinity of lakes, ponds, and other bodies of water that serve as breeding habitats. Adult chironomid midges are short-lived. Thousands of these pests can be found dead on window sills, porches and bushes in a 24 hour period.

No-See-Ums (Biting Midget)

No-see-ums, or Culicoides, are very small grayish colored flies about the size of an ordinary pinhead. They can be serious pests in areas where large broods can make them almost intolerable. These flies feed on blood and produce a very painful, burning bite. They seek blood meals primarily during the evening and the very early morning and are most abundant from mid to late summer.

Horse and Deer Flies

Horse and Deer flies, known as Tabanids, are relatively large compared to an adult mosquito, reaching sizes up to an inch in length. They are very persistent daytime feeders and typically swarm towards larger objects, such as cars. Their bite is extremely painful as they lacerate the skin with blade-like mouth parts for a bloodmeal.

Crane Fly

Crane flies are often mistaken for mosquitoes due to their overall similarities (slender abdomen, narrow wings, antennae and long legs.) However, crane flies are normally much larger than mosquitoes reaching body sizes of 1 to 2 inches in length. Most species are tan colored and are weak, clumsy flyers. The larvae live in moist soil, muddy water, or decomposing material. The adult flies, unable to bite, have no economic or medical importance.

Black Fly

Black flies or Buffalo gnats are clearwinged, humpbacked, chunky, blackish gnats that breed in fast moving streams and rivers. These flies are about 1/8 of an inch in length and can be serious biting and nuisance pests. They produce an irritating bite with their sharp mouthparts as they take in a bloodmeal. Preferring to bite on the neck, face or arms, they seek a host during daytime and evening hours.

Stable Fly (Not Pictured)

Perhaps the most injurious insect attacking horses is the stable fly, a small fly similar in appearance to the common housefly. They prefer to bite the animals on the legs and when encountered by people will target the ankles. Large numbers of these flies can breed in masses

of straw, grain, hay, weeds and other materials that have become water-soaked or contaminated with manure.

Moth Fly

Moth flies are small flies, about 1/8 of an inch in length, and are typically gray to black in color. These flies are in the family *Psychodidae* and are often called drain flies because they are commonly found breeding in drains. Although moth flies do not bite, they can be serious nuisance pests in homes and restaurants. The larvae feed on decaying matter in dirty or clogged drains and develop into adult flies within 8 to 24 day depending on the temperature.

Insect Repellents Containing DEET

Repellents that contain DEET (N,N-diethyl-m-toluamide) can be very effective in preventing insect bites. However, DEET may cause allergic and toxic reactions in children and adults, especially when used on the skin repeatedly and/or in high concentrations (cover 20-30%). Use insect repellents only as directed; using more DEET than necessary will not improve protection but will increase the likelihood of toxicity or allergic reactions. Do not use repellents on infants and caution children to avoid getting repellents in their eyes.

The typical mosquito is about 3/8 of an inch long, slender, light brown to black in color, and has a long protruding mouthpart called a proboscis.