

Mosquitoes



The purpose of this article is to provide you with basic facts about biology and control of pest mosquitoes in Michigan. Knowledge of the different kinds of mosquitoes in Michigan is essential if they are to be controlled using the integrated pest management philosophy.

Modern mosquito control involves integration of a variety of methods to achieve the single end of preventing mosquito bites, and can be done in an environmentally acceptable manner through the use of physical methods, personal protection measures, biological controls, and appropriate and judicious application of insecticides.

BIOLOGY

Mosquitoes are annoying because the female bites in order to acquire a blood meal for the development of her eggs. Male mosquitoes do not bite. Mosquito bites may simply cause a short-term itching sensation in the skin, or can lead to inflammation, allergic reactions and possibly to secondary infection with bacteria at the site of the bite. In large numbers, mosquitoes comprise a nuisance and can greatly reduce the quality of life for people and animals. Large populations of mosquitoes can also impact economic activity, including recreation and tourism industries.

Mosquitoes are true flies and like other insects have a development cycle involving

complete metamorphosis from the egg to the adult stage. Mosquito eggs are laid singly or in clusters on water or in mud and debris near water prone areas. Tiny larvae hatch from the eggs and develop in the water. The larvae feed on a variety of microorganisms and organic matter in the water, and develop through four larval stages to the pupal stage. Adult mosquitoes emerge from the pupal stage and fly away. Male mosquitoes feed on nectar and do not bite for blood; female mosquitoes of most species require a blood meal to develop their eggs, and may bite several times during their lifetime. Female mosquitoes not only bite people, but also other animals including birds, mammals, frogs, and snakes.

Michigan has five major classes of pest mosquitoes based upon larval habitat and life history: the spring floodwater mosquitoes, the summer floodwater mosquitoes, the cattail mosquitoes, the swamp/marsh mosquitoes and the container-breeding mosquitoes. Overall, there are about 60 different species of mosquitoes in Michigan. From a pest point of view, the most important groups of mosquitoes are the floodwater mosquitoes.



Larvae of **spring floodwater mosquitoes** hatch from the eggs in March, in pools of water formed by melted snow in the

woods. The eggs occur in the leaf litter at the bottom of the pools. These larvae develop slowly because of low water temperatures, and emerge as adults in May, before the pools dry up. The female spring floodwater mosquitoes can be very long-lived, and may bite several times. They lay eggs in the woods where they will be flooded the following year. Spring floodwater mosquitoes have only one generation per year, so even if these eggs are flooded by summer rains, they will not hatch until the following spring.

Summer floodwater mosquitoes include several of our common pest mosquitoes in Michigan. Larvae hatch from eggs after rainfall in the summer (usually 1 inch or greater) in shallow flooded areas such as meadows, roadside ditches, highway right-of-ways, tire tracks, cow hoof prints, and other habitats. The larvae develop very quickly (7-10 days) and several generations may occur each summer depending upon the frequency and intensity of rainfall. For any given summer, we cannot predict in advance how bad the summer mosquitoes will be, because we can't predict the rainfall.

CONTROL



Mosquito control should involve careful consideration of the biology of the mosquitoes that are causing the nuisance problem or disease threat. In all cases, larval mosquito control should be considered as the first option for abatement. This involves location of larval habitats, followed by their modification or treatment in such a way that the integrity of the habitat is preserved but the mosquito larvae are reduced in numbers. By dealing with larval mosquitoes, the adults may never become a problem. Adult mosquito control invariably involves the use of insecticides.

The larval habitats of spring and summer floodwater mosquitoes can be permanently

eliminated through environmental sanitation and civil engineering, and should be the first



thing to consider for mosquito control. Because of the temporary nature and small size of mosquito floodwater habitats, they often can be altered to prevent

mosquito production. However, there are laws and policies regulating alterations of wetlands, and the Michigan Department of Natural Resources must be consulted before these activities take place. Indeed, professionals responsible for mosquito control are in the unique position of finding a balance between preservation of our wetlands and elimination of mosquito sources, but this balance can often be achieved with the careful planning and consultation with authorities. Landscape planners should consider carefully the kinds of mosquito habitats they may be creating when wetlands are integrated into landscape or neighborhood designs. However, it is entirely possible to reduce larval mosquito sources and at the same time preserve wetlands and other desirable habitats.

Source reduction of larval mosquitoes may involve: (1) installation of a catchment; (2) installation of tile leading to a catchment or drain; (3) modification of grade to permit drainage; or (4) conversion of a mosquito-producing area to a non-mosquito-producing body of water such as an ornamental pond, water hazard, or permanent wetland. For tiling purposes, "sock" tile, which allows water entry but prevents roots and debris from clogging the tile, is very useful when dealing with woodland mosquito habitats.

Often, larval mosquitoes must be controlled through the use of insecticides that are applied directly into the water where larvae occur. In such instances, presence of larvae should be confirmed with use of a mosquito dipper and visible inspection. There are many registered larval mosquito insecticides.

Adult mosquito control can also be

accomplished through the application of registered insecticides. Essentially, there are three ways to accomplish this. First, adult mosquitoes can be killed on the wing during their normal flight time (dusk) using ultra-low volume (or ULV) equipment (a type of sprayer that is hand-held, mounted on a vehicle, or fixed to aircraft) and an insecticide. This method is sometimes called "cold fogging," although the droplet size of ULV applications comprise a cloud that is technically not a fog. This is an excellent method for controlling mosquitoes, because it allows for use of a small amount of material (generally about 1-5 fl oz per acre) on tiny droplets in a narrow band of time and space.



A second approach to killing adult mosquitoes is using thermal fogs. In this technology, an insecticide is heated along with another combustible material such as kerosene or oil, thus creating a fog that moves through the air, around vegetation, among flying insects. For mosquito control, the best time to make a thermal fog application is in the evening when thermal inversion conditions exist. A thermal inversion occurs when the warm air (heated by the earth during the day) has not yet mixed with cooler air above it. The insecticidal fog remains most stable and near the ground under conditions of thermal inversion. Thermal foggers can be purchased commercially in sizes small enough for backyard use to sizes large enough for widescale application.

Another way to control mosquitoes is to use "harborage" or "barrier" techniques. This involves spraying a dilution of a registered insecticide onto vegetation surrounding the area to be protected. This area could be a backyard, a cemetery, a park, fairway, etc. The insecticide provides a residual of active ingredient on plant leaf surfaces, and when mosquitoes fly from the harborage areas (the woods) through this zone, they die or

are repelled and do not move into the open to bite. Equipment for harborage application varies with the size of the area to be protected, but can range from a small hand pump sprayer to a motorized backpack sprayer to a large Buffalo turbine rig.

Flying predators are often cited in the popular press as means for controlling mosquitoes by predation. However, scientific studies do not support the contentions that bats, swallows, purple martins, dragonflies, or other flying predators are effective, even though these methods might sound appealing and the animals themselves have aesthetic and intrinsic value. One has to bear in mind that predation is a natural process that is ongoing, yet we have mosquitoes anyway, often in large numbers. Actually, birds and bats do not include many mosquitoes in their diets, despite some claims to the contrary. The idea that they eat thousands of mosquitoes per night comes from statements in the natural history literature indicating that these predators would have to eat this many to maintain their existence. Outdoor electronic bug zappers with ultraviolet lights do not control mosquitoes. So-called "mosquito plants" do not effectively repel mosquitoes, and are not recommended for this purpose despite advertisements to this effect. Other devices such as those advertised to repel mosquitoes by high frequency sound do not actually repel mosquitoes.

PERSONAL PROTECTION

Personal protection measures against mosquito bites is mostly a matter of common sense. People can avoid mosquito bites by remaining indoors when mosquitoes are active, or by avoiding areas where mosquito populations are dense.



Well maintained window screens, screened in porches, and door screens allow ventilation while preventing mosquitoes from entering homes. Repellents applied to skin and clothing are very useful for protection against mosquito bites. The choice of which repellent to use depends upon personal preference. For those repellents containing DEET, this active ingredient varies in concentration in different formulations. Higher concentrations generally will have greater effect and last longer than lower concentrations. Home products such as citronella candles and mosquito coils may offer some relief from mosquito bites in backyard settings, decks, and other small outdoor spaces. Insecticides in pressurized, hand-held cans can be used to spray insecticide mists into the air indoors and outdoors to reduce mosquito numbers in small areas. Persons should carefully read the label on containers of repellent and follow the directions.

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