

# Mosquitoes

## In and Around Homes

Mosquitoes are well known as annoying pests and as carriers of disease-causing agents to humans and animals. Their rapid wing movement produces a distinctive high-pitched hum, and their bites cause red, itchy welts. Mosquitoes are small, slender flies that are members of the family Culicidae. They generally look alike to the naked eye, but the different species vary greatly, with various patterns of bands, stripes, and spots that adorn their bodies.

Knowing which mosquito species lives in and around your home is important because they vary in biology and behavior and have different impacts on humans and wildlife. Understanding their biology will help you make more informed decisions about dealing with the health risks they pose, whether to attempt mosquito control, and what methods to use to control them.

### Mosquito Species in Alabama

In Alabama, there are about 60 different species of mosquitoes. Some are disease vectors, or carriers; some are nuisance species, which are bloodsuckers but are not known to transmit disease; and some are beneficial species. The male mosquito can be distinguished from the female by the featherlike appearance of the antenna.

The most common mosquitoes that carry disease are shown in table 1. They are the Asian tiger mosquito (*Aedes albopictus*), Japanese encephalitis mosquito (*Ochlerotatus japonicas*), southern house mosquito (*Culex quinquefasciatus*), yellow-fever mosquito (*Aedes aegypti*), and eastern treehole mosquito (*Ochlerotatus triseriatus*). The yellow-fever mosquito used to be very common in Alabama but is being gradually displaced by the Asian tiger mosquito.

The other mosquito species commonly found in Alabama is the beneficial cannibal mosquito, *Toxorhynchites rutilus*. Its larva feeds on the larvae of other mosquitoes. Its adult only feeds on nectar. It is relatively large (body length about 7 to 9 mm and wingspread about 12 to 14 mm) than the bloodsucking



(Photo credit: Susan Ellis, Bugwood.org)

species (body length about 3 to 6 mm and wingspread about 8 to 10 mm). Its body is covered with shiny metallic blue scales, and its mouth is prominent and curved upward.

### Mosquito Life Cycle and Biology

Successful mosquito management requires knowledge of where and how mosquitoes develop and reproduce. All mosquitoes have four life stages: egg, larva (wigglers), pupa, and winged adult. The number of days to complete a life cycle from egg to adult varies with species and temperature, from less than a week to weeks or months.

#### Eggs

Mosquitoes lay eggs singly on a moist surface of soil or a cavity wall but always in association with water (such as in ditches, street catch basins, tire tracks, streams that are drying up, and fields or excavations that hold water for some time) or in rafts on the surface of still water. The water is often stagnant and close to the home in discarded tires, ornamental pools, unused wading and swimming pools, tin cans, bird baths, plant saucers, and even gutters and flat roofs.

## Disease-Carrying Mosquito Species

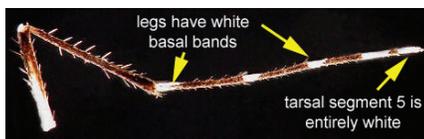
(All figures are courtesy of Florida Medical Entomology Laboratory, permission by Dr. Jorge Rey, except the top right photo in figure 1 is credited to Ary Farajollahi at Rutgers University and figure 2 is credited to Kent Loeffler)

**Species** Asian tiger mosquito (figure 1)

**Body** Black and white with striking dark and light stripes over much of the body

**Scutum** Single white stripe down the middle

**Legs** Black with white bands



**Figure 1.** Asian tiger mosquito, *Aedes albopictus*

**Species** Japanese encephalitis mosquito (figure 2)

**Body** Black and white with striking dark and light stripes over much of the body

**Scutum** Wide, yellowish-white stripe down the middle and two light stripes to either side

**Legs** Black with white bands



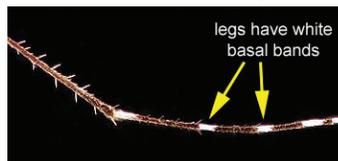
**Figure 2.** Japanese encephalitis mosquito, *Ochloerotatus japonicas*

**Species** Yellow-fever mosquito (figure 3)

**Body** Black and white with striking dark and light stripes over much of the body

**Scutum** Lyre-shaped pattern of white scales

**Legs** Black with white bands



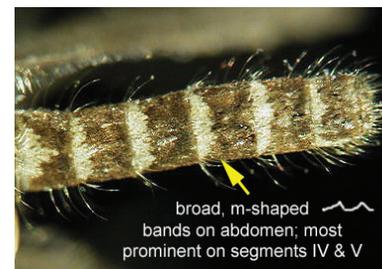
**Figure 3.** Fig. 3. Yellow-fever mosquito, *Aedes aegypti*

**Species** Southern house mosquito (figure 4)

**Body** Brown with whitish M-shaped bands only on the abdomen

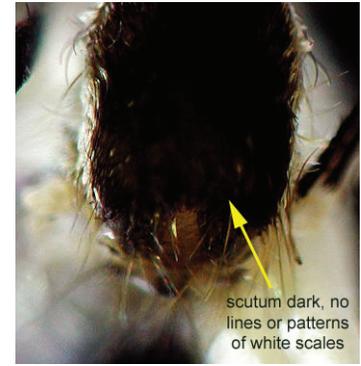
**Scutum** No markings

**Legs** Brown



**Figure 4.** Southern house mosquito, *Culex quinquefasciatus*

<b>Species</b>	Eastern treehole mosquito (figure 5)
<b>Body</b>	Dark with silvery-white scales on the sides of the body
<b>Scutum</b>	Wide dark stripe down the middle and pale white strips along the lateral margins
<b>Legs</b>	Dark



**Figure 5.** Eastern treehole mosquito, *Ochlerotatus triseriatus*

Females lay 100 to 200 eggs per batch and deposit an egg batch every 7 to 10 days. Eggs can take from days to months to hatch, depending on the availability of water and the temperature. Eggs laid in flood-prone sites can accumulate for years until they hatch under favorable environmental conditions, thus resulting in explosive population levels in a relatively short time.

### **Larvae and Pupae**

All mosquitoes spend their larval and pupal stages in still water. The larva has an enlarged thorax but no legs and is called a wriggler because of its unique swimming style. The pupa is a mobile but nonfeeding stage, often called a tumbler because when disturbed at the water surface, it will quickly tumble downward and then rise slowly. A larva goes through four molts in about 7 to 10 days and becomes a pupa that molts into the winged adult in 2 to 3 days in breeding season.



**Figure 6.** Mosquito larva (Photo courtesy of Florida Medical Entomology Laboratory, Dr. Jorge Rey)

### **Adults**

The longevity of the adults varies greatly. In the hot summer, most females do not live more than 2 weeks, and males have an even shorter life span. When adult mosquitoes emerge from the aquatic stages, they mate and seek food. All the mosquitoes rest in and around

structures and vegetation. Some species, such as the Asian tiger mosquitoes, are good fliers while others, such as southern house mosquitoes and eastern tree-hole mosquitoes, do not fly far—only a few hundred yards from where they emerged from the breeding site, although fly ranges also depend on the wind.

In Alabama, mosquitoes may overwinter as eggs (Asian tiger and Japanese encephalitis mosquitoes), as mated females (southern house mosquitoes), or as eggs and larvae inside containers. During both the adult and immature stages, mosquitoes serve as valuable prey to numerous forms of wildlife including birds, bats, and aquatic animals and fish.

All the common mosquito species breed in a variety of human-made containers and natural sites in and around homes.

### **Feeding Habits**

Mosquito larvae generally eat organic materials, bacteria, and microscopic plants and animals found in water. Pupae do not feed.

Adult males feed solely on nectar and plant juices and live for only a short time after mating. Adult females feed on flower nectar as well as blood. They need human, bird, or animal blood to obtain the protein necessary for the development of their eggs. Once the blood is digested and the eggs are laid, the female again seeks blood to produce a second batch of eggs. Depending on her stamina and the weather, she may repeat this process many times without mating again. Female mosquitoes use their sensory chemoreceptors (mostly present on the antennae and mouth parts) to sense odor and chemical cues in the moist air to locate their host or food source.

Some mosquitoes feed only on birds, mammals, reptiles, or amphibians while others readily attack whatever host comes along. Recent studies have found

a correlation between mosquito bite patterns and reproductive cycles in animals. Mosquito feeding peaks on each host during the host's reproductive period. This finding may aid in preventing the transfer through mosquitoes of viruses from animal hosts to humans.

Some species will actively bite during the day (Asian tiger mosquitoes and Japanese encephalitis mosquitoes); some may bite day and night but prefer shaded habitats (Eastern treehole mosquitoes); others prefer feeding at dawn and dusk (southern house mosquitoes). Asian tiger mosquitoes are more aggressive than other species. They rest in shade but leave it to bite in direct sun if a meal is available.

Male and female mosquitoes in the genus *Toxorhynchites* feed on plant nectar only. Their larvae are cannibalistic and prey on other mosquitoes. They breed in tree holes and other water-filled cavities.

## Diseases Spread by Mosquitoes

Mosquitoborne diseases, such as malaria, yellow fever, dengue, and dengue hemorrhagic fever (DHF), have plagued humans for years. Organized mosquito control has greatly reduced the incidence of these diseases, but there are still a few, including eastern equine encephalitis (EEE) and West Nile encephalitis (WNE), that mosquitoes can transmit.

EEE, although a rare illness in humans, may cause disease and death in humans, horses, and birds, including pheasants and emus that are not native to the United States. The disease is most severe in infants but also in the elderly and those who have underlying medical conditions. The EEE virus is maintained in nature between mosquitoes and wild birds that live in freshwater swamps.

WNE is also a serious, life-altering, and even fatal viral disease found in both tropical and temperate regions. It is known to infect humans, domestic animals, squirrels, alligators, and crocodiles. This virus is also transmitted by mosquitoes that bite and infect birds. The birds are the amplifying host, developing sufficient viral levels to spread the virus among bird populations and humans.

Mosquito vectors reported to transmit EEE include the Asian tiger mosquito, Japanese encephalitis mosquito, and other avian-feeding mosquito species. Reported WNE vector mosquitoes include the Asian tiger mosquito, Japanese encephalitis mosquito, southern house mosquito, Eastern treehole mosquito, and other avian-feeding mosquito species. There is no effective cure for these viral diseases; therefore, prevention is very important.

Several species that are of medical significance to humans breed in a variety of natural and artificial water-filled containers. In Alabama, they include the yellow fever mosquito (*Aedes aegypti*), Asian tiger mosquito (*Aedes albopictus*), eastern tree-hole mosquito (*Ochlerotatus triseriatus*), and *Ochlerotatus japonicas*.

Pet owners should be concerned with mosquito control because mosquitoes transmit heartworm to dogs. Your veterinarian can prescribe a drug treatment that prevents the worms from reaching the adult stage in your dog.

## Protecting Yourself from Bites

The most effective way to protect yourself from being bitten is to avoid mosquitoes by scheduling outdoor activities before or after peak mosquito activity, which is usually in the late afternoon and at dusk. Whenever you are outdoors during mosquito season, wear long sleeves and pants. You can also use repellents containing EPA-registered products (DEET, oil of lemon eucalyptus, PMD, IR3535, and Picaridin) to discourage mosquitoes from biting. The EPA characterizes the active ingredients in DEET and Picaridin as conventional repellents and oil of lemon eucalyptus, PMD, and IR3535 as biopesticide repellents, which are derived from natural materials. For more information, see the Environmental Protection Agency website at [www.epa.gov/pesticides/health/mosquitoes/ai\\_insectrp.htm](http://www.epa.gov/pesticides/health/mosquitoes/ai_insectrp.htm).

DEET is one of the most effective and oldest mosquito repellents and is registered for use on clothing and skin (excluding sensitive areas and irritated skin). Concentrations of 10 to 15 percent DEET are recommended for adults; products containing less than 8 percent are recommended for children. These concentrations are less prone to cause skin irritation, and they are more affordable. Picaridin, also known as KBR3023, works comparably with DEET products of similar concentration. Oil of lemon eucalyptus provides protection similar to low-concentration DEET products but should not be used on children under 3 years old.

Some natural products have been used as mosquito repellents, but they require frequent reapplication (at least every 2 hours) and higher concentrations than DEET requires, and their effectiveness is debatable. Such products include citronella oil, lemon eucalyptus oil, cinnamon oil, castor oil, rosemary oil, lemongrass oil, cedar oil, peppermint oil, clove oil, geranium oil, or possibly oils from verbena, pennyroyal, lavender, pine, cajeput, basil, thyme, allspice, soybean, and garlic.

Certain products containing permethrin are recommended for use on clothing, shoes, bed nets, and camping gear and are registered with EPA for this use.

Warning: Follow directions on the label; do not overuse; wash treated skin with soap after returning indoors, and wash treated clothing before wearing it again.

## Mosquito Proofing Your Home

*For homeowners, the most effective method of controlling mosquitoes is eliminating standing water where mosquitoes can breed, thus reducing the availability of water suitable for larval and pupal growth.*

**Examine your home and neighborhood, and take the following precautions:**

- Dispose of water holders, such as automobile tires, tin cans, glass bottles, etc.
- Clean clogged roof gutters, and drain flat roofs.
- Flush your sump-pump pit weekly.
- Stock ornamental pools with mosquito-larvae-eating fish (*Gambusia*).
- Change the water in birdbaths, fountains, and troughs at least twice a week.
- Use plants that attract other insects such as dragonflies (nymphs) and certain aquatic beetles that feed on mosquito larvae.
- Clean and chlorinate swimming pools, and empty them when not regularly used.
- Drain standing water, and turn over unused wading pools and other containers that collect rainwater.
- Cover containers used to store rainwater for garden use tightly; use window screen or plastic during drought periods.
- Remove or treat sewage leaks and lagoons.
- Remove or treat natural containers such as bamboo stumps, rot holes of trees, etc.

**Use the following measures to keep mosquitoes out of your home:**

- Install 16- to 18-mesh window and door screen.
- Repair broken screens on windows, doors, and porches.
- Caulk cracks and crevices where insects can enter.
- Remove tall weeds and overgrowth where mosquitoes prefer to rest.

## Controlling Mosquitoes

State and local agencies in charge of mosquito control typically use a variety of techniques in an integrated pest management (IPM) program. Homeowners can use a number of products and materials singly or in combination.

### Larvicides

Larvicides are used in breeding sites (water) to kill larvae before they emerge as adults. Using such a product can reduce or eliminate the need for ground or aerial application of pesticides to kill adult mosquitoes. Use a mosquito larvicide when it is impractical to eliminate breeding sites and when the breeding sites are obvious and accessible. Registered products are not harmful to fish and mammals when used according to label directions.

The following are common ways to kill larvae:

- The mosquito-eating fish *Gambusia* complex (closely related to guppies) can be raised in large numbers and released in mosquito breeding sites. *Gambusia* feed on many kinds of insect larvae but prefer wigglers and other top feeders.
- *Bacillus thuringiensis israelensis (Bti)* and *Bacillus sphaericus* are microbial bacteria for bio-control of mosquito larvae in outdoor mosquito-breeding areas. Examples of common trade names are Aquabac, Teknar, Vectobac, LarvX, VectoLex CG, WDG, and Mosquito Dunks. Bti toxin attacks the digestive tract of wigglers and the larvae of some aquatic gnats and black flies.
- Methoprene is an insect growth regulator hormone that prevents adult emergence by disrupting larval development. Examples of common trade names are Altosid, which is applied in briquet (similar in form to charcoal briquets), pellet, granule, or liquid form, and PreStrike, which is sold as granules for homeowners.
- AgniqueMMF is a nontoxic, physical action treatment to control both disease carrying and nuisance mosquitoes. It can spread quickly and completely across the water's surface. It is a monomolecular film that reduces the surface tension of the water and makes it difficult for the larvae and pupae to attach. The film also blocks their breathing tubes, causing the larvae and pupae to drown. Resting males and egg-laying females that come in contact with the film will

also drown. When the correct amount is applied, there will be no breaks or gaps in the film, so the mosquitoes cannot emerge.

- Insecticides such as temephos (Abate), malathion (Fyfanon), and pyrethrins can also be applied to breeding habitats of mosquito larvae.

### **Adulticides**

If larval control fails, adult mosquito control may be necessary. Adulticides kill adult mosquitoes. Because mosquitoes can fly from some distance away, taking additional measures against adults over a large area or for a neighborhood is needed. Adult control is generally done during the daytime with insecticide applications in mosquito-preferred resting sites.

Yard foggers and mosquito misters are ready-to-use products that typically contain pyrethrins. They can be set off shortly before outside activity but will provide only temporary relief from mosquitoes.

The most effective and convenient way to treat mosquito resting sites, such as shrubs, lower limbs of shade trees, under decks, and other shaded areas, is to spray the areas with adulticide, using a hose-end sprayer.

Be aware that many of the consumer products that claim to attract, repel, or kill mosquitoes still lack supporting research data or are unproven. When it comes to managing mosquitoes, a good rule of thumb is that if the device or method sounds too good to be true, then it probably is.

### **Other Control Methods**

If mosquito breeding is extensive in areas such as woodland pools or roadside ditches, the problem may be too great for individual homeowners to handle. In such cases, call the organized mosquito control agency in your area. These agencies have highly trained personnel who can deal with the problem effectively.

The use of mosquito nets is also recommended. Mosquito nets are often used where mosquito-borne diseases are common. Mosquito netting can be hung over beds, from the ceiling or a frame, built to tents, or installed in windows and doors. It is important that the netting not have holes or gaps large enough to allow mosquitoes to enter and that the netting not rest directly on human skin.



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**For more information**, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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Use pesticides only according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use pesticides on plants that are not listed on the label.

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The pesticide rates in this publication are recommended only if they are registered with the Environmental Protection Agency and the Alabama Department of Agriculture and Industries. If a registration is changed or cancelled, the rate listed here is no longer recommended. Before you apply any pesticide, fungicide or herbicide, check with your county Extension agent for the latest information.

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