

# Mosquitoes in Kansas

Mosquitoes are insects that pose a health risk to humans and animals because they can transmit viruses and roundworms. The two primary mosquitoes in Kansas are *Aedes* spp. and *Culex* spp. This publication provides information on the biology and behavior, health risks, and management of mosquitoes.

## Biology and Behavior

Mosquitoes have four life stages: egg, larva, pupa, and adult (Figure 1). Adults are  $\frac{1}{8}$  to  $\frac{1}{2}$  of an inch (3.8 to 10.1 millimeters) in length, with long antennae and legs, and extended mouthparts (Figure 2). Female and male adult mosquitoes feed on the nectar of flowering plants. Only female mosquitoes bite, ingesting animal or human blood to obtain proteins for egg production. Adult females lay between 30 and 500 eggs during their lifespan. However, the number of eggs laid depends on the species. *Aedes* mosquito females lay eggs in areas near the waterline or in moist soil. *Culex* mosquito females lay eggs bound together, forming a raft on the water surface.

Larvae emerge (eclose) from eggs and live in water from four to 14 days, depending on water temperature. Larvae, also called wrigglers, are  $\frac{1}{8}$  to  $\frac{1}{2}$  of an inch (3.8 to 10.1 millimeters) long with an enlarged head and thorax (middle body segment), and narrow abdomen (last body segment) (Figure 3). There are four larval instars (stages between each molt). *Aedes* and *Culex* mosquito larvae are located just below the water surface and breathe through a tube (similar to a snorkel) on the end of the abdomen.

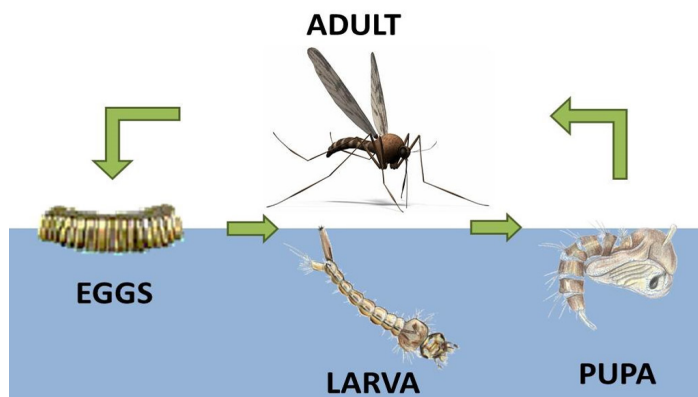


Figure 1. Life cycle of mosquito.

Pupae, also called tumblers (Figure 4), live in water but do not feed. Adults emerge (eclose) from pupae after two to four days. The life cycle, from egg to adult, takes seven to 14 days to complete. However, development time can vary depending on temperature and mosquito species. Adult female mosquitoes can live up to 30 days, although the lifespan is contingent on temperature and food supply. In general, mosquito adults stay within a mile of breeding habitats. Adult mosquitoes reside in wooded areas or areas with abundant vegetation. When not active, adult mosquitoes rest on the underside of plant leaves. All mosquitoes breed in stagnant or standing water. Mosquitoes overwinter as eggs or adults, depending on the species.

Female mosquitoes can sense heat and carbon dioxide emitted from the breath and skin of humans and animals. Females can also sense certain odors, carboxylic acid, lactic acid (sweat), and human and animal movement. Mosquitoes are attracted to dark colors and some humans more than others because of differences in body odors. When a female mosquito bites, she injects saliva that acts as an anticoagulant, which prevents the blood from clotting. The injected saliva contains agents that increase blood flow, thus enabling the female to withdraw blood. In addition, the injected saliva triggers the body's immune system to release histamine, an organic compound that causes swelling and itching. Adult female biting activity varies by species. *Aedes* spp. females are active in the morning and evening, and *Culex* spp. females are active just before sunset and daybreak.



Figure 2. Adult female mosquito withdrawing blood from a host.

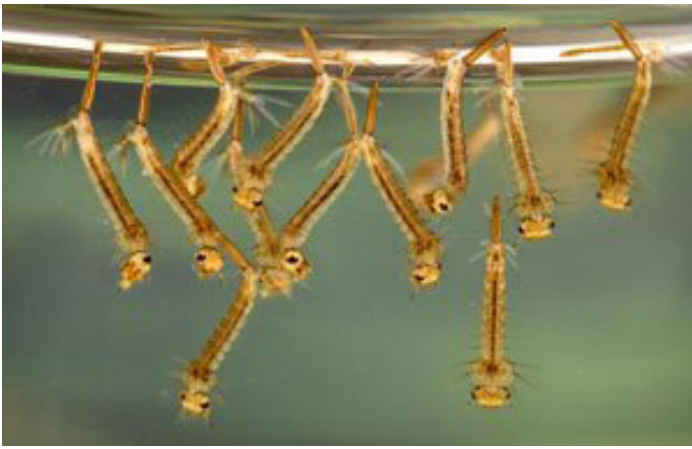


Figure 3. Mosquito larvae located below the water surface (US EPA).

## Health Risks

Mosquitoes in Kansas that can vector, or transmit, viruses are *Aedes* spp. and *Culex* spp. The mosquitoes and the viruses they vector are presented in Table 1. Mosquitoes transmit viruses to humans but can also transmit viruses to horses. Mosquitoes are known to transmit Eastern and Western equine encephalitis viruses and West Nile virus to horses. Mosquitoes can also infect dogs and cats with heartworm, which is a small threadlike parasitic roundworm.

Table 1. Mosquitoes and the associated viruses they vector.

Mosquito (Common Name)	Viruses Vectored
<i>Culex</i> spp. (Northern/common house mosquito)	St. Louis encephalitis virus, West Nile virus, Western equine encephalitis virus
<i>Aedes aegypti</i> (Yellow fever mosquito)	Chikungunya virus*, Dengue fever virus*, Eastern equine encephalitis virus, Yellow fever virus*, Zika virus*
<i>Aedes albopictus</i> (Asian tiger mosquito)	Chikungunya virus*, Dengue fever virus*, Yellow fever virus*, Zika virus*

\*Chikungunya virus, Dengue fever virus, Yellow fever virus, and Zika virus are not common in Kansas.

## Management

The management strategies used to reduce mosquito larvae and adult populations, and avoid adult female mosquito bites include 1) source reduction, 2) personal protection, 3) repellents, and 4) insecticides.

### 1. Source Reduction

Eliminate breeding habitats where mosquito larvae can develop by removing stagnant or standing water from items or areas that collect water such as those listed in Table 2. Removing water sources where mosquitoes breed reduces subsequent adult mosquito populations. Replace the water in birdbaths once a week to remove mosquito larvae that may be present in the water.



Figure 4. Mosquito pupae located below the water surface (Ask A Biologist).



Figure 5. Old or used tires filled with water provide a breeding habitat for mosquito larvae (Raymond Cloyd).

Table 2. Items or areas that can collect water and provide a breeding habitat for mosquitoes.

Wheelbarrow
Pet food or water dish
Old or discarded tire (Figure 5)
Wading pool
Birdbath (Figure 6)
Tree stump
Low area in the garden or turfgrass
Air conditioner drip tray
Saucer or dish underneath flowerpot
Empty bucket
Children's toy (Figure 7)
Plastic cover on boat and/or swimming pool
Ditch
Rain/roof gutter
Trash can
Rain barrel

### 2. Personal Protection

To avoid female mosquito bites when outdoors:

- Wear long-sleeved shirts and long pants.
- Avoid outside activities at dusk or dawn when mosquitoes are most active.



**Figure 6.** Birdbath filled with water provides a breeding habitat for mosquito larvae (Raymond Cloyd).



**Figure 7.** Children's toys that collect water serve as a breeding habitat for mosquito larvae (Raymond Cloyd).



**Figure 8.** Repellent products that can be applied to the skin to protect against female mosquito bites (Raymond Cloyd).



**Figure 9.** Repellent that contains permethrin as the active ingredient (Raymond Cloyd).

Always follow directions on the product label when using repellents.

Do not use products that contain more than 30% DEET. In addition, do not use any products containing more than 30% active ingredient on children, and avoid using any products on infants less than two months old. Permethrin is the active ingredient in repellent products that can only be applied to clothing, gear, and tents (Figure 9). Do not apply permethrin to the skin. Adult mosquitoes are

repelled or killed when they land on surfaces treated with permethrin.

#### 4. Insecticides

Insecticides used to manage mosquito larval populations are called larvicides, which includes an insect growth regulator and two stomach poisons. The insect growth regulator methoprene is the active ingredient in certain products. When applied to stagnant or standing water, methoprene prevents mosquito larvae from developing into adults. Methoprene is not harmful to humans or animals.

The bacteria *Bacillus thuringiensis* subsp. *israelensis* (*Bti*) and *Bacillus sphaericus* (*Bs*) are stomach poisons that kill mosquito larvae after they have consumed the bacteria. *Bacillus thuringiensis* subsp. *israelensis* is the active ingredient in several products including Mosquito Dunks and Mosquito Bits (Figure 10). *Bacillus thuringiensis* subsp. *israelensis* and *Bs* are combined in a single product (Figure 11). Apply products to stagnant or standing water. Mosquito larvae are killed within eight to 12 hours after

- Place netting over infant strollers.
- Avoid wearing dark-colored clothing.
- Ensure that windows, screens, and doors are tightly sealed.
- Repair damaged window screens to prevent adult mosquitoes from entering homes.

### 3. Repellents

Repellents interfere with the mosquito's ability to sense or detect odors. However, repellents differ in how long (hours) they protect humans from female mosquito bites. The effectiveness in repelling female mosquitoes varies depending on the mosquito species and amount of active ingredient in the formulation. For example, products with a higher percentage of active ingredient provide longer-lasting protection. Common repellents include those containing DEET (N,N-diethyl-meta-toluamide), picaridin, IR3535 (ethyl butyl acetyl aminopropionate), and oil of lemon eucalyptus as the active ingredients. All four repellents can be applied to the skin (Figure 8).

consuming the product. Products containing *Bti* and/or *Bs* will manage mosquito larval populations for one to four weeks after application and are not harmful to humans and animals.

## What Does Not Work Against Mosquitoes

Many products and devices sold for use against adult mosquitoes are not effective in managing adult mosquito populations. Examples include the following:

- Traps based on the release of carbon dioxide do not reduce adult mosquito populations.
- Ultrasonic devices do not repel adult mosquitoes.
- Electric bug zappers do not attract adult mosquitoes.
- Citronella candles and torches do not provide consistent repellent activity against adult mosquitoes.
- Electronic emitters have no effect on adult mosquito populations.
- The mosquito plant (*Pelargonium × citrosium*) does not have any effect on adult mosquito populations.



Figure 10. Mosquito dunks (left) and bits (center and right) kill mosquito larvae when applied to water sources (Raymond Cloyd).



Figure 11. Larvicidal product containing two active ingredients, *Bti* and *Bs* (Raymond Cloyd).

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