

# Understanding and Managing Mosquitoes from Homeowners to Local Mosquito Control

## Executive Summary

Missouri currently has 5 types of mosquitoes that can transmit disease to humans. To reduce risk, homeowners can control mosquito populations by eliminating standing water or treating it with environmentally safe larvicides. Homeowners can also contact professionals from local and state mosquito control programs to report areas of concern. Mosquito control programs use science-based approaches to control and reduce the risk of mosquito-borne diseases in communities. Continuing to fund these programs will aid in the prevention and rapid response of Missouri to current and future mosquito-borne disease outbreaks.

## Highlights

- Missouri averages over 20 reported cases of West Nile Virus annually, with 1 in every 150 cases resulting in severe neuroinvasive disease.
- Regular statewide mosquito surveillance is important for tracking West Nile Virus in birds, mosquitoes, and humans as well as the potential introduction and spread of the Yellow Fever Mosquito which has been detected in states surrounding Missouri.

## Limitations

- Staffing and funding shortages limit the capacity of mosquito control programs to adequately meet their objectives of: (1) regular mosquito surveillance, (2) source reduction, (3) control of all life stages, (4) pesticide resistance testing, and (5) public education and involvement.
- Pesticides are a major tool in mosquito control, but only one-third of mosquito programs nationwide are capable of testing for pesticide resistance in their mosquito populations.

## Mosquitoes in Missouri

There are about 55 types of mosquitoes in Missouri, each with a unique lifestyle (Claborn et al., 2018, 2019; McCauley, 2000). Like bees and butterflies, mosquitos are pollinators feeding on the nectar of flowers. Female mosquitoes bite humans and other animals when they need protein from the blood meal to produce eggs. And most mosquitoes prefer to feed on animals other than humans (McCauley, 2000). Mosquitoes are also important food sources for fish, birds, lizards, and frogs. So, although they can be annoying when they bite, mosquitoes serve important functions in our environment.

A small number of mosquitoes in Missouri can transmit diseases. These are the *Aedes*, *Anopheles*, and *Culex* mosquitoes.

*Aedes albopictus*, commonly known as the Tiger Mosquito, is a black-and-white-striped mosquito that aggressively bites humans during the day. It is an invasive mosquito and has only been in Missouri since the 1980s. However, it is the most abundant and widespread mosquito across the state, especially in cities and suburbs (Claborn et al., 2019; Westby et al., 2021). The Tiger Mosquito is not the most effective transmitter of diseases like dengue, chikungunya, Zika, or West Nile, but, there is worry about the theoretical potential of disease outbreaks facilitated by this species in densely populated U.S. cities (Manore et al., 2017).

*Aedes aegypti* commonly known as the Yellow Fever Mosquito, is an extremely dangerous vector not only of Yellow Fever, but also West Nile Virus, dengue, chikungunya, and Zika (Vector Disease Control International, 2016). The Yellow Fever Mosquito specializes in living near and around humans and strongly prefers biting

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humans, which increases its disease transmitting potential (McBride et al., 2014). The Yellow Fever Mosquito has been detected in states surrounding Missouri, but surveys in Missouri over the past 10 years have yet to detect the Yellow Fever Mosquito (Claborn et al., 2019; Hahn et al., 2016; Laporta et al., 2023). However, climate change will impact the distribution of the Yellow Fever Mosquito, likely expanding its range into Missouri (Laporta et al., 2023).

Missouri also has a substantial population of *Anopheles quadrimaculatus* commonly known as the common malaria mosquito (Claborn et al., 2019). This mosquito can transmit malaria as its name suggests, but since Missouri does not get regularly imported cases of malaria, the risk of disease transmission is possible but low.

By far, the most common mosquito borne illness in Missouri is West Nile Virus (CDC, 2023a; McDonald, 2021; Missouri DHHS, 2023). West Nile Virus was first detected in Missouri in 2002 with 168 human cases (CDC, 2023a; McDonald, 2021; Missouri DHHS, 2023). Missouri averages over 20 reported cases of West Nile Virus annually, and most recently in 2023 there were 27 reported cases (note: cases of West Nile Virus across the United States are significantly under-reported) (CDC, 2023a). Most people with West Nile virus are asymptomatic (Hart et al., 2014; McDonald, 2021). However, about 1 in 5 people who are infected experience flulike symptoms. One in 150 infected people develop the severe neuroinvasive form of the virus, which is a major threat to seniors and those with a weakened immune system. Even if patients recover, they often have residual neurological deficits (CDC, 2023b; Hart et al., 2014; McDonald, 2021; St. Louis County, Missouri, 2023). The *Culex* mosquitoes are the major transmitters of this disease and Missouri has one urban and two rural *Culex* mosquitoes that are responsible for West Nile Virus outbreaks (Claborn et al., 2019; S. L. LaDeau et al., 2008).

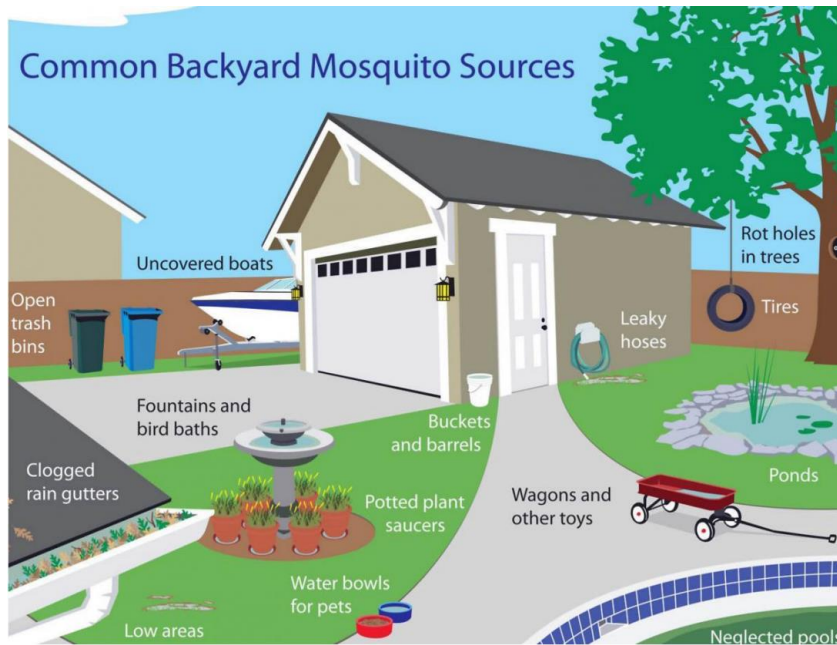
## Controlling Mosquitoes

Mosquitoes have four life stages – egg, larvae, pupae, and adult. Three of these life stages, egg, larvae, and pupae, occur in standing water, so eliminating this resource is a first line of defense for homeowners.

Homeowners can remove standing water sources by:

- Removing any uncovered garbage containers and trash piles
- Keeping gutters clean and clear of debris
- Turning over any unused flowerpots and buckets
- Covering standing rain barrels with netting
- Replacing water in birdbaths weekly
- Identifying and fixing any areas of the yard that collect and hold water

**Figure 1.** Common backyard mosquito sources (source: St. Charles County Mosquito Control)



If standing water cannot be eliminated and larvae are present, environmentally friendly larvicides can be used. The bacterium *Bacillus thuringiensis israelensis* referred to as “Bti” produces toxins that target the larvae of mosquitoes when consumed (CDC, 2020; US EPA, 2016). Bti does not pose risk to humans, pets, wildlife, insects, crops, or water supplies. It has even been approved for pest control in organic farming operations (CDC, 2020). Bti has been developed into wettable dunks (donut-looking objects) and bits (granules) for homeowners to purchase. Mosquito Dunks® release long-term larvicide on the water’s surface and can last for 30 days or longer (*Mosquito Dunks*®, n.d.), while Mosquito Bits® are quick acting, killing mosquito larvae within minutes (*Mosquito Bits*®, n.d.).

Professionals at local government agencies can also be used to remove or treat standing water. They can collect and dispose of illegally dumped trash and tires, clean and maintain public spaces like parks and greenways, and address and treat neglected swimming pools, drainage ditches, ponds, and flood zones (CDC, 2022).

Mosquitoes are typically more abundant in neighborhoods with unmanaged trash piles and decaying and abandoned infrastructure that capture rain (Bodner et al., 2019; Dowling et al., 2013; S. LaDeau et al., 2013; Little et al., 2017). However, during hot and dry periods, rainwater evaporates and mosquitoes tend to be more abundant in neighborhoods with consistent irrigation (Becker et al., 2014; Little et al., 2017).

### Local and state mosquito surveillance and control

Most cities and counties in Missouri have their own mosquito control programs or contract mosquito control program services from nearby municipalities. Mosquito control programs use science-based approaches developed and supported by the Environmental Protection Agency, Centers for Disease Control, American Mosquito Control Association, and National Association of County & City Health Officials. Control measures include:

- Regular mosquito surveillance
- Source reduction
- Control of all life stages
- Pesticide resistance testing
- Public education and involvement

Mosquito control is a community effort and programs encourage residents to report potential larvae habitat or other mosquito related concerns. Many control programs aim to respond to 100% of mosquito bite activity complaints (e.g., [2020 Annual Report, St. Charles County Mosquito Control](#)). Many programs have online webpages where residents can find online forms to submit complaints or phone numbers to contact program staff.

However, local mosquito surveillance programs across the U.S. often do not have the resources, funding, or capacity to meet all control measures (Moise et al., 2018; Roy et al., 2022). In a report from 2020, no programs in the U.S. Department of Health and Human Services Region 7, which includes Nebraska, Iowa, Kansas, and Missouri, reported being fully capable of performing all control measures. The major gap being the lack of ability to test for pesticide resistance which nation-wide only one-third of programs reported being capable of doing (Roy et al., 2022). Staffing shortages are also problems for control districts in Missouri (Lindberg, 2022). One proposed solution was to include more local funding through taxes, and in surveys from three counties in Texas, residents were willing to pay about \$50 in taxes to expand mosquito control in their areas (Dickinson et al., 2022). With continued land use and climate change, invasive mosquitoes and their diseases will continue to spread into previously inhospitable areas of the United States, including Missouri. Supporting mosquito and vector control agencies, which are tasked with monitoring and implementing science-based strategies, will help mitigate mosquito populations and reduce risks of uncontrolled disease outbreaks.

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