W1349

# Travel Considerations: Eastern Equine Encephalitis

**A. M. Tucker,** Learning and Training Specialist 3: Vectors and Vector-Borne Diseases, Department of Entomology and Plant Pathology
**R. T. Trout Fryxell,** Professor of Medical and Veterinary Entomology, Department of Entomology and Plant Pathology

## Introduction

Eastern Equine Encephalitis (EEE) is a virus that was first identified in an outbreak in Massachusetts in 1938. Today, infections are of greater concern for equids, especially horses, than humans. Roughly six to eight humans in the United States are diagnosed with EEE each year in the months of May through October. While this disease is rarely diagnosed in humans, about 30 percent of those with severe EEE die. Roughly 184 cases of EEE are reported in horses and other equids every year. Transmission of the virus typically occurs along the Atlantic coast from Massachusetts through New Jersey and south into the Gulf Coast states. There are no preventative vaccines or medical treatments for EEE in humans; therefore, use of strategies to prevent mosquito bites is the best way to reduce risk of contracting EEE.

## Transmission of Disease Pathogens

Figure 1 shows the complex transmission cycle of EEE. The primary mosquito vector is the black-tailed mosquito (*Culiseta melanura*, Figure 2 on the left). This species feeds primarily on birds, which are the amplifying host (host in which the virus replicates). While the black-tailed mosquito will opportunistically feed on humans, it is more likely that they contribute to amplifying the virus in the environment. Of importance, cattail mosquitoes (*Coquillettidia perturbans*, Figure 2 on the right) and several Aedes species are more likely to transmit EEE to humans, horses, pigs and other animals after feeding on an infected bird. These vectors are called bridge vectors since they are not the primary vectors and are necessary for the virus to be transmitted to dead-end hosts (hosts that do not permit viral amplification).

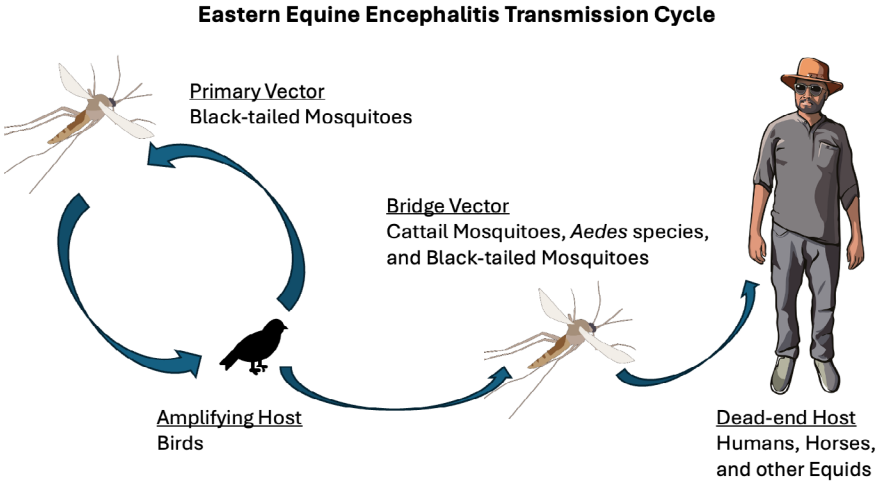


***Figure 1.*** *The transmission cycle of EEE. Graphic Credit: A. M. Tucker developed in PowerPoint, mosquito (NIAH BIOART Source #000360), and standing person (NIAH BIOART Source #000555).*


***Figure 2.*** *The primary mosquito vector, the black-tailed mosquito,* Culiseta melanura *on the left and the bridge mosquito vector, the cattail mosquitoes,* Coquillettidia perturbans*, on the right. Photo credit; Walter Reed Biosystematics Unit (WRBU).*

## Mosquito Life Cycle

All mosquito species require water for their development from eggs to adults. Female black-tailed mosquitoes will lay their eggs in a raft formation near the edges of woodland pools, swamps and floodplains. The female cattail mosquito will lay her eggs on or near emerging vegetation, including cattails, in permanent freshwater sources. Some female *Aedes* species, are container species and will lay their eggs on or near the surface of water in containers. Additional information on container mosquitoes can be found in the UT Extension Publication W1293 Managing Container Mosquitoes. Other female *Aedes* species are floodwater mosquitoes and will lay their eggs in transitional water areas.

Unique to the cattail mosquito is their use of the siphon to pierce the base of aquatic plants (e.g., cattails and lilies), while the other species breathe through the water surface using their siphon as a snorkel. For all these vectors, only female adults bite to feed on blood, which is required for successful egg development. Both sexes will feed on nectar sources.

## EEE in the US

Eastern equine encephalitis (EEE) is endemic, naturally occurring, to the U.S. As mentioned, human cases are infrequent but can become severe. They are commonly reported (for years 2003-2023) in states along the Atlantic coast, in the Great Lakes and in the South. Tennessee had one reported case in 2019. Occasionally cases are reported in states outside of these areas, specifically Missouri (one case in 2011) and Montana (one case in 2016). Data collected focuses on where the individual lives and does not rule out that the individual traveled to an area where EEE is more common. All these states have swamps and/or wetlands with vegetation which allow the cattail mosquito to develop.

## Signs and Symptoms

Most individuals who become infected with EEE have no symptoms (asymptomatic). Symptomatic individuals often suffer from nausea, vomiting, fever, headache and other symptoms similar to the common flu. A small number of people will exhibit more severe symptoms related to EEE neuroinvasive disease which are listed below.

- Altered mental state
- Seizures

Children who contract the neuroinvasive disease are likely to have a neurological disability if they recover, and death is a possibility. Men have a higher incidence contracting the neurological disease than women.

## Medical Testing and Treatment of EEE

While rarely diagnosed, EEE is a nationally reportable disease to state health departments and the Centers of Disease Control and Prevention (CDC) because of the high fatality rate and risk of spreading to other states. There are multiple serum and spinal fluid tests that can be recommended by your doctor to confirm the diagnosis of EEE. There are no specific treatments for EEE, and currently there is no vaccine for humans. Most human cases are treated similarly to the flu with bed rest, fluids and over-the-counter medications to reduce fever and manage symptoms. In more severe, neuroinvasive disease cases, hospitalization may be necessary to relieve more severe symptoms.

## Control Measures for Mosquitoes

Control of the various mosquito species to prevent exposure to bites can be difficult due to the differences in egg and the immature development with various habitats. The first and most important step for reducing exposure to mosquitoes is to remove habitats where they lay eggs and develop as larvae. This is achieved by removing standing water around the home or business. Most mosquitoes that transmit EEE use aquatic environments that support wetland life, so reduction of standing water can be difficult to achieve. Instead, treating these areas with known biopesticides and/or larvicides and managing aquatic vegetation (e.g., removing or minimizing cattails after a case is diagnosed) may be the best way to prevent future cases. Biological and synthetic (also called conventional) pesticides applications will vary according to the label and local and state laws; always read the product label prior to purchase and use.

## Steps to Prevent Mosquito Bites

Since there is no vaccine for EEE, it is necessary to prevent mosquito bites to reduce the potential for contracting EEE. Because mosquitoes may fly indoors it is important to prevent them from entering the home or business. The amount of time spent outdoors without protective clothing or use of repellents will also increase the risk of acquiring EEE.

- Maintain intact screens on windows and doors.
- Avoid known areas such as swamps and wetlands with heavy vegetation when mosquitoes are active.
- Remove aquatic vegetation such as water lilies and cattails which reduces the primary vector's aquatic living habitat thus reducing the number of adult cattail mosquitoes.
- Wear protective clothing such as long-sleeved shirts, long pants and/or clothing which is treated with permethrin when outdoors.
- Use a repellent when working or playing in wetland habitats

## Online Resources and References


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