

**A Synopsis of The Mosquitoes of Missouri  
and Their Importance From a Health Perspective  
Compiled from Literature on the Subject**

by

Dr. Barry McCauley  
St. Charles County  
Department of Community Health and the Environment  
St. Charles, Missouri

Mark F. Ritter  
City of St. Louis Health Department  
St. Louis, Missouri

Larry Schaughnessy  
City of St. Peters Health Department  
St. Peters, Missouri

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This handbook has been prepared for the use of health departments and mosquito control professionals in the mid-Mississippi region. It has been drafted to fill a perceived need for a single source of information regarding mosquito population types within the state of Missouri and their geographic distribution. Previously, the habitats, behaviors and known distribution ranges of mosquitoes within the state could only be referenced through consultation of several sources - some of them long out of print and difficult to find. It is hoped that this publication may be able to fill a void within the literature and serve as a point of reference for furthering vector control activities within the state.

Mosquitoes have long been known as carriers of diseases, such as malaria, yellow fever, dengue, encephalitis, and heartworm in dogs. Most of these diseases, with the exception of encephalitis and heartworm, have been fairly well eliminated from the entire United States. However, outbreaks of mosquito borne encephalitis have been known to occur in Missouri, and heartworm is an endemic problem, the costs of which are escalating each year, and at the current moment, dengue seems to be making a reappearance in the hotter climates such as Texas. There is, also, always the possibility in this age of rapid travel and high mobility that new threats will arise (such as the West Nile virus which has recently appeared on the East coast, or that other old foes will return.

In the literature on the subject, it has been noted that there are within the state of Missouri approximately 55 separate species falling within nine genera of mosquitoes. Each of these has its own unique lifestyle and bionomic preferences. What is common among them are a few biological commonalities and similarities. They all require water for three of the four stages of life which they undergo. Only the female mosquito bites. The male feeds on plant nectars and sugars and is not even equipped with a proboscis or stinger. Among the female mosquitoes, most species, but not all, require the protein from blood in order to lay viable eggs. Some species are potential disease carriers and some are not. Some prefer mammalian hosts, some avian ones, some reptilian, and some do not seem to care, but are opportunistic biters of anything that moves and breathes. Most species seem to prefer clean water in which to lay their eggs, but some thrive only in brackish and polluted water. The following sections will portray a brief synopsis of the life cycle of the mosquito to explore some of the basic facts of their life history. After that, we will explore some aspects of the known bionomic patterns of each of the mosquitoes listed in the relevant literature as occurring within the state. This does not purport to be a scholarly review, but will serve as an entry level guideline and introduction geared to providing basic information in layman's terms so that those in charge of providing relief from mosquito annoyance and protection against mosquito borne disease will be able to refer to a single source in their effort to determine exactly what species of mosquito they are apt to encounter and where they are likely to encounter it.

### **Brief overview of mosquito's life cycle**

As is the case with most insects, the mosquito undergoes a complete metamorphosis of four distinct life stages on its way to becoming an adult. It begins as an egg, progresses through four larval levels or "instars" as they are called, changes into a pupa, and finally becomes an adult. The first three of these stages occur in water, and it generally requires between one to two weeks for a mosquito to pass through all of the aquatic phases, depending on the weather.

Eggs of various mosquito groups are laid on or near bodies of water. Almost any calm and/or stagnant body of water is capable of supporting a larval mosquito population. Even some of the rank-est and most polluted ditches and ponds can produce prolific numbers of these insects. Each species has distinct ovipositing preferences and different habitats in which it survives. It is fascinating and instructive to consider just how adaptable these insects are. Knowledge of the wide variety of environmental preferences and life histories of the various species resident in Missouri provides some insight into just how difficult it is to effect control over them.

Mosquitoes of the genuses *Anopheles* and *Toxorhynchites* lay single eggs directly on the water surface. *Aedes*, *Psorophora* and *Orthopodomyia* mosquitoes also lay single eggs, but they are laid above the water line on dry or moist surfaces subject to flooding and hatch when the water level rises. *Culex*, *Culiseta*, *Uranotaenia* and *Coquillittidia* mosquitoes lay their eggs in groups or rafts on the surface of the water. The larvae hatch from the eggs within hours and begin feeding on decaying plant matter.

Larvae require water for the entire four stages of development (called instars) through which they pass. All but one species must breathe and eat at the water's surface. The species which does not require breathing at the air/water interface attaches itself to the stems of cattails and breathes air with a snorkeling effect through the plant. Some mosquito larvae can be distinguished by their posture in the water. Anopheline mosquitoes have no air tube and lay parallel to the surface and are assisted in this by specialized hairs which act as air sacks. The other species hang down from the surface at various angles and breathe through a specialized siphon tube. In the case of *Coquillittidia*, the larvae attach themselves to the roots of emergent vegetation and breathe through the stems of the plants.

Within a few days to several months, depending on species and temperature, a larva will develop into a pupa. Pupae are the final non-feeding stage of development which occurs before metamorphosing into an adult. Pupae also breathe at the surface and require several days to develop and to break out of their skins, which are then used by the newly hatched adults as a floating device to rest as its outer cuticle hardens.

When the adult mosquito emerges, it takes several days to rest and build strength. During this time the males and females both rely on sugar feeding, provided by nectars, which are the mosquitoes normal source of nutrient. Once mature, the reproductive cycle will begin. At this time the adult female will search for a host to provide a blood meal. It is to obtain this blood meal that the female mosquito "bites," which is actually to say that she inserts her proboscis into the skin of her victim to obtain blood. The blood meal is used to provide protein for eggs which will then be deposited on or near water. The female will then seek another blood meal to begin the cycle over again. The adult mosquito can live for several weeks to several months, depending on species and on environmental conditions.

#### **Species recorded in Missouri**

*Anopheles barberi*

#### **Bionomics**

Rot cavities of trees, stump holes, artificial containers. Has demonstrated laboratory condition potential as a malaria vector but is probably too rare

in Missouri to be of any importance as a vector. Overwinter as larvae frozen in ice. Distribution potentially throughout entire state.

*Anopheles crucians*

Ponds, lakes, swamps, and semi permanent and permanent pools, generally near aquatic vegetation, usually shaded environment. Has been infected with both *Plasmodium vivax* and *P. falciparum* under experimental conditions and has been found infected in nature. However, too rare in Missouri to be considered important. Overwinter as fertilized female. Distributed throughout all but the northernmost counties in the state.

*Anopheles  
pseudopunctipennis*

Pools and drying streams in full sunlight containing mats of Spirogyra and also along margins of slow moving streams during the dry season against leaves, sticks and debris. Although known as a vector of malaria, very rare in Missouri and not considered as being of any importance here. Found in southwestern part of state.

*Anopheles punctipennis*  
(Say)

Ponds, temporary pools, springs, pools in intermittent streams, borrow pits, wheel ruts, rainwater barrels, artificial containers. Prefer cool, clear water. Overwinter as inseminated females. Distributed generally throughout the state.

*Anopheles quadrimaculatus*

Permanent fresh water in sluggish streams, canals, ponds with growing vegetation. Flight range usually 1 mile or less, but much longer flights have been documented. Overwinter as inseminated females. Good carrier of dog heartworm (*Dirofilaria immitis*). Also capable of vectoring malaria, and considered the most important malaria transmitter in the southeastern United States. Overwinters as fertilized female in caves, hollow trees, or other sheltered locations. Distribution range includes the entire state.

*Anopheles walkeri*  
(Theobald)

Fresh water marshes with floating debris and/or emergent and floating vegetation. Adults have been found resting around shaded bases of cut grass and other shoreline shrubbery. Allegedly overwinter as special eggs which are capable of overwintering. Range of distribution includes the entire state.

*Toxorhynchites rustibus  
septentriontronaes*

Rot cavities and occasional artificial containers. Largest and most colorful mosquito in North America. Larvae predacious, feeding on smaller aquatic animals, including mosquito larvae. Larvae frequently found in same areas as immature stages of *An barberi* & *Ae. triseriatus*. Long larval period (several weeks to several months, 4-7 day pupation). Distribution is in the lower two thirds of the state.

*Uranotaenia sapphirina*

Permanent ponds, pools and lakes with floating vegetation exposed to sunlight. Commonly associated with *An quadrimaculatus* in its larval habitat in southern states. Rarely bite humans. Of statewide distribution.

*Culiseta impatiens*

Large species. Females overwinter as adults and usually first to fly in spring. Eggs in rafts in deep, well shaded pools. Tolerate high pollution.

	Overwinter as adult female. Distribution in northern and north central part of state.
<i>Culiseta inornata</i>	Large species. Ground pools, brackish ditches, artificial containers. Occasionally attack man, but not persistent biters. Western Equine Encephalitis vector. Eggs laid in rafts on water surface. Female overwinters as adult. Distribution statewide.
<i>Culiseta melanura</i>	Small permanent water bodies such as swamps. Attracted to light traps. Eastern Equine Encephalitis vector. Said to overwinter as larvae under the ice. Only specific reference to catches of this mosquito located were from Fort Leonard Wood area and Lake Killarney area in Iron County.
<i>Orthopodomyia alba</i>	Rot cavities of trees. Seem to avoid sunlight when raised in cages in captivity. Distributed throughout the state.
<i>Orthopodomyia signifera</i>	Rot cavities and artificial containers (particularly wooden ones). Overwinter as larvae. Never been known to attack man, but is known to take avian blood. Distributed statewide.
<i>Coquellittidia perturbans</i>	Moderately large. Eggs on surface of water with heavy emergent vegetation. Attach to roots of submerged stems of plants where they remain throughout larval development. Hard to catch in larval form. Pass winter as mature larva. Eastern Equine Encephalitis vector potential. Distributed statewide.
<i>Psorophora ciliata</i>	Large species. Unshaded temporary rain-filled pools. Develop rapidly, in 4-6 days. Pupal stage 2 days. Persistent biters, painful. Attack either day or night. Distributed statewide.
<i>Psorophora howardii</i>	Very large species. Larvae in shaded or partly shaded temporary rain filled pools. Predacious. Persistent biters. Attack either day or night. Overwinter as eggs. Distribution is in lower two thirds of the state.
<i>Psorophora cyanescens</i>	Eggs deposited on soil or in small cracks or holes at bottom of dried pools. Hatching never occurs same year eggs laid. Larval period short - between 3-4 days. Pupal period 24 hours or less. Persistent biters. Adults numerous after summer rains. Overwinter in egg stage. Distributed throughout lower three quarters of state.
<i>Psorophora ferox</i>	Temporary rain pools, usually in or near thickets, in overflow pools along streams and occasionally in potholes in stream beds after summer rains. Develop rapidly. Persistent biters - painful - attack even open daylight. Overwinter in egg stage. Distributed throughout state.
<i>Psorophora horrida</i>	Temporary shaded pools following heavy and prolonged summer rains. Rapid hatchers. Distributed throughout state.

<i>Psorophora longipalpus</i>	Heavily shaded pools following heavy rain. Distribution in western third of state.
<i>Psorophora varipes</i>	Temporary floodwater pools. Larvae usually found in floating mats of debris and dead twigs, leaves and the line. Persistent biters - in woodlands - daylight biters. Only records found were from bootheel area.
<i>Psorophora columbiae/</i> <i>Ps. confinnis</i>	Eggs laid in soil in depressions subject to flooding. Winter passed in egg stage. Usually oviposition occurs where there is rank low growing vegetation. Larval period 4-10 days. Flight range up to 9 miles. Persistent biters. Distributed throughout state.
<i>Psorophora discolor</i>	Temporary rain filled pools. 10 days- 2 weeks to develop. Troublesome biters, particularly at night. Cattle principle sources of blood meals. Horses, mules and hogs also important sources. Distributed throughout state.
<i>Psorophora signipennis</i>	Temporary ground pools. Egg to adult in 5 days with favorable conditions. Winter passed in egg stage. Distributed throughout state.

Enumeration of the various *Aedes* species found throughout Missouri has been rendered somewhat tentative due to a recent proposal to split this group into two parts. This proposal has not yet won general recognition. If it does, specimens within the subgenera *Ochlerotatus* and *Finlaya* will be placed within a new genus named *Ochlerotatus*. Subgenera *Aedes*, *Aedimorphus*, and *Stegomyia* will remain within the genus *Aedes*.

<i>Aedes</i> ( <i>Ochlerotatus</i> ) <i>atlanticus</i>	Temporary pools in open fields and woodlands. Eggs laid at edge of water and hatch with rise of water after rains. Distributed in lower third of state.
<i>Aedes</i> ( <i>Ochlerotatus</i> ) <i>canadensis</i>	Temporary or semi permanent shaded woodland pools. Attack in shaded situations throughout the day. Distributed throughout state.
<i>Aedes</i> ( <i>Ochlerotatus</i> ) <i>dorsalis</i>	Winter in egg form. hatch in spring flooding. Breeding continuous through warm season depending on reflooding of marshes. Both brackish and fresh water. Seems to prefer grassy situations in direct sunlight, but also found in shaded pools. Attack day or night. Western Equine Encephalitis vector. Distributed throughout the state.
<i>Aedes</i> ( <i>Ochlerotatus</i> ) <i>dupreei</i>	Temporary rain pools usually in woodlands. Hide among leaves and debris. difficult to collect. Females do not seem to bite man often. Found in lower third of state.
<i>Aedes</i> ( <i>Ochlerotatus</i> ) <i>flavescens</i>	Early spring in deep temporary pools in meadows and marshes of open plains. Day and early evening biters. Found in far northern part of state.
<i>Aedes</i> ( <i>Ochlerotatus</i> )	Breed in clean or slightly muddy water following storms. Distribution in

<i>fulvus pallens</i>	south central portion of the state.
<i>Aedes (Ochlerotatus) grossbecki</i>	Early spring pools - woodland pools - persistent biters - apparently single brooded. Found in eastern third of state.
<i>Aedes (Ochlerotatus) infirmatus</i>	Early spring to late fall, temporary pools following rain. Persistent biters. Daytime attackers near wooded areas. Distribution in southeastern third of state.
<i>Aedes (Ochlerotatus) nigromaculis</i>	Overwinter as egg. Day biters, but not active in evening. Greatest abundance in irrigated pastures. Distributed in western three quarters of the lower half of the state and entire state north of St. Louis area.
<i>Aedes (Ochlerotatus) sollicitans</i>	Mostly salt marsh mosquito, but also brackish water in swamps. Strong fliers. Some caught in traps as far as 100 miles from salt water pools in which they developed. Persistent biters. Distribution spotty with small pockets indicated along Mississippi river south of St. Louis and in the central state region on the western border near Kansas City.
<i>Aedes (Ochlerotatus) sticticus</i>	Floodwater pools in river valleys both in woodlands and open country. Eggs stay viable as much as 3 seasons. Distributed throughout the state.
<i>Aedes (Ochlerotatus) stimulans</i>	Temporary pools, especially woodlands ones. Spring mosquitoes. Adults long lived. Persistent biters. Distribution in northern third of the state.
<i>Aedes (Ochlerotatus) thibaulti</i>	Larvae prefer flooded bases of sweet and tupelo gum trees in early spring. Distribution indicated as southeastern part of state including bootheel.
<i>Aedes (Ochlerotatus) tormentor</i>	Female indistinguishable from <i>Ae. atlanticus</i> . Temporary pools after summer rains. Rare. Southeastern area of state.
<i>Aedes (Ochlerotatus) trivittatus</i>	Floodwater pools in meadows, swamps & woodlands. Persistent biters day and dusk biters. Prefer open or lightly wooded terrain. Vector of virus closely related to California Encephalitis. Distribution in entire state.
<i>Aedes (Finlaya) atropalpus</i>	Rockholes along streams. Persistent biters but troublesome only along rocky streams. Capable of transmitting Eastern Encephalitis in laboratory. Distribution limited. breeding has been found in Iron County only.
<i>Aedes (Finlaya) epactius</i>	A neotropical mosquito with primary range from Arizona to Oklahoma. Extends into Kansas, Arkansas and Missouri at the end of its range. Distribution in southwestern portion of the state.
<i>Aedes (Finlaya) triseriatus</i>	Treehole mosquito. Larvae develop in holes in deciduous trees and artificial containers. Several broods / year. Fly mostly early A.M. or eve-

ning. Occasionally serious pest in residential areas. Distribution throughout the state.

<i>Aedes (Stegomyia) aegypti</i>	Artificial containers. Several broods/year. Fly mostly early AM or evening. Day feeders. Human blood preferred. Don't fly far from where hatched. Vector of yellow fever and dengue. Distribution range includes southern third of the state.
<i>Aedes (Stegomyia) albopictus</i>	Tires and artificial containers. Newly introduced "Asian Tiger Mosquito". Competes with <i>Aedes aegypti</i> in Florida for breeding areas. Distribution sporadic. Has been found in St. Louis Metropolitan area, around Kansas City, near Columbia and Jefferson City, near Joplin and near the West Plains area as well as in the southeast counties north of the bootheel.
<i>Aedes (Aedimorphus) vexans</i>	Bite at dusk. Floodwater mosquito. Migrate up to 10 miles. Distribution general throughout state.
<i>Aedes (Aedes) cinereus</i>	Single brooded - woodland pools and occasionally marshes. Localized mosquito, does not fly far. Distribution throughout state.
<i>Culex pipiens</i>	Floodwater in rain barrels, catch basins, ditches, etc. "Northern House Mosquito. Vector: <i>Wuchereria bancrofti</i> ; Western Equine Encephalitis; St. Louis Encephalitis; West Nile Encephalitis; bird malaria & dog heartworm. Distribution throughout the state.
<i>Culex quinquefasciatus</i>	Same as <i>pipiens</i> . "Southern House Mosquito." Western Equine Encephalitis, St. Louis Encephalitis, and <i>Wuchereria bancrofti</i> . Distribution throughout the state.
<i>Culex restuans</i>	Wide variety of aquatic habitats, including pools, ditches and artificial containers. Vector: Western Equine Encephalitis. Distribution throughout the state.
<i>Culex salinarius</i>	Fresh or foul water, grassy pools, ditches, ponds, rain barrels. Rest in day time in outbuildings and similar structures. Ready biters. Distributed throughout entire state.
<i>Culex tarsalis</i>	Clear or foul water. Painful and persistent biters at dusk and after dark. Chief vector of Western Equine Encephalitis, vector of California Encephalitis and St. Louis Encephalitis. Domestic and wild birds chief hosts, but also bites man. Distributed throughout the state.
<i>Culex erraticus</i>	Grassy shallow margins of ponds, lakes, marshes and streams. Not troublesome biter. Distributed throughout the state.
<i>Culex peccator</i>	Pools, streams and marshy areas. Distributed in southern three quarters of the state.

Culex territans

Semi permanent and permanent streams, swamps and ponds. Not known to bite man. Feed mostly on cold blooded creatures, particularly frogs. Distributed throughout the state.

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