



Pest e-alerts



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Oklahoma Mosquitoes and Zika

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When considering the impact of the heat and recent rains especially around urban or suburban areas, the concern mounts for mosquito development and the pathogens they carry. The biggest concern right now is the impact of the Zika virus in Oklahoma. The mosquitoes that carry Zika are the yellow fever mosquito (*Aedes aegypti*) (Figure 1) and the Asian tiger mosquito (*Aedes albopictus*) (Fig. 2).



Figure 1: Female yellow fever mosquito (*Aedes aegypti*). Credit: James Gathany, CDC.



Figure 2: Adult Asian tiger mosquito (*Aedes albopictus*). Credit: James Gathany, CDC.

Both of these mosquitoes are considered to be container breeding mosquitoes and will lay their eggs in containers holding water as well as in treeholes. The yellow fever mosquito and the Asian tiger mosquito tend to feed day or night when a potential host comes near them. The yellow fever mosquito has been shown to enter and stay within houses if conditions are proper. Female mosquitoes from each species prefer to feed on a person's lower extremities.

Recently, a study (Monaghan et al. 2016. PLOS Currents Outbreaks) showed the potential abundance of the main Zika vector, yellow fever mosquito (*Aedes aegypti*), in relation to its known distribution and favorable development conditions (Fig. 3). It showed that Oklahoma had the potential to have a moderate to high yellow fever mosquito populations from the months of June through September (Fig. 3). This coincides with actual reported distribution of *Aedes aegypti* within the US as reported by Hahn et al. 2016 with (Fig. 4) except for the area in Arizona.

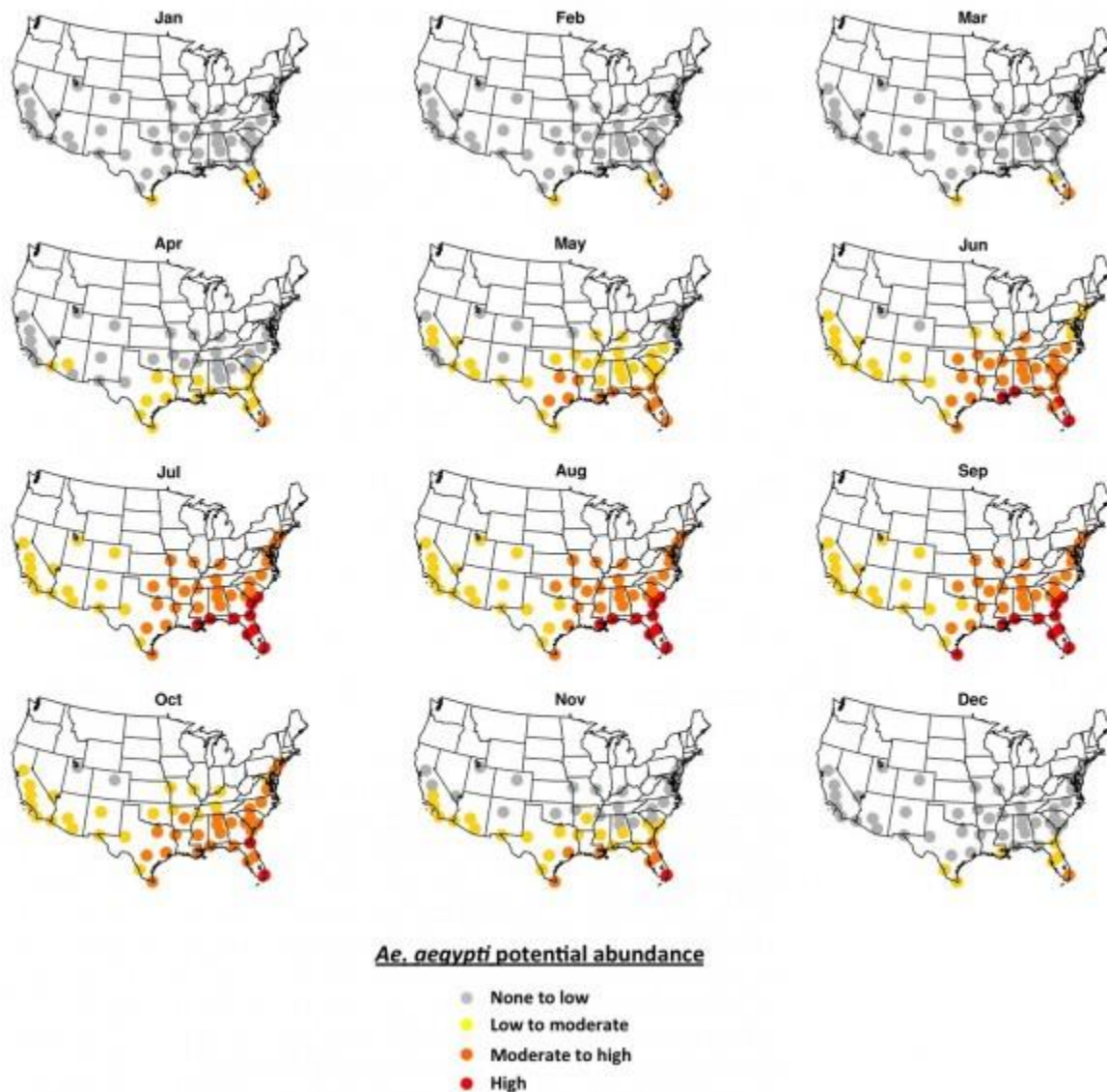


Figure 1: Potential seasonal abundance of the yellow fever mosquito (*Aedes aegypti*). Credit: Monaghan et al. 2016. PLOS Currents Outbreaks.

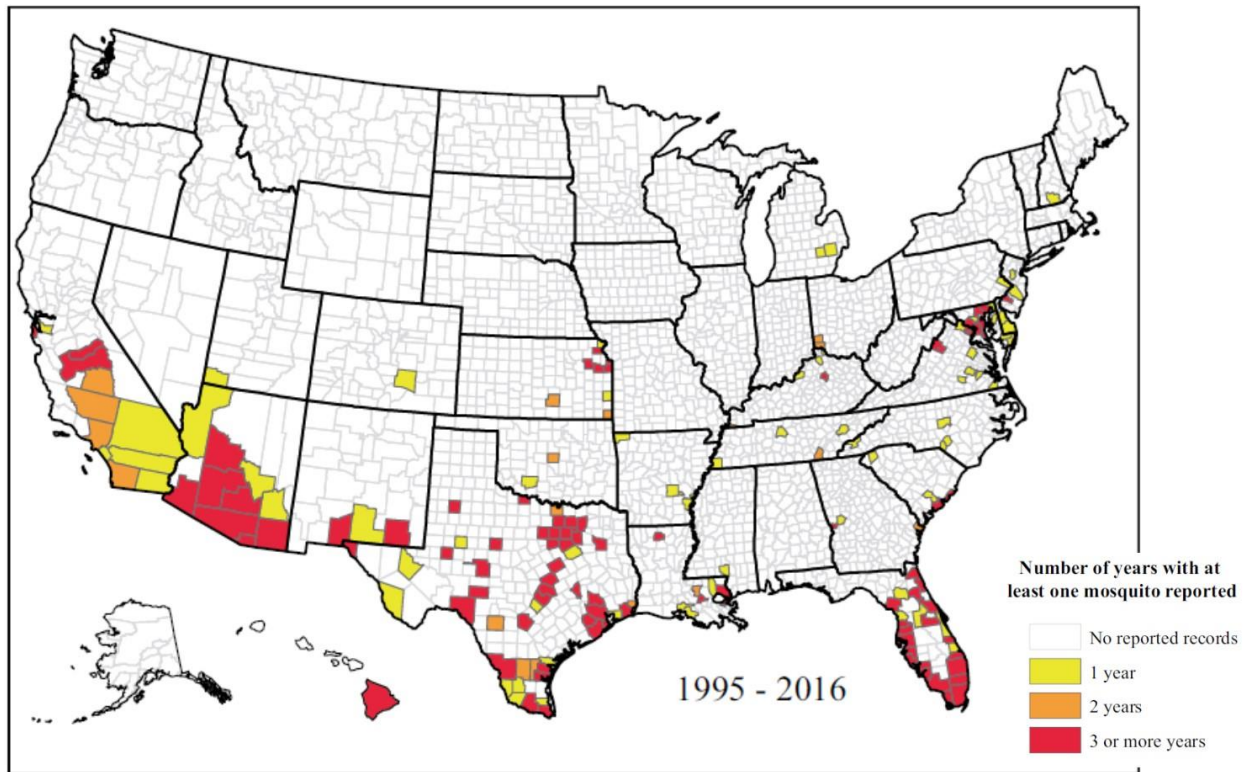


Figure 2: Actual counties where *Aedes aegypti* have been documented in the US. Credit: Hahn et al. 2016. *J. Med. Entomol.*

For the Zika virus to be transmitted locally it would have to be introduced by infected people that have traveled from countries where Zika is present. The local mosquito population would feed on these infected travelers and then the virus would have to sustain itself within the mosquito population before feeding on an uninfected person. Monaghan et al. (2016) identified the potential risk of travelers coming in from Zika infected countries and being fed upon by the local mosquito population where the

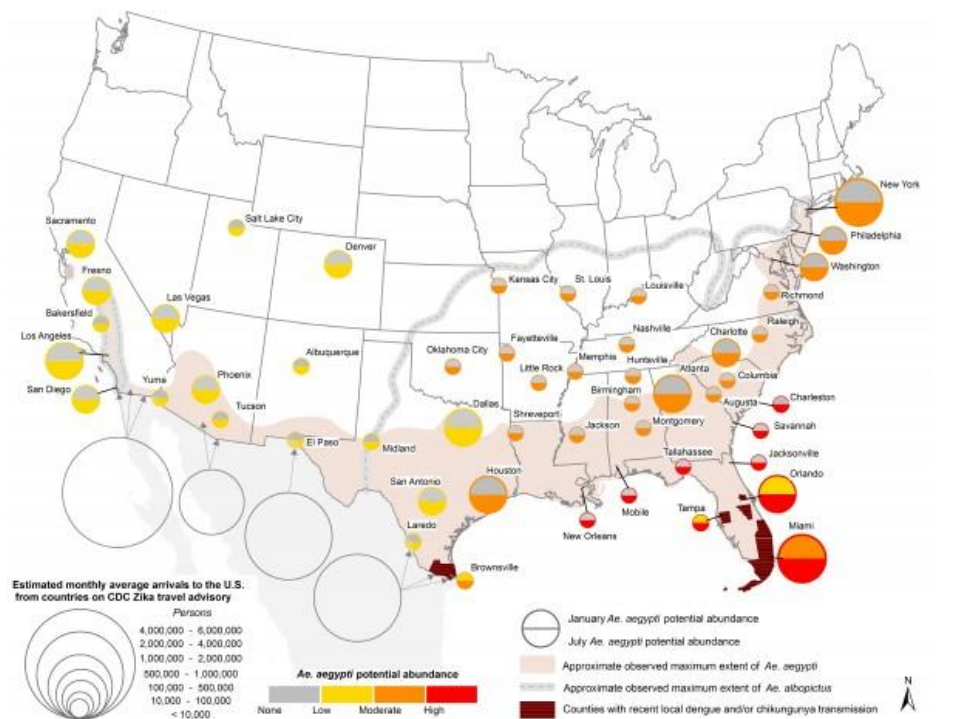


Figure 3: U.S. map showing 1) *Ae. aegypti* potential abundance for Jan/July (colored circles), 2) approximate maximum known range of *Ae. aegypti* (shaded regions) and *Ae. albopictus* (gray dashed lines), and 3) monthly average number arrivals to the U.S. by air from countries on the CDC Zika travel advisory. Credit: Monaghan et al. 2016. *PLOS Currents Outbreaks.*

Zika virus could become established locally (Fig. 5). They identify that travelers coming into Oklahoma City, OK from Zika infected countries from July through September have a moderate chance of being fed upon by the local *Aedes* mosquito populations (Fig. 5).

Mosquitoes have four distinct life stages: egg, larva (four stages), pupa, and adult (Fig. 6). The larval and pupal stages are found only in water. Eggs are laid on the water or at the edge of the water depending on species. Only adult female mosquitoes bite and feed on blood. They must do so to develop their eggs. How long each stage lasts depends on both temperature and species characteristics.

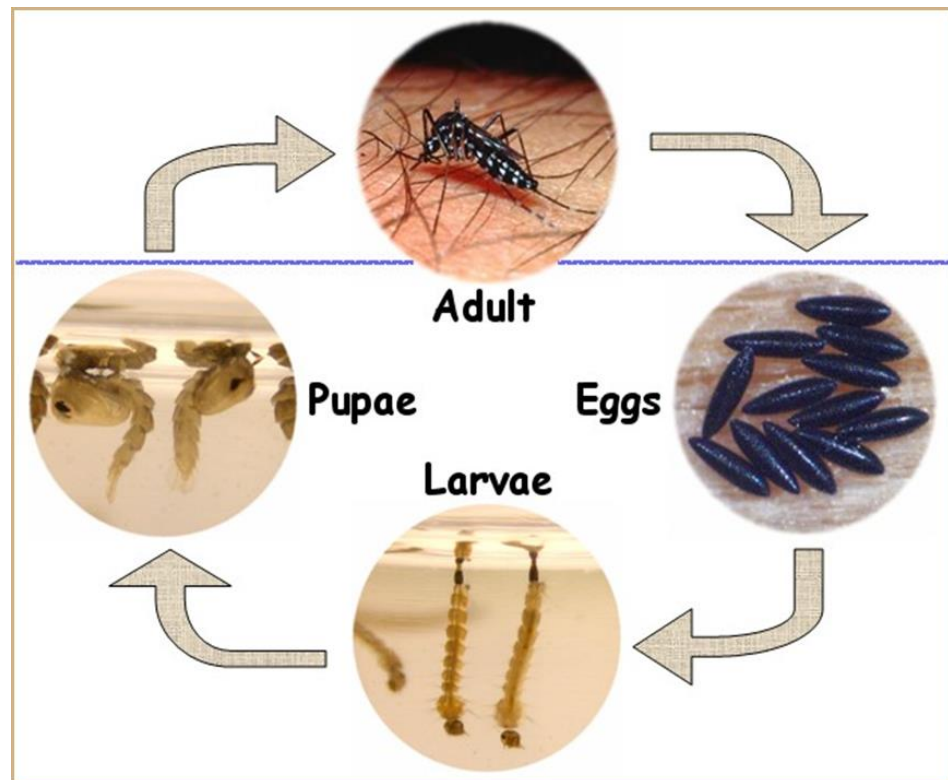


Figure 4: Life cycle of the Asian tiger mosquito (*Aedes albopictus*). Credit: R. Wright and R. Grantham OSU.

Container mosquitoes

Several species of mosquitoes lay their eggs on or at the edge of water in containers of all types ranging from small cans, buckets, bird baths, flower pot bases, plugged rain gutters, poorly maintained water gardens to old tires. Most of these species develop from egg to adult in 7-10 days and can have continuously emerging adults all summer. The **Asian Tiger Mosquito, *Aedes albopictus***, an introduced species, occurs in almost any kind of container and has become the **most important pest species** in most urban areas of Oklahoma **from early June through the fall**. It readily bites humans and feeds during mid-afternoon to early evening.

This species is difficult to control in the larval stage because it occurs in many small containers that hold water. The usual mosquito adult sprays do not work well because these sprays must be applied around sunset or later when the thermal currents are not rising and when most mosquitoes are active. Since the Asian Tiger mosquito is most active in mid-to-late afternoon, the usual mosquito adult spray programs are not applied when the mosquito is active and the spray droplets do not contact the adults.

Mosquito Control

Mosquito control can be divided into two areas: larval control and adult control. Most often the more successful control programs combine both of these two to reduce mosquito populations. These combined programs are known as an Integrated Pest Management (IPM) program, which take into account ecological, social, and economic criteria when implementing control strategies. An IPM program includes both non-chemical and chemical strategies to reduce mosquito populations. Some non-chemical methods include source reduction (eliminating standing water where mosquito larvae can develop), utilizing biological control agents such as *Gambusia* fish that feed on mosquito larvae, and invertebrate predators, parasites, or pathogens that also target mosquito larvae.

The first step to implementing any control program for mosquitoes is a surveillance program that identifies and quantifies mosquito development areas. These programs are usually deployed by a local mosquito control district but Oklahoma is lacking in these districts except for the larger metropolitan areas such as Oklahoma City and Tulsa. Some local city governments will implement these on merely a complaint basis but is usually dependent on city budget funds that are available for this specific purpose. Some pest control operators will also provide this service before they implement any control methods.

Larval Control

Probably the most efficient means to reduce a mosquito population is by eliminating any larval development sites on your property. As mentioned earlier, reducing mosquito larvae can be accomplished either in a non-chemical (reducing standing water) or a chemical (larvicides) manner. Larvicides are chemicals that can be applied to mosquito development areas such as bodies of water and are classified as either stomach toxins (*Bacillus thuringiensis*), contact larvicides (pyrethroids), surface agents (oils or soaps), natural agents, and insect growth regulators (IGR; methoprene, diflubenzuron). When applying larvicides, efforts should be made to concentrate application to the edges of the water near shorelines of ponds since mosquito larvae are not present in the entire water body. Listed below are some recommendations from the American Mosquito Control Association (www.mosquito.org):

1. Irrigate lawns and gardens carefully to prevent water from standing for several days.
2. Clean debris from rain gutters and remove any standing water under or around structures, or on flat roofs. Check around faucets and air conditioner units and repair leaks or eliminate puddles that remain for several days.
3. Destroy or dispose of tin cans, old tires, buckets, unused plastic swimming pools or other containers that collect and hold water. Do not allow water to accumulate in the saucers of flowerpots, cemetery urns or in pet dishes for more than 2 days.

Adult Control

When dealing with an adult population of mosquitoes, homeowners should consider several factors when choosing a control technique. The first is to understand the specific goal for eliminating the mosquito population. For example, controlling a mosquito problem around

outdoor entertainment areas versus reducing the impact mosquitoes have on everyday activities. Adult mosquito control options can depend on which goal you are targeting and the quickest and easiest manner to reduce a population is to utilize insecticides that are applied through either a fogger or ultra-low volume applicator.

Personal Protection

Everyone should exercise good judgment in preventing mosquito bites. If mosquito populations are high, one should avoid being in areas where they are abundant, wear long sleeves and long pants, and/or use a repellent. All the most effective brand name repellents contain the same repellent, DEET. **Many formulations will not say DEET** on the label, but all must list the active ingredient name, **N,N-diethyl-meta-toluamide** on the label. Look for this chemical name and its percentage concentration before buying a product. Concentrations can range from 7% to 100% with most being in the range of 10 to 24%. All concentrations are effective except that the higher concentrations last longer. Even the lowest concentration, which is preferred for small children, gives one to two hours of protection if it is not washed or rubbed off. Use according to label instructions. Also, when applying the repellent be sure to apply to your clothing as well since most of the mosquitoes previously described can bite through clothing especially thin types such as t-shirts or any type of shirt such as those that wick away sweat such as athletic apparel.

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