

What's in your landscape? Plants can alter West Nile virus risk

CHAMPAIGN, Ill. — A new study looks at how leaf litter in water influences the abundance of *Culex pipiens* mosquitoes, which can transmit West Nile virus to humans, domestic animals, birds and other wildlife.

The study found that different species of leaf litter in standing water influence where *Culex pipiens* mosquitoes deposit their eggs, how quickly the larvae grow, how big they get and whether they survive to adulthood. Because the mosquitoes feed on bacteria that grow on leaf litter, the team also measured how native and non-native leaf species influenced bacterial abundance and diversity.

The study is [reported](#) in the journal *Parasites and Vectors*.

When added to standing water, the leaves of two non-native, invasive plants, Amur honeysuckle (*Lonicera maackii*) and autumn olive (*Elaeagnus umbellata*), yielded significantly higher numbers of adult mosquitoes than other leaf species did, the researchers report.

“The invasive honeysuckle was definitely the highest quality habitat in terms of the adult mosquito emergence rates, even when you had very high densities of the larvae,” said graduate student Allison Gardner, who led the research with University of Illinois [entomology](#) professor [Brian Allan](#) and [Illinois Natural History Survey](#) entomologist [Ephantus Muturi](#). The INHS is a division of the [Prairie Research Institute](#) at the U. of I.

A third invasive plant, multiflora rose (*Rosa multiflora*) was associated with low numbers of eggs laid and low survival of the larvae, the researchers found.

The team also made an unexpected, but promising, discovery: One of the plants studied, a native blackberry (*Rubus allegheniensis*), seemed to encourage *Culex pipiens* mosquitoes to deposit a lot of eggs on the water's surface – but very few of the resulting larvae survived to adulthood.

“The blackberry was one of the most attractive habitats to the mosquitoes, but also one of the lowest quality habitats in terms of the larval survival rate,” Gardner said.

“Blackberry was a really poor habitat: It took the larvae a long time to develop and the adult mosquitoes that eventually emerged were small,” Allan said. “What’s exciting about this is that it suggests that blackberry functions as a kind of ecological trap, enticing mosquitoes to lay their eggs in a place where the larvae are unlikely to survive.”

This finding could lead to new, biological methods of controlling *Culex pipiens* mosquitoes, he said.

Two other native plants, elderberry (*Sambucus canadensis*) and serviceberry (*Amelanchier laevis*), had different effects on the mosquitoes. Elderberry attracted mosquitoes looking for a place to lay their eggs, and the larval survival rates were low, but not as low as for blackberry. The

mosquitoes deposited the lowest number of eggs in water infused with serviceberry leaves, but the survival of the larvae was a fairly robust, 62 percent. (See [graphic](#).)

The team also analyzed the bacteria that colonized the different leaf types.

“We wanted to understand the mechanism by which plants differ in their ability to support mosquito oviposition, development and survival,” Muturi said.

Sites with more bacterial diversity had higher numbers of mosquito eggs than those with less diversity, the researchers found. But bacterial abundance, not diversity, was associated with better larval survival.

This finding could explain the unexpected role of blackberry leaves as an ecological trap, Muturi said. Blackberry leaf debris in water hosted a high diversity of bacterial species, but bacterial abundance was rather low, giving the developing larvae little sustenance.

“If you are a mother, you want your kids to develop in an area that has more resources, more food to eat,” Muturi said. “But sometimes a mother makes a mistake and chooses the wrong habitat. An ecological trap is a mismatch between the choice that the mother makes and the quality of the habitat.”

Future studies will explore whether blackberry leaves can be used to undermine the viability of disease-carrying mosquitoes, Allan said.

In the meantime, those working to stop the advance of invasive plants like honeysuckle and autumn olive have another reason to do so, Allan said.

“These are some of the most widespread invasive exotics in North America,” he said. “Plants like honeysuckle are having very significant ecological impacts, displacing a lot of native species. And now we’re seeing that some of them also enhance the transmission of a dangerous disease.”

The U.S. Environmental Protection Agency, the Institute for Sustainability, Energy and the Environment at the U. of I., and the Illinois Used Tire Management Fund supported this research.