

Mosquitoes that transmit West Nile virus love to bite non-native lizards. What's next?

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Credit: UF/IFAS Lawrence Reeves

In the United States, West Nile virus circulates among wild birds, transmitted by *Culex* mosquitoes, which transmit West Nile virus and other viruses in the southern United States. Humans can become infected

when a person is bitten by a West Nile-carrying mosquito.

A new study published in *Frontiers in Tropical Diseases* by faculty at UF/IFAS Florida Medical Entomology Laboratory finds that *Culex* mosquitoes prefer to feed on lizards. This finding might help researchers find ways to reduce the number of West Nile-carrying mosquitoes within an ecosystem.

"We found that lizards, especially the nonnative brown anoles, are major hosts for some of the most important West Nile virus (WNV) and St. Louis encephalitis (SLEV) virus vectors in Florida," said Lawrence Reeves, an assistant professor and entomologist. "Then, in Arizona, we also found that lizards were major hosts for the western West Nile virus *Culex* vectors as well."

Scientists previously thought *Culex* mosquitoes fed primarily on birds and mammals. Researchers believed that interaction facilitated the transmission of WNV among birds and the subsequent infections of humans and horses.

The new finding helps scientists understand how diseases spread by *Culex* mosquitoes expand in ecosystems and how they might reach humans and domesticated [animals](#).

Mosquitoes bite a wide range of animals, and each mosquito species has distinct preferences for certain kinds of animals. Scientists call such animals "hosts."

"The process of transmitting mosquito-borne diseases to humans and wildlife all comes down to which mosquitoes feed on which animals," explained Reeves. "Only certain mosquito species can transmit viruses, and only certain [animal species](#) can become infected and pass on a virus to new mosquitoes."

Whether the lizards play a role in the transmission of these diseases spread by *Culex* mosquitoes is a key question that emerged from the study. It offers researchers, like Reeves, a new direction to explore.

"If lizards are poor hosts for these viruses, [mosquito bites](#) on lizards could translate to fewer West Nile virus-carrying mosquitoes flying around," said Reeves.

The *Culex* mosquitoes that vector WNV and SLEV were previously understood to feed almost entirely on birds and mammals. That understanding is based on large-scale studies done in the 1960s and 1970s, before the brown anole and other invasive lizards were widespread in Florida, explained Reeves.

For Reeves' study, the team collected blood-fed mosquitoes in Florida and Arizona and identified the animals on which they fed. They evaluated the host associations for 10 *Culex* species from Florida and Arizona using DNA barcoding. This process includes extracting and sequencing DNA from each blood-fed mosquito as part of the process.

In Florida, scientists collected mosquitoes from five counties: Alachua, Levy, Indian River, Pinellas and Miami-Dade. In Arizona, mosquitoes were collected at wild areas of the Sky Islands Region in Cochise, Pima and Santa Cruz counties.

Here is what they learned:

- Not all *Culex* species fed from lizards to the same degree.
- Only lizard species that are active during the daytime and associated with trees were bitten by mosquitoes.
- In Florida, brown anoles—the small, brown lizards often seen on sidewalks—were the most frequently fed-upon host for *Culex nigripalpus*, one of the most important vectors of WNV and

SLEV.

"These insights are important because lizards might help reduce the transmission of WNV and SLEV—both viruses infect birds, and any time a human is infected by one of these viruses, that virus would have come from a vector mosquito that had previously fed on an infected bird," said Reeves.

Culex mosquitoes, known to spread zoonotic Flaviviruses like WNV and SLEV, are a public health risk as they spread viruses among wild animals, and occasionally, from wild animals to humans, Reeves said.

Culex mosquitoes pick up these viruses when they feed on the blood of an infected bird. Then, when that mosquito goes on to feed from new animals, the virus can be transmitted when that mosquito takes blood from any subsequent host. If a bird becomes infected, any mosquitoes that feed from it while the infection is active may pick up the virus. On the other hand, some animals, like humans, represent dead ends for these viruses: if a human is infected with WNV or SLEV, [mosquitoes](#) that feed from that human will not pick up the [virus](#).

"The key question that stems from our study is whether lizards can serve as hosts for these viruses," he said. "If not, if they are dead ends, it is possible that the presence of lizards, including some of these invasive species, has a beneficial effect by reducing the transmission of these viruses and the risk that humans will become infected"

On the other hand, if lizards are dead-end hosts for WNV and SLEV, every mosquito bite that goes toward a lizard, rather than to a bird or human, is one less opportunity for WNV or SLEV to be transmitted.

"If that's the case, it may be possible to use [lizards](#) as a sort of biological control to help dampen the transmission of West Nile and other similar

viruses," said Reeves.

More information: Lawrence E. Reeves et al, Lizards Are Important Hosts for Zoonotic Flavivirus Vectors, Subgenus Culex, in the Southern USA, *Frontiers in Tropical Diseases* (2022). [DOI: 10.3389/fitd.2022.842523](https://doi.org/10.3389/fitd.2022.842523)

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