Climate, genetics can affect how long virus-carrying mosquitoes live

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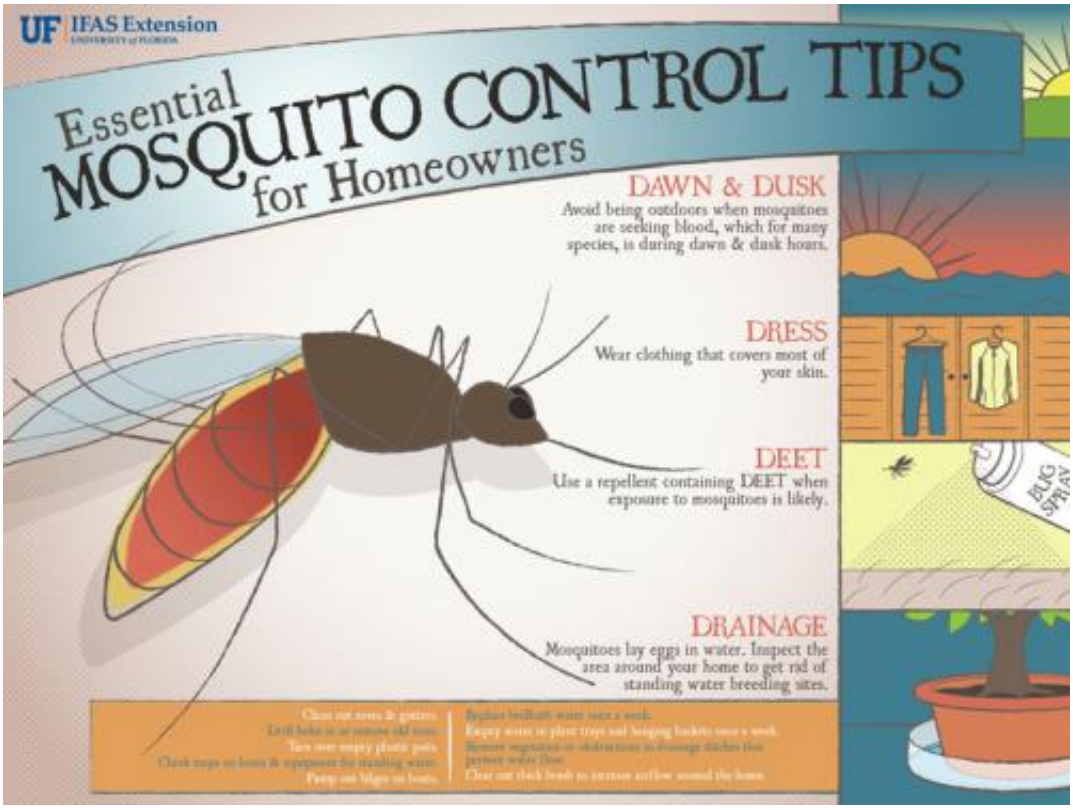

Credit: University of Florida

(Medical Xpress)—It's just math: The longer a mosquito lives, the better its odds of transmitting disease to humans or animals.

But as it turns out, factors such as the mosquito's own genetics and the climate it lives in have a big – albeit complicated and not wholly

understood – role to play in its lifespan.

University of Florida researchers, hoping to better understand how West Nile virus affects mosquitoes, set up an experiment they outline in the *Journal of Vector Ecology*'s current issue.

Mosquitoes can transmit any number of pathogens to humans, including protozoan malaria, West Nile, dengue and chikungunya viruses. Malaria cases range between 350 million and 500 million each year, with 1 million to 3 million deaths every year.

In the experiment, UF researchers examined survival rates for mosquitoes from two laboratory-reared colonies, one from Gainesville and one from Vero Beach.

Half of each of the mosquito colonies was fed West Nile virus-infected blood, the other half kept as a control population, and fed blood without the virus.

They divided the groups once more, this time keeping the mosquitoes at two temperatures, one group at 80.6 degrees, the other at 87.8 degrees Fahrenheit – a rather large difference in temperature for cold-blooded insects.

Their findings were both unexpected and illuminating, said Barry Alto, a UF assistant professor of arbovirology based at the Florida Medical Entomology Laboratory in Vero Beach.

"Our results indicate that interactions between mosquitoes and arboviruses are really complex … these things that haven't really been taken into account previously might make a difference," said Alto, part of UF's Institute of Food and Agricultural Sciences.

The researchers found that warmer temperature shortened survival. Also, for the most part, the Vero Beach mosquitoes lived longer than those from Gainesville, indicating that some groups, or strains, of mosquitoes might just be genetically hardier than others.

They found that in general, the mosquitoes fared better at cooler temperatures.

But they also found that the West Nile virus-carrying mosquitoes from Gainesville fared worse than their counterparts at the hotter temperatures, and to their surprise, that the Vero Beach-bred mosquitoes carrying West Nile virus lived longer than all other groups at the cooler temperature, including control-group mosquitoes not exposed to the virus.

Ingesting virus-infected blood may take a toll on the mosquito's health, Alto said, but it's clear that other factors: immune response, genetics and the environment, are also at play and need more study.

"It's quite complex, there's a lot of stuff going on here," Alto said. "But I think the take-home message is that these viruses, when they're in mosquitoes, not only can they alter parameters like survivorship that are really important to disease transmission, but they can alter them in non-intuitive ways—sometimes enhancing, sometimes decreasing survivorship, and that those situations arise when you start considering other factors of the environment, like temperature."

Adding to scientists' knowledge base of how disease affects insects is key to finding the best ways to limit its spread, Alto said.

"In the most general sense, in order for humans to control disease, we really need to know how the mosquito interacts with these viruses," he said. "In the absence of a human vaccine, the best way to control any sort

of mosquito-borne virus is to control the mosquito. Simply put, if the mosquito doesn't bite you, you're not going to get the pathogen."

More information: Alto, B. W., Richards, S. L., Anderson, S. L. and Lord, C. C. (2014), "Survival of West Nile virus-challenged Southern house mosquitoes, Culex pipiens quinquefasciatus, in relation to environmental temperatures." *Journal of Vector Ecology*, 39: 123–133. DOI: 10.1111/j.1948-7134.2014.12078.x

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