

Mosquitos more resilient to saltwater than previously thought

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The researchers at the buried tubs in the nursery garden of the Hortus. Credit: *Parasites & Vectors* (2024). DOI: 10.1186/s13071-024-06268-8

Dutch mosquitos are more resilient to saltwater than previously thought. Environmental scientist Sam Boerlijst discovered this during his Ph.D. research at the Hortus botanicus. This knowledge is crucial for understanding how mosquito-borne disease transmission might change in the future.

The study is [published](#) in the journal *Parasites & Vectors*.

"When it comes to diseases and mosquitos, people often think of the exotic tiger mosquito," says Sam Boerlijst, a Ph.D. candidate at the Institute of Environmental Sciences (CML). "But the common Dutch mosquito can also transmit diseases. Fortunately, this isn't happening much yet, and we want to keep it that way."

Boerlijst participated in a research project that investigates how changes in climate or land use impact the spread of mosquito-borne diseases.

From fresh to salt: Can a mosquito adapt?

Boerlijst focused on salinization. He says, "The Dutch [coastal area](#) is becoming saltier due to the warming climate and rising sea levels. We don't yet fully understand what this means for mosquito populations and the diseases they carry, such as the West Nile virus and avian malaria."

The common house mosquito is known to be very sensitive to salt, which could be good news regarding [disease](#) risk: fewer mosquitos mean less chance of disease spread. But this silver lining might be too optimistic, Boerlijst says. "An initial test with mosquitos from Leiden showed they were much more salt-tolerant than we expected. This made us wonder: could mosquitos quickly adapt to an increasingly saline environment?"

48 tubs in a secret garden

The researchers collected mosquito eggs from Leiden, Utrecht and Nijmegen—Dutch cities that lie progressively farther from the coast -, to test for a difference in salt tolerance. In a hidden garden at the Hortus botanicus, Boerlijst and his colleagues buried 48 tubs.

"Those we filled with water, bacteria, a few plants and some nutrients. In this naturalistic setup, we exposed the three groups of mosquitos to different salt concentrations and observed their development: how quickly they matured, the survival rates of males versus females, and overall survival," he explains.

It turned out that even in water half as salty as seawater, the mosquitos managed well, especially those from Leiden and Nijmegen. "This suggests that even inland mosquitos might have already adapted," says Boerlijst.

The great taste test: Do mosquitos lay eggs in salt water?

Surviving in saltwater is one thing, but wanting to lay their eggs there is another. Boerlijst says, "Female mosquitoes taste or smell the water to determine if it's a suitable place. They can detect proteins from predators like salamanders or bacteria that indicate water quality. We were curious if they also consider salt levels."

Boerlijst investigated this with a "colonization experiment," placing groups of water containers with varying salt concentrations around the Hortus. He and his colleagues counted the eggs daily to gauge mosquito preferences. "We found that mosquitoes occasionally lay eggs in the saltiest water they can survive in, but they do prefer slightly less salty conditions," he adds.

Pioneers in a changing coastal climate

Dutch mosquitoes are more resilient to salinity than previously thought. "This is quite concerning," Boerlijst says. "Mosquitoes are [pioneer species](#). They thrive in disturbed areas where other species struggle. If predators and competing species don't adapt as quickly and disappear, mosquito populations could proliferate."

However, Boerlijst emphasizes that this is not immediately predictable. He explains, "It's a complex interplay of various factors. Temperature, humidity, and nutrient levels can either amplify or counteract each other. For instance, mosquitoes are less tolerant of salt at higher temperatures.

"We also need to consider the effect of fluctuations in temperature, as [climate change](#) means greater extremes. Only by understanding all these interactions can we make accurate predictions. Mosquitoes are annoying, but hopefully, we can prevent them from becoming dangerous."

More information: Sam Philip Boerlijst et al, Taking it with a grain of salt: tolerance to increasing salinization in *Culex pipiens* (Diptera: Culicidae) across a low-lying delta, *Parasites & Vectors* (2024). [DOI: 10.1186/s13071-024-06268-8](#)

Provided by Leiden University

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