

Orchids mimic human body odor to attract mosquitoes

January 6 2017



A mosquito with pollen sacs attached to its head visits a *Platanthera* orchid.
Credit: Photo credit: Jeff Riffell

According to Shakespeare, "A rose by any other name would smell as sweet." But what makes a rose smell sweet? And why has it evolved to smell that way?

Dr. Jeff Riffell, an associate professor in the Department of Biology at the University of Washington, has spent his career trying to answer such questions. He notes that for a rose, "There are actually about 300 chemicals in its bouquet."

Riffell is interested in how chemical signals, like smells, affect behavior. An important example is how plants use smell to attract pollinators over long distances, which explains why some flowers have evolved to smell sweet. But what if a plant relies on [mosquitoes](#) for pollination? Riffell's team found that the result is a plant that smells more like a sweaty gym sock than a rose.

Mosquitoes are not particularly good at pollinating plants, but do visit them to drink their nectar. It seems that at least one plant, the orchid *Platanthera obtusata*, has taken advantage of these blood-sucking visitors as pollinators.

Riffell describes a common day studying these orchids: "We'll be cruising around, being bitten by these mosquitoes—so that's kind of a bummer—but we'll see these bright pollen sacs attached all over their heads." In areas where the orchids are common, mainly in the NW

United States, they depend almost exclusively on mosquitoes for pollination. For example, Riffell's team found that out of 167 insect visits to orchids, 166 of them were made by mosquitoes.

However, the orchids are a bland green color, and tend to blend in with their background. It was therefore a mystery how the orchids were able to attract mosquitoes and stand out amongst other plants.

That's when Riffell's team began to think with their noses. They began bagging orchids with oven bags to collect the chemical "smells" released by orchids. Riffell describes this as "Very low-tech chemistry (chemistry in the field is great)."

But the team quickly switched to some high-tech chemistry to separate out the dozens of chemicals that make up the orchid's bouquet. They found that many of the chemicals were the same ones given off by common blood-hosts of the mosquitoes. As Riffell puts it, "Smell your armpit, a plant might be emitting that same chemical."

They then examined what happened in a mosquito's brain when it was exposed to the orchid's bouquet. They found a strong, specific pattern of brain activity when mosquitoes were exposed to the bouquet, and although individual chemicals never reproduced this pattern, some were more important than others at generating the response.

Riffell was excited to find these results, since "These are some of the first demonstrations of how mosquito nervous systems process complex sensory information." They also looked at the brain's response to DEET "just to see what would happen," Riffell admits. It seemed to activate all sorts of neural pathways, leading the team to conclude that DEET might be "really confusing" to a mosquito.

Certain features of the orchid-specific brain pattern were recreated when

mosquitoes were exposed to body odor. They also found that mosquitoes would actively fly upwind and land on the odor source when exposed to orchid or body odor scents. These results provide strong evidence that orchids use a particular bouquet that shares features with blood-hosts to attract the mosquitoes they rely on for pollination.

Understanding how mosquitoes process scents might lead to the development of "mosquito bait" that could be used to attract mosquitoes in a given area and census them for diseases such as malaria and Zika, or to develop new repellents.

In the meantime, Riffell and his team are trying to determine how mosquito-mediated pollination affects orchid reproduction. For example, do [orchids](#) visited by mosquitoes produce more seeds? For now he says, "We just like going out in the field and doing research," despite the mosquito bites and an occasional whiff of BO in the air.

Provided by Society for Integrative & Comparative Biology

Citation: Orchids mimic human body odor to attract mosquitoes (2017, January 6) retrieved 26 April 2024 from <https://phys.org/news/2017-01-orchids-mimic-human-body-odor.html>

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