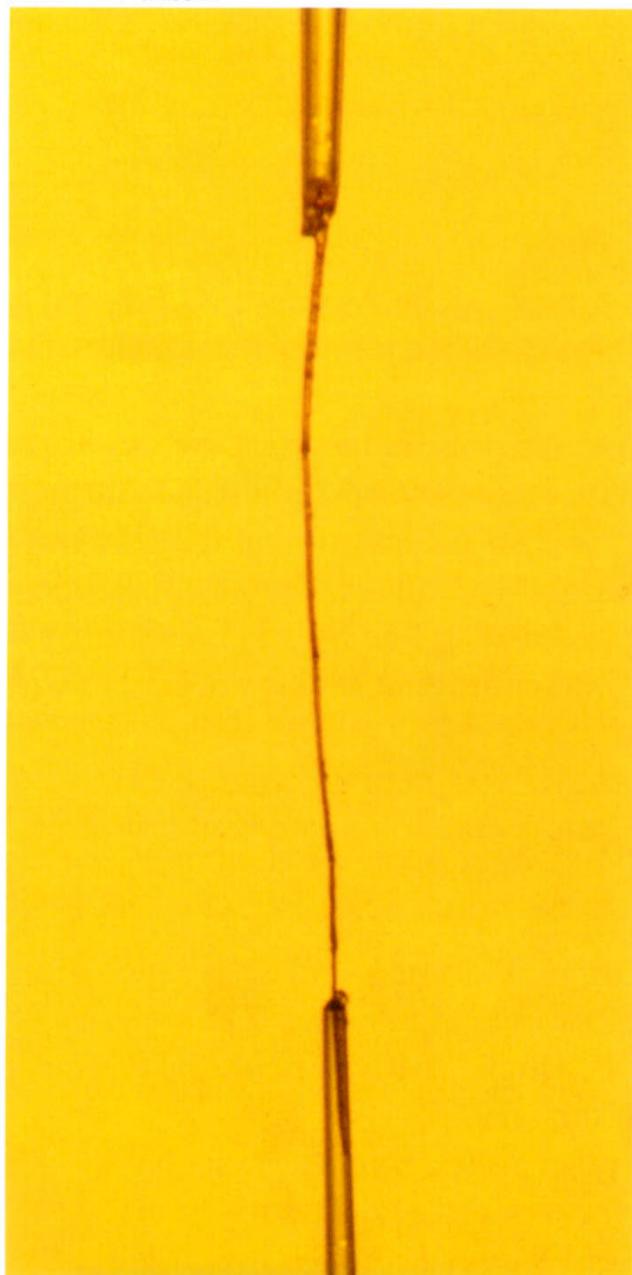


Detached Antennae Tell What an Aphid Can Smell

WILANT VAN GIESSEN



Though detached from the insect, this aphid antenna (between electrodes) generates minute electrical signals when exposed to certain plant odors. (K5750-1)

Looking over the menu of plants growing in a typical field, how does an aphid decide which crop to feed on?

Plant color—particularly yellow and green—has long been established as one stimulus. Another, scientists now confirm, is the odor coming from the plant.

How do they know this? An Agricultural Research Service scientist snipped off the aphid's antennae to detect the odors appealing to the pest. Among the favorites are the so-called green-leaf odors—the dominant smell of cut grass.

It's an important finding for scientists trying to understand the behavior of aphids.

These crop-damaging pests suck juices from a wide variety of plants. They also spread harmful plant viruses as they feed.

Understanding how an insect perceives its world and how that perception affects its behavior is one of the first steps toward preventing its damage to crops.

Over the last 4 years, studying the pea aphid's sensitivity to plant odors has been the job of Wilant van Giessen. He's a graduate student from the Department of Entomology of Wageningen Agricultural University in The Netherlands. Working under a cooperative research agreement between ARS and Clemson University, he is studying the basic behavior of aphids as part of an overall effort to find new ways to control the pests.

Based at the U.S. Vegetable Laboratory operated by ARS in Charleston, South Carolina, van Giessen is an expert in electroantennography—the science of measuring what an insect smells through the antennae that serve a function similar to that of the human nose.

To detect what an aphid smells, van Giessen cuts off an antenna—

only 2 millimeters long—and attaches tiny electrodes at each end. These minute glass tubes are filled with a salt solution to conduct an electrical current.

Then he exposes the antennae to different plant odors, recording and analyzing results that look on a computer screen like an electrocardiogram. It's all done under a stereo microscope—and it must be done quickly. Once an antenna is cut, it only retains its sensitivity for 20 to 30 minutes, at best.

And there are other things that can throw off the results. "When I conduct these experiments I make sure they aren't cutting the grass outside the lab," van Giessen says.

Van Giessen is now studying whether winged aphids are more sensitive than wingless ones to plant odors. "We think that in general, they are more so, because their primary job is to find a new plant on which their offspring can feed," van Giessen says. "Wingless aphids concentrate more on feeding and reproduction, rather than moving from plant to plant."

Van Giessen says he has used the pea aphid as a model system because it is larger than most aphids and feeds on a variety of crops besides peas. But he has also studied other aphids, including green peach and potato aphids, and he plans to work on the birch aphid, which feeds only on birch trees.—By **Sean Adams**, ARS.

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