Plants Send SOS When Caterpillars Bite

By emitting chemical distress signals, some corn, cotton, and tobacco plants can summon tiny parasitic wasps to rescue them from hungry caterpillars like the tobacco budworm and corn earworm. Breeding crop varieties specifically for their wasp-calling traits is of keen interest to scientists seeking ways to reduce insecticide use.

But until recently, researchers believed that plants use the same SOS distress signal—no matter what the attacker. [See "Beneficials Are Money in the Bank," *Agricultural Research,* February 1993, pp. 20-22.] Now, a team of scientists has proven otherwise by showing that plants actually emit signals specific to the caterpillar pest attacking them.

By releasing blends of 10 to 12 different chemical compounds called volatiles, plants can quickly and accurately communicate their attacker's identity to friendly parasitic wasps—a finding that could improve their use in integrated pest management programs.

This chemical tête-à-tête "is a much more sophisticated system than we ever suspected," says University of Georgia graduate student Consuelo DeMoraes. She conducted the study under the direction of ARS entomologist W. Joe Lewis and his colleague, ARS chemist James H. Tumlinson. They reported the finding in the June 1998 issue of ***Nature***.

Before their work, "it had not been shown scientifically that plants could send specific information," says Lewis. He is at ARS' Insect Biology and Population Management Research Laboratory in Tifton, Georgia.

Specificity is key to survival of both the plant and the wasps, he adds. For example, *Cardiochiles nigriceps* wasps can only reproduce using tobacco budworms as hosts for their brood. In fact, the finicky wasp will ignore plants signaling attack by the budworm's close relative, the corn earworm—a pest with its own natural enemies.

By releasing a large, aromatic plume into the air, plants not only help their wasp allies quickly find them, they also tell the wasp who their attacker is. This helps the wasp avoid wasting precious energy.

"Without a specific signal from the plant, the parasitoid might otherwise spend all its time tracking false cues," says Lewis. "It's like finding a needle in a haystack. It has to find this one particular host in order to reproduce."

In field trials at Tifton, scientists observed that *C. nigriceps* wasps more often flew to plants signaling attack by tobacco budworms than to those pestered by corn earworms. In experiments with tobacco, tobacco budworm-infested plants accounted for 164 out of 198 total wasp visits.

In separate experiments, the scientists also monitored plants whose leaves had been chewed by the caterpillars and subsequently removed. This eliminated the possibility of the wasps' homing-in on chemical cues in the caterpillars' saliva or feces, rather than on the plants' signals. As before, *C. nigriceps* zeroed-in on the tobacco budworm-damaged plants. This happened 32 of 48 times.

The scientists also ran a chemical analysis of the plants' signals using a special glass sleeve and gas chromatography techniques. This showed consistent differences in concentrations of volatile compounds emanating from the plants, depending on which caterpillar pest had attacked them.

Lewis is also monitoring the effects of too much nitrogen on the signaling capacity of cotton plants.

"You can select varieties for their inherent ability to defend themselves," he says. "But you also have to know how to manage them so that trait is expressed."—By **Jan Suszkiw**, ARS.

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Corn earworm on an immature cotton boll.