

Caterpillar thwarts corn's smelly SOS

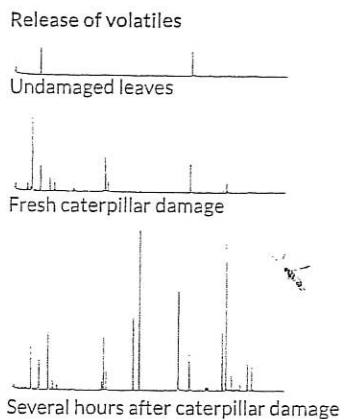
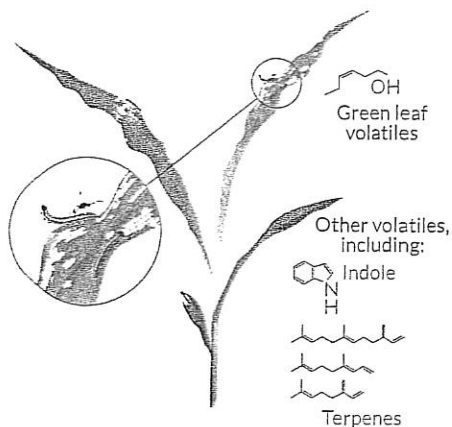
Pest may co-opt plant's distress signal to avoid wasp attacks

BY SUSAN MILIUS

Here's the story of a caterpillar that foils gruesome violence orchestrated by corn.

No, that's not backward. Plants often look helpless to a human, but they fight

with smells and other invisible chemistry. A growing body of evidence, for example, shows that plants under attack can waft out scents that attract help, such as tiny wasps that deal a lingering



Smell the leaves Maize leaves don't normally give off much in the way of smells (top graph, each peak represents an airborne compound). When caterpillars bite into a leaf, though, a wave of leafy green volatile compounds rises (middle). In a few hours, the leaf synthesizes other volatiles (bottom), including indole and terpenes, that lure such caterpillar enemies as a female parasitoid wasp. New work suggests that caterpillars that bulk up on indole-rich foliage can repel wasps.

death to leaf-chewing caterpillars.

A dream for future farming is to boost such crop powers. Yet a tale, published May 16 in *Science Advances*, of how attacking *Spodoptera littoralis* caterpillars can escape a trap set for them by maize plants shows how complex a task that could be.

These attackers are “greenish, brownish, ugly caterpillars,” says Ted Turlings of the University of Neuchâtel in Switzerland, who makes no secret of where his allegiance lies. The caterpillars damage maize, cotton and a variety of other crops in the Middle East, Africa and elsewhere. But maize fights back, of course. As the caterpillars crunch into a leaf, substances in their spit trigger a burst of furious plant chemistry, which causes the release of certain scents.

The first wave of odors from damaged plants, the cut-grass smell, comes just from ripped tissues spilling their innards. Then within hours, maize sends out new scents that can advertise the kind of pests attacking it. “You can actually smell it yourself,” Turlings says. Or at least his trained nose can.

T.C.J. TURLINGS AND M. ERB/ANNUAL REVIEW OF ENTOMOLOGY 2018

These telltale plant substances help female *Microplitis rufiventris* wasps track down a suitable species of caterpillar in which to inject an egg. “Out of that egg comes a little larva, and it starts eating the insides of the caterpillar—not a very pleasant thing,” Turlings says. Caterpillars continue feeding for several days but then just passively stay alive longer as a source of fresh baby food.

What Turlings and colleagues have found, however, is that what the caterpillar eats makes a difference. Wasps were more interested in caterpillars grazing on maize that researchers genetically engineered not to produce a plant defense compound called indole. In contrast, wasps weren't very likely to inject eggs if this caterpillar species had been feeding on normal maize leaves.

Indole's “mothball-like odor [is] terrible in high dosages,” Turlings says. Caterpillars didn't like it much either—except when female wasps were zinging nearby. Then the caterpillars fed willingly enough, a test showed. “It's almost like self-medicating,” he says.

There's a cost to the caterpillars'

choice to tolerate indole-rich foliage. “They grow fatter but not healthier,” Turlings says. More die prematurely. On the plus side, wasp eggs don't flourish as well inside these caterpillars if a wasp does try to use them as zombified baby food. The odor of pure indole could attract the wasps, but caterpillars that bulked up on indole-rich leaves did not, the researchers found in lab tests. This caterpillar's foraging evolution had found a loophole in maize's defense strategy.

Just about every plant tested so far synthesizes special compounds that can lure in some kinds of natural enemies of pests, Turlings says. Yet he'd never run across a caterpillar with this bad-food strategy of avoiding the wasps.

Caterpillars evolving a work-around defense against a widespread plant defense isn't a shock to chemical ecologist James Tumlinson of Penn State. In these ornate biological systems of deceit and manipulation, “pretty much anything you can think of is possible,” he says. “Once we get over our surprise, it nearly always makes evolutionary sense.” ■

Name: _____ Date: _____ Section: _____

Scientific Method: Caterpillars and Corn

Directions: Answer the following thoroughly and in complete sentences where appropriate.

1. What kind of symbiotic relationship exists between the wasp larvae and the caterpillars? Explain how you know this.

2. Why do caterpillars feed on maize leaves willingly even though the odor produced by the chemical indole is “terrible in high doses”?

3. Based on the article “Caterpillar thwarts corn’s smelly SOS”, fill out the following chart:

Observation	
Scientific Question	
Hypothesis	
Experimental design (how would you test the hypothesis)	
Conclusion	