SCIENCE NEWS 1997 December 20/27, 1997
Vol. 152 No. 25/26 p. 391

Fine-tuned plant response to insect attack

A caterpillar takes a chew of tobacco leaf. Then another. And another. A wasp appears and plants its stinger in the caterpillar, which eventually becomes food for the wasp's offspring.

There's more to this encounter than meets the eye. Prompted by spittle from the caterpillar, the wounded tobacco plant lofts a chemical scent into the air that tells the parasitic wasps where to find a nice, juicy meal. Even after the caterpillar has been removed, the wasps home in on a plant that has just been attacked.

"They don't just fly around at random until they bump into it," says James H. Tumlinson of the Department of Agriculture's research service in Gainesville, Fla.

Tumlinson and his coworkers are studying the chemical volleying that goes on between many plants and insects, whether enemies or allies. They have now found that plants customize the chemical SOS they emit, alerting the particular wasp that specializes in preying on the offending caterpillar. Consuelo M. De Moraes of the University of Georgia in Tifton reported the new findings at this week's meeting in Nashville of the Entomological Society of America.

De Moraes tested the tobacco plant's response to two closely related insects: the tobacco budworm (*Heliothis virescens*), a common pest of the plant, and the corn earworm, also called the cotton bollworm (*Helicoverpa zea*), which normally doesn't touch the stuff. She induced the earworm to chew on tobacco by providing it with nothing else to eat.

When the plants were moved to the field, parasitic wasps appeared at the plants being chewed on by the budworm, the wasps' preferred host. That result was expected, says Tumlinson, "since you don't normally find corn earworm on tobacco."

The researchers then tested the wasps' reaction to the two caterpillars' attacks on cotton. "The wasps could detect the tobacco budworm on cotton, and they would go to it and not to the corn earworm," he continues. "They could tell the difference."

The difference, the researchers demonstrated, came from a change in the blend of volatile chemicals emitted by the plant in response to each insect's chewing. The researchers fitted glass sleeves over the plant to capture its emissions. An air pump pulled the chemicals onto adsorbent filters.

When they separated and analyzed the chemicals, they found subtle differences in the plant's chemical responses, says Tumlinson. Instead of giving off compound A when one insect feeds and compound B when another feeds, "they give off different proportions, or ratios, of compounds A and B." The compounds contain five-carbon structures known as terpenes. Corn plants also produced a varying chemical response when fed upon by the two pests, De Moraes reported.

Although the response needs to be examined in other plants, the results are "a very significant advance" in understanding the complex interactions of plants and feeding insects, says entomologist Richard L. Lindroth of the University of Wisconsin-Madison.

Researchers are interested in exploiting the chemical crossfire between plants and insects (SN: 12/22&29/90, p. 410) as a means of protecting crops. Earlier this year, Tumlinson's group reported the structure of the chemical compound in beet armyworm saliva that induces corn to churn out its chemical SOS.

A wild variety of cotton emits "huge bouquets, or plumes, of these signals," says Tumlinson. It may be possible to enhance the production of such signals in domestic crops as well. De Moraes is exploring the use of specific blends to attract larger numbers of parasitic wasps in the field.

—C. Mlot