PLANTS

Flowers might gossip via electric fields

Plants sense bees' electrical signals and alert neighbors, tests hint

BY RACHEL BERKOWITZ

Flowering plants may have a secret power for knowing when to lure pollinators.

Their flowers could act as antennas for bees' electrical signals and transmit those signals to the soil, biophysicist Daniel Robert reported March 6 in Minneapolis at the American Physical Society meeting. The finding offers a possible clue to how floral neighbors share information about when to produce nectar, saving energy for when pollination looks promising.

If a bee's flapping wings trigger even a small voltage difference in plants, it could be "an interesting demonstration of communication," says biomechanics researcher Víctor Ortega-Jiménez of the University of Maine in Orono.

Researchers have long proposed that plants have a form of electrical communication. "This process implies information exchange that's much faster than chemical communication," says Robert, of the University of Bristol in England. But how plants' electrical communication works and whether it links species and organisms that have a presence above and below ground remains a puzzle.

Robert and colleagues had previously found that bumblebees carry a positive electric charge, while flowers carry a negative one. In petunias, stems not only become more negatively charged when a bee approaches, but their flowers also increase scent production—hinting that the plant can detect pollinators based on a noncontact electrical signal.

In the new study, ecologist Fraser Woodburn, who works in Robert's lab, designed antennas to give off signals that mimic those produced by a bee's wings flapping in an electric field. The antennas were placed above daffodils cultivated in the lab. The team also placed electrodes on stems. By measuring the variation in voltage at the stem surface, the researchers could infer if the plants could detect the signal.

Daffodils, the results suggest, could receive electrical signals from the antennas without physically contacting them. Changing the flower's shape by removing the center trumpet or petals reduced the daffodil's signal-receiving ability, the team reports, perhaps by making it less of a "dish."

Next, the researchers took the work outside, to hogweed plants and buttercups in the University of Bristol gardens. The team again mimicked sending bees' electrical signals above a row of flowers outfitted with electrodes. Nearby flowers in the same soil also donned electrodes, but those plants were covered with a metal shield to block any electrical or chemical signals in the air.

Surprisingly, the electrodes on the shielded plants detected electrical signals, suggesting the plants passed them underground. Those signals maintained their strength even on plants farther away from the initial beelike signal.

"What is extraordinary about this work is that it suggests that plants perhaps talk to each other through electric fields," says physicist Scott Waitukaitis of the Institute of Science and Technology Austria in Klosterneuburg.

The team stops short of saying that plants use these electrical signals, says Waitukaitis, who studies electrical exchanges between objects. This idea, though far-fetched, "is not entirely out of the realm of reason, and more work should certainly be done," he says.

Biophysicist and botanist Ingo Dreyer of the University of Talca in Chile is skeptical of the result. A flying bee "hardly exchanges charges with its environment," Dreyer says. What's more, the input signal in the experiments was 10 volts while the detected signal was less than 20 millivolts—roughly one five-hundredth the strength of the original. That raises questions about transmission, he says.

The weak, detected signal, Robert says, indicates "a slow conductive process, but nonetheless conductive." The signal could be transmitted underground to other plants through electrolytes, wet soil or fungus, he says. Still, the general consequences of that conduction are not clear.

The exchange could ultimately help plants conserve energy, Robert says. Making nectar to attract pollinators is expensive. Finding a way to time production to when pollinators are present could pay off. ■

When a bee approaches a buttercup, the flower can sense electrical changes triggered by the insect's flapping wings and alert nearby plants via its own electrical signals, new research suggests.

TXJULES/ISTOCK/GETTY IMAGES PLUS