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Discovering New Dimensions to Plant-Bacterial Interactions

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The interactions of plants and bacteria can affect plant health in many ways.

Disease-causing bacteria (pathogenic bacteria) can cause serious losses to farmers and homeowners. On the other hand, certain bacteria living inside plants can enhance plant growth, and other symbiotic bacteria can fix nitrogen and make it available to the plant at no cost. The more fully we understand how plants detect and respond to bacteria, the better our chances of specifically enhancing beneficial bacteria and minimizing the damage done by pathogenic bacteria.

OBJECTIVES

Our goals have been:

- To determine how individual bacterial cells communicate with each other.
- To learn what the plant does to disrupt or manipulate this communication.
- To determine whether plants can detect the signals that bacteria use to coordinate their infection of a host.

ACHIEVEMENTS

The Bauer lab was the first to discover that various crop plants, including soybean, tomato, pea, and rice, are able to affect bacterial behaviors by producing compounds that mimic the signal molecules that bacteria exchange among themselves. The production of these "signal-mimic" compounds gives plants a variety of tools they can use to manipulate the behavior of the bacteria they encounter. Analysis of signal-mimic compounds has led to the detection of a dozen mimic activities capable of affecting the behavior in a wide diversity of bacteria. A survey of other crop species has led to identification of several rich sources of these antibacterial compounds.

Since bacteria depend so much on the cell-to-cell exchange of signals to coordinate the infection of plant hosts, we looked to see if plant hosts might have the ability to detect the bacterial signals and use this information to respond in appropriate ways. In collaboration with scientists at the Australian National University, the Bauer lab was the first to show that a plant is able to detect bacterial signals and make very extensive and specific responses to those signals. These results indicate that plants have a broad range of functional responses to the bacterial signals and, if exploited, these responses may play important roles in the beneficial or pathogenic outcomes of plant-bacterial interactions.

THE FUTURE

With combined funding in the amount of $253,771 from the USDA National Research Initiative (NRI) Competitive Grants Program and the Ohio Plant Biotechnology Consortium (OPBC), we plan to determine the chemical structures of the antibacterial signal-mimic compounds from plants and precisely which behaviors in the bacteria they can affect. Once the structures and behaviors are determined and documented, we will look at practical applications for their use.

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