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Researchers Learn How a 'Crop-Killing' Bacterium Infects Plant Cells

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In a world with a growing population and a changing environment, food security is an important issue. Scientists have been working to learn more about how a destructive bacterium called Xanthomonas, which is known as a crop killer, infects plants. This devastating bacteria can infect at least 400 species of plants, including cotton, rice, beans, and citrus. It can cause black and brown spots to form, and ruins crops. If the bacteria becomes deeply embedded in the plant, the only way to get rid of it is to destroy the entire crop by burning it.

Image credit: Nestor Gil (https://d3bkbkx82g74b8.cloudfront.net/eyJidWNrZXQiOiJsYWJyb290cy1hc3NldHMiLCJrZXkiOiJfcHVibGljXC9fZmlsZXNcL3

Reporting in *Nature Communications* (https://www.nature.com/articles/s41467-021-24375-3), scientists have now learned more about how Xanthomonas bacteria infect plant cells, which can help researchers develop new ways to combat the pathogen. The bacteria are known to use a tool called a toxic effector protein to take over the normal processes in a plant cell, which stops the organism from mounting an immune response.

Normally, plant cells have a kind of cytoskeleton shield against invaders. But Xanthomonas can penetrate it. The bacteria produce a toxic protein, XopR, which can behave like liquid droplets that stick to the outside of plant cells. The plant cell membrane can also take on liquid-like characteristics as well, causing the toxic protein and plant cell membrane to merge. Thus, XopR proteins can infiltrate the cytoskeleton of the plant cell, giving it access to the host cell's mechanisms. Once that occurs, XopR works to overwrite cellular codes that would normally trigger an immune response. Instead, the plant stops fighting the pathogen, and it becomes vulnerable to further infection.

Now that scientists have outlined the process that gives Xanthomonas access to plant cells, they may be able to develop ways to prevent that infection, whether through preventing it chemically, or by creating new growth protocols that can stop the infection from taking root.

“Our research greatly advances our knowledge of previously unknown mechanisms by which bacterial effectors cause damage in [a] plant host cell. By understanding the exact mechanism of infection, our study sets the foundation for future research on how to prevent such infections through non-invasive means, such as changing plant growth conditions or using new nutrients," suggested Associate Professor Miao Yansong of the School of Biological Sciences at NTU. "This allows us to better treat infected plants and explore ways to grow resilient crops with greater immunity to the disease without using genetic engineering.”

Sources: Phys.org (https://phys.org/news/2021-08-infection-method-crop-killer-bacteria.html) via Nanyang Technological University (NTU) (https://www.ntu.edu.sg/news/detail/infection-method-behind-crop-killer-bacteria-revealed), Nature Communications (https://www.nature.com/articles/s41467-021-24375-3)

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