Corn spots: Study finds important genes in defense response

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The hypersensitive defense response in corn protects the plant by killing a few of its own cells in a rapid and localized response. NC State and USDA researchers have now identified the top candidate genes involved in this response. Credit: Dr. Peter Balint-Kurti, USDA and NC State

When corn plants come under attack from a pathogen, they sometimes respond by killing their own cells near the site of the attack, committing "cell suicide" to thwart further damage from the attacker. This cell sacrifice can cause very small, often microscopic, spots or lesions on the plant.

But up until now it's been difficult to understand how the plant regulates this "spotty" defense mechanism because the response is so quick and localized.

Researchers at North Carolina State University have identified a number of candidate genes and cellular processes that appear to control this so-called hypersensitive defense response (HR) in corn. The findings, which appear in *PLOS Genetics*, could help researchers build better defense responses in corn and other plants; HR is thought to occur in all higher-order plants, including all trees and crop plants, and is normally a tightly regulated response.

The 44 candidate genes appear to be involved in defense response, programmed cell death, cell wall modification and a few other responses linked to resisting attack, says Dr. Peter Balint-Kurti, the paper's corresponding author and a U.S. Department of Agriculture (USDA) professor who works in NC State's plant pathology and crop science departments.

To arrive at the finding, the NC State researchers joined researchers from Purdue University in examining more than 3,300 maize plants that contained a similar mutation: They all had exaggerated HR because one particular resistance gene, Rp1-D21, doesn't turn off.

"It's similar to a human having an auto-immune response that never stops," Balint-Kurti says. "This mutation causes a corn plant to inappropriately trigger this hypersensitive defense response, causing spots on the corn plant as well as stunted growth."

The researchers examined the entire corn gene blueprint – some 26.5 million points in the 2 to 3 billion base pair genome – to find the genes most closely associated with HR. Balint-Kurti said the top candidates made sense, as they mostly appear to be linked to defense or disease resistance.

"All of the processes associated with the top candidate genes have been previously associated with HR," Balint-Kurti said. "Hopefully this work

provides an opening to really characterize this important defense response and learn more about it in other plants."

More information: "Multivariate Analysis of Maize Disease Resistance Suggests a Pleiotropic Genetic Basis and Implicates a Glutathione S-transferase Gene" Published: Aug. 28, 2014, in *PLOS Genetics* DOI: 10.1371/journal.pgen.1004562

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