Late blight research pairs spectroscopy with classic plant pathology diagnostics

June 9 2020

Kaitlin (Katie) Gold is an assistant professor within the Plant Pathology and Plant-Microbe Biology section of the School of Integrative Plant Science at Cornell University. At her lab, the Grape Sensing, Pathology, and Extension Lab at Cornell AgriTech (GrapeSPEC), she studies the fundamental and applied science of plant disease sensing. The GrapeSPEC Lab uses proximal and remote spectroscopy, data science, and fundamental plant pathology to improve the three pillars of integrated grape disease management: understanding pathogen biology, host susceptibility, and fungicide efficacy.

Though she now focuses on grapes, Gold and colleagues at the University of Wisconsin-Madison recently published research showing how they used contact spectroscopy to non-destructively sense how plant pathogens differentially damage, impair, and alter plant traits during the course of infection. This research centered on late blight of potato and tomato. The hyperspectral sensors Gold and colleagues used measure light reflectance in the visible to shortwave infrared range of the electromagnetic spectrum- 7x more wavelengths than the human eye can see.

"We previously found that this technology could be used to pre-symptomatically detect late blight infection in potato," Gold explained. Late blight pathotypes are defined as clonal lineages and asexual descendants of a single genotype. In their latest research, they paired machine learning-based hyperspectral analysis with a molecular assay (qrt-PCR) to better understand what pathogen processes might be the root cause of their ability to discriminate between clonal lineages.

They found that they could use hyperspectral sensors to accurately differentiate between these two late blight clonal lineages.

"Surprisingly, we find that our ability to differentiate between them was more accurate at the earliest stages of infection: before symptoms appeared rather than after," said Gold. "Using qrt-PCR, we found modest evidence to support that this ability may be linked to differences in pre-symptomatic effector expression between the two lineages. This is the first time hyperspectral sensors have been used to distinguish between pathotypes and is an important step forward for the discipline of plant disease sensing."

This proof of concept work sets a roadmap for the future use of hyperspectral sensors as automated, non-destructive, and scalable tools to identify pathotype in real time, in both late blight and other pathosystems.

"Spectroscopy is one of the only diagnostic technologies that is both scalable and has a passive monitoring capacity. Current methods to determine late blight clonal lineage require active, destructive sampling. Despite being at the earliest stages of development, this work opens a door to a world where hyperspectral sensors could one day be used to passively detect different pathotypes in the field at scale."

Asked for her thoughts about this research, Gold said, "This work was my favorite dissertation chapter and was truly a joy to do. I loved that we were able to pair this 'space age-esque' technology with a classic plant pathology diagnostic method."

More information: Kaitlin M. Gold et al, Contact Reflectance Spectroscopy for Rapid, Accurate, and Nondestructive Phytophthora infestans Clonal Lineage Discrimination, *Phytopathology* (2019). DOI: 10.1094/PHYTO-08-19-0294-R

Provided by American Phytopathological Society