Receptor networks underpin plant immunity

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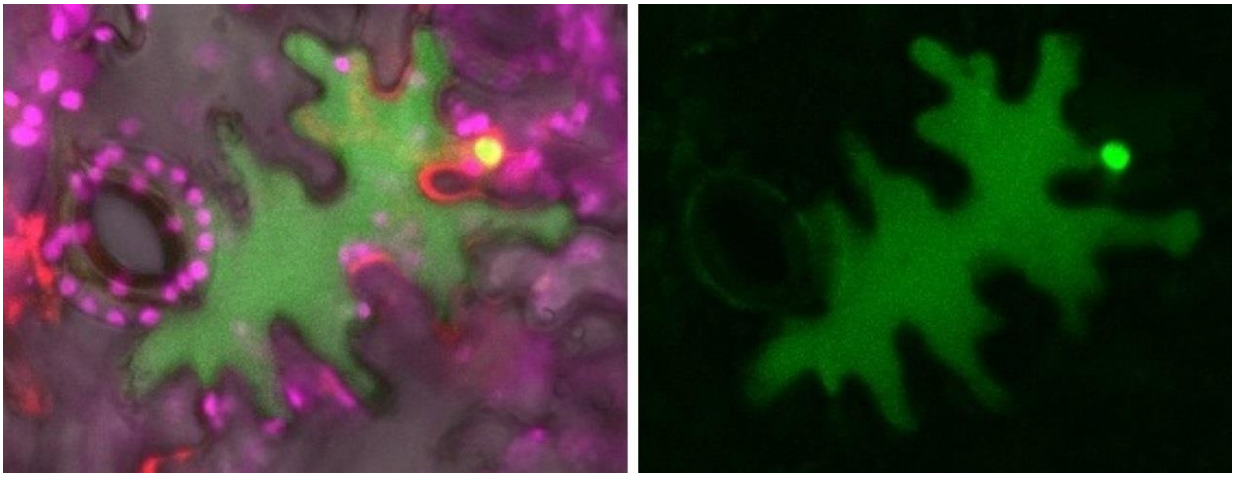

Credit: John Innes Centre

Fresh insights into plant immunity amount to a new field of discovery that could advance the next generation of disease-resistant crops.

The prospect is outlined by researchers at The Sainsbury Laboratory (TSL) in an article that challenges an enduring and highly-influential model established in the mid-20th century.

American plant pathologist Harold Henry Flor proposed the "gene-for-gene" hypothesis that explains how particular varieties of plants can resist certain races of plant parasites.

Now, more than 75 years later, scientists from TSL in Norwich, UK, describe how Flor's model is superseded by a more complex view of pant immunity.

In a Perspective article published in the journal *Science*, the team reviewed recent scientific literature to conclude that the plant molecules that act as sensors of invading parasites typically work together to form networks. These networks are more complex than the interaction matrix proposed by Flor.

"We knew little about how plant immune sensors work. Recent work shows that these plant sensors interact with each other to bring about a more robust and effective immune response." says Chih-hang Wu, the first author of the article.

Youssef Belkhadir, a plant biologist at the Gregor Mendel Institute in Vienna, Austria, who wasn't associated with the article but has published some of the most influential papers on the topic, says: "the network feature of immune receptors enables the plant to integrate multiple stimuli from the environment and deliver an optimal response. It's the plant version of the fight or flee response."

Indeed, given that plants are typically rooted to the ground and can't run away from attack, they have developed an intricate network of molecules that is very effective at detecting and fending off attacking parasites.

The network feature of this immune system also benefits plant evolution. It helps plants evolve faster to keep up with the fickle parasites that are ever changing to evade the plant's immune system. This has implications for breeding crops that are resilient to parasite attack.

Lida Derevnina, an author of the study, added "an improved understanding of plant immune systems could enable optimal use and

deployment of disease resistance in agriculture. We lose much of our crops to pathogens. The fundamental knowledge we have acquired can directly guide new strategies of plant breeding."

The authors conclude that a new field, studying plant immune receptor networks, is emerging.

Sophien Kamoun, the senior author of the paper, says "Harold Flor's model has been hugely insightful and effective in guiding both applied and basic research. But moving forward, we need to capture the full complexity of plant immune systems to advance knowledge and deliver the next generation of disease resistant crops."

More information: Chih-Hang Wu et al. Receptor networks underpin plant immunity, *Science* (2018). DOI: 10.1126/science.aat2623

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