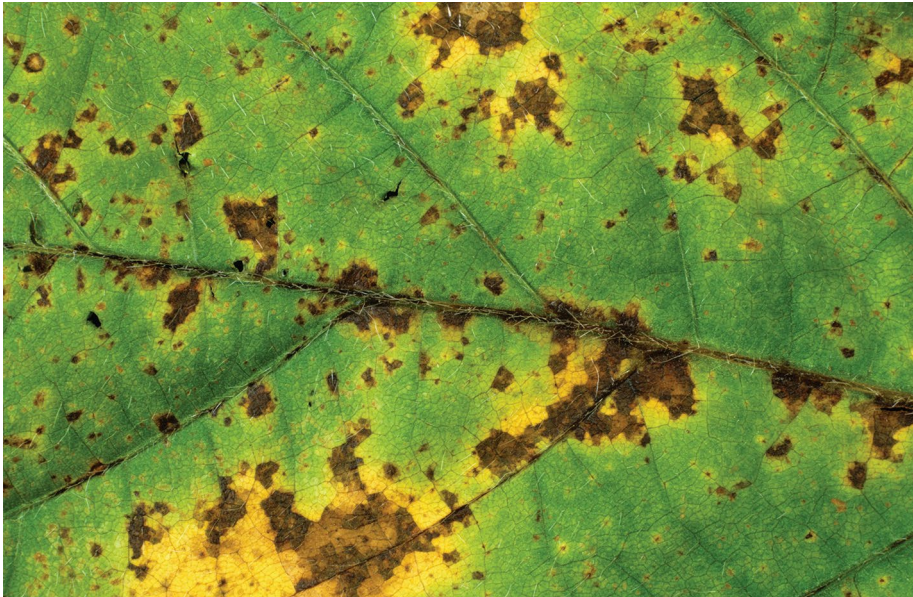


PLANT IMMUNITY

Kinases everywhere

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Credit: Nigel Cattlin / Alamy Stock Photo

Plants fight unwanted invaders. One of the conserved defensive strategies in their arsenal is the fast and massive production of extracellular reactive oxygen species (ROS), often used as a robust stress readout. This ‘ROS burst’ has antimicrobial effects and is also a secondary systemic signal. In *Arabidopsis* immunity, ROS are mainly produced by the NADPH oxidase, and integral membrane protein, RESPIRATORY BURST OXIDASE HOMOLOGUE D (RBOHD). This oxidase is part of an early signalling complex associated with the plasma membrane. After perception of a pathogen signal by membrane pattern recognition receptors, several pathways are initiated. In one of them, the BIK1 kinase phosphorylates and activates RBOHD, which produces superoxide ions.

Gitta Coaker and colleagues recently added a novel layer of complexity to this mechanism. They screened mutants for ten members of the hard-to-pronounce mitogen-activated protein kinase kinase kinase (MAP4K) family, finally focussing on SIK1 because its null mutant

has a lower ROS burst. After autoimmunity symptoms are eliminated, the mutant is less responsive to diverse microbial features, including flagellin, during the immune response. The authors demonstrate that SIK1 interacts with, phosphorylates and stabilizes BIK1. Not content with stabilizing BIK1, a major activator of RBOHD, SIK1 also directly phosphorylates RBOHD itself. So this kinase has a dual role to promote immunity through ROS production.

Critical immune responses are constrained by a multitude of converging post-translational regulatory pathways, as unbalanced or untimely signalling would be detrimental for the plant. In this case, both ROS-producer RBOHD and its upstream regulator BIK1 are controlled by multiple mechanisms, including kinases and phosphatases. SIK1 will probably not be the last on this list.

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