Arabidopsis MAP Kinase Phosphatase 1 (AtMKP1) negatively regulates MPK6-mediated PAMP responses and resistance against bacteria

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A primary component of plant defense is the detection of pathogen-associated molecular patterns (PAMPs) by plasma membrane-localized pathogen recognition receptors. PAMP perception results in rapid and transient activation of phosphorylation-dependent signaling pathways that lead to a wide array of defense-related responses, including extensive changes in gene expression. In Arabidopsis, several kinases, including the mitogen-activated protein kinases (MAPKs) MPK6 and MPK3, are rapidly activated after PAMP treatment, and are thought to positively regulate a wide array of defense-related responses. In contrast, negative regulation of PAMP responses by downstream phosphatases remains poorly understood. Here we report the identification of Arabidopsis MAP Kinase Phosphatase 1 (MKP1) as a negative regulator of diverse PAMP responses, including activation of MPK6 and MPK3, transient production of extracellular reactive oxygen species, accumulation of a subset of PAMP-regulated transcripts, and inhibition of seedling growth. In agreement with the enhanced PAMP response phenotypes observed in the mkp1 mutant, we found that mkp1 seedlings and adult plants are more resistant to the virulent bacterial pathogen Pseudomonas syringae pv. tomato (Pto) DC3000. Further genetic analysis revealed that MPK6, but not MPK3, is required for the mkp1-dependent increase in resistance to Pto and enhanced PAMP-induced growth inhibition observed in mkp1 seedlings. Together, our data support a role for MKP1 as a negative regulator of MPK6-mediated PAMP responses.

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