How jasmonate signaling is enhanced under phosphorous-deficient conditions in plant physiology

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Arabidopsis thaliana. Credit: Wikimedia Commons, CC BY-SA

Phosphorus (P) is a macronutrient essential for various biological processes in plants. Inorganic phosphate (Pi) deficiency modulates the signaling pathway of the phytohormone jasmonate (a fatty acid compound ubiquitous in the plant kingdom and crucial for various physiological processes) in Arabidopsis thaliana, but the underlying molecular mechanism currently remains elusive.

In a study published in *The Plant Cell*, researchers from the Xishuangbanna Tropical Botanical Garden (XTBG) of the Chinese Academy of Sciences used molecular and genetic approaches to reveal the biological functions of PHOSPHATE STARVATION RESPONSE1 (PHR1) in the jasmonate signaling pathway and to clarify how inorganic phosphate (Pi) deficiency cooperates with endogenous jasmonate signaling to mediate physiological processes in plants.

They confirmed that Pi deficiency activates jasmonate-related responses in Arabidopsis, including anthocyanin accumulation, decreased primary root growth, and increased expression of jasmonate-responsive genes. They also observed that the coronatine insensitive1 (coi1)-mediated pathway is critical for Pi deficiency-stimulated jasmonate signaling.

They then found that the jasmonate zim-domain (JAZ) repressors physically interact with PHR1, PHL2, and PHL3. Disruption of PHR1, PHL2, and PHL3 attenuates jasmonate-induced anthocyanin accumulation and root growth inhibition. PHR1 and its close PHR1-LIKE (PHL) homologs positively affect jasmonate synthesis under Pi-deficient conditions in the absence of methyl jasmonate (MeJA), whereas they exert little effect on jasmonate accumulation in response to MeJA exposure.

In addition, PHR1 directly stimulates the expression of several jasmonate-responsive genes, whereas JAZ proteins interfere with the transcriptional function of PHR1. The MYC transcription factors

physically associate with PHR1 and promote Pi deficiency-induced jasmonate signaling. PHR1 functions synergistically with MYC2 in jasmonate signaling, whereas JAZ1 inhibits their transcriptional functions and physical interaction.

The results suggest that PHR1, the core transcription factor of Pi signaling, positively regulates jasmonate-mediated anthocyanin accumulation and root growth inhibition.

"Our study provides a mechanistic understanding of how jasmonate signaling is enhanced under Pi-deficient conditions," said Hu Yanru of XTBG.

More information: Kunrong He et al, PHOSPHATE STARVATION RESPONSE1 (PHR1) interacts with JASMONATE ZIM-DOMAIN (JAZ) and MYC2 to modulate phosphate deficiency-induced jasmonate signaling in Arabidopsis, *The Plant Cell* (2023). DOI: 10.1093/plcell/koad057

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