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RACK1 Integrates Light and Brassinosteroid Signaling to Coordinate Cell Division During Root Soil Penetration

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Abstract : Light and brassinosteroids are essential external and internal cues for plant survival. Although the coordination of light with phytohormone signals is crucial for plant growth and development, the molecular connection between light and brassinosteroid signaling during root soil penetration remains elusive. Here, we reveal that light-stabilized RACK1 couples a brassinosteroid signaling cascade to drive cell division in root meristems. RACK1 family scaffold proteins positively regulate light-induced the promotion of root elongation during soil penetration. Under the light condition, RACK1A interacts with both phyB and SPA1, then reinforces the phyB-SPA1 association to accumulate its abundance in roots. In response to brassinosteroid signals, RACK1A competes with BKI1 to attenuate the BRI1-BKI1 interaction, thereby leading to activating BRI1 actions in root development. Furthermore, RACK1A binds to BES1 to repress its DNA binding activity toward the target gene CYCD3;1. This ultimately allows to release the inhibition of CYCD3;1 transcription, and promotes cell division during root growth. Our study illustrates a new mechanistic model of how plants engage scaffold proteins in transducing light information to facilitate brassinosteroid signaling for root growth in the soil.

Keywords : root growth, cell division, light signaling, brassinosteroid signaling, soil penetration, scaffold protein, RACK1
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