CONCERTED PLANT GROWTH AND DEFENSE THROUGH TARGETED PHYTOHORMONE CROSSTALK MODIFICATION

Grace A. Johnston[1], Hannah M. Berry[1,2], Mikiko Kojima[3], Hitoshi Sakakibara[4] and Cristiana T. Argueso[1,2]*

1. Department of Agricultural Biology, Colorado State University, Fort Collins, CO 80523, USA

2. Graduate Program for Cell and Molecular Biology, Colorado State University, Fort Collins, CO 80523, USA

3. RIKEN Center for Sustainable Resource Science, Suehiro, Tsurumi, Yokohama 230-0045, Japan

4. Graduate School of Bioagricultural Sciences, Nagoya University, Chikusa, Nagoya, 464-8601 Japan

*Author for correspondence: Cristiana T. Argueso -Department of Agricultural Biology, Colorado State University, Fort Collins, CO 80523, USA - +1-970-227-3553 - cris.argueso@colostate.edu

Preprint server: This manuscript has been deposited at bioRxiv, MS ID#: BIORXIV/2024/588615

Classification: Biological Sciences, Plant Biology

KEYWORDS

Cytokinin, salicylic acid, jasmonic acid, phytohormone crosstalk, growth-defense tradeoff

ABSTRACT

Plants constantly integrate environmental signals with developmental programs to optimize their growth and fitness. Integration of these myriad signals is done at the level of phytohormones and the extensive crosstalk amongst different phytohormonal signaling pathways, which then regulate cell physiology to adapt growth to prevailing conditions. Excessive activation of the plant immune system often leads to decreased plant growth, a process known as the growth-defense tradeoff. Recent research has shown that the growth-defense tradeoff can be uncoupled, through the genetic manipulation of regulators with function in a variety of physiological and signaling responses. However, identification of such regulators can be laborious and time-consuming. Here, we demonstrate that engineering of specific nodes of hormonal crosstalk can produce increased plant growth and broad-spectrum pathogen resistance, bypassing the laborious and time-consuming identification of regulatory genes. We show that engineering the negative crosstalk of the defense phytohormone salicylic acid SA on cytokinin signaling in autoimmunity mutants results in plants resistant to pathogens from diverse lifestyles, and relieves suppression of reproductive growth. Moreover, engineering of the crosstalk results in a novel inflorescence phenotype through altered shoot apical meristem activity, associated with regulation of nitrogen response and cellular redox status. Our data suggest that targeted phytohormone crosstalk engineering can be used to achieve specific traits in plants.