International Research Journal of Plant Science (ISSN: 2141-5447)
Vol. 14(6) pp. 01-2, December, 2023
DOI: http:/dx.doi.org/10.14303/irjps.2023.52
Available online @ https://www.interesjournals.org/plant-science.html

Perspective

Jasmonic acid: Mastering the symphony of plant defense and development

Sanjida Mostofa*

Department of Energy Plant Research Laboratory, Michigan State University, USA

Email: mostofas@msu.edu

INTRODUCTION

In the intricate tapestry of plant signaling, jasmonic acid (JA) emerges as a pivotal orchestrator, influencing a myriad of processes crucial for both defense against environmental threats and the regulation of developmental pathways. This article delves into the multifaceted roles of jasmonic acid, exploring its significance as a modulator of plant defense mechanisms and developmental processes (Ruan et al., 2019).

Jasmonic acid is a lipid-derived phytohormone synthesized from linolenic acid, a component of membrane lipids. It is produced in response to various environmental cues, including herbivore attacks, pathogen infections, and mechanical damage. The synthesis of JA involves a series of enzymatic reactions, ultimately leading to the production of bioactive JA (Vick et al., 1984).

Upon activation, JA signals through a complex signaling cascade. The perception of JA is mediated by receptors, leading to the activation of downstream components, including the transcription factor MYC2. This transcription factor, in turn, regulates the expression of genes involved in various JA-mediated responses (Stintzi et al., 2001).

One of the primary roles of jasmonic acid is to orchestrate defense responses against herbivores. When plants sense herbivore damage, JA levels increase, triggering a cascade of events. JA induces the production of specialized metabolites, such as terpenoids and alkaloids, known to deter herbivores. Additionally, JA promotes the expression of genes encoding defensive proteins, including protease inhibitors and proteinase inhibitors, which interfere with herbivore digestion (Wasternack et al., 2006).

Jasmonic acid is also a key player in plant defense against pathogens, especially necrotrophic pathogens that thrive on dead plant tissue. Upon pathogen attack, JA levels rise, activating defense mechanisms that include the production of antimicrobial secondary metabolites and the induction of pathogenesis-related proteins. JA-mediated defenses often work in conjunction with salicylic acid-mediated defenses, providing a layered and robust immune response against a broad spectrum of pathogens (Wang et al 2020).

Beyond biotic stress, JA is implicated in responses to various abiotic stresses, such as drought and salinity. JA signaling pathways intersect with those involved in stress responses, contributing to the plant's ability to withstand adverse environmental conditions. This highlights the versatility of JA as a modulator of plant responses to a range of stressors (León et al., 1999).

Jasmonic acid is not solely confined to the realm of defense; it also plays a crucial role in regulating plant development. The hormone is involved in processes such as seed germination, root growth, and reproductive development. JA influences seed germination by promoting dormancy in certain conditions and inhibiting it in others. In roots, JA modulates growth and architecture, affecting lateral root formation and elongation. Additionally, JA regulates flower development and fertility, contributing to the reproductive success of plants (Mueller et al.,1997).

The intricate regulatory network of plant hormones involves extensive cross-talk, ensuring a finely tuned response to diverse environmental cues. Jasmonic acid interacts with other hormones, particularly salicylic acid and ethylene, forming a complex network of signaling pathways. The delicate balance and integration of these pathways enable

Received: 01-Dec-2023, Manuscript No. IRJPS-23-122648; **Editor assigned:** 02-Dec-2023, PreQC No. IRJPS-23-122648 (PQ); **Reviewed:** 16-Dec-2023, QCNo. IRJPS-23-122648; **Revised:** 22-Dec-2023, Manuscript No. IRJPS-23-122648 (R); **Published:** 29-Dec-2023

Citation: Sanjida Mostofa (2023). Jasmonic acid: Mastering the symphony of plant defense and development. IRJPS. 14:52.

plants to tailor their responses based on the nature of the stress encountered (Wang et al.,2021).

Understanding the roles of jasmonic acid in plant defense and development opens avenues for applications in agriculture and biotechnology. By manipulating JA signaling pathways, researchers aim to enhance plant resistance to pests and pathogens, ultimately contributing to sustainable agriculture with reduced reliance on chemical pesticides. Moreover, harnessing the regulatory role of JA in plant development holds promise for optimizing crop traits, such as root architecture and stress tolerance (Seo et al., 2001).

Jasmonic acid stands as a versatile and central player in the complex interplay between plants and their environment. Its dual roles in defense against herbivores and pathogens, as well as its involvement in developmental processes, underscore the hormone's significance in ensuring the survival and success of plants (Ali et al., 2020).

CONCLUSION

As we continue to unravel the intricacies of JA signaling, there is tremendous potential for leveraging this knowledge to develop resilient crops, fostering sustainable agriculture in the face of environmental challenges. JA not only modulates the symphony of plant defense and development but also offers a promising melody for the future of agricultural innovation.

REFERENCES

Ruan J, Zhou Y, Zhou M, Yan J, Khurshid M, et al (2019) . Jasmonic acid signaling pathway in plants. Int J.Mol Sci. 20(10):2479.

Vick BA, Zimmerman DC. (1984).Biosynthesis of jasmonic acid by several plant species. Plant physiol. 75(2):458-61.

Stintzi A, Weber H, Reymond P, Browse J, Farmer EE. (2001). Plant defense in the absence of jasmonic acid: the role of cyclopentenones. Proc Natl Acad Sci. 98(22):12837-42.

Wasternack C, Stenzel I, Hause B, Hause G, Kutter C, et al., (2006). The wound response in tomato–role of jasmonic acid. J Plant Physiol. 163(3):297-306.

Wang J, Song L, Gong X, Xu J, Li M. (2020). Functions of jasmonic acid in plant regulation and response to abiotic stress. Int J Mol Sci. 21(4):1446.

León J, Sánchez-Serrano JJ. (1999).Molecular biology of jasmonic acid biosynthesis in plants. Plant Physiol Biochem. 37(5):373-80.

Mueller MJ. Enzymes involved in jasmonic acid biosynthesis. (1997). Physiol Plant. 100(3):653-63.

Wang Y, Mostafa S, Zeng W, Jin B. (2021). Function and mechanism of jasmonic acid in plant responses to abiotic and biotic stresses. Int J Mol Sci. 22(16):8568.

Seo HS, Song JT, Cheong JJ, Lee YH, Lee YW, et al., (2001). Jasmonic acid carboxyl methyltransferase: a key enzyme for jasmonate-regulated plant responses. Proc Natl Acad Sci. 98(8):4788-93.

Ali MS, Baek KH. (2020). Jasmonic acid signaling pathway in response to abiotic stresses in plants. Int J Mol Sci. 21(2):621.

Citation: Sanjida Mostofa (2023). Jasmonic acid: Mastering the symphony of plant defense and development. IRJPS. 14:52.