COMMENT

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Towards improving drought resistance and lodging resistance in cotton



LI Fuguang

Abstract

Cotton is one of the most important fiber and oil crop in the world and the fiber yield as well as quality traits are negatively affected by drought and lodging. Improving root gravitropism is a very effective way to enhance the crop resistance to drought and lodging stresses. Recent advance in origin and formation of root gravitropism may provide new insights to increase drought and lodging resistance in cotton.

Keywords: Cotton, PIN, Drought resistance, Lodging resistance, Root gravitropism

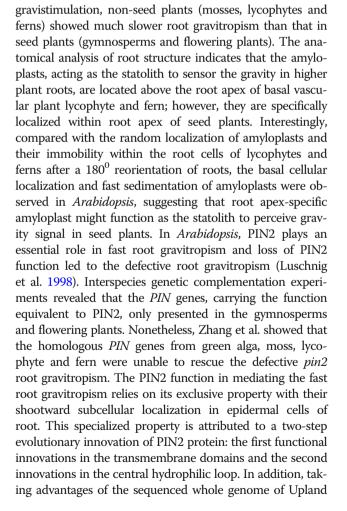
Cotton (Gossypium spp.), one of the most important oil and industrial crops in the world, contributes about ten billion dollars to the global economy per year and provides several million jobs in the industry and on the farm. Besides its economic value, cotton is also an excellent system for studies of cell elongation, polyploidization and cell wall biosynthesis. However, fiber yield and quality are greatly constrained by various abiotic and biotic stresses. Among these abiotic stresses, drought and lodging are the major factors causing extensive and massive yield reduction near the crop harvest stage worldwide (Shah et al. 2019). Therefore, improving drought and lodging resistance in cotton cultivars is one of the most important projects during cotton breeding. Increasing gravitropism to make root deep into soil to seek water is considered as an effective way. Recently, one important finding about the origin of gravitropism was published in the journal Nature Communications (Zhang et al. 2019), which greatly broads our view in plant gravitropism and provides clues to enhance drought and lodging resistance in cotton.

The published paper, entitled "evolution of fast root gravitropism in seed plants", was led by Institute of Science and Technology, Austria, and Shaanxi Normal University, China and Northwest University, China (Zhang et al. 2019). In this study, multiple plant species representing the lineages of mosses, lycophytes, ferns, gymnosperms and flowering plants (*Arabidopsis* and cotton) were enlisted to examine the speeds of their root gravitropic response. After

Correspondence: lifuguang@caas.cn

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Institute of Cotton Research of Chinese Academy of Agricultural Sciences, Anyang 45500, China



© The Author(s). 2019 **Open Access** This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated. cotton, 17 GhPIN genes were identified and the biological roles of GhPIN genes were widely characterized (Zeng et al. 2019; Xu et al. 2019; Zhang et al. 2017). Among the 17 GhPIN genes, GhPIN1-3 and GhPIN2 are involved in cotton root development (He et al. 2017). In addition, the expression levels of many GhPIN transcripts are induced by salt and drought stresses (He et al. 2017), indicating that GhPIN genes may be involved in abiotic stress response in cotton. Together, these studies systematically characterize the evolution and biological functions of PIN genes in Arabidopsis and cotton. Potentially, PIN genes can be used to improve the drought and lodging resistance in cotton by molecular selection breeding and gene editing (for example CRISPR / Cas9 system, i.e., clustered regularly interspaced short palindromic repeats / CRISPR-associated proteins) technology in the future.

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Authors' contributions

Li FG prepared and wrote the manuscript. The author read and approved the final manuscript.

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No other data related to this study is available at this time.

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Not applicable.

Consent for publication

Not applicable.

Competing interests

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