Transcriptome analysis reveals the regulatory mechanism by which MdWOX11 suppresses shoot formation in apples

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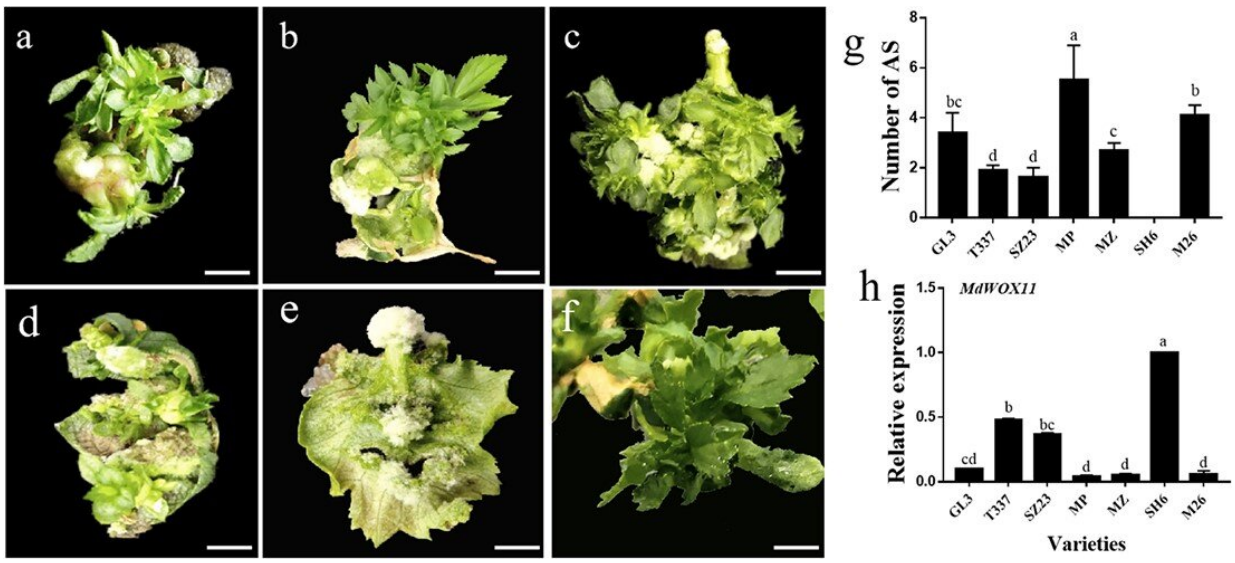
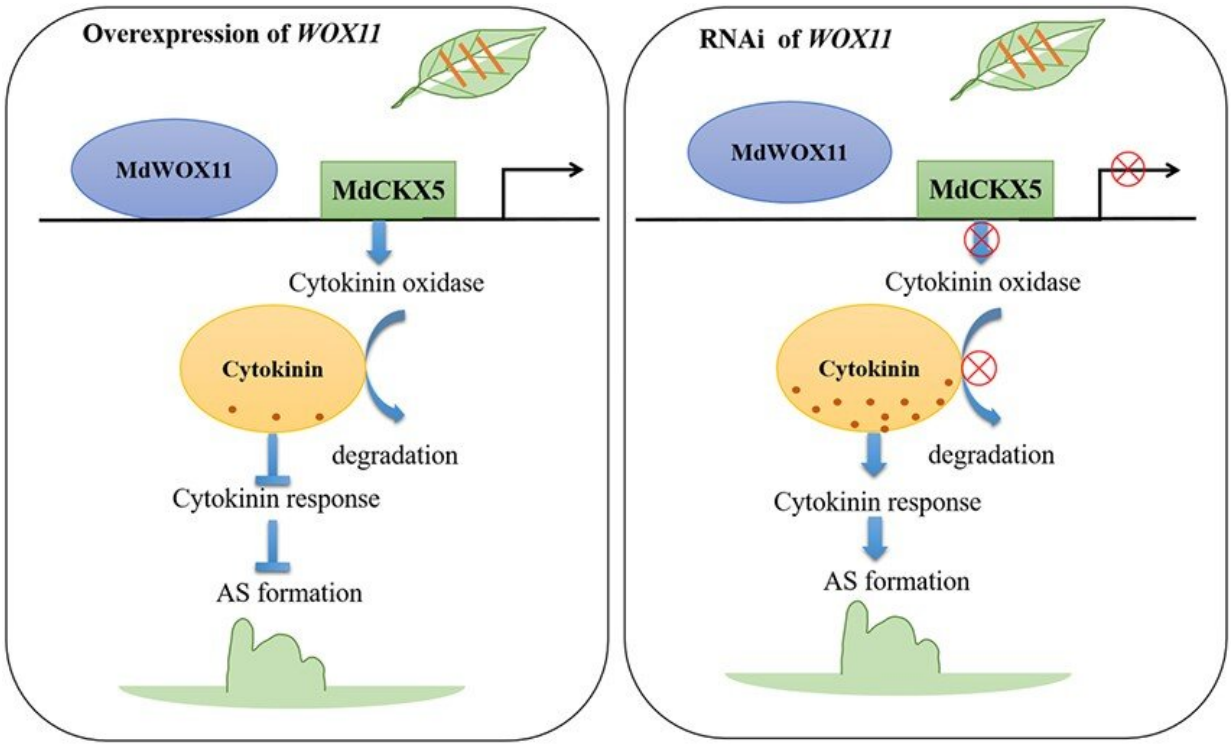


Morphological observations of the regeneration of adventitious shoots (AS) in six apple rootstocks. Credit: Nanjing Agricultural University The Academy of Science

Recently, a team led by Professor Dong Zhang from the College of Horticulture, Northwest A&F University, published a research article entitled "Transcriptome analysis reveals the regulatory mechanism by which MdWOX11 suppresses adventitious shoot formation in apple" in *Horticulture Research*.

The authors showed that the genotype of apple leaves was a key factor affecting their capacity for AS formation, and an appropriate CK/IAA ratio could promote AS formation. In addition, they found that the expression level of MdWOX11 was negatively correlated with AS formation ability. The authors then analyzed the phenotypes of MdWOX11 transgenic plants to demonstrate that overexpression of MdWOX11 suppressed AS formation. Analysis of endogenous hormones showed that the trends in hormone content differed between the MdWOX11-RNAi and MdWOX11-OE transgenic lines at three stages of AS development.

The authors next performed RNA-seq analysis of GL-3 and MdWOX11 transgenic lines at three stages of AS development and identified 8066 differentially expressed genes (DEGs). Cluster analysis of the expression profiles of hormone-related and shoot development-related genes in MdWOX11 transgenic plants during AS formation showed that expression of genes related to CK signaling pathway and shoot development was higher in GL-3 than in MdWOX11-OE transgenic plants during the callus and AS emergence stages. However, expression of the cytokinin oxidase gene MdCKX5 was higher in MdWOX11-OE transgenic plants than in GL-3 and MdWOX11-RNAi transgenic plants.



A hypothetical model of MdWOX11 regulating the transcription of MdCKX5 to mediate AS formation in MdWOX11 transgenic apple. Credit: Nanjing Agricultural University The Academy of Science

To identify genes that act downstream of MdWOX11, the authors performed a yeast one-hybrid (Y1H) assay, dual-luciferase assays, and ChIP-qPCR. The results verified the binding of MdWOX11 to the MdCKX5 promoter and indicated that MdWOX11 enhanced the promoter activity of MdCKX5. Therefore, the authors proposed a working model by which MdWOX11 regulates MdCKX5 transcription to mediate AS formation in apple. Specifically, MdWOX11 binds to the promoter of MdCKX5 and induces its expression; MdCKX5 then promotes CK degradation, and low expression of CK response-related genes inhibits AS formation.

In conclusion, "this study sheds light on the mechanism by which MdWOX11 regulates AS formation and provides insight into the overall regulation of AS formation in apple rootstocks," the authors state.

More information: Jiangping Mao et al, Transcriptome analysis reveals the regulatory mechanism by which MdWOX11 suppresses adventitious shoot formation in apple, *Horticulture Research* (2022). DOI: 10.1093/hr/uhac080

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