Mutations in wheat TaAPA2 gene result in pleiotropic effects on plant architecture

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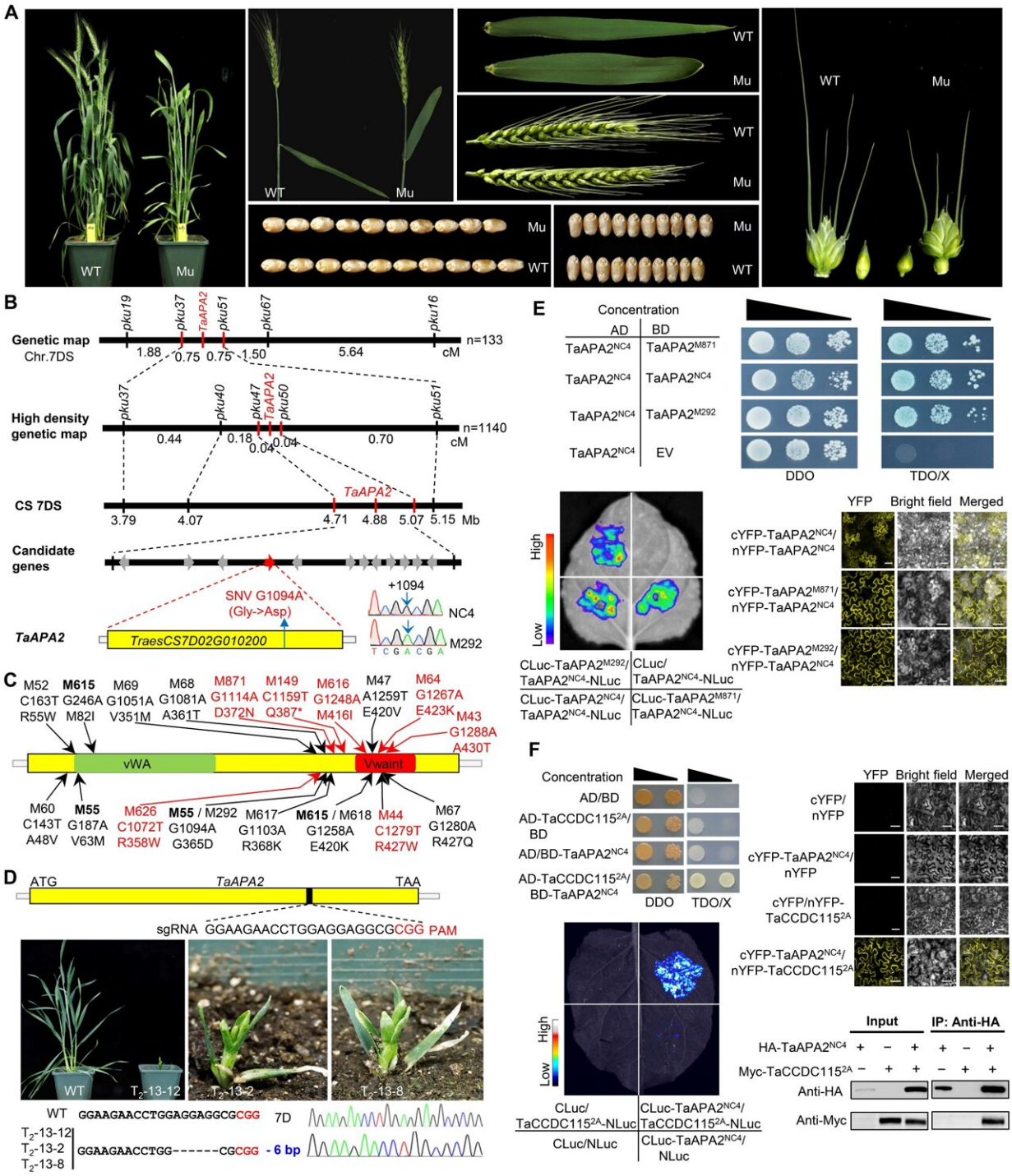

Cloning and functional characterization of *TaAPA2*. Credit: Science China Press

This study is reported by Shisheng Chen's group at the National Key Laboratory of Wheat Improvement, Peking University Institute of Advanced Agricultural Sciences. Plant architecture has significant impact on plant development and productivity, and thus has been extensively investigated in various plant species. However, studies on the genes and molecular mechanisms regulating plant architecture in wheat remain limited.

The recent assembly of reference genome sequences and generation of mutant populations have provided researchers with the necessary resources to identify genes involved in regulating plant architecture in wheat. Shengsheng Bai, Guiping Wang, and their colleagues in Chen's group aimed to identify a gene responsible for regulating wheat architecture. The study is published in the journal *Science China Life Sciences*.

The team used map-based cloning to identify the TaAPA2 gene, revealing that it encodes a novel protein with vWA and Vwaint domains. They then demonstrated its crucial role in regulating diverse architectural traits of wheat using three approaches: 20 independent EMS mutants, CRISPR/Cas9-mediated gene editing, and stable transgenic complementation.

The authors provided evidence that the semidominant EMS mutations in TaAPA2 likely act through dominant-negative effects and validated interactions between wild-type $TaAPA2^{NC4}$ and the mutant proteins, as well as self-interactions of $TaAPA2^{NC4}$. Additionally, the team found that TaAPA2 interacted with TaCCDC115, a protein involved in vacuolar-type H+-ATPase (V-ATPase) assembly.

Knockout mutants of TaCCDC115 in the common wheat variety Fielder displayed significant growth retardation. An interaction between TaCCDC115 and a V-ATPase subunit, TaVHA-c, was observed to

interfere with the binding between TaAPA2 and TaCCDC115 in Nicotiana benthamiana leaves.

"Having cloned TaAPA2, we are now ready to delve deeper into its molecular mechanisms. TaAPA2 presents a significant potential for enhancing our understanding of vWA domain-containing proteins and their roles in shaping plant architecture in wheat," says Chen.

More information: Shengsheng Bai et al, Mutations in wheat TaAPA2 gene result in pleiotropic effects on plant architecture, *Science China Life Sciences* (2024). DOI: 10.1007/s11427-024-2620-7

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