Study sheds light on mechanism of OsIRO3 modulating Fe homeostasis in rice

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Iron (Fe) is one of the indispensable micronutrients for plant growth and development. Plants have evolved intricate mechanisms to maintain Fe homeostasis.

Oryza sativa Iron-Related Bhlh Transcription Factor 3 (OsIRO3/OsbHLH63) has been identified as a negative regulator of Fe deficiency response signaling, however, the underlying mechanism remains unclear.

In a study published in *Plant Journal*, researchers from Xishuangbanna Tropical Botanical Garden (XTBG) of the Chinese Academy of Sciences showed that the loss-of-function of OsIRO3 caused the up-regulation of many Fe deficiency inducible genes in the root.

They generated two iro3 loss-of-function mutants with the CRISPR-Cas9 gene editing system and found that loss-of-function of OsIRO3 leads to the disruption of Fe homeostasis.

Furthermore, the expression of Iron-Related Bhlh Transcription Factor 2 (OsIRO2) and Oryza sativa FER-Like FE Deficiency-Induced Transcription Factor (OsFIT) and their downstream genes were considerably enhanced in the iro3 root both under Fe sufficient and Fe deficient conditions. Therefore, the expression of Fe deficiency inducible genes is disrupted in the iro3 mutants.

They further found that OsIRO3 directly recognizes the OsIRO2 promoter, and represses the transcription of OsIRO2. In addition to the direct repression, OsIRO3 also indirectly represses the transcription of OsIRO2 since OsIRO3 interacts with Oryza sativa Positive Regulator Of Iron Homeostasis (OsPRI) proteins, OsPRI1/2, to attenuate their transactivation activity towards OsIRO2. OsIRO3 contains an EAR motif recruiting the OsTPL/OsTPRs corepressors, which partially accounts for its repression function.

"This study expands our knowledge of the Fe homeostasis transcription network mediated by the OsIRO3-OsIRO2 module. Based on previous knowledge and our new findings, we propose a putative mechanism in

which OsIRO2 is regulated antagonistically," said Liang Gang of XTBG.

More information: Chenyang Li et al, OsIRO3 negatively regulates Fe homeostasis by repressing the expression of OsIRO2, *The Plant Journal* (2022). DOI: 10.1111/tpj.15864

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