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Crystal structure of tetrameric Arabidopsis MYC2-DNA complex

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Jasmonates (JAs) are essential plant hormones that play important roles in the regulation of plant growth and adjustment against environmental stresses. In the JA signaling pathway, the core transcription factors are a class of basic helix-loop-helix (bHLH) proteins, so-called MYC proteins, including MYC2, MYC3 and MYC4, with different regulatory capacities. Here we report the 2.7 Å crystal structure of the MYC2 bHLH domain complexed with G-box DNA, showing a previously unseen cis-tetrameric structure. Biochemical assays confirmed that full-length MYC2 forms a stable homo-tetramer both in solution and in DNA-bound states, whereas MYC3 only forms homodimer. ITC (Isothermal titration calorimetry) assays demonstrated that the tetramerization led to much enhanced DNA binding affinity, and FRET (Fluorescence Resonance Energy Transfer) assay indicated DNA looping potential of tetrameric MYC2. Luciferase assay further confirmed the importance of tetramerization in transcriptional regulation. Our studies provide mechanistic explanations on the regulatory differences of MYC transcription factors.

Keywords: basic helix-loop-helix, tetramerization, transcription regulation