

MeETC1 positively regulates the cold tolerance of cassava plants by increasing anthocyanin biosynthesis

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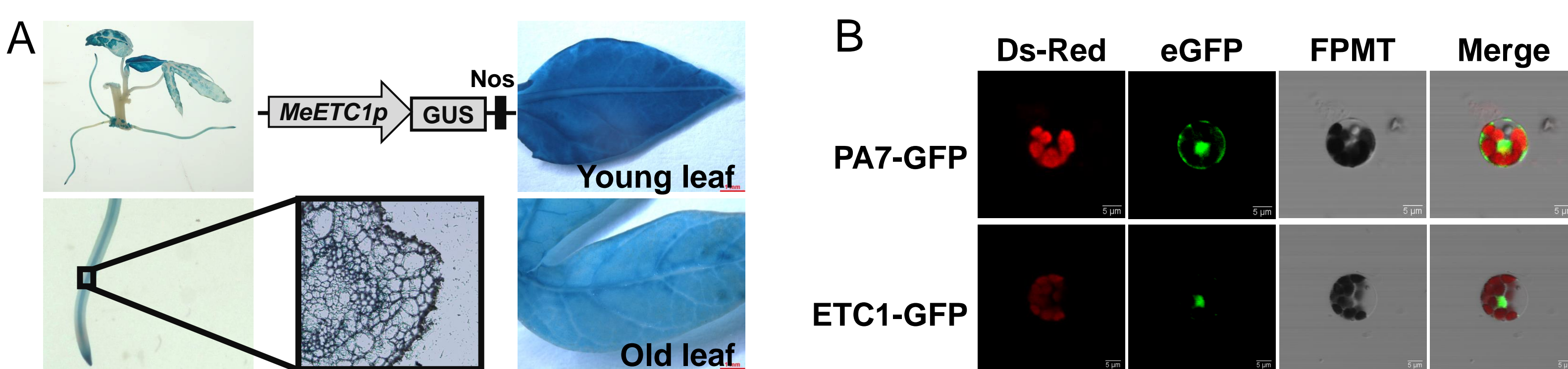
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Abstract

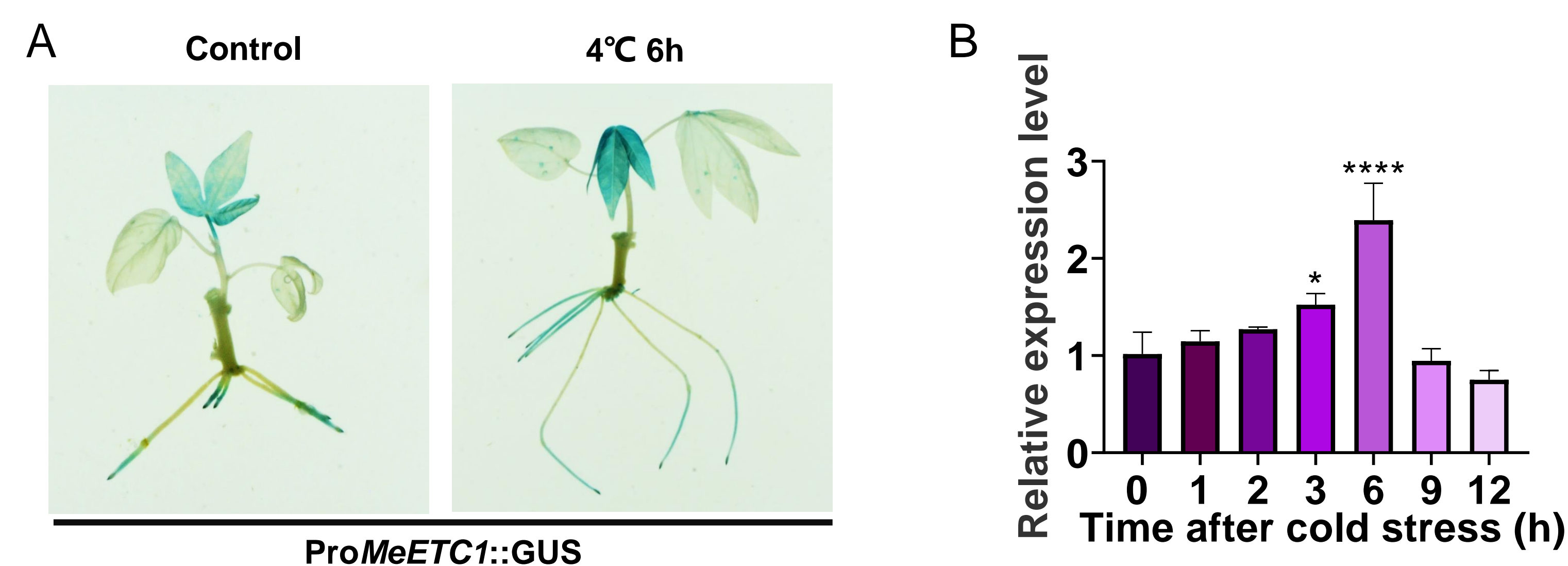
Cassava is vulnerable to low temperatures. In this study, we demonstrate an MYB TF *ETC1* positively regulates cold response and tolerance by up-regulating anthocyanin biosynthesis in cassava. Transient expression assays and dual-luciferase reporter assays showed that *MeETC1* directly bound to the promoters of *MePAL* and *MeDFR*, key modulators of anthocyanin biosynthesis, and activated its expression to promote anthocyanin accumulation and reactive oxygen species (ROS) scavenging. Yeast one hybrid and electrophoretic mobility shift assays showed that *MeICE1* positively activated *MeETC1* expression by binding to MYC cis-element, indicating that cassava use the ICE1-ETC1 pathway to active the cold response alternatively. Our findings shed light on the functions of MeETC1 and underly cold tolerance response mechanism in tropical plants.

Results

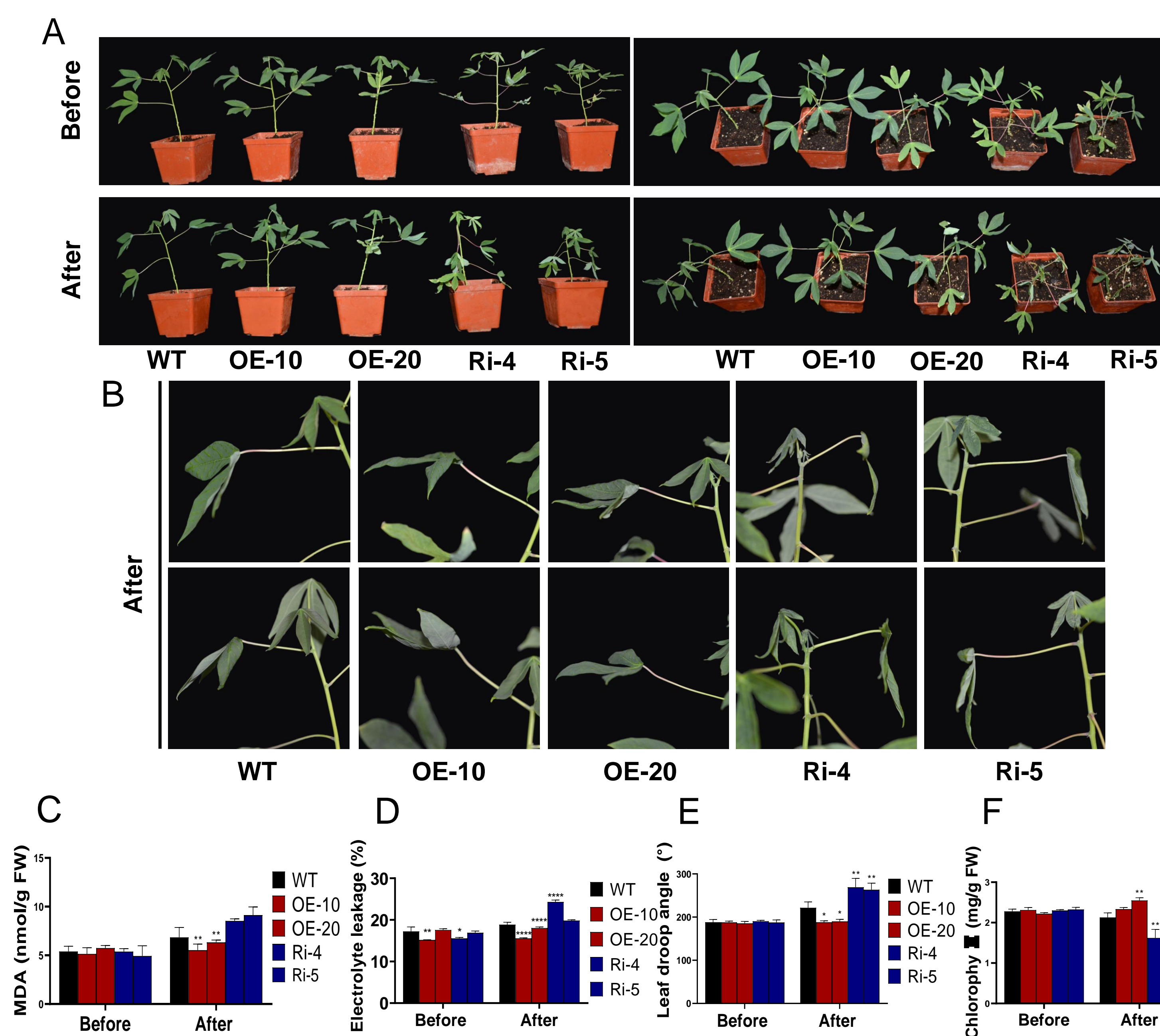
1 Analysis of subcellular localization and expression pattern of MeETC1



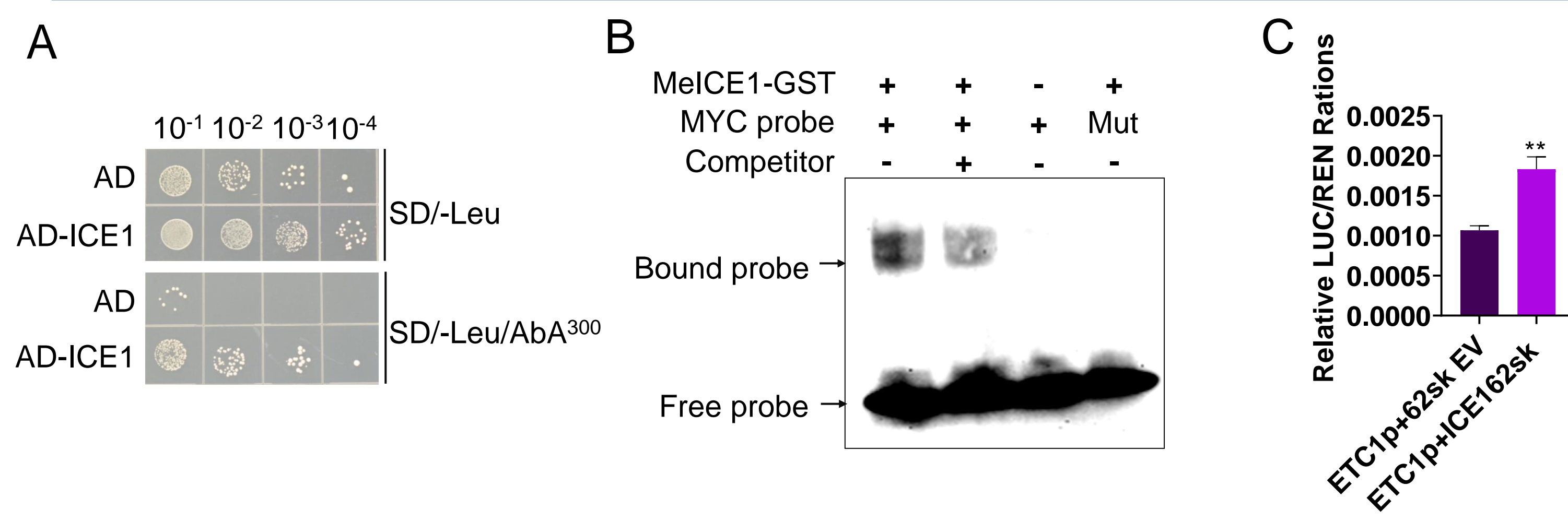
2 MeETC1 is responsive to low-temperature



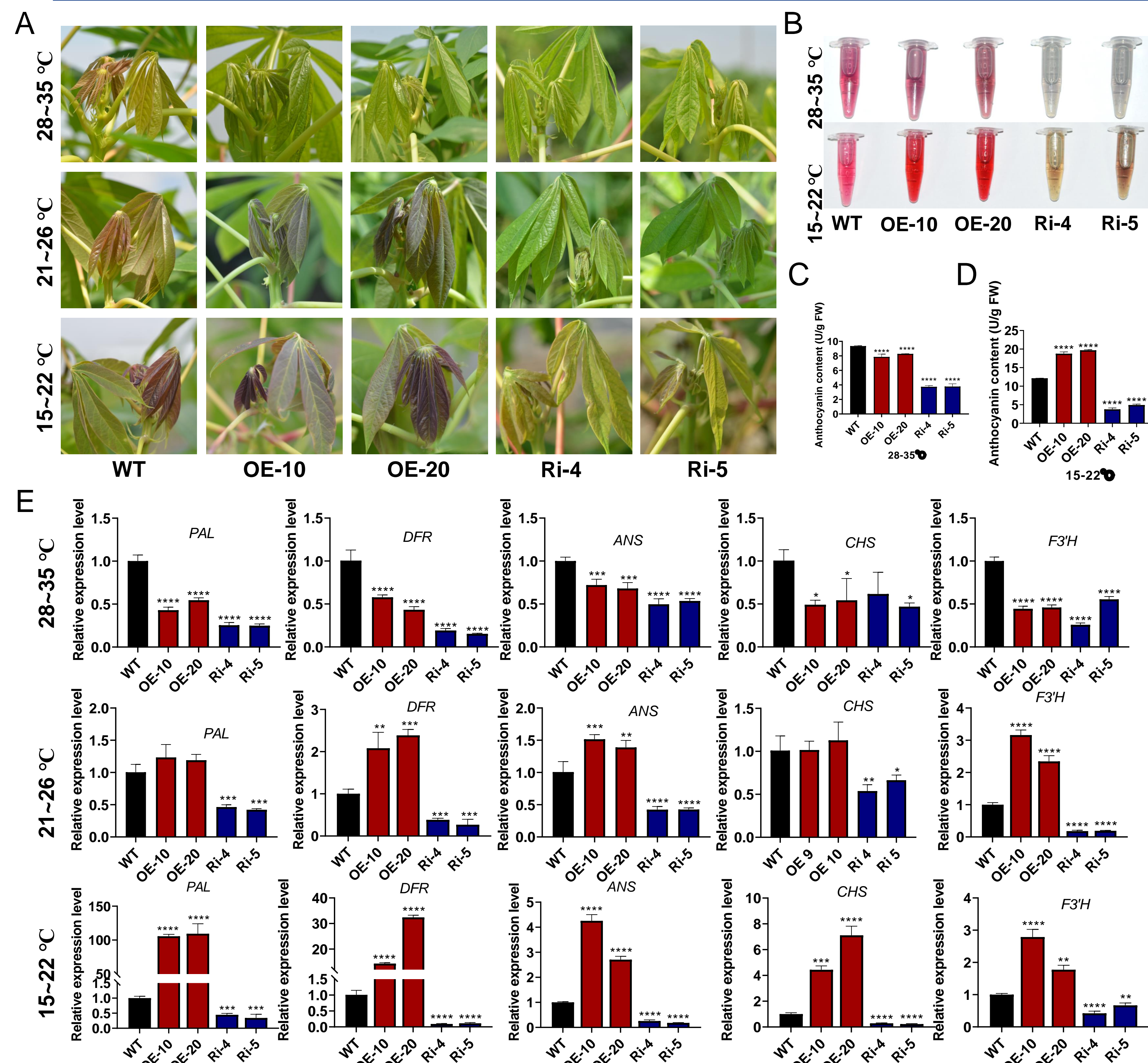
3 MeETC1 positively regulates cold tolerance of cassava



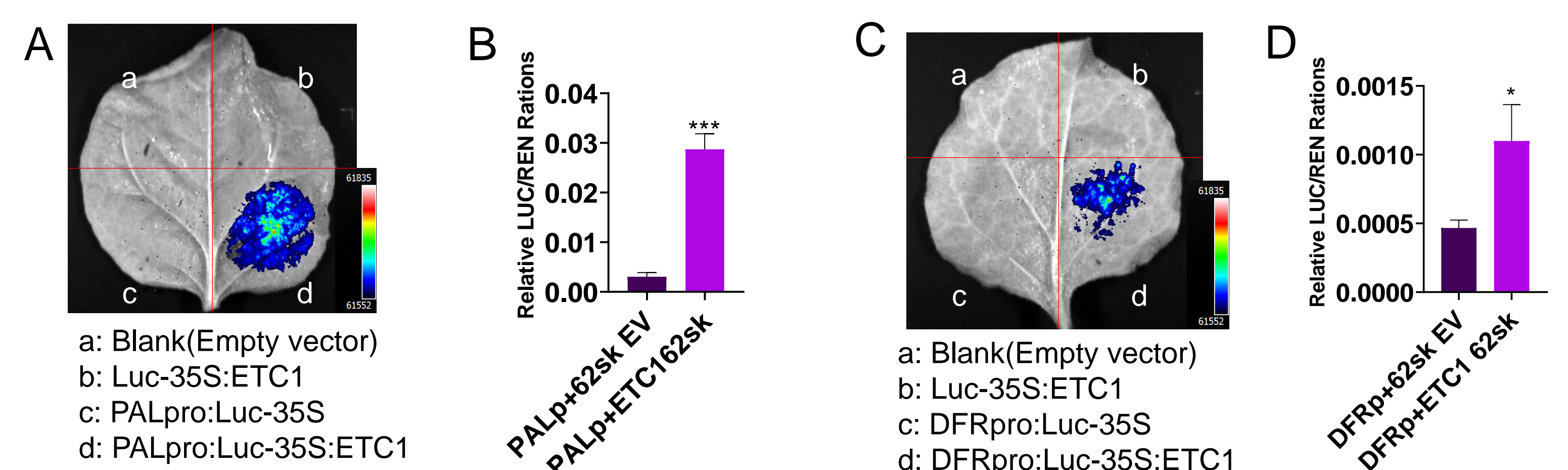
4 MeICE1 is a transcription activator of MeETC1



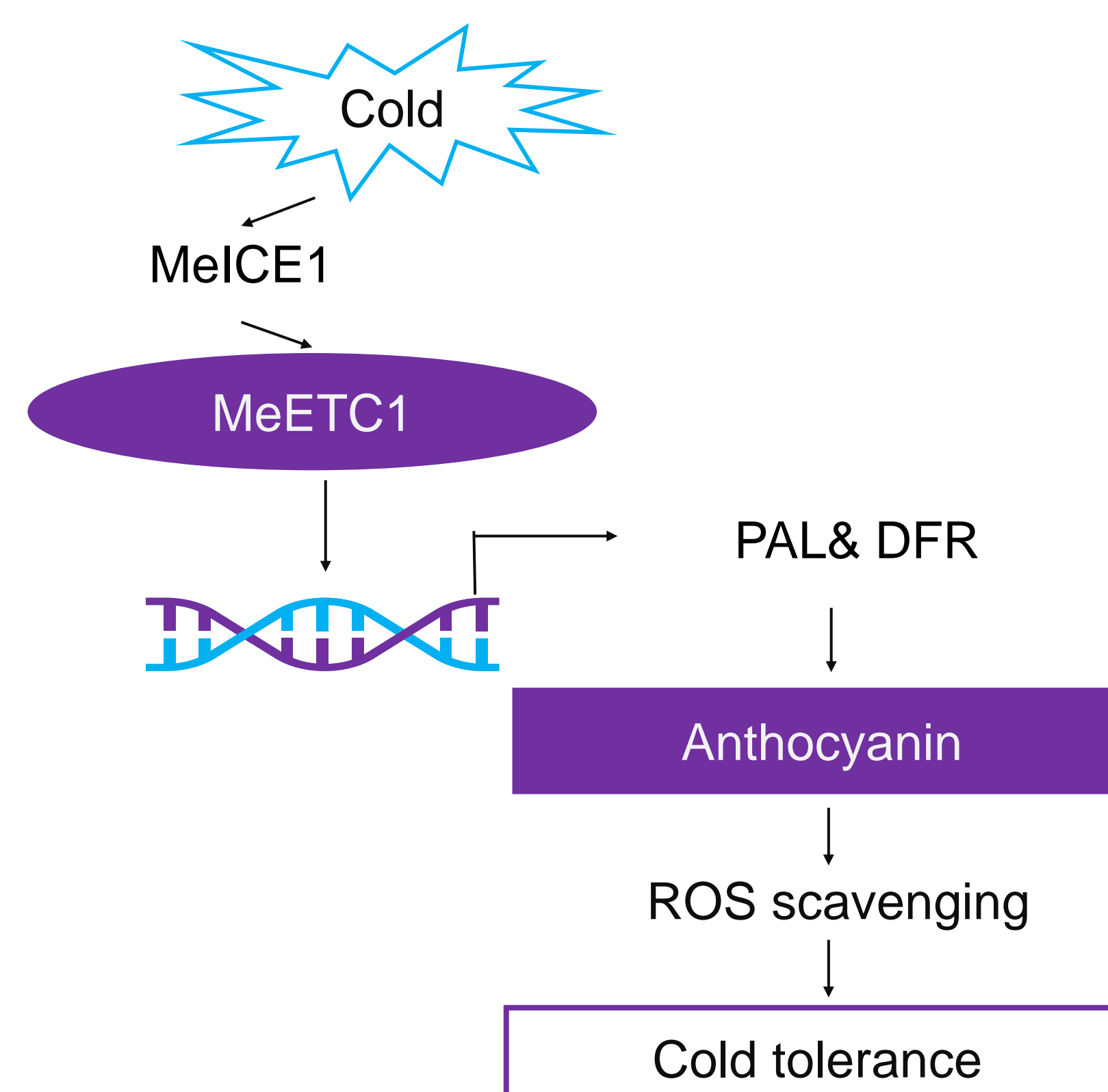
5 MeETC1 promotes anthocyanin accumulation in cassava under cold treatment in the field



6 MeETC1 directly binds to the promoter of MePAL and MeDFR



7 Discussion and conclusion



Based on all the data presented above, we conceived a general model for the function of ETC1 in response to cold in cassava. An R3-MYB TF gene, *ETC1*, was identified from cassava and verified to be targeted by *ICE1* for cold response. Under cold stress, ETC1 binds to the promoter region of *PAL* and *DFR*, genes related to anthocyanin biosynthesis, through the MBS cis-element to promote the accumulation of anthocyanins, thereby scavenging excess ROS, thus reducing the damage of low-temperature stress to cassava.