Heat and disease: The genetic tug-of-war in pepper immunity

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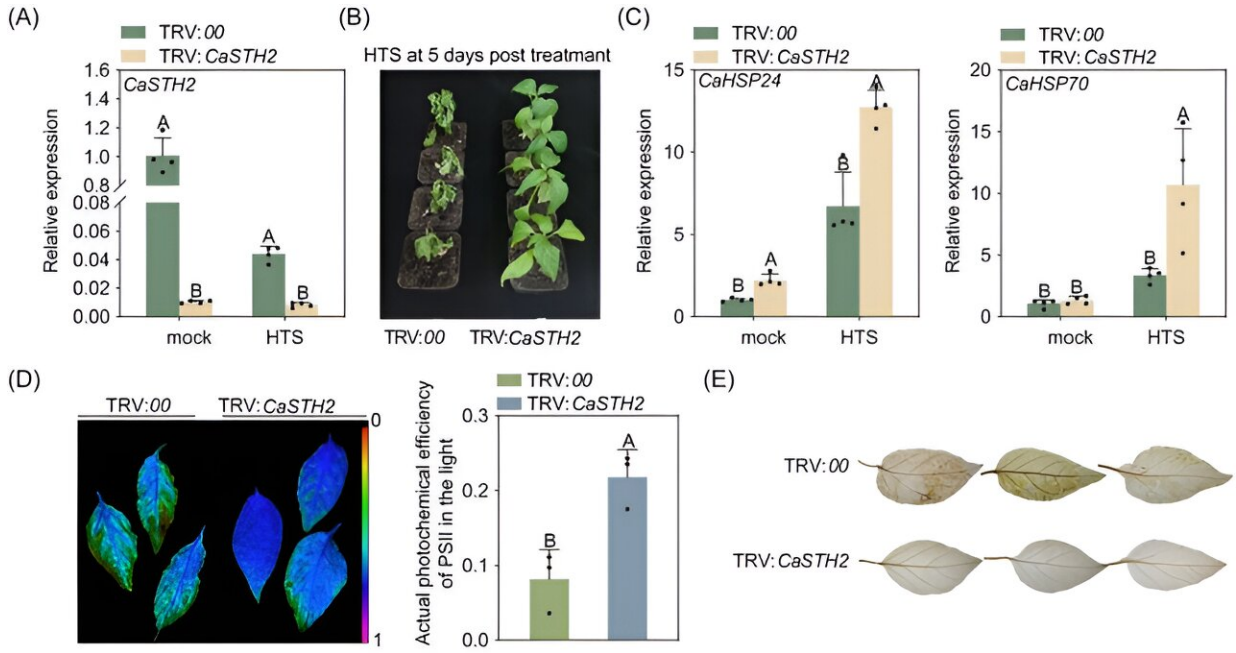

Impact of CaSTH2 silencing on pepper plants' thermotolerance. Credit: *Horticulture Research* (2024). DOI: 10.1093/hr/uhae066

Plants face simultaneous challenges from pathogens and environmental stresses, especially in tropical and subtropical regions. Pathogens trigger immune responses through specific receptors, while high temperatures activate heat tolerance mechanisms. Both responses involve common signaling elements, but their coordination remains poorly understood. Due to these issues, an in-depth investigation into the regulatory

mechanisms is needed.

Researchers from Fujian Agriculture and Forestry University and China Agricultural University published a study on March 2, 2024, in *Horticulture Research* that reveals that the pepper gene SALT TOLERANCE HOMOLOG2 (CaSTH2) inhibits both immune responses and heat tolerance by physically interacting with the transcription factor CaWRKY40. This discovery sheds light on the complex regulatory networks that plants use to balance their defenses.

The study identifies CaSTH2 as a key negative regulator in pepper plants, inhibiting the transcription factor CaWRKY40, which is crucial for activating genes related to immunity and heat tolerance. Experiments using gene silencing and overexpression in pepper and Nicotiana benthamiana showed that CaSTH2 reduces the plant's defense against Ralstonia solanacearum infection (RSI) and its ability to tolerate high temperatures.

Various assays, including Bimolecular Fluorescence Complementation (BiFC), Co-immunoprecipitation (CoIP), pull-down, and Microscale Thermophoresis (MST), confirmed that CaSTH2 physically interacts with CaWRKY40. Furthermore, CaSTH2 blocks CaWRKY40's interactions with CaWRKY27b and CaWRKY28, which are essential for activating defense-related genes.

This comprehensive analysis demonstrates how CaSTH2 modulates the plant's defense mechanisms by interfering with critical protein interactions, providing new insights into the regulatory networks governing plant immunity and stress responses.

Dr. Sheng Yang from China Agricultural University stated, "This study highlights the intricate balance of plant defense mechanisms. Understanding the role of CaSTH2 provides valuable insights into how

plants regulate their immune responses and stress tolerance, which could be crucial for developing more resilient crops."

The findings on CaSTH2's role could lead to new strategies in crop breeding to enhance resistance against pathogens and environmental stresses. By manipulating the expression of CaSTH2, scientists might improve the immunity and heat tolerance of pepper and other crops, contributing to agricultural sustainability and food security.

More information: Xingge Cheng et al, CaSTH2 disables CaWRKY40 from activating pepper thermotolerance and immunity against Ralstonia solanacearum via physical interaction, *Horticulture Research* (2024). DOI: 10.1093/hr/uhae066

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