High temperature-responsive poplar lncRNAs modulate target gene expression by RNA interference or acting as RNA scaffolds enhancing heat tolerance

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Abstract

High temperature stress increasingly threatens plant development and survival. Long noncoding RNAs (lncRNAs) participate in plant stress responses, but their functions in the complex stress-responsive network remain elusive. Poplar is one of the most widely planted trees in the world and contributes to terrestrial ecological stability. In this study, we identified 261 high temperature-responsive lncRNAs in poplar (Populus simonii). These lncRNAs were predicted to target a total of 353 target genes of which 163 are cis-targets and 190 trans-targets. To determine the function of select heat-responsive lncRNAs, transient overexpressed and repressed lncRNA were implemented in poplar leaves and roots. As expected, the abundance of lncRNA target transcripts were altered. One such lncRNA TCONS_00202587 binds to upstream sequences of targets via its secondary structure and interfere with the target gene transcription. Another lncRNA TCONS_00260893 could enhance Ca2+ influx in response to high-temperature treatment by interfering with a specific variant/isoform of the target gene. Two lncRNA targets overexpressed experiment revealed heat tolerance in Arabidopsis. These results revealed lncRNAs could regulate their targets genes by acting as potential RNA scaffolds or through RNA interference pathway. It is indicated a new layers of highly complex RNA-based gene regulation in heat tolerance of perennial plants.

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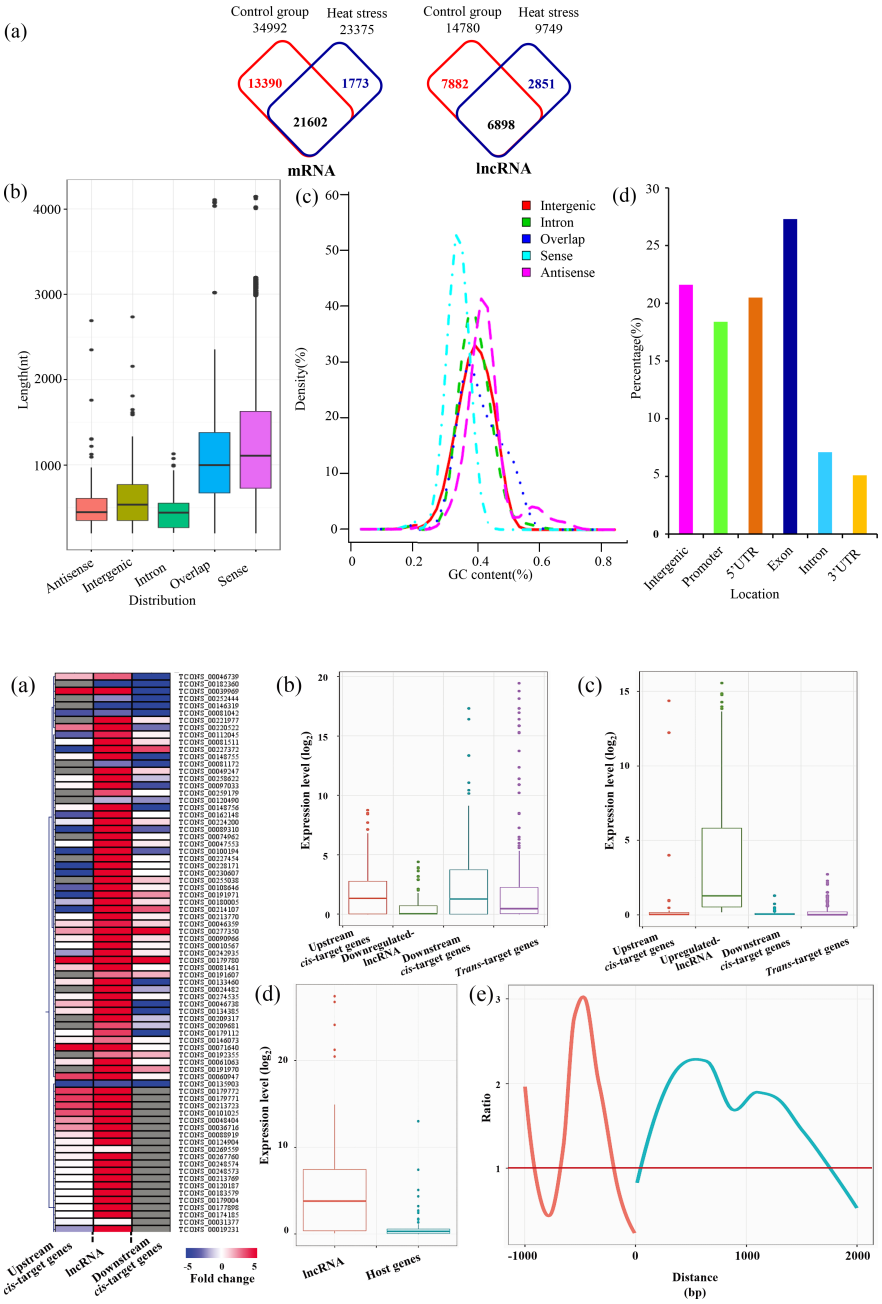

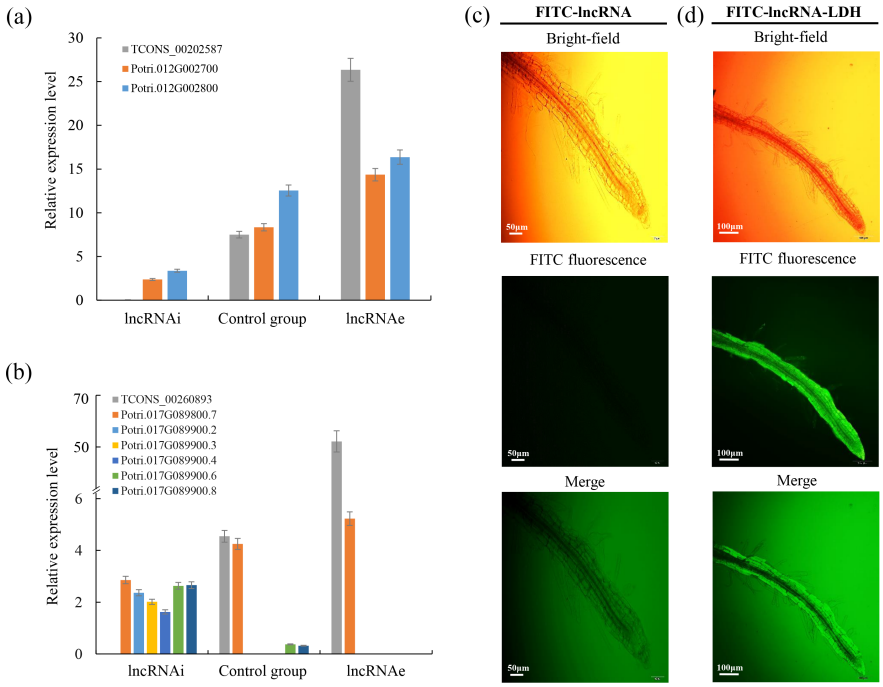

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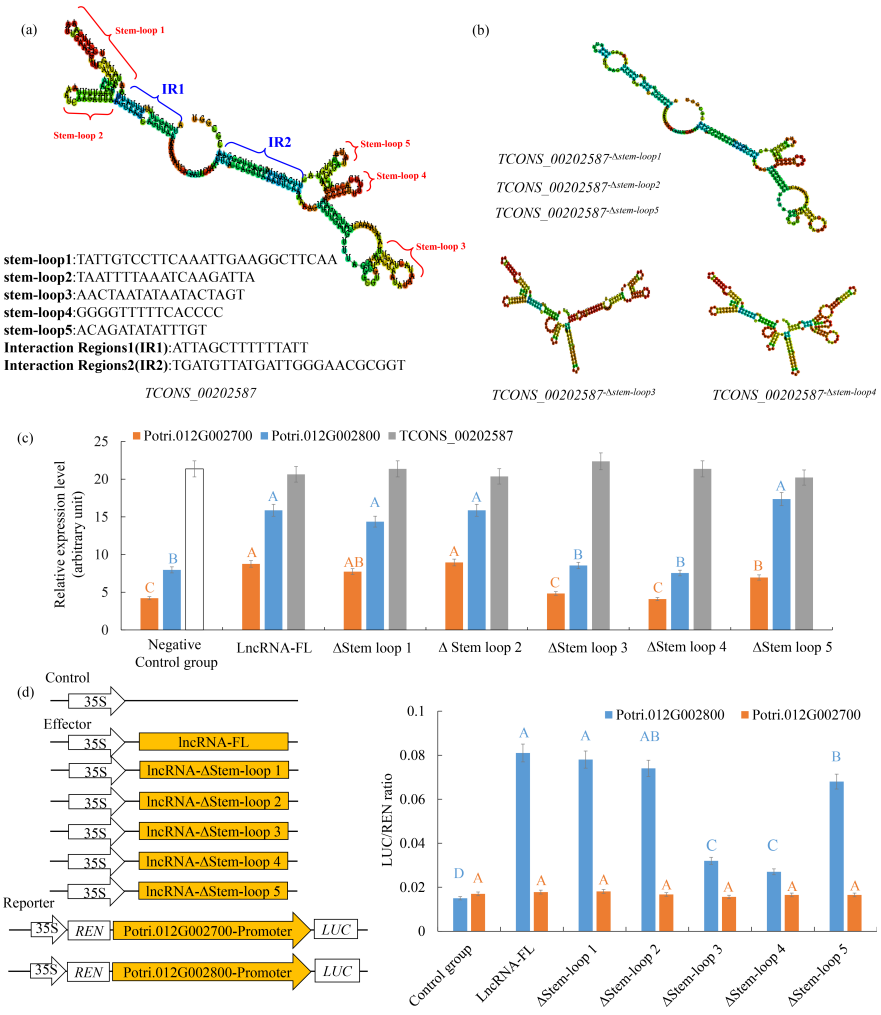

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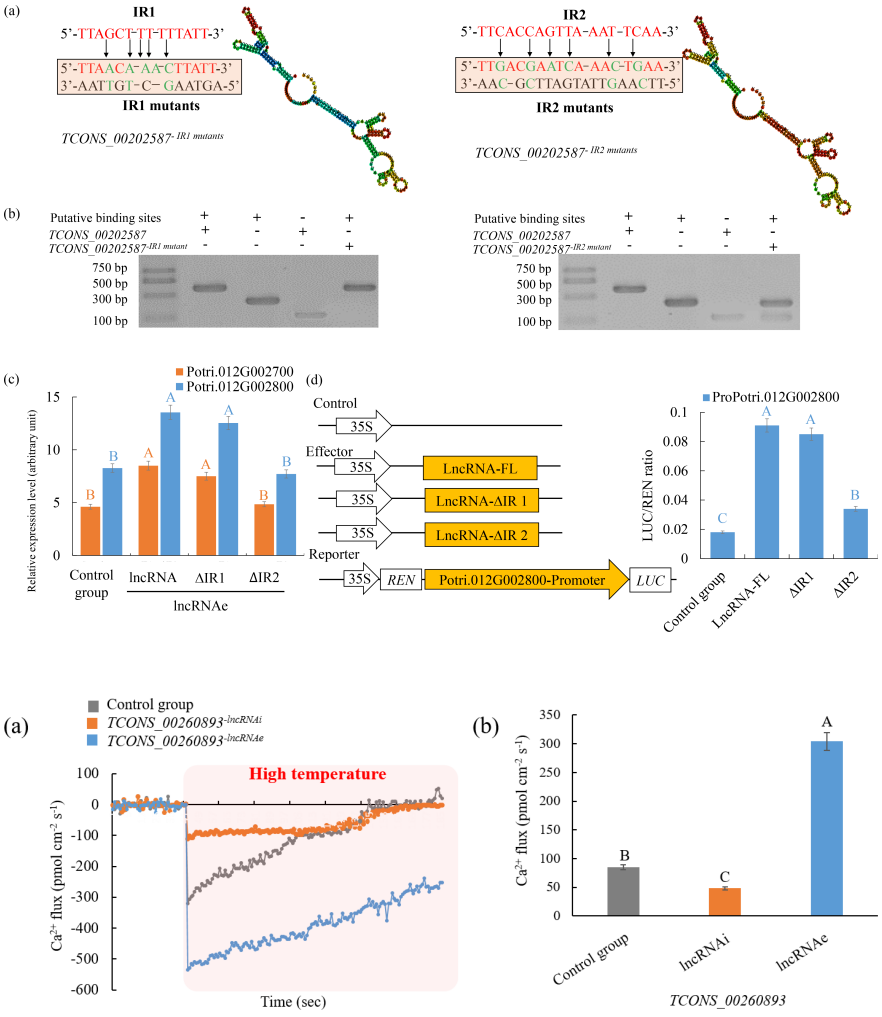

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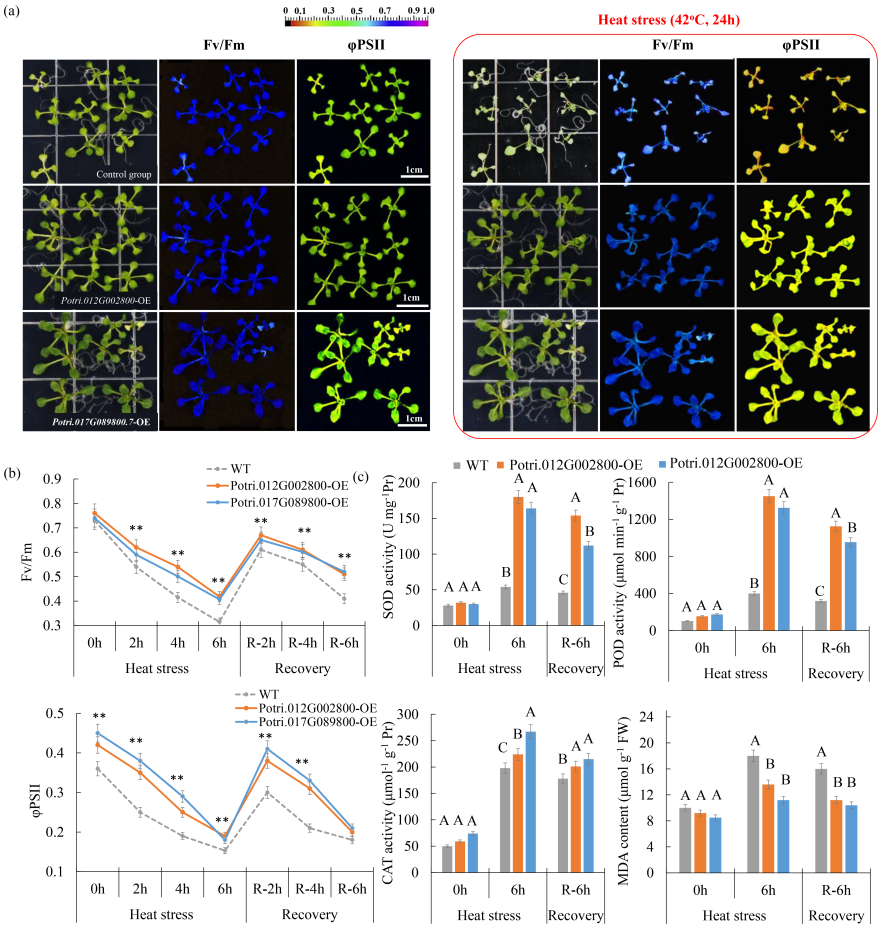

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