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Authors: Jingli Yang, Shicheng Zhao, Bo Zhao, Chenghao Li

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Overexpression of *TaLEA3* induces rapid stomatal closure under drought stress in *Phellodendron amurense* Rupr.

Jingli Yang[1†], Shicheng Zhao[2†], Bo Zhao[1], Chenghao Li[1*]

[1]State Key Laboratory of Tree Genetics and Breeding, Northeast Forestry University, 26 Hexing Road, Harbin 150040, China;

[2]School of Phamacy, Harbin University of Commerce, Harbin 150076, China;

[*]Corresponding author (e-mail: chli0@163.com, telephone: 86-451-82191556, fax: 86-451-82191556)

[†]These authors contributed equally to this work.

Abstract

Late embryogenesis abundant (LEA) proteins participate in drought stress responses in plants. In the present study, the gene *TaLEA3* from the drought-resistant plant *Tamarix androssowii* was transformed into Amur cork tree (*Phellodendron amurense*) via *Agrobacterium tumefaciens* to investigate the mechanism of stomatal closure in response to osmotic stress. Our results showed that *P. amurense* overexpressing *TaLEA3* were resistant to drought stress by rapid stomatal closure. To study the stomatal movement regulated at the molecular level, a model system for stoma closure was established in *in vitro P. amurense.* In this work, we found that the increased Ca^{2+} accumulation in guard cells of transgenic plants caused stomatal closure and activated K^+ efflux under polyethylene glycol (PEG) stress. Moreover, H^+ changes might provide a needed pH condition for stomatal closure. Further, nitric oxide (NO) fluorescence was measured using an NO-specific fluorescent probe, diaminofluorescein-FM diacetate, which showed that guard cell NO fluorescence was stronger in transgenic plants compared with wild type plants. Additionally, five genes encoding nitrate reductase were up-regulated, indicating that *TaLEA3* overexpression positively regulated NO biosynthesis and accumulation in the guard cells. This