Transcriptional Profiling Reveals Adaptive Responses to Boron Deficiency Stress in Arabidopsis

Lishun Peng, Changying Zeng, Lei Shi, Hongmei Cai, and Fangsen Xu

National Key Laboratory of Crop Genetic Improvement and Microelement Research Centre, Huazhong Agricultural University, Wuhan 430070, China.
E-mail: fangsenxu@mail.hzau.edu.cn

Institute of Tropical Biosciences and Biotechnology (ITBB), State Key Laboratory of Tropical Crop Biotechnology, Chinese Academy of Tropical Agricultural Sciences (CATAS), Haikou 571101, China

Author for correspondence and reprint requests


Boron (B) is a micronutrient for vascular plants, and B deficiency has been recognized as a limiting factor for crop production in many areas worldwide. To gain a better insight into the adaptability mechanism of plant responses to B starvation, an Arabidopsis whole genome Affymetrix GeneChip was used to evaluate global gene expression alterations in response to short- and long-term B deficiency stress. A large number of B deficiency-responsive genes were identified and grouped by their functions. Genes linked to jasmonic acid (JA) showed the most prominent response under B deficiency. The transcripts for biosynthesis and regulation of JA were constantly induced during short- and long-term B deficiency stress. A set of well-known JA-dependent process and responsive genes showed the same expression profile. This suggested that JA could be a pivotal player in the integration of adaptive responses to B deficiency stress. Moreover, other functional groups of B deficiency-responsive genes (including various encoding the biosynthesis of antioxidants, the basic components of Ca$^{2+}$ signalling, protein kinases, cell wall-modifying enzymes and proteins, H$^+$-ATPase, K$^+$ transporters, and a set of enzymes involved in central metabolism and cellular growth) were also observed, and their physiological roles under B deficiency stress are discussed. These results provide some information for a better understanding of plant-adaptive responses to B deficiency stress and potential strategies to improve B efficiency in crops.

Key words: Arabidopsis, Boron Deficiency Stress, Transcriptional Profiling