SYMP-19

Functional analysis of CBL-CIPK complexes in plant abiotic stresses and in nutrition sensing

Yong-Hwa Cheong, Sunchon National Univ., Korea

Calcium signaling begins with calcium sensors that detect the changes in cellular calcium. The calcineurin B-like proteins (CBLs) represent a unique family of plant calcium sensors that relay the signal by interacting with a family of protein kinases (CIPKs). In a genetic screen, we identified among a number of T-DNA insertional lines of CIPKgenes a mutant with a drought-tolerant phenotype. The mutant represented a null allele of CIPK23 (also referred to as SnRK3.23 and PKS17) gene that is expressed in diverse tissues including root hairs, vascular tissues, and the stomatal guard cells. Among several factors that control drought tolerance in plants, including gene expression, ABA biosynthesis, and ABA sensitivity, only ABA sensitivity in guard cells was altered in the cipk23 mutant plants. Examination of plant growth under other stress conditions revealed that the cipk23 mutants displayed hypersensitivity to low potassium in the medium. The lower tolerance to poor potassium nutrition correlated with lower efficiency of K+ uptake in the roots. Two CBL proteins (CBL1 and CBL9) interacted with and served as upstream regulators of CIPK23. The double mutant cbl1cbl9, but not the cbl1 or cbl9 single mutant, showed altered phenotype in stomatal response and low potassium sensitivity just like the cipk23 mutant, suggesting that CBL1 and CBL9 are functionally redundant in regulating these processes. As K+ uptake is connected to transpiration through open stomata, our results identify a CBL-CIPK calcium sensing pathway that coordinates the water usage and mineral nutrition.