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A rice SnRK3 kinase is associated with cold signaling pathway and interacts with a vacuolar-targeted calcium binding protein

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Objectives

To investigate function of rice SnRK3 kinase in cold and calcium signaling pathway

Materials and Methods

1. Materials: *Oryza sativa* cv. Dongjin, Rice 5K cDNA chip
2. Methods: Northern blot, Microarray, Yeast two hybrid, Calcium binding assay *in vitro* kinase assay, Confocal microscopy of GFP-fused protein.

Results and Discussion

Calcium signaling has been implicated in stress responses of a plant in which diverse calcium sensors and secondary signal molecules mediate and specify the downstream events. SNF1 related protein kinase group3 (SnRK3) family and calcineurin B-like proteins (CBL) are such kind of key decoding molecules recently identified in Arabidopsis. We previously isolated a cold-inducible SnRK3 kinase, OsPK1 from rice by differential screening. Northern blot analysis showed that OsPK1 transcript level was greatly increased by low temperature and calcium treatment. To investigate *in vivo* function of OsPK1, we generated 35S -OsPK1 transgenic rice and DNA chip analysis showed that 25 % of up or down regulated genes in the transgenic rice were cold-regulated. In addition, OsPK1 was shown to interact with a rice CBL homolog, OsCBL1 in a yeast two hybrid system. OsCBL1 showed high Ca²⁺ binding activity and localized primarily to the vacuolar membrane in onion epidermal cells. Taken together, our present results strongly suggest that OsPK1 may play a key role, at least, in a branch of cold signaling pathway in rice. Possible association with vacuolar CBL protein and relevant physiological outputs in cold responses remains to be elucidated.

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