SOS2 PROMOTES SALT TOLERANCE IN PART BY INTERACTING WITH THE TONOPLAST VATPASE AND UPREGULATING ITS TRANSPORT ACTIVITY


*) Department of Soil, Plant and Environmental Sciences, University of Naples “Federico II”, Via Università 100, 80055 Portici (Italy)
**) Institute for Integrative Genome Biology and Department of Botany and Plant Sciences, University of California, Riverside, California 92521 (USA)
***) Department of Plant Sciences, University of Arizona, Tucson, Arizona 85721 (USA)
****) CNR – Institute of Plant Genetics, Via Università 133, 80055 Portici (Italy)

salt stress, Vacuolar ATPase (VHA), SOS2, Proton Force Motif (PMF)

To cope with salt stress conditions, plants have evolved strategies to maintain low Na\(^+\) concentrations in the cytoplasm. These strategies include the activation during salt stress conditions of membrane localized transporters such as SOS1 and NHX1 that extrude Na\(^+\) ions out of the cells or sequestre them in the vacuole.

Previous studies have shown that the activity of both SOS1 and NHX1 is dependent of SOS2.

The driving force for SOS1 and NHX1, as well as many other transport activities, is the proton force motif (PMF) generated by H\(^+\) pumping ATPases, such as the plasma membrane H\(^+\)-ATPase, and the tonoplast H\(^+\)-pyrophosphatase and H\(^+\)-ATPase. The Vacuolar H\(^+\)-ATPase (V-ATPase, VHA) is the major proton pump that establishes and maintains an electrochemical proton-gradient across the tonoplast, thus providing the driving force for the secondary active transport of metabolites and ions.

The V-ATPase is a complex multi-subunit enzyme, composed of a V\(_{1}\) peripheral stalk that binds and hydrolyses ATP and a V\(_{0}\) membrane sector that provides the pathway for the entry of the protons into the vacuolar lumen. In the genome of Arabidopsis thaliana, genes encoding for at least 12 V-ATPase subunits have been identified.

In this study, we used Tandem Affinity Purification (TAP) tagging to isolate proteins interacting in vivo with the protein kinase SOS2. Using this strategy, we found that SOS2 interacts with subunits forming the cytoplasmic sector of the V-ATPase and that this interaction is enhanced under salt stress conditions. Parallel experiments using the Yeast-Two-Hybrid system showed that SOS2 interacts with at least 2 of the 3 VHA-B subunit isoforms present in Arabidopsis. Furthermore, we show that the V-ATPase activity is altered in both sos2-2 and sos3-1 mutants. The results suggest that, under salt stress conditions, SOS2 interacts with cytoplasmic VHA-B subunits thus stimulating H\(^+\) transport into the vacuole and providing an increased driving force for the compartimentation of Na\(^+\) ions in the vacuole.