ROS-ACTIVATED FLUXES OF ELECTROLYTES ACROSS THE PLANT PLASMA MEMBRANE UNDER ABIOTIC STRESS CONDITIONS

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Fluxes of electrolytes and release of ions from plant cells are induced by stresses, such as salinity, drought, heavy metals and others; however, the mechanism and role of this phenomenon have only recently been explored. Our data show that stress-induced electrolyte fluxes (also referred as 'electrolyte leakage') are mainly related to the efflux of K^+ and organic anions and mediated by the plasma membrane ion conductances with different kinetics of activation and cation selectivity and involve several groups of ion channels, such as GORK, SKOR, annexins and ALMT. Stress-induced electrolyte fluxes are accompanied by enhanced generation of reactive oxygen species (ROS). ROS have been shown to activate GORK, SKOR, and annexins. The ROS-activated K^+ efflux through GORK channels results in dramatic K^+ loss from root cells that stimulates proteases and endonucleases, promoting PCD and autophagy. Nevertheless, in moderate stress conditions, K^+ efflux could play an essential adaptive role as a 'metabolic switch', inhibiting anabolic reactions and stimulating catabolic processes; this saves energy for adaptation and repair needs. Under stress conditions, ROS can be generated by NADPH oxidases, which are directly activated by cytosolic Ca^{2+}. This forms a mechanism enhancing electrolyte fluxes, via so-called ROS-Ca^{2+} hub, which amplifies initially weak stress via overproduction of ROS. Our unpublished data point to the molecular mechanism underlying K^+ efflux from roots in response to NaCl and other stresses, which includes ROS interaction with specific Cys moieties in the ion channel GORK, leading to its activation and dramatic loss of K^+. We also report that the leak of ascorbate via ALMT-like conductances catalyses hydroxyl radical generation and activation of ROS-dependent ion fluxes in root cells. Overall, we propose the comprehensive scheme of stress- and ROS-induced ion fluxes in root cell membranes under different conditions and physiological states.