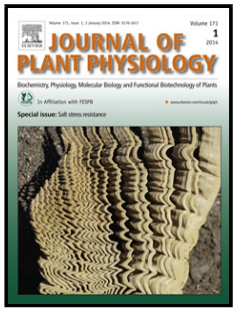

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Title: Plant Water Transport and Aquaporins in Oxygen-Deprived Environments

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Abstract

Oxygen deprivation commonly affects plants exposed to flooding and soil compaction. The resulting root hypoxia has an immediate effect on plant water relations and upsets water balance. Hypoxia inhibits root water transport and triggers stomatal closure. The processes contributing to the inhibition of root hydraulic conductivity and conductance (hydraulic conductivity of the whole root system) are complex and involve changes in root morphology and the functions of aquaporins. Aquaporins (AQPs) comprise a group of membrane intrinsic proteins that are responsible for the transport of water, as well as some small neutral solutes and ions. They respond to a wide range of environmental stresses including O_2 deprivation, but the underlying functional mechanisms are still elusive. The aquaporin-mediated water transport is affected by the acidification of the cytoplasm and depletion of ATP that is required for aquaporin phosphorylation and membrane functions. Cytoplasmic pH, phosphorylation, and intracellular Ca^{2+} concentration directly control AQP gating, all of which are related to O_2 deprivation. This review addresses the structural determinants that are essential for pore conformational changes in AQPs, to highlight the underlying mechanisms triggered by O_2 deprivation stress. Gene