Scientific Paper:

Physiologia Plantarum (2022) 174(2), e13649

Alternative oxidase plays a role in minimizing ROS and RNS produced under salinity stress in *Arabidopsis thaliana*

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Abstract:

Under stress conditions, the overproduction of different reactive oxygen species (ROS) and reactive nitrogen species (RNS) causes imbalance in the redox homeostasis of the cell leading to nitro-oxidative stress in plants. Alternative oxidase (AOX) is a conserving terminal oxidase of the mitochondrial electron transport chain, which can minimize the ROS. Still, the role of AOX in the regulation of RNS during nitro-oxidative stress imposed by salinity stress is not known. Here, we investigated the role of AOX in minimizing ROS and RNS induced by 150 mM NaCl in Arabidopsis using transgenic plants overexpressing (AOX OE) and antisense lines (AOX AS) of AOX. Imposing NaCl treatment leads to a 4-fold enhanced expression of AOX accompanied by enhanced AOX capacity in WT Col-0. Further AOX-OE seedlings displayed enhanced growth compared with the AOX-AS line under stress. Examination of NO levels by DAF-FM fluorescence and chemiluminescence revealed that AOX overexpression leads to reduced levels of NO. The total NR activity was elevated under NaCl, but no significant change was observed in wild-type (WT), AOX OE, and AS lines. The total ROS, superoxide, H_2O_2 levels, and lipid peroxidation were higher in the AOX-AS line than in WT and AOX-OE lines. The peroxynitrite levels were also higher in the AOX-AS line than in WT and AOX-OE lines; further, the expression of antioxidant genes was elevated in AOX-AS. Taken together, our results suggest that AOX plays an important role in the mitigation of ROS and RNS levels and enhances plant growth, thus providing tolerance against nitro-oxidative stress exerted by NaCl.

Keywords: *Arabidopsis thaliana*, reactive oxygen species, reactive nitrogen species, alternative oxidase, RNS regulation, salinity stress