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Recurrent water deficit causes alterations in the profile of redox proteins in citrus plants

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Title:

Recurrent water deficit causes alterations in the profile of redox proteins in citrus plants

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Abstract

Plant acclimation to recurrent stress involves profound alterations in multiple genetic, metabolic and physiological processes. Stressful conditions usually implicate imbalance in reactive oxygen species (ROS) production and removal rates, which may lead to oxidative stress. However, the primary cellular targets of oxidative stress and their relevance in plant acclimation to abiotic stresses remains poorly characterized. By comparing redox proteomic and sugar profiles in citrus Valencia (VO) scions grafted onto two rootstocks with different soil water extraction capacities – Rangpur Lime (RL) and Sunki Maravilha (SM) – here we demonstrate that both ROS-mediated post-translational protein modification and changes in sugar composition are associated with acclimation to recurrent drought in citrus. The redox proteomic analysis of the distinct scion/rootstock combinations exposed to one (WD1), two (WD2) or three (WD3) water deficit episodes revealed a total of 32 and 55 redox protein spots present in VO/RL and VO/SM plants, respectively. Mass spectrometry analysis of these protein spots revealed essential targets of ROS-mediated posttranslational protein modification in citrus plants challenged by recurrent drought. The oxidation of cysteine thiol groups into glyceraldehyde 3-phosphate dehydrogenase (GAPDH) was shown to increase in WD3 samples of the VO/RL combination, whereas the opposite was observed for the VO/SM combination. Similarly, recurrent drought promoted the oxidation of catalase thiol groups in VO/SM, but not in VO/RL. Carbohydrate profiling revealed that glucose, fructose and galactose may also contribute to the phenotypic differences observed between the citrus genotypes exposed to drought. These findings reveal for the first time that recurrent drought differentially affects the profile of redox proteomics of citrus, suggesting that this alteration may be part of the stress memory in perennial plants.

Keywords: successive drought, antioxidant system, proteomics, acclimated, *citrus spp.*