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L21. The role of roots as modulators of nitric oxide and hydrogen peroxide defence signalling in citrus

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Although nitric oxide (•NO) and hydrogen peroxide (H_2O_2) are important signalling components for the plant stress response, the mechanism by which both molecules contribute to stress tolerance has not been clearly defined. We recently demonstrated that root pre-treatment with H_2O_2 or •NO (applied as SNP) prior to salinity systemically prepare citrus leaves to tolerate salt stress. In the present study using the same root-based H_2O_2/SNP pre-treatment system we focused on the role of roots as oxidative/nitrosative sensors and aboveground related signal emitters. The results showed that treatments with both signalling compounds altered H_2O_2 or •NO homeostasis in roots under stress-free and salt stress conditions. Using protein and gene expression signatures several sources of H_2O_2 and •NO have been identified in roots of citrus. Confocal laser scanning microscopy analysis revealed that H_2O_2 or •NO was mainly produced in vascular bundles. Pre-exposure to both molecules caused the response of several genes and proteins involved in the oxidative metabolism. Post-translational modifications such as carbonylation, S-nitrosylation and protein tyrosine nitration was of physiological significance for H_2O_2 or •NO signalling under normal and salt stress conditions. Pre-treatment with both molecules promoted the maintenance of the cellular redox homeostasis and mitigated the oxidative and nitrosative damage produced by hydroxyl radical and peroxynitrite. In summary, the current data indicate that root exposure to H_2O_2 or to •NO involves the upstream co-activation of signalling events and provide evidence for the existence of a defensive root–leaves loop in oxidative and nitrosative reactions in citrus plants.