Mannitol transport and oxidation are synchronized in *Olea europaea* under salt and drought stresses

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Abstract

The intracellular accumulation of organic compatible solutes acting as osmoprotectants, such as polyols, is an essential response mechanism of several plants to drought and salinity. In *Olea europaea* a mannitol transport system (OeMaT1) has been previously characterised as a key player in plant response to salinity, and here, heterotrophic sink models, such as olive suspension-cultured cells and fruit tissues, and source leaves were used for analytical, biochemical and molecular studies focused on mannitol metabolism to better understand its involvement in drought and salt stress tolerance. The kinetic parameters of mannitol dehydrogenase (MTD) determined in mannitol-growing cells, at 25 ºC and pH 9.0, were as follows: K_m, 54.5 mM mannitol and V_{max}, 0.47 µmol h^{-1} mg^{-1} protein. The corresponding cDNA was cloned and

subsequently named *OeMTD1*. *OeMTD1* expression was correlated with MTD activity, *OeMaT1* expression and carrier-mediated mannitol transport, in both mannitol- and sucrose-growing cells. Moreover, sucrose-growing cells showed only residual OeMTD activity, even though high levels of *OeMTD1* transcription were observed. The results support that OeMTD is regulated at both transcriptional and post-transcriptional levels due to substrate influence. Remarkably, MTD activity and *OeMTD1* expression were dramatically repressed after Na^+, K^+ and PEG treatments, both in mannitol- and sucrose-growing cells. In contrast, salt and drought significantly increased mannitol transport activity and *OeMaT1* expression, thus allowing for the intracellular accumulation of this polyol. Altogether, the results strongly suggest that olive tree copes with drought and salinity by tightly coordinating mannitol transport with intracellular metabolism. Taking into account the protective role of mannitol in olive tree, it would be extremely interesting to investigate if a criterious exogenous addition of this polyol during usual agricultural practices could be beneficial for olive tree development and productivity, and consequently for the whole olive-based industry.

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