Mycorrhizal inoculation affects oxidative stress response in wheat plants under manganese stress

Rafaela Sousa[1], A. Nogales[2], L. Rodrigues[3], H. Cardoso[4], M.D. Campos[3], C. Campos[3*]

[1] Escola de Ciências e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

[2]Sustainable Plant Protection Program. Institute of Agrifood Research and Tecnology. Cabrils Center. Cabrils, Barcelona, Spain

[3]MED (Instituto Mediterrâneo para a Agricultura, Ambiente e Desenvolvimento) & CHANGE – Global Change and Sustainability Institute, IIFA (Instituto de Investigação e Formação Avançada), Universidade de Évora, Pólo da Mitra, Ap. 94, 7002-554 Évora, Portugal.

[4]MED—Mediterranean Institute for Agriculture, Environment and Development & CHANGE — Global Change and Sustainability Institute, Escola de Ciências e Tecnologia, Departamento de Biologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora, Portugal

*Email: mccampos@uevora.pt

The symbiotic relationship between arbuscular mycorrhizal fungi (AMF) and the majority of terrestrial plants is one of the most beneficial interactions occurring in nature. AMF play a major role in plants' nutrient uptake from soil, and can protect plants from a variety of both abiotic and biotic stresses. Manganese (Mn) is a micronutrient element essential for normal plant growth and development. However, excessive levels of Mn in the soil can be damaging to the plants. High levels of Mn are often associated to acidic soils, and it has been observed that wheat plants can exhibit symptoms of Mn toxicity if grown in these conditions. This work aimed to determine the effect of AMF inoculation on wheat (*Triticum aestivum* L. var. Ardila), in a context of manganese toxicity, on the expression of genes related to oxidative stress responses and on total oxygen reactive species (ROS) production. Wheat plants were grown in greenhouse conditions, in pots with sterilized soil, being half of the plants inoculated with the AMF *Rhizoglomus irregulare*. Half of the pots were supplemented with 7.5 ppm of Mn to promote a Mn stress condition. Weight of the plants was measured after 7 weeks, and samples of aerial parts were taken for real-time qPCR analysis of genes related to oxidative stress response (*SOD1*, *GPx*, *APx* and *Trx*).

AMF colonization enhanced wheat growth, more evident in the Mn-addition treatment. Furthermore, AMF increased *SOD1* expression in the Mn treatment, whereas *GPx* and *TRx* showed a decreasing trend in inoculated plants, for both Mn conditions. *APx* showed no differences amongst treatments. AMF significantly decreased total ROS in the Mn treatment. This work underscores that AMF have an impact on wheat oxidative stress response, offering insights into the broader goal of developing crop varieties more tolerant to abiotic stresses.