

How *Epichloë* and arbuscular mycorrhizal fungi interact with wild barley under salt stress

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The symbiotic interactions between plants, endophytic fungi, and arbuscular mycorrhizal fungi (AMF) constitute a critical area of plant-microbe research. In many cool-season grass species, *Epichloë* endophytes and AMF can simultaneously establish mutualistic relationships with their hosts. The plant provides both habitat and a carbon resource for their fungal partners, while gaining enhanced abiotic and biotic stress tolerance via *Epichloë*-mediated mechanisms and improved nutrient acquisition and water uptake via AMF symbiosis. Previous studies have primarily focused on nutrient-dependent interactions between *Epichloë* and AMF, whereas environmental stresses such as salinity remain less explored, limiting our understanding of their synergistic potential in saline ecosystems.

This study investigated the combined effects of *Epichloë bromicola*, two AMF species (*Glomus mosseae* and *G. claroideum*) and a mixed AMF inoculum of both *G. mosseae* and *G. claroideum* (known as Gmix) associated with wild barley (*Hordeum spontaneum*) under salt stress. *Epichloë*-infected and *Epichloë*-free seeds of wild barley were inoculated with AMF

treatments or maintained as non-mycorrhizal controls, then exposed to three concentrations (0 mM, 100 mM, 300 mM) of salt (NaCl). Plant growth parameters, nutrient content, and AMF colonisation rates were evaluated through four harvests conducted at 7-day intervals over 28 days, with qPCR quantification of AMF biomass. The main findings were:

- (1) The presence of *E. bromicola* significantly increased root biomass, root-to-shoot ratio and spikelet number of wild barley plants compared to the control under 300 mM salt stress, but the effect was weakened with time.
- (2) Co-infection of wild barley plants with both *E. bromicola*, and the AMF treatments reduced sodium content, increased the potassium/sodium ratio and reduced salt stress toxicity. *G. mosseae* increased nitrogen content in aboveground plant organs, while *G. claroideum* and Gmix increased phosphorus content in the plant root system.
- (3) In *E. bromicola*-infected wild barley plants, colonisation by *G. mosseae* and Gmix led to growth reductions in root biomass, root-to-shoot ratio and spikelet numbers indicating an antagonistic interaction between *E. bromicola* and *G. mosseae*.