Differential responses of Glomeromycotina and Mucoromycotina to soil nutrient availabilities: Insights from field experiments on durum wheat.

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Present in the earliest root fossils of the Devonian period, Glomeromycotina (G) and Mucoromycotina (M) both form arbuscular mycorrhizal structures and have evolved with numerous plant lineages, including agricultural crops. Despite recent increased interest in M-Arbuscular Mycorrhizal Fungi (M-AMF), their ecological roles and the impacts of environmental and agricultural practices on them remain less understood compared to G-AMF, largely due to challenges in microscopic identification and molecular characterization. We investigated the colonization and responses of G-AMF and M-AMF under varying nutrient supply conditions.

Two field experiments explored the effects of either long-term phosphorus (P) fertilization or nitrogen (N) combined with water stress on the mycorrhization of durum wheat (*Triticum durum*), including 15 genotypes in the second experiment. In both experiments, mycorrhization levels were obtained through microscopic examination adapting the Trouvelot method. For the N and water experiment, analyses were supplemented by metabarcoding of the SSU rDNA from root and soil DNA.

P fertilization adversely affected both G-AMF and M-AMF colonization levels, with a more pronounced negative impact on M-AMF. Conversely, the N and water stress specifically diminished M-AMF abundance, whereas G-AMF colonization remained unaffected and depended on wheat genotype and root morphology.

These distinct responses to environmental stresses and intra-specific variability of the host suggest differing regulatory mechanisms for these fungal symbioses.

The presence of both fungal groups in close proximity within root cortex cells and their distinct responses to environmental stresses highlight the intricate dynamics of mycorrhizal symbioses and questions their respective potential to foster more sustainable agricultural practices.

Key words: fine endophyte, arbuscular mycorrhizal fungi, Illumina, microscopy