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EXPRESSION OF FUNGAL AND PLANT PHOSPHATE TRANSPORTERS IN ARBUSCULATED CELLS: A COMPETITION FOR PI UPTAKE?

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Phosphorus (P) is an essential plant nutrient and is limiting for plant growth in most natural and agricultural ecosystems throughout the world. In an evolutionary context, the development of mutualistic interactions with arbuscular mycorrhizal fungi (AMF) is considered the most important adaptation of terrestrial plants to face mineral nutrition requirements (Bonfante and Genre, 2008). Although being a major benefit of the symbiosis, the molecular mechanisms underlying fungal-mediated uptake, translocation and assimilation of inorganic phosphate (Pi) from the soil to the colonized root cells of the plant remain poorly known. Current data suggest that Pi, taken up by the extraradical mycelium (ERM) from soil solutions through high-affinity Pi transporters (PT), is translocated along AM fungal hyphae as polyphosphate (poly-Pi), and after hydrolysis, in the arbuscule, Pi is exported from the AM fungus to the periarbuscular space where is taken up by plant cortical cells thanks to mycorrhiza-inducible PTs (Javot et al., 2007).

The aims of this study were to analyze the expression profile of the high-affinity PT gene (*GintPT*) of the AMF *Glomus sp. DAOM 197198* in different fungal structures (spores, ERM and arbuscules) and to investigate the influence of different environmental conditions on its expression level. Mycorrhizal roots of *Medicago truncatula* were exposed to low (32 mM) or high Pi concentrations (300 mM). After a morphological analysis of the mycorrhization level, we collected arbusculated cortical cells using the laser microdissection technology and we performed semi-quantitative RT-PCR experiments to monitor the expression profiles of both *GintPT* and the *M. truncatula* PT, *MtPT4*, which is known to be exclusively expressed in arbusculated cells. We also evaluated *GintPT* modulation in ERM grown in monoxenic solid culture over the interaction with non-host (*Arabidopsis thaliana*) plants by qRT-PCR assays. Our findings show that *GintPT* is constitutively expressed along all the steps of the fungal life cycle suggesting that P uptake is necessary for fungal viability and metabolism. Interestingly, changes in Pi concentrations in the nutrient solution do not lead to modulation of *GintPT* expression level in the arbuscules. By contrast, the plant *MtPT4* shows enhanced transcript levels at 300 μM Pi concentration. The findings open new scenarios to the current view of the Pi export from fungus towards plant at the arbuscule interface, since they suggest a competition for the Pi uptake between the two symbionts.