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Variations in response of determinate common bean (*Phaseolus vulgaris* L.) genotypes to arbuscular mycorrhizal fungi (AMF) inoculation

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Abstract: This study evaluated seedling traits (shoot/root length, fresh and dry weights of shoots/roots, number of leaves, shoot diameter), phosphorus (P) content, mycorrhizal colonization (MC), and relative mycorrhizal dependency (RMD) of 21 common bean genotypes inoculated by 4 different arbuscular mycorrhizal fungi (AMF) [*Glomus intraradices* (Gi), *Glomus mosseae* (Gm), *Gigaspora margarita* (Gim), and commercial AMF (AMF)] in a growth chamber under controlled growing conditions. With the exception of shoot diameter, inoculated plants had better seedling traits than noninoculated plants. P content of shoot was also higher in inoculated plants than in noninoculated plants. Of the 20 genotypes and Nadide cv. examined, 5 responded positively and 3 responded negatively to inoculation with all AMF types. Great variations in RMD and MC were observed, with the highest RMD and MC in the T120 (69.54%) and T71 (81.09%) genotypes and the lowest in the V77 (1.26%) and V78 (31.42%) genotypes. Positive correlations were found between RMD and seedling traits, with the exception of shoot length as well as root length, P content, and colonization. MC was significantly correlated only with P content.

Key words: Common bean, seedling growth, mycorrhizal dependency

1. Introduction

Approximately 80% of terrestrial plant species establish mutualistic associations with arbuscular mycorrhizal fungi (AMF), which play a vital role in plant nutrition and both natural and agricultural ecosystems (Qiao et al., 2015). AMF have widespread application in horticultural production (Azcón-Aguilar and Barea, 1997). Used as biofertilizers and bioprotectors, AMF can enhance crop productivity, making it possible, with appropriate and effective management, to reduce chemical fertilizer and pesticide inputs.

The common bean (*Phaseolus vulgaris* L.) is the most important food legume consumed worldwide. With 632,301 t produced annually, Turkey accounts for 2.96% of the world's fresh broad bean production (http://faostat.fao.org/, 2013). Beans are an important source of proteins, vitamins, and minerals such as Ca, Cu, Fe, Mg, Mn, and Zn in human diets, especially in developing countries (Broughton et al., 2003). Originating in the Americas, beans are now cultivated throughout the world and have evolved extensive genetic variations for nutrient efficiency in adaptive response to varying environmental conditions (Hacısalihoglu et al., 2005). *P. vulgaris* and *P. coccineus* are the most widely produced species of the genus *Phaseolus*, which includes approximately 230 separate species. Most of the beans cultivated in Turkey belong to the *P. vulgaris* species (Madakbaş and Ergin, 2011).

AMF are well known to have significant positive effects on many crops, including beans, under various biotic and abiotic stress conditions; however, regardless of crop, genetic variations in plant response to AMF are nearly universal (Declerck et al., 1995; Parke and Kaeppler, 2000; Linderman and Davis, 2004; Sensoy et al., 2007; Demir et al., 2015). This interaction depends on nutrition relations between 90% of higher plants and the fungus. Arbuscular mycorrhizal fungus improves uptake of immobilized plant nutrition, especially phosphorus (Goltapeh et al., 2008; Sawers et al., 2008; Eke et al., 2016). Soil microorganisms such as mycorrhizal fungus enhance the availability and uptake of mineral nutrients for plants. The achievement of arbuscular mycorrhizal fungi inoculation rests on the specific host–fungus combinations and also on the types

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