Effect of arbuscular mycorrhizae on phosphorus deficit stress during early development stage of basil (*Ocimum basilicum* L.)

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INTRODUCTION

Basil (*Ocimum basilicum* L.) is one of the most important and widely used medicinal and aromatic plants. Phosphorus (P) is known as the least available plant nutrient under most soil conditions and therefore represents a major limiting factor for crop production (Hinsinger 2001), because P is involved in primary metabolism processes such as light and dark reactions of photosynthesis (Rychter and Rao, 2005). One of the widely spread adaptation to low P availability in terrestrial ecosystems is development of mycorrhizal associations. Root development is a highly plastic process which is influenced by plant endogenous characteristics (genetic control) and different external stimuli (environmental control) (Malamy 2005), and it is well known that P availability could act as an signal with a profound impact on root system development (López-Bucio et al. 2003). Also, there is evidence that AM fungi could substantially change root architecture (Atkinson et al. 2003). Plant root system characteristics are of fundamental importance to soil exploration and below-ground resource acquisition especially under suboptimal soil conditions (Manschadi et al. 2008).

AIMS

(i) To quantify affinity of different basil accessions to AM inoculation; (ii) To quantify AM-induced changes in early basil root under limited P availability; (iii) To assess possible effect of AM inoculation on photochemical efficiency and gas exchange parameters under limited P availability.

MATERIALS AND METHODS

EXPERIMENTAL DESIGN AND TREATMENTS

- Experiment was conducted in growing chamber at 300 µmol m^{-2} s^{-1} PAR, 25/20 °C, 16/8 h day/night period, and 75% relative air humidity.
- Four basil accessions Genovense, Sweet basil, Dark opal, and var. *purpurascens* 'Erevanskii' were grown for 60 days in 2L pots filled with vermiculite.
- Treatments were represented as AM-inoculated (AMI) and AM-free (AMC) plants.
- AM inoculation was performed by application 0.5 g (2000 spores) of Mycodrip (*Rhizophagus irregularis*, Symbiom LTD) per pot.
- Plants were irrigated by modified Magnavaca nutrient solution (Magnavaca et al. 1987), pH 6.0, 1.0 µmol P L^{-1}.

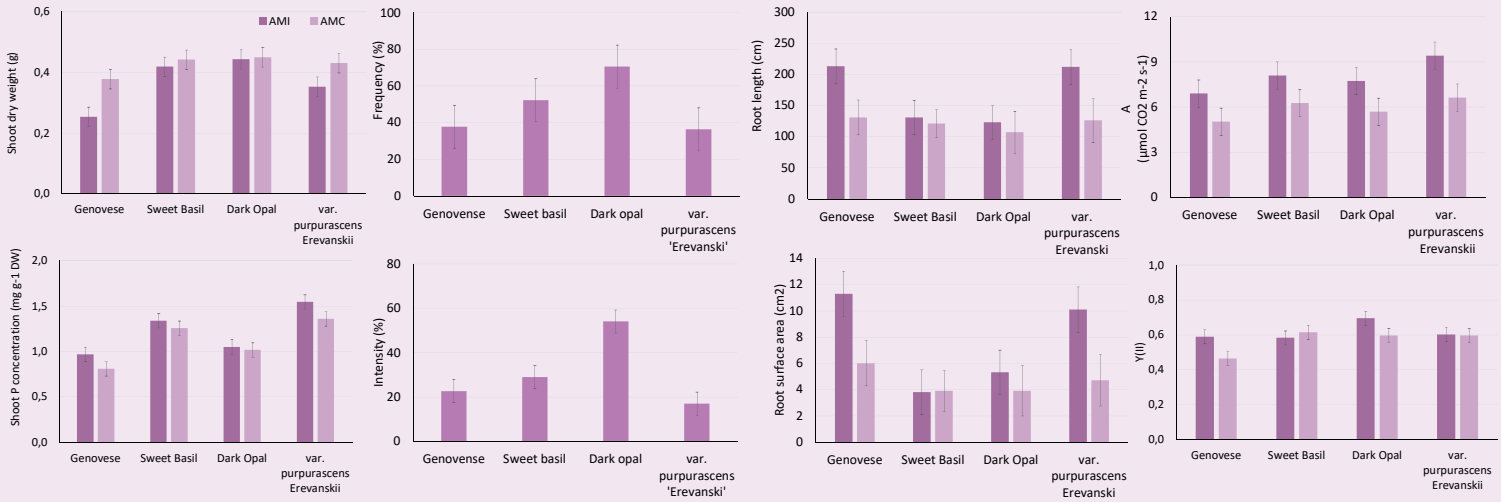
MEASUREMENTS

- Chlorophyll fluorescence - maximal quantum yield of PS2 (Fv/Fm), actual quantum yield of PS2 (YII), apparent electron transport rate (ETR) and proportion of open PS2 (qP) (Schreiber et al. 1994).
- Leaf gas exchange parameters - net photosynthetic rate (A), transpiration rate (E), stomatal conductance (gs), intercellular CO_2 concentration (C_i).
- Root morphology – total root length, volume, surface, average diameter, length of the roots with different diameter, number of root tips, number of forks etc.
- Frequency (F%) and intensity (I%) of mycorrhization (Trouvelot et al. 1986)
- Shoot fresh and dry weight
- Shoot mineral composition (P, K, Ca, Mg, Fe, Mn, Zn, Cu).

GENOVESE | SWEET BASIL | DARK OPAL | 'EREVANSKII'

RESULTS AND DISCUSSION

SHOOT DRY WEIGHT AND P CONTENT | MYCORRHIZATION | ROOT MORPHOLOGY | PHOTOSYNTHETIC EFFICIENCY



CONCLUSIONS

(i) Basil accessions differ in affinity to form AM association, and highest frequency and intensity of mycorrhization was found in Dark opal, followed by Sweet basil.

(ii) AM inoculation increased total root length, surface area, volume, it caused similar increase of both fine and coarse roots length, and it increased number of root tips and forks which indicates higher branching degree. However, those changes were much less pronounced in accessions with higher mycorrhization frequency and intensity (Dark opal and Sweet basil).

(iii) AM inoculation increased phosphorus uptake, photochemical efficiency, (YII, ETR and qP in all accessions except in var. Purpurascens) and stomatal conductance, net photosynthetic rate without increasing intercellular CO_2 concentration.

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