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-Short communication

MICROBIAL INOCULANTS ON THREE MEDICINAL PLANTS OF THE LAMIACEAE, COLONIZED WITH ARBASCULAR MYCORRHIZAL FUNGUS

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Arbascular mycorrhizal (AM) fungal association plays an important role in the nutrient cycling through their microbial activity and their involvement in plant nutrient acquisition (Bethlefalvay et al. 1999). A wide spectrum of studies has been carried out on their ecology and their distribution, their effects on host physiology, biochemistry and genetics (Li et al. 2006). In the present study the roots of three medicinal plants were analyzed growing in experimental pots inoculated with fungi. Plant growth-promoting rhizobacteria (PGPR) and actinomycetes in order to evaluate AM fungal infection and colonization.

Pot experiment was carried out on *Ocimum basilicum, O. sanctum, O. gratissimum* in sandy loam soil. Pre-soaked seeds of the above medicinal plants were sown at 4.0 cm depths of the pot soil (soil characteristic are shown in Table 1). Surrounding rhizosphere of one week seedling plants were separately inoculated with 25.0 ml culture of each phosphate solubilizing fungi PGPR bacteria i.e. *Penicillium* sp. [Dw B1], *Penicillium* sp. [Dw B4] *Aspergillus* sp. [Dw B2], *Penicillium* sp., *Aspergillus* sp. [Dw B3], and 7 phosphate solubilizing bacteria, *Bacillus* sp. [BGgd 20], *Bacillus* sp. [BEyr 22] *Micrococcus* sp. [Dsh 15], *Micrococcus* sp. [Hsh 18], *Pseudomonas* sp. [Kyg 11], *Arthrobacter* sp. [Dsh 15], *Serretia* sp. [Kkg 9] and *Azotobacter* sp. [Gmg 16], *Azotobacter* sp. [Hvbd 7], *Gluconobacter* sp. [Rmv 10], *Streptomyces* sp. [Hu A1]. Watering through misting for 2 hours twice a day was done regularly. Hogland nutrient solution was added to each pot at 25 ml/ month. Finally, 120-day-old plant roots were taken out for analysis of AM colonization by following KOH digestion and trypan blue staining of 1 cm roots bits of each plant (Phillips and Hayman 1970, Kormanic and McGraw 1982). Microscopic observations for the presence of vesicles and arbuscules within the stained roots were recorded and per cent colonization was calculated.

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Table1. Showing characteristics of soil used for experimental pots

Parameters	Mean value
Coarse sand	44%
Fine sand	17%
Slit	14%
Clay	09%
Texture	Sandy clay
pH	6.7
Organic carbon	0.28%
Available nitrogen	142.7 kg/ha
Available phosphate	32.4 kg/ha
Available potassium	17.2 kg/ha

Analysis of roots of different *Ocimum* sp. exhibited AM colonization. However, they differed in occurrence of colonization and their patterns. Since the experiment was carried out in natural and unsterile soil, uninoculated plants were also infected and colonized with least percent colonization (6.2% to 11.4%) except for *O. basilicum, O. sanctum* (Table 2). Mycorrhizal inoculation with *Arthrobacter* do not infected with mycorrhizal roots of *O. sanctum,* similarly *Gluconobacter* sp. Rmv10 with mycorrhizal roots of have not observed in the root colonization of *O. basilicum, O. sanctum* and *O. gratissimum*. A significant higher root colonization was recorded with the inoculation of mycorrhiza with treatment of *Micrococcus* sp. [H sh 18] (44%) on *Occimum basilicum* (39%) followed by *Azotobacter* sp. [Gmg 1] and *Aspergillus* sp. [Dw B2] (32%). Higher per cent root colonization was observed in the roots of *O. sanctum* with treatment *Azotobacter* sp. [Hvbd 7], followed by the treatment of *Bacillus* sp. [BEyr 22]. The extra radical mycelium connects plants roots to the surrounding soil micro habitat increasing the soil volume explicated by host plants. Similarly, mycorrizhal hypae transport mineral nutrient over greater distances from depleted zones (Jakobsen 1995). And thus, under low nutrient conditions AM fungal colonized roots may have an enhanced uptake of relatively in mobile macro and micro nutrient (Subramanian and Charest 1999, Azcon et al. 2002). In addition, mycorrhizal roots often have not only increased length but also modified root architecture (Berta et al. 1995, Lakshman 1996). A limited range of colonization implies low level of potential and infectivity of indigenous AM fungi. In the present study *O. gratissimum* have lower colonization range from 12.2 to 28.2%. It may also reflect the lower potential of plants towards AM fungi infection (Rahangdale and Gupta 1999). The observation of this study was supported by early works of (Lakshman 1998, Sabard et al. 2007, Dash and Gupta 2011). Hence it can be deduced that each plant has its own preference towards mycorrhization (Zaidi et al. 2003). Several environmental factors such as soil moisture, temperature, pH, nutrients and change in plant community composition can influence the AM fungal root colonization.

Table 2. Screening of percent root colonization of tree *Lamiaceae* members for 90 days

Treatment	*O. basilicum*	*O. sanctum*	*O. gratissimum*
Control	3.0 ± 00	1.2 ± 1.0	3.4 ± 1.0
Pencillium sp. Dw B 1	0.0	1.0	17.6 ± 1.0
Pencillium sp. Dw B 4	23.4 ± 2.0	17.6 ± 1.0	21.5 ± 2.2
Aspergillus sp. Dw B 2	32.0 ± 1.0	28.1 ± 1.0	34.2 ± 1.0
Aspergillus sp. DW B 3	18.4 ± 2.0	13.3 ± 1.0	13.2 ± 2.1
Bacillus sp. BGgd 20	15.3 ± 2.2	17.1 ± 0.0	19.2 ± 1.0
Bacillus sp. BE yr 22	13.2 ± 1.2	14.2 ± 2.2	12.5 ± 1.0
Pseudomonas sp. Kyg 11	17.2 ± 0.0	16.3 ± 3.1	13.1 ± 2.2
Serretia sp. Kkg 9	16.1 ± 1.0	14.2 ± 1.1	18.1 ± 2.0
Azotobacter sp. Gmg 16	39.3 ± 7.0	31.4 ± 2.0	19.3 ± 5.0
Azotobacter sp. Hvbd 7	32.5 ± 0.0	42.1 ± 2.1	17.4 ± 2.0
Arthrobacter sp. Dsh 15	42.0 ± 2.0	0.0	15.3 ± 5.2
Micrococcus sp. H sh 18	44.1 ± 3.1	9.8 ± 1.0	2.2 ± 0.0
Micrococcus sp.	11.6 ± 1.0	17.2 ± 2.1	13.4 ± 3.0
Gluconobacter sp. Rmv 10	0.0	0.0	1.4 ± 0.0
Streptomyces sp. HU A1	13.4 ± 5.0	12.2 ± 2.0	15.3 ±5.2

Each value 4 triplicates is the mean value of ± standard error.

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