Effect of AM Fungi Funneliformis mosseae on the Growth of Ocimum sanctum

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Abstract

AM Fungi are the obligatory symbiotic fungi, which form association with almost 80-90% of the plants species. AM fungi are known to increase the plant growth by providing the nutrients available in soil to plants. The aim of the experiment was to see the effect of AM Fungi Funneliformis mosseae on the growth of Ocimum sanctum plant. In the Pot culture experiment Ocimum sanctum was grown by sowing seeds. 50% of the pots were inoculated with spores of Funneliformis mosseae while 50% were kept as Control. Plants were uprooted after three months and effect of F.mosseae was observed on the parameters like number of leaves, height of the plant, length of root, fresh and dried weight of plant. The results obtained for all the above parameters were significantly more in F.mosseae inoculated plants as compared to control plants. The results revealed that inoculation of mycorrhiza significantly increases the growth of plant and biomass.

Keywords
Arbuscular Mycorrhizal Fungi, Ocimum sanctum, Funneliformis mosseae, Growth.

Introduction

Ocimum sanctum is a plant having great economical value and is used in Ayurveda as medicine. There are evidences that Ocimum sanctum can address physical, chemical, metabolic and psychological stress through a unique combination of pharmacological actions (Marc Maurice Cohen, 2014). The symbiotic root-fungal association increases the uptake of less mobile nutrients (Ortas et al., 2001), essentially phosphorus (P) but also of micronutrients like zinc (Zn) and copper (Cu). The symbiosis has also been reported as influencing water uptake.

AMF can also benefit plants by stimulating the production of growth regulating substances, increasing photosynthesis, improving osmotic adjustment under drought and salinity stresses and increasing resistance to pests and soil borne diseases (Al-Karaki, 2006). These benefits are mainly attributed to improved phosphorous nutrition (Plenchette et al., 2005). The ability of VAM fungi to enhance host-plant uptake of relatively immobile nutrients, in particular phosphorus and several micronutrients, has been the most recognized beneficial effect of mycorrhizae.
VAM fungi have the potential to reduce damage caused by soil borne pathogenic fungi, nematodes and bacteria. AMF may be useful in the development of effective methods of plant cultivation and may improve the quality and quantity of obtained material (Khaosaad et al., 2006; Muthukumar et al., 2006)

**Materials and Method**

**Experimental Design**

3 sets of Mycorrhizal and Non- Mycorrhizal pots were taken each containing 5kg of substrate soil: sand in the ratio of 3:1 and 50gm of coco peat was added in each pot.

*5 gms of Funneliformis mosseae* containing 50 spores were inoculated at the time of germination of seeds.

The plants were watered every alternate day.

The plants were uprooted 90 days after sowing and analysed for growth parameters

**Root Colonization:** It was checked by Phillips and Hayman’s method, 1970.

**Spore Extraction:** Spore count was done by Gerdeman and Nicolson’s method, 1963

**Mycorrhizal Inoculation Effect:** It was calculated by the following formula (Bagyaraj et al., 1988).

\[
\text{MIE} = \frac{\text{Dry weight of inoculated plants} - \text{Dry weight of non-inoculated plants}}{\text{Dry weight of inoculated plants}} \times 100
\]

**Results and Discussion**

The Fresh weight of leaves and shoots was checked immediately after uprooting. The dry weight was taken after drying the plant material at 72°C for 48 hrs. The results given in table 1 show that shoot length, root length and number of leaves of Mycorrhizal plants was more than that of control plants, also the fresh weight and dry weight of the Mycorrhizal plants was more as compared to control plants. Our results of the present experiment confirm reports on enhanced plant growth due to AM inoculation to medicinal plants (Earanna, 2001; Bobby and Bagyaraj, 2003; Nisha and Rajeshkumar, 2010; Vasanthakrishna et al., 1995; Rajan et al., 2000, H.S Seema et al., 2015).

**Table.1**

| Sr No. | Type of plant | Description (Each pot containing 5 plants) | Stem length (cm) | Root length (cm) | Number of leaves | Fresh weight of stem of all plants (g) | Dry weight of all stems (g) | Fresh weight of all leaves (g) | Dry weight of all leaves (g) |
|--------|---------------|-------------------------------------------|------------------|------------------|-----------------|--------------------------------------|----------------------------|-------------------------------|----------------------------|
| 1      | Mycorrhizal Plant | pot 1 | 11.100±1.517 | 8.900±0.894 | 13.000±1.581 | 2.4380 | 0.553 | 6.755 | 1.074 |
| 2      | Mycorrhizal Plant | pot 2 | 12.400±2.074 | 11.800±2.864 | 21.000±7.450 | 4.2000 | 0.91 | 8.555 | 1.425 |
| 3      | Mycorrhizal Plant | pot 3 | 11.200±1.095 | 11.400±0.894 | 17.000±2.915 | 2.4380 | 0.553 | 6.755 | 1.074 |
| 4      | Non- Mycorrhizal Plant | pot 1 | 11.600±1.817 | 7.000±2.739 | 9.600±1.817 | 1.402 | 0.220 | 3.980 | 0.625 |
| 5      | Non- Mycorrhizal Plant | pot 2 | 10.000±1.871 | 8.200±2.387 | 11.400±0.894 | 1.402 | 0.220 | 3.980 | 0.625 |
| 6      | Non- Mycorrhizal Plant | pot 3 | 10.200±1.483 | 6.400±1.140 | 11.600±2.302 | 1.402 | 0.220 | 3.980 | 0.625 |
a) Mycorrhizal spore isolated from inoculum of TERI (Funneliformis mosseae) b) Control Ocimum sanctum roots stained with trypan blue c) roots showing infecton of mycorrhiza (Funneliformis mosseae) stained with trypan blue. d) Mycorrhizal spore isolated from inoculated pot after 90 days e) Mycorrhizal spore isolated from inoculated pot after 90 days with hyphae f) Root stained with trypan blue showing presence of vesicle g) Mycorrhizal and control plant showing difference in their growth h) Ocimum sanctum pots.

The Mycorrhizal Inoculation Effect (MIE) is a parameter to assess the growth improvement brought about by inoculation with a mycorrhizal fungus. MIE of F.mosseae in O.sanctum was found to be 48% (H.S seema et al., 2015).

**Spore Density**

50 spores in 5kg of soil was added. After 90days spore density was found to be 60 spores per 20gm of soil, which is much higher compared to the results obtained by Mala et al., 2010.

**Structural change in the Mycorrhizal spore**

The spores of *Funneliformis mosseae* obtained from pure culture of TERI did not show oil globules whereas after three months of association with *Ocimum sanctum*, the spores showed presence of big oil globules in it.

**Mycorrhizal Infection in the Roots**

The percentage infection in root was found to be 90% in the form of arbuscules, vesicles and hyphae.

In conclusion, inoculation of Mycorrhiza (*F.mosseae*) in *O.sanctum* increases the shoot length, root length, number of leaves and dry weight, fresh weight of plants by 50%. The substrate used for growing plant i.e soil: sand: cocopeat was found to be
effective in pots having capacity of carrying 5Kg soil. Oil globules were very prominently seen in the spores after 90 days of infection in the plant.

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