Journal on New Biological Reports
JNBR 5(1) 68 – 70 (2016)

ISSN 2319 – 1104 (Online)

Published by
www.researchtrend.net

AM–leguminous crop plants interaction in the natural and environmentally degraded ecosystem–a case study

Vineeta Sharma

Department of Botany, PGGCG Sector –42, Chandigarh

Corresponding author: vineetashard5728@yahoo.com

| **Received**: 16 March 2016 | **Accepted**: 12 April 2016 |

ABSTRACT

Percent mycorrhizal infection and percent root volume occupied by the AM fungi was found to be significantly more in the leguminous crops grown in undisturbed soils in comparison to the cultivated soils, indicating the negative effect of fertilizers, pesticides and fungicides on these non–target fungi forming association with the roots of the leguminous crop plants.

Key Words: Chandigarh, Diversity, Endomycorrhizal Fungi.

INTRODUCTION

AM fungi are the most widespread plant symbionts that improve the productivity of the plants (Fedderman *et al.* 2010). These fungi play vital role in transformation of plant nutrients from unavailable to available forms. They improve the host plant growth by better uptake of water and other minerals especially the uptake of phosphorus (P), which is present in fixed form in soil (Yamawaki et al. 2013). A lot of work has been done on the effect of these fungi on the improvement of growth of plants (Cavagnaro et al. 2012, Kaur et al. 2014 and Aminifar & Sirousmehr 2014). However, little information is available on the colonization potential of these fungi in plants grown in the soil amended with chemical fertilizers, fungicides and other amendments *viz.* non–cultivated soils. Studies were conducted to know, if the soil amendments have any effect on the percent mycorrhizal infection and root volume colonization by AM fungi in non–cultivated and cultivated soil

MATERIALS AND METHODS

Material: The following crop plants were collected from fields around Chandigarh during the period Feburary 2012 to December 2012 and also grown in non–cultivated soil; *Cajanus cajan* (L.) Millsp., *Cassia tora* L., *Cicer arietinum* L., *Lens culinaris* Medik, *Phaseolus vulgaris* L., *Pisum sativum* L., *Sesbania aculeata* L., *Trigonella foenumgraecum* L., *Vigna aureus* (L.) Wilczek and *Vigna mungo* (L.) Hepper. The same lot of seeds of respective plants were used for experimental trials. The sample of plants were preserved in Formalin Acetyl Alcohal (Formalin, acetic acid, 50% ethanol mixed in the ratio of 13: 5: 200 respectively)

Methods: Identification of the endomycorrhizal fungi associated with the plants was done according to Hall and Fish (1979).

Raising of inoculums of AM fungi was done by collecting soil of the rhizosphere of leguminous plants as it contains spores/ chlamydospores/ sporocarps of AM fungi. The roots of the leguminous plants were uprooted from the above mentioned soils were chopped into pieces and mixed in to the collected soil. *Sesbania aculeata* L. (an important stock plant for raising inoculums)

was raised over the soil filled in earthen pots. AM fungi multiplied inside the plant roots and this soil–root mixture was used as inoculums in various field experiments.

Clearing and staining of roots was done following the methods of Phillips and Hayman (1970). The percent mycorrhizal infection was made after Biermann and Linderman (1981). The percent root volume occupied by the fungus was calculated after Toth and Toth (1982). For comparative evaluation of endomycorrhizal development in cultivated (Disturbed) and undisturbed land, all the leguminous plants were grown in undisturbed land (not under cultivation for the last 10 years) and their root samples were studied along with the sample collected from the plants growing in cultivated land.

RESULTS

The study of different crop plants-endomycorrhizae interaction has revealed the association of species of only three genera with these plants (Table 1). The species of *Glomus* were found to be associated with eight crops (*Cajanus cajan, Cassia tora, Cicer arietinum, Lens culinaris, Sesbania aculeate, Trigonella foenumgraecum, Vigna aureus* and *Vigna mungo*) whereas only *Acaulospora* speices were associated with *Phaseolus vulgaris* and *Pisum sativum. Aculospora trappei* was also found to be associated with the *Cajanus cajan.*

Table 1. Diversity of endomycorrhizal fungi in different crop plants.

Sr. no.	Crop plant	Endomycorrhizal fungus
1	*Cajanus cajan* (L.) Millsp.	*Glomus fueigamus*, *Acaulospora trappei*, *Glomus fuegianum*
2	*Cassia tora* L.	*Glomus pubescens*
3	*Cicer arietinum* L.	*Glomus fuegianum*
4	*Lens culinaris* Medik	*Glomus pubescens*
5	*Phaseolus vulgaris* L.	*Acaulospora trappei*
6	*Pisum sativum* L.	*Acaulospora trappei*
7	*Sesbania aculeata* L.	*Glomus fuegianum*
8	*Trigonella foenumgraecum* L.	*Glomus pubescens*
9	*Vigna aureus* (L.) Wilczek	*Glomus pubescens*
10	*Vigna mungo* (L.) Hepper.	*Glomus pubescens*

The studies concerning the percentage of mycorrhizal infection in cultivated and undisturbed soils of these plants (Table 2) have revealed varying percentage of mycorrhizal infection in these plants. *Vigna aureus* has the maximum percentage of mycorrhizal infection whereas *Trigonella foenumgraecum* has least percentage of infection. The percentage of mycorrhizal infection is higher in undisturbed soils than the cultivated soils. This possibly indicated the effect of soil amendments/ chemicals present in the cultivated soil, which have a negative effect on these non-target fungi.

Table 2. Percent mycorrhizal infection in root samples collected from undisturbed land than the cultivated.

Sr. no.	Crop plant	Mycorrhizal Infection (%)	
		Cultivated soil	Undisturbed soil
1	*Cajanus cajan* (L.) Millsp.	41.0	55.7
2	*Cassia tora* L.	37.5	45.0
3	*Cicer arietinum* L.	26.2	67.0
4	*Lens culinaris* Medik	43.0	56.0
5	*Phaseolus vulgaris* L.	46.0	57.5
6	*Pisum sativum* L.	44.4	53.3
7	*Sesbania aculeata* L.	25.0	60.9
8	*Trigonella foenumgraecum* L.	22.8	45.0
9	*Vigna aureus* (L.) Wilczek	65.0	74.1
10	*Vigna mungo* (L.) Hepper.	47.0	59.1

The study of Table 3 depicts the percentage of root volume of the plants colonized by these fungi. Of all these plant species *Vigna aureus* has maximum occupation of root volume by fungi. Whereas *Cicer arietinum* has the least (%) occupied by the fungi. Study of table 2 and 3 further reveal that the percentage of mycorrhizal infection and root volume occupation increases in the undisturbed soil, than the cultivated soil, which is again indicative of the negative effect of abiotic/ biotic factors on the occurrence of these fungi. These results are in accordance with the earlier findings of Prasher et. al. (2004, 2005 and 2006) which have indicated the negative effect on abiotic/biotic disturbances of the diversity of mycorrhizal fungi in ferns.

Table 3. Percent root volume occupied by fungus in the roots of plants growing on cultivated soils and undisturbed soils.

Sr. no.	Crop plant	Root volume (%) occupied	
		Cultivated soil	Undisturbed soil
1	*Cajanus cajan* (L.) Millsp.	26.4	63.9
2	*Cassia tora* L.	17.9	33.8
3	*Cicer arietinum* L.	17.3	72.2
4	*Lens culinaris* Medik	25.7	62.7
5	*Phaseolus vulgaris* L.	37.7	48.5
6	*Pisum sativum* L.	20.7	48.8
7	*Sesbania aculeata* L.	36.9	69.4
8	*Trigonella foenumgraecum* L.	24.5	51.5
9	*Vigna aureus* (L.) Wilczek	69.2	72.7
10	*Vigna mungo* (L.) Hepper.	38.6	67.0

ACKNOWLEDGEMENT

The author is thankful to Principal Govt. Postgraduate Girls college sector 42, Chandigarh for providing the infrastructural facilities.

REFERENCES

Aminifar J and Sirousmehr A. 2014. Arbuscular Mycorrhizal fungi community, nutrient availability and soil glomalin in organic farming. Int J Farming Allied Sc 3(1): 1–6.

Biermann B and Linderman RG. 1981. Quantifying Vesicular–Arbuscular Mycorrhizae: A Proposed Method Towards Standardization. New Phyol. 87(1): 63–67.

Cavagnaro TR, Barrios–Masias FH and Jackson LE. 2012. Arbuscular mycorrhizas and their role in plant growth, nitrogen interception and soil gas efflux in an organic production system. Pl Soil 353: 181–194. DOI 10.1007/s11104–011–1021–1026.

Fedderman NR, Finally T, Boller F and E Malin. 2010. Functional diversity in arbuscular mycorrhiza the role of gene expression, phosphorous nutrition and symbiotic efficiency. Fungal Ecol 3: 1-8.

Hall IR. and Fish BJ. 1979. A key to the Endogonaceae. Trans British Mycol Soc 73(2): 261–270.

Kaur R, Singh A and Kang JS. 2014. Influence of Different Types Mycorrhizal Fungi on Crop Productivity. Curr Agri Res J 2(1): 51–54.

Phillips JM and Hayman DS. 1970. Improved procedures for clearing roots and staining parasitic and vesicular–arbuscular mycorrhizal fungi for rapid assessment of infection. Trans British Mycol Soc 55: 158–161.

Prasher IB, Baghla A and Khullar SP. 2004. VAM association in some ferns from Chail, Himachal Pradesh, N.W. Himalaya. Indian Fern J. 21: 144-149.

Prasher IB, Sharma S and Khullar SP. 2005. Mycorrhizal association of some ferns from Kangra District (Himachal Pradesh) Indian Fern J 22: 81-86.

Prasher IB, Baghla A and Khullar SP. 2006. Seasonal variation in VAM in species of *Onychium kaulfuss* (Cryptogrammaceae). Indian Fern J 23: 125-132.

Toth R and Toth D. 1982. Quantifying vesicular–arbuscular mycorrhizae using a morphometric technique. Mycologia 74: 182–187.

Yamawaki K, Matsumura A, Hattori R, Tarui A, Hossain MA, Ohashi Y and Daimon H. 2013. Effect of inoculation with arbuscular mycorrhizal fungi on growth, nutrient uptake and curcumin production of turmeric (*Curcuma longa* L.). Agricul Sc 4(2): 66–71.