

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.904.019>

Assessment of AM Fungi Colonization and Spore Population in Different Mungbean Growing Areas of Punjab, India

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ABSTRACT

Keywords

AM fungi,
colonization,
Ferozepur, Kharif,
Mungbean, Spring,
Spore populations

Article Info

Accepted:
04 March 2020
Available Online:
10 April 2020

Arbuscular mycorrhizal fungi (AM fungi) have been found associated with a wide variety of agricultural and horticultural crops, but in legumes it occurs widely. AM fungi are cosmopolitan and ubiquitous in nature under different ecosystems. Different Mungbean growing areas of the Punjab were surveyed to observe the AM fungus colonization with Mungbean and spore population in rhizosphere soil of the crop. The samples from Ferozepur district showed maximum colonization of 80 per cent followed by 78 and 76 per cent colonization of the samples collected from Faridkot and Tarn-Taran districts during spring 2017, respectively. Similarly, in kharif 2017, maximum mycorrhizal colonization was 78 per cent in samples collected from Ferozepur district followed by 77, 69, 60 and 58 per cent colonization in the samples of Faridkot, Moga, Ludhiana and Patiala districts, respectively. Similar trend has been observed in spore population in different districts of Punjab during spring and kharif season. It has been observed that the variance in root colonization and spores population of AM Fungi mainly is due to the different types of soils in different regions of Punjab.

Introduction

Mycorrhiza is a symbiotic mutualistic relationship between fungus and plant roots. It was considered as a very important symbiotic relationship between microorganisms and higher plants. The Arbuscular Mycorrhizal (AM) fungus is widely distributed in natural and agricultural environments and had been found associated with more than 90 per cent of vascular plants and 80 per cent of land plants (Wand and Qiu 2006). Arbuscular mycorrhizal fungi (AMF) colonize the roots of host plants and enhanced the surface area of roots, which directly contributed to the

improved uptake of nutrients like N, P etc and enhanced the growth parameters of plants. AM fungi colonization improved the nutrient uptake and growth of Mungbean plants had been reported by Manke *et al.*, (2008) and Kumar *et al.*, (2017). So to investigate the level of colonization of AM fungi in root plants, different districts of Punjab were surveyed in kharif and spring season.

Materials and Methods

Survey for AM fungus

The different Mungbean growing districts viz; Faridkot, Ferozepur, Ludhiana and Moga etc

were surveyed during spring and kharif seasons in 2017. The rhizosphere soil samples along with complete healthy plants having well developed roots were collected in different polythene bags. All the collected samples were examined in the laboratory to observe AM colonization in root segments and spore population from the soil samples.

Root colonization and spore population

The mycorrhizal colonization was observed through staining of roots according to the procedure of Phillips and Hayman (1970). The AM infection was measured by the method suggested by Biermann and Lindermann (1981). The spores of AM fungi were extracted by wet sieving and decanting technique of Gerdemann and Nicolson (1963). The spore population was counted using counting dish from 25ml spore suspension.

Results and Discussion

AM fungi root colonization

Different Mungbean growing areas of Punjab were surveyed to observe the AM fungus colonization in Mungbean and spore population in rhizosphere soil of the crop. The samples of healthy plants along with soil were collected from Amritsar, Barnala, Bathinda, Faridkot, Ferozepur, Ludhiana, Mansa, Moga, Patiala, Sangrur, Shri Muktsar Sahib and Tarn-Taran districts of Punjab during spring season in 2017 whereas Faridkot, Ferozepur, Ludhiana, Moga and Patiala districts were surveyed during kharif 2017. The average percentage colonization along with spore population of AM fungus was recorded (Table 1 and 2). The samples from Ferozepur district showed maximum colonization of 80 per cent followed by 78, 76, 60, 70, 65, 64, 61, 54, 51, 44 and 27 per cent colonization in the samples collected from Faridkot, Tarn-

Taran, Patiala, Moga, Amritsar, Ludhiana, Shri Muktsar Sahib, Mansa, Barnala and Bathinda districts during spring 2017, respectively. Similarly, in kharif 2017, maximum mycorrhizal colonization was 78 per cent in samples collected from Ferozepur district followed by 77, 69, 60 and 58 per cent colonization in the samples of Faridkot, Moga, Ludhiana and Patiala districts. The minimum colonization of 27 and 58 per cent was recorded from the samples collected from Bathinda and Patiala districts in spring and Kharif season, respectively (Fig. 1 and 2). The samples collected from Faridkot, Ferozepur, Ludhiana and Moga districts in spring season exhibited less mycorrhizal colonization as compared to kharif season in same districts. The percentage colonization was significantly different from each other with respect to the samples collected from different districts. Singh and Singh (2001) reported maximum colonization of 72.5 per cent in the root samples collected from Ludhiana followed by 67.2, 65.9, and 64.6 per cent colonization from the samples of Bathinda, Jalandhar and Faridkot. The minimum colonization of 55 per cent was observed from the sample of Hoshiarpur. Then, Hindumuthi and Reddy (2012) observed mycorrhizal colonization in Mungbean plants collected from Adilabad, Nizamabad and Karimnagar districts of Andhra Pradesh. The mycorrhizal colonization was varied from 36.74 to 90.68 per cent in Mungbean roots.

Spore population

The highest spore population was 800 and 780 spores per 100g rhizosphere soil sample that was collected from Ferozepur district during spring and kharif 2017 seasons. The minimum spore populations were 125 and 450 spores per 100g rhizosphere soil in the samples of Bathinda and Patiala districts during spring and kharif seasons, respectively

(Fig. 2 and 4). The spore population recorded in various districts in spring and kharif seasons was statistically significantly different from each other.

Hindumathi and Reddy (2012) found that the spore population was ranged from 12 to 89

spores per 10g soil in rhizosphere soil samples collected from Mungbean field in Adilabad, Nizamabad and Karimnagar districts of Andhra Pradesh. The spores of *Glomus* spp. were found predominant in all the samples collected from different districts of Punjab in spring and kharif seasons.

Table.1 Root colonization and spore population of Arbuscular Mycorrhizal fungus in different Mungbean growing areas of Punjab in spring 2017 season

Districts	Colonization (%)	Mycelium	Arbuscules	Vesicles	Total
Amritsar	65.00 (53.70)	++	++	+++	475.00
Barnala	44.00 (41.50)	++	+	+	250.00
Bathinda	27.00 (31.20)	+	+	+	125.00
Faridkot	78.00 (62.00)	+++	+++	+++	675.00
Ferozepur	80.00 (63.50)	+++	+++	+++	800.00
Ludhiana	61.00 (51.30)	++	++	+++	475.00
Mansa	51.00 (45.50)	++	+	++	300.00
Moga	70.00 (56.70)	+++	++	+++	600.00
Shri Muktsar Sahib	54.00 (47.20)	++	+	++	350.00
Patiala	60.00 (50.75)	++	++	+++	430.00
Sangrur	64.00 (54.11)	++	++	++	500.00
Tarn-Tarn	76.00 (62.00)	+++	++	+++	625.00
C D at 5%	3.08				67.42

+ = Scanty ; ++ = Moderate ; +++ = Abundant
 Figures in parentheses are arc sin transformed value of respective data

Table.2 Root colonization and spore population of Arbuscular Mycorrhizal fungi in different mungbean growing areas of Punjab during kharif season

Districts	Colonization (%)	Mycelium	Arbuscules	Vesicles	Total
Faridkot	77.0 (61.34)	+++	++	+++	660.0
Ferozepur	78.0 (62.06)	+++	++	+++	780.0
Ludhiana	60.0 (50.75)	++	+	++	450.0
Moga	69.0 (56.16)	++	+	+++	560.0
Nabha	58.0 (49.25)	+++	+	++	450.0
CD at 5 %	3.45				34.97

+ = Scanty ; ++ = Moderate ; +++ = Abundant
 Figures in parentheses are arc sin transformed value of respective data

Fig.1 Colonization of Arbuscular Mycorrhizal fungi in different districts of Punjab in spring Season

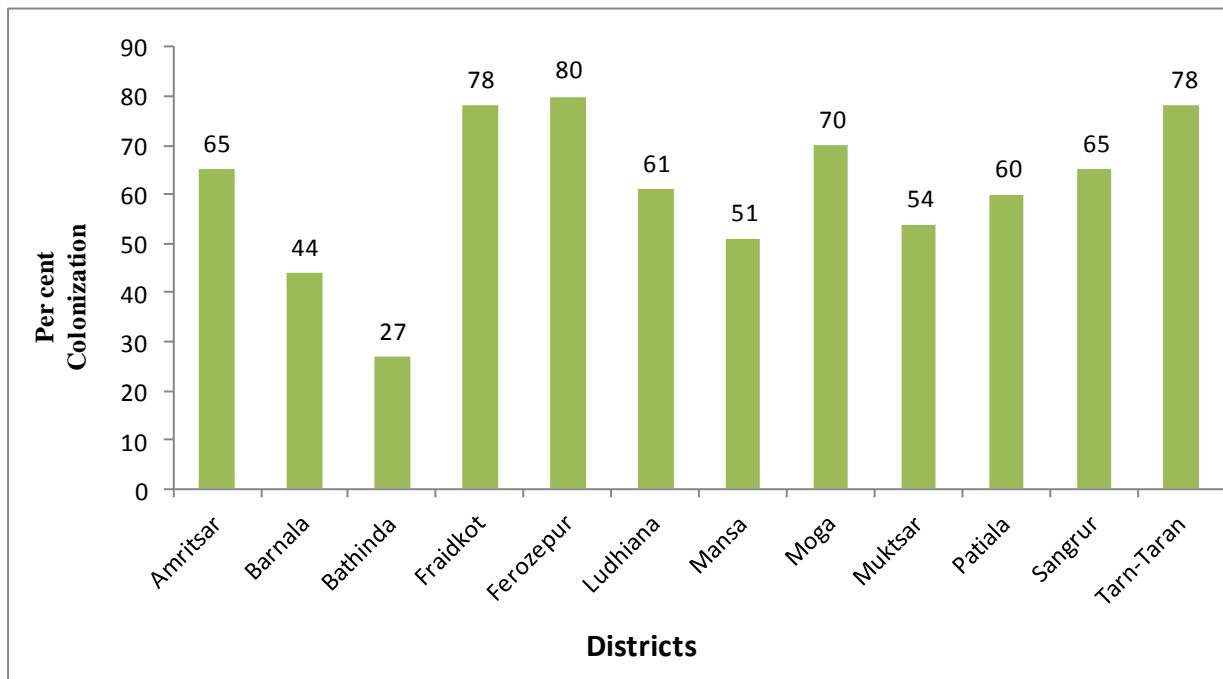


Fig.2 Total number of Arbuscular Mycorrhizal spores in different districts of Punjab in spring season

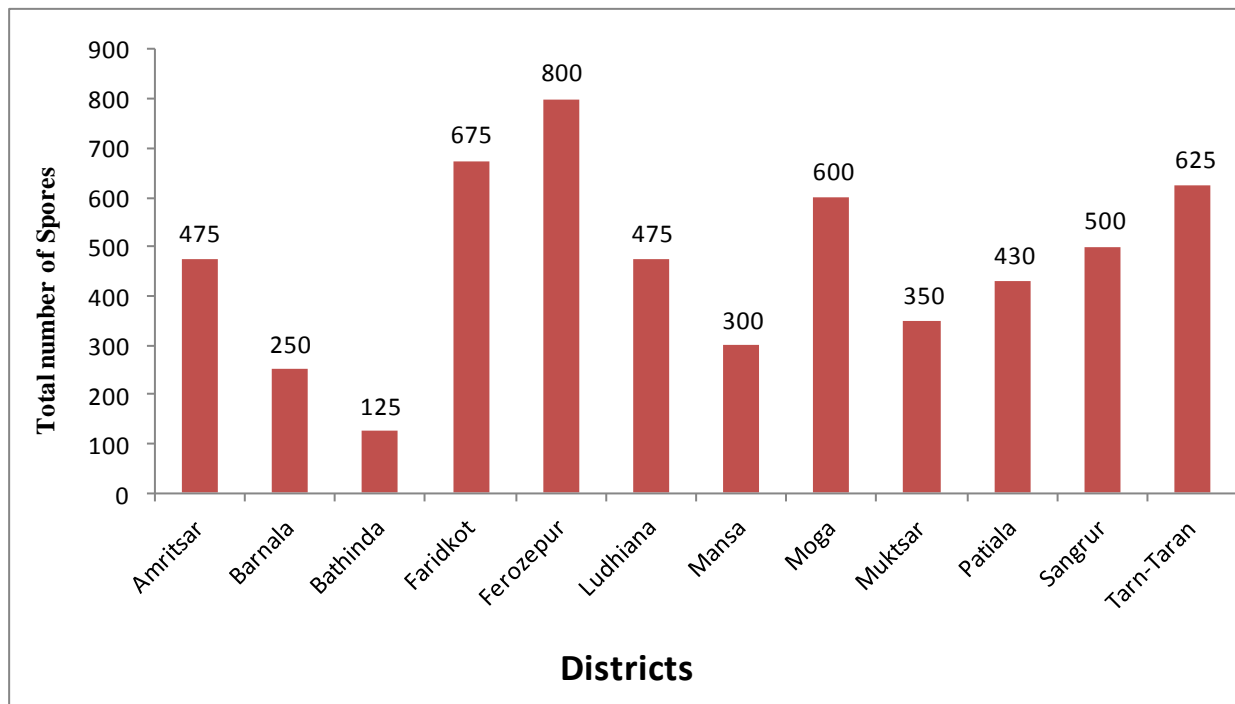


Fig.3 Colonization of Arbuscular Mycorrhizal fungi in different districts of Punjab in kharif season

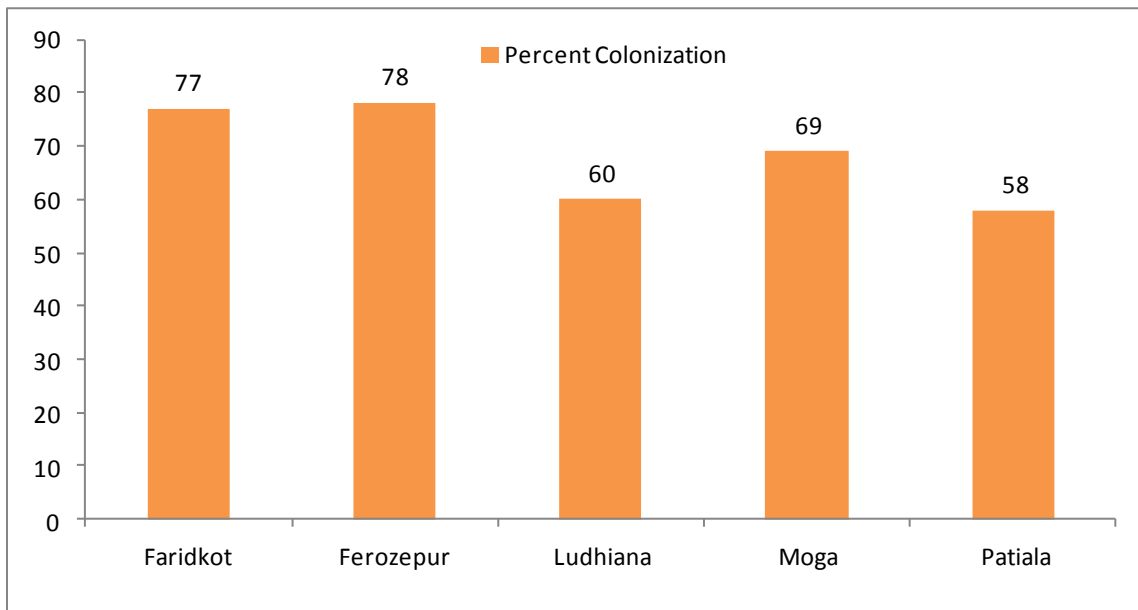
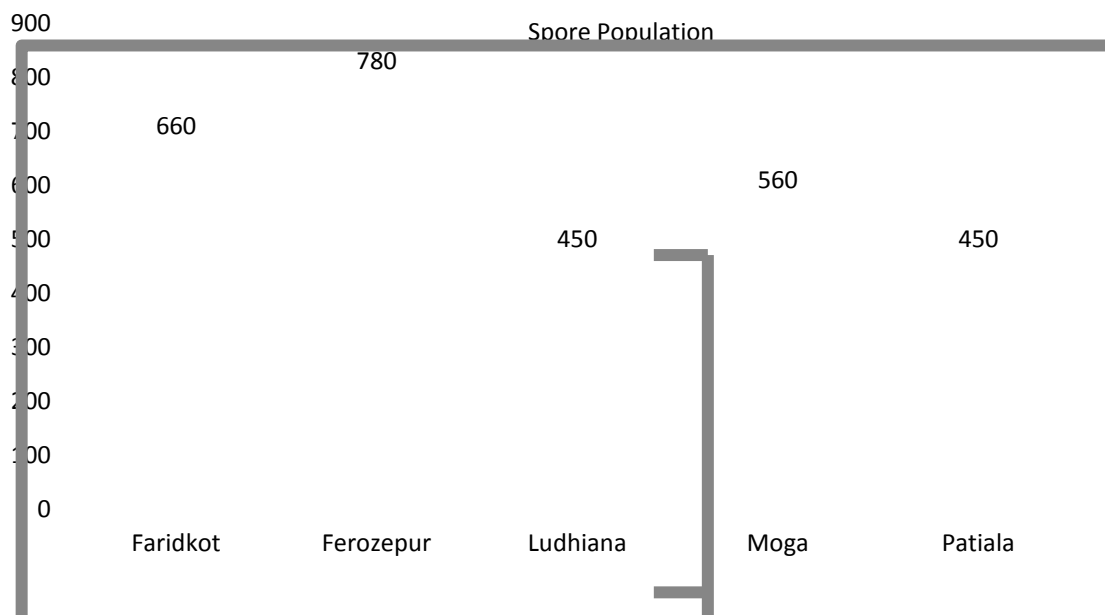


Fig.4 Total number of Arbuscular Mycorrhizal spores in different districts of Punjab in kharif season



The spore population of *Glomus* spp. varied from 76.72 to 440.29 from samples of Bathinda and Ferozepur districts in spring season, respectively. But in kharif season, the

spore population varied from 170.34 to 398.24 in samples collected from Patiala and Ferozepur districts. Singh and Singh (2001) observed the highest spore population (485

spores per 50g) of VAM fungus in the rhizosphere soil collected from Ludhiana district. It was minimum (360 spores per 50g) of soil in the sample of Hoshiarpur district.

Regarding mycorrhizal structures like mycelium, they were present in moderate form during spring and abundantly during kharif season. The arbuscules were observed again in moderate form in spring and kharif seasons in thinner rootlets. After that, the thicker stained root samples exhibited vesicle storage structure that were present abundantly in the host root tissue in spring and kharif seasons, respectively. The vesicles were elongated, present inter-cellularly in root tissues. Hindamuthi and Reddy (2012) observed the abundant presence of mycelium, moderate number of vesicles and arbuscules of AM fungus in root samples collected from Mungbean crop during summer season.

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How to cite this article:

Amandeep Singh, Daljeet Singh Buttar and Randeep Singh. 2020. Assessment of AM Fungi Colonization and Spore Population in Different Mungbean Growing Areas of Punjab. *Int.J.Curr.Microbiol.App.Sci.* 9(04): 152-157. doi: <https://doi.org/10.20546/ijcmas.2020.904.019>