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Research Article

VIGOUR PRODUCTIVITY AND ASSOCIATION OF MYCORRHIZAL FUNGAL ON CICER *ARIETINUM* L. FROM DIFFERENT STUDY SITES

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ABSTRACT
Chickpea (*Cicer arientum* L.) is belongs to family Fabaceae, plants are one of the most important sources of pulses in world. It is the third most widely grown grain legume in the world after bean and soybean. The mycorrhizas are symbiotic association with plant roots and fungi for enhance the growth of the plants. The present study, eight parameters of biomass productivity, AMF assessment of % root colonization and spore density was studied in chickpea plant. Biomass and AMF studies were recorded after 4 months duration in winter season. In this study, five replications were used. In biomass production, height of stem (31.5 cm) was observed more site-4 while less in site 1. Length of root (17.5cm), number of branch (17), number of leaves (135), fresh of shoot weight (19.25 g) and dry shoot weight (6.26 g) was increased in site 1 than others. Fresh weight of root (5.8 g) of site no-3 was increased while less in site 1. Dry root weight (2.8 g) found more in site 3 and less in site 1. In AMF studies, spore density was found more in site 3 (574/100 g soil) followed by site 1 and site 4. AMF percentage of root colonization was increased in site 3 (69.80%) while less in site 4. AMF root colonization types are hyphal, arbuscular vesicular and dark septate endophytes (DSE) are found. Among AMF spore viz. *Acaulospora*, *Glomus*, and *Sclerocystis* genus was found but *Glomus* was found dominant.

Keywords: *Cicer arietinum L, Biomass Production, AMF Spore Density and Root Colonization*

INTRODUCTION
The agronomical importance of chickpea is based on its high protein concentration (approx. 19.3–25.4%) for the human and animal diet, being used more and more as an alternative protein source. Grain legumes are a major source of protein in human and animal nutrition and play a key role in crop rotations in most parts of the world. When grown in rotation with other crops, under certain environmental conditions, they can improve soil fertility and reduce the incidence of weeds, diseases and pests (Chemining and Vessey, 2006; Albayrak *et al.*, 2006).
Plants coexist with a wide variety of beneficial and pathogenic microorganisms at all stages of their life. They employ several genome specific mechanisms to shape the structure and function of their microbial environment (Berg and Smalla, 2009; Lau, 2011). Most legumes possess two main types of root symbiosis with microorganisms, namely atmospheric N2-fixing bacteria and mycorrhizal fungi, thus establishing a triple association capable of supplying plants, especially for N and P requirements (Silveira and Cardoso, 2004).
The Mycorrhizal infected plants have also been shown to better tolerate to the environmental stresses such as nutrient deficient soils, drought conditions, salinity and pathogens than non-mycorrhizal plant (McArthur and Knowles, 1993; Sylvia *et al.*, 1993; West, 1995). The AM Fungi is ubiquitous group of fungi (Smith and Read, 1997). AM Fungi belongs to phylum Glomeromycota (Schenck and Perez, 1988). The general consensus is that AM fungi improve phosphate nutrition of legumes, which in turn enhances plant growth and nitrogen fixation (Cluett & Boucher, 1983). AMF have been shown to differentially colonize plant roots, causing a variety of effects on plant growth, biomass allocation, and photosynthesis (Fidelibus *et al.*, 2000).
Therefore the present investigation was made to Productivity and Association Mycorrhizal Fungal of Cicer *arietinum* L. from different study sites.

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MATERIALS AND METHODS

Ecological Conditions of the Study Area

Naldurg (17.82^0N 76.30^0E) region of Osmanabad districts soil type is deep loamy, alluvial, shallow to sandy and loamy brown to black. The summer temperature going up to 41^0 C or even more, while the winters are usually 10.1-24^0 C. Naldurg place is located at an altitude of 566m and receives an average annual rainfall of 760 mm. in monsoon (June to September) period.

Sample Collection Sites

The rhizosphere soil and root samples were collected from five different sites (sites 1-5) at Naldurg region, for biomass production and Arbuscular Mycorrhizal Fungal study. Five different replications of rhizosphere soil and root samples were collected in separate ziplock polythene bags. Soil samples were used for Isolation, identification and density of AM fungal spores and roots for assessment of % root colonization.

Vigour Productivity

Chickpea plants were collected during Nov-Feb 2015 after 4 months in winter season. Fresh weight of shoot and root samples were recorded. Shoots and roots were separated and oven dried at 60°C for 48 h for the determination of dry mass after recording their lengths (Muthukumar and Udaiyan, 2000).

Mycorrhizal Study

i) Isolation of AMF from Rhizosphere Soil

100 chickpeas of rhizospheric soil was dissolved in 1000 ml of water and decanted through a series of 355 to 35 µm sieves (Gerdemann and Nicolson, 1963). Residues were filtered through Whatman filter paper No 1 and all spores were counted under the stereo-zoom dissection microscope. Intact & healthy AM fungal spores were mounted in PVLG (Polyvinyl alcohol-lacto glycerol) with and without Melzer's reagent for identification using keys (Schenck and Perez,.1988). and INVAM (http://www.invam.caf.wvu.edu). Some spores were identified only up to genus level.

ii) Estimation of Arbuscular Mycorrhizae Fungi Colonization in Roots

The roots were fixed in to FAA. Fixed roots were washed to free FAA cleared in water. Roots are placed in glass vial with 10% KOH and stained in 0.05% trypan blue-lactophenol to determine mycorrhizal colonization, these VAM fungal colonized segments studied.

Then transferred the sieving on to a gridded petriplate and observed it under the binocular microscope 400X (Lawrence and Mayo LM-52-3521). The percent root colonization was measured by using the formula (Giovannetti and Mosse, 1980).

RESULTS AND DISCUSSION

Vigour Productivity

The present study, eight parameters of biomass productivity, AMF assessment of % root colonization and spore density was studied in chickpea plant (Table 1). Biomass and AMF studies were recorded after 4 months duration in winter season.

In this study, five replications were used. In biomass production, height of stem (31.5 cm) was observed more in site 4 while less in site 1. Length of root (17.5cm), number of branch (17), number of leaves (135), fresh of shoot weight (19.25 g) and dry shoot weight (6.26 g) was increased in site 1 than others. Fresh weight of root (5.8 g) of site 3 was increased while less in site 1. Dry root weight (2.8 g) found more in site 3 and less in site 1.

Mycorrhizal Study

AMF percentage of root colonization was increased in site 3 (69.80%) while less in site 4. AMF root colonization types are hyphal (H), arbuscular (A), vesicular (V) colonization was found in all sites while dark septate endophytes (DSE) are found in site 1 & 2 only. In AMF studies, spore density was found more in site 3 (574/100 g soil) followed by site 1 and site 4. Among AMF spore viz. *Acaulospora, Glomus,* and *Sclerocystis* genus was found but *Glomus* was found dominant (Table 2, Figure 1 & 2).

Table 1: Biomass productivity in *Cicer arientum* (Chickpea) from different study sites

Sr.No	Parameters	Site 1	Site 2	Site 3	Site 4	Site 5	Mean
1	Height of Stem(cm)	27.8	24.00	26.7	31.5	24..5	26.9±1.1
2	Length of root (cm)	17.5	14.5	16.5	9.5	10	13.6±2.0
3	Number of branch	17	04	12	03	02	7.6±2.3
4	Number of Leaves	135	56	139	100	48	95.6±1.3
5	Fresh weight of shoot (gm).	19.25	7.04	19.12	8.00	3.38	11.35±3.3
6	Fresh weight of root (gm)	2.10	1.04	5.8	1.11	0.47	2.10±2.5
7	Dry weight of shoot (gm)	6.26	4.79	1.46	3.22	1.75	3.49±1.5
8	Dry weight of root (gm)	1.00	0.65	2.8	0.70	0.20	1.07±0.11
SE±		15.60	6.61	16.16	12.01	13.11	--
CD @ 5%		36.98	15.66	38.30	28.48	27.97	--

Values represent three replications.

Table 2: Arbuscular Mycorrhizal Fungal status in *Cicer arientum* (Chickpea)from different sites

Sr. No	Parameters	Site 1	Site 2	Site 3	Site 4	Site 5	Mean
1	AMF Spore density	564	414	574	465	316	466.6±3.4
2	Percentage(%) of root colonization	47.50	54.75	69.80	62.67	60.50	59.04±4.1
3	Types of root colonization	H,V,A,DSE	H,V,A,DSE	H,V,A	H,V,A	H,V,A	H,V,A,DSE

Values represent three replications, H=hypal, V=vesicular, A=arbuscular, DSE= dark septate endophytes.

The biocontrol role of AM fungi studied here under sterile and unsterile conditions provide almost similar results. This confirms that AM fungi consortia used in this study have potential role as a biocontrol agent under any conditions they are used (Mishra *et al.*, 2009). AMF is of interest for the reclamation and revegetation of degraded lands (Miller *et al.*, 1992), and effective in increasing nutrient uptake, particularly phosphorus, and biomass accumulation of many crops in soils low in phosphorus (Turk *et al.*, 2006). AM fungi are also most important for providing biocontrol through competition for space by virtue of their ecological obligate association with roots (Singh and Vyas, 2009).

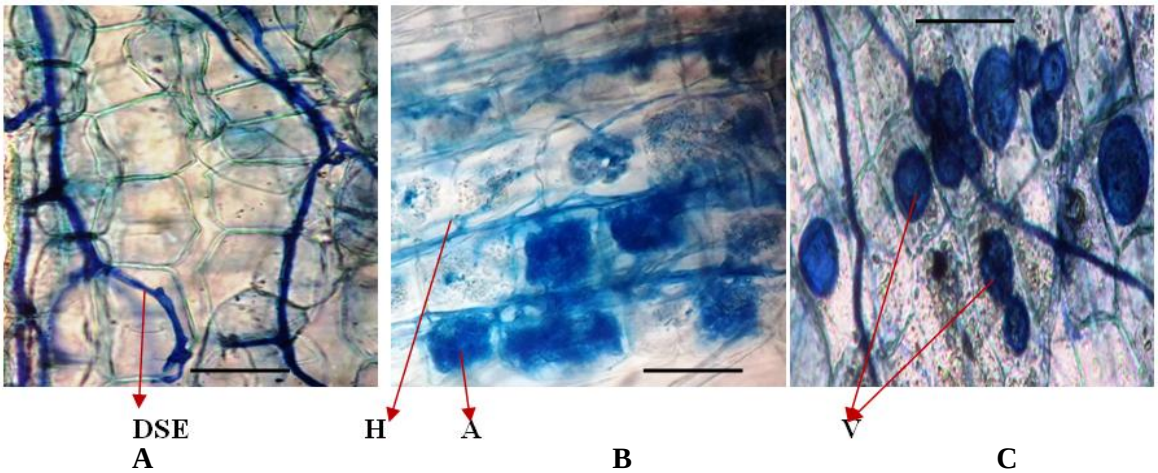
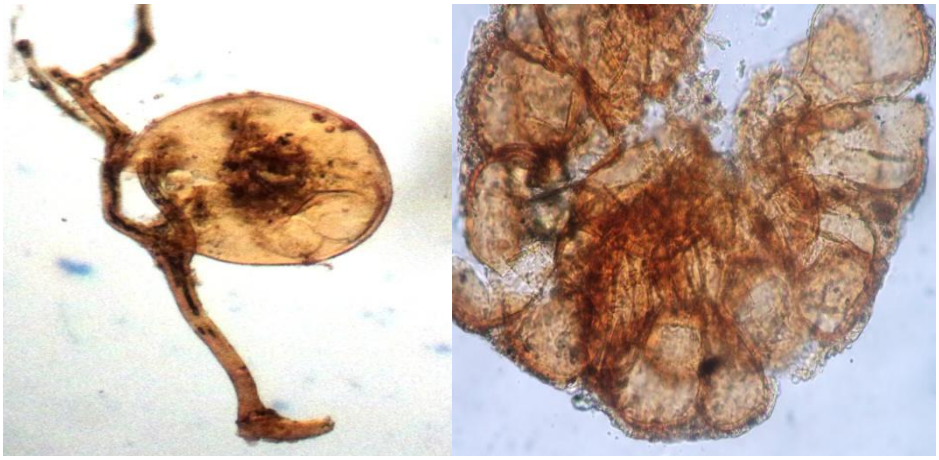


Figure 1: AMF root colonization types, A=DSE(Dark septate endophytes), B=H(hyphal) and A (arbuscules), C=V(vesicles), Scale bar=50µm



***Glomus* sp** ***Sclerocystis* sp**

Figure 2: Studied Arbuscular Mycorrhizal fungal (AMF) genera

Conclusion

In this investigation it was concluded that association of AMF can enhance the biomass productivity.

REFERENCES

Albayrak S, Sevimay CS and Tongel O (2006). Effect of inoculation with *Rhizobium* on seed yield and yield components of common vetch (*Vicia sativa* L.). *Turkish Journal of Agriculture and Forestry* **30** 31-37.

Berg G and Smalla K (2009). Plant species and soil type cooperatively shape the structure and function of microbial communities in the rhizosphere. *FEMS Microbiology Ecology* **68** 1-13.

Chemining wa GN and Vessey JK (2006). The abundance and efficacy of *Rhizobium leguminosarum* bv. *viciae* in cultivated soils of eastern Canadian prairie. *Soil Biology & Biochemistry* **38** 294- 302.

Cluett HC and Boucher DH (1983). Indirect mutualism in the legume-*Rhizobium*-mycorrhizal fungus interaction. *Oecologia* **59** 405–408.

Fidelibus MW, Martin CA, Wright GC and Stutz JC (2000). Effect of arbuscular mycorrhizal (AM) fungal communities on growth of 'Volkamer' lemon in continually moist or periodically dry soil. *Scientia Horticulturae* **84** 127–140.

Gerdemann JW and Nicolson TH (1963). Spores of mycorrhizal Endogone species extracted from soil by wet-sieving and decanting. *Transactions of the British Mycological Society* **46** 235-244.

Giovannetti M and Mosse B (1980). An evaluation of techniques for measuring vesicular-arbuscular infection in roots. *New Phytologist* **84** 489-500.

McArthur DAJ and Knowles NR (1993). Influence of species of vesicular-arbuscular mycorrhizal fungi and phosphorous nutrition on growth, development & mineral nutrition of potato (*Solanum tuberosum* L.). *Plant Physiology* **102** 771-782.

Miller RM and Jastrow JD (1992). The application of VA mycorrhizae toecosystem restoration and reclamation. *In: Mycorrhizal Functioning,* edited by Allen MF (Chapman & Hall, Ltd.,) London, England 438-467.

Mishra M, Singh PK and Vyas D (2009). Phytoprotection role of AM fungi against the *Fusarium* wilt of tomato. *Biozone* **1** 98–109.

MuthukumarT and Udaiyan K (2000). The role of seed reserves in arbuscular mycorrhizal formation and growth of *Leucaena leucocephala* (Lam.) de Wit. and *Zea mays* L. *Mycorrhiza* **9** 323 -330.

Schenck NC and Perez Y (1988). *Manual for the Identification of VA Mycorrhizal Fungi*, 2nd edition (University of Florida, Gainesville) Florida 167-223.

Silveira APD and Cardoso EJBN (2004). Arbuscular mycorrhiza and kineticparameters of phosphorus absorption by bean plants. *Scientia Agricola* **61** 203-209.

Singh PK and Vyas D (2009). Biocontrol of plant diseases and sustainable agriculture. *Proceeding of National Academy of Sciences India* **79** 110-128.
Smith SE and Read SE (1997). *Mycorrhizal Symbiosis* (Academic San Diego, CA).
Sylvia DM, Hammond LC, Bennett JM, Haas JH and Linda SB (1993). Field response of maize to a VAM fungus and water management. *Agronomy Journal* **85** 193-198.
Turk MA, Assaf TTA, Hameed KM and Al-Tawaha AM (2006). Significance of mycorrhizae. *World Journal of Agricultural Sciences* **2** 16-20.
Vivekanandan AS, Ganasena HPM and Shivanayagan T (1972). Statistical evaluation of the accuracy of three techniques used in the estimation of leaf area of crop plant. *The Indian Journal of Agricultural Sciences* **42** 457 - 860.
West HM (1995). Soil phosphate status modifies response of mycorrhizal and non-mycorrhizal *Senecio vulgaris* L. to infection by the rust, *Puccinia lagenophorae* Cooke. *New Phytologist* **129** 107-116.