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Effect of Glomus Fecundisporum Schenck and Smith on Plant Growth and P-Uptake In Vigna Radiata L.

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ABSTRACT
Agricultural production systems are limited by the capacity of the associated ecosystems to sustain their natural properties, even though advances in agricultural technology have reduced our dependency somewhat in this regard the relationship between sustainable agriculture and the environment is one of complimentary and interdependent. The soil is a part of farmer's environment as well as resource to be exploited. Biological management of soil fertility implies the harnessing of biological resources of ecosystem, particularly those of the soil itself, for the manipulation of soil fertility. The most direct means of biological management are those associated with the use of manipulation of biological populations, such as N-fixing bacteria, mycorrhiza and other soil flora and fauna. Arbuscular Mycorrhizal Fungi (AMF) has been described as a 'universal Symbiosis' in plant kingdom. This association plays an important role in the acquisition of mineral nutrients, specially the slowly mobile ion such as phosphorous. In the present work, the attempt has been made to find a niche for the production of mycorrhizal inoculated seedling with an objective of substituting partially or completely the heavy fertilizer application with mycorrhizal inoculation. The effect of most dominant *Glomus* sp. was studied on the major crop of Vidarbha region by performing the pot experiments. The results on *Vigna radiata* L. with AM inocula of *Glomus fecundisporum* Schenck and Smith has benefits over control to the host plant at 50% P fertilization. The present research data provides information for utilization of AM fungi as bio-fertilizer in soil management to protect soil cover and increase yield of this crop in this region. For sustainable development of agriculture *Glomus fecundisporum* Schenck and Smith and some more native species of AM fungi can be taken into account in near future.

Keywords:- *Glomus fecundisporum* , P-uptake , *Vigna radiata* L.

INTRODUCTION

Arbuscular Mycorrhizal Fungi (AMF) has been described as a 'universal Symbiosis' in plant kingdom. The beneficial effects of these intimate associations are well documented. These are symbiotic association formed between zygomycetes (order –Glomales) and with the roots of most terrestrial plants. These association creates an intimate link between plant root and the soil in many types of natural ecosystem throughout the world.

Overall, the use of sophisticated agricultural practices has had, so far, a net beneficial effect upon agricultural production, human welfare, nutrition and health. But mismanagement and overuse have the potential to overwhelm the ability of natural processes to "absorb" these practices. A critical challenge facing most countries is to halt and reverse the present extent of environmental degradation resulting from excessive exploitation of natural resources, especially those manifested in desertification, soil erosion, water logging and soil and water salinization, in order to ensure the needs of future generations.

The increasing use of chemical fertilizers for increasing crop productivity is adversely affecting the quality of the soil. Application of chemical biocides is an effective technique to manage plant disease but is controversial because of its highest costs and environmental effects. It is believed that soil microorganism plays a major role in nutrient cycling and plant growth. In contrast to conventional agriculture and contrary to the chemical fertilizers the organic manures and bioinoculants are less expensive and increase productivity without harming the environment.

It is well known that Am fungi improve the growth of plants by increasing the absorptive surface of roots composed with root hairs and thus help in the absorption of phosphorus copper and zinc which are relatively immobile in the soil and form Am colonization and sporulation composition of plotting mixture is of great importance. Artificial introduction of more efficient species of Am fungi into soils, where they are lacking or are present in low numbers or inefficient species in the form of an inoculants can improve the growth of many plants.

AMF and P-Uptake

Phosphate is relatively immobile in soil and diffuses only slowly to the plant root. As a result, in soils of low P availability, depletion zones soon develop around the roots. It is now well established that mycorrhizal infection can enhance the uptake of P (Plenchette, et al., 1983). Most of the work has been focused on phosphate nutrition, because P is one of the major plant nutrients and in P deficient soils AM can stimulate plant growth by several folds. The studies on effect of P-uptake and plant growth were carried out in different plant species by Krishna and Bagyaraj, 1982; Krishna et.al., 1984; Bolant,1991.

Taking into consideration the beneficial effect of AM fungi, the present scheme of work is proposed. In this work, the attempt has been made to find a niche for the production of mycorrhizal inoculated seedling with an objective of substituting partially or completely the heavy fertilizer application with mycorrhizal inoculation. We have screened different mycorrhizal species having positive effects on various crop plant's seedlings, survival, growth, nutrient uptake and yield under field conditions and Finally The effect of most dominant *Glomus* sp. was studied on this major crop of the region by performing the pot experiment.

MATERIAL AND METHODS

PURE INOCULUM PRODUCTION:

Glomus fecundisporum schenck and smith was found to be the most dominant amongst all isolated AMF spores from the medico-botanical garden of Shri Shivaji Science College, Amravati. Hence it was selected for inoculum production and pot experiment. The spores were isolated to obtain effective, indigenous isolates. Funnel technique was used to produce pure inoculum of these isolates.

POT EXPERIMENT

The experiments were carried out in the polyhouse under controlled conditions in the month of March to May with three replications. The rhizosphere soil was collected from medico-botanical garden of Shri Shivaji Science College, Amravati and used for pot (polybag) experiments. The sample soil was analysed for physico-chemical parameters (Jackson, 1967) prior to the experiment particularly to know the phosphorus status by Olsen method. Plants were uprooted on 7, 14,21 and 28 DAS (Days After Sowing). The growth parameters were recorded. Rhizosphere soil from each polybag of each treatment was wet sieved to confirm the presence of spores of the appropriate fungus at the end of experiment.P-Uptake by the plants was recorded.

RESULT AND DISCUSSION:

Table-2 shows the variations in root, shoot length; and number of leaves of *Vigna radiata* L. plants during 4weeks of growth period, recorded at 7, 14,21 and 28 DAS intervals. After 28 DAS there is slight increase in the growth parameters with AMF and phosphorus levels at 50 and 100%.

Similar studies have been done by following workers. The application of beneficial microorganisms can enhance the growth and increase the yield of crops. In this context, Yasmeen et.al.,2012 have analyzed the growth, yield and nutrient status of *V. radiata* L. in a field experiment. One of the main objectives of their study was to explore the beneficial effects of potential bacterial inoculants (nitrogen fixers and phospate solubilizer) and indigenous mycorrhizal fungus that can be used as biological fertilizers. Their study suggests that the combined application of mix bacterial inoculants and AM fungus was more effective than other inoculation treatments and are suggested to be important bio-resource for efficient bioinoculant development for *V. radiata* productivity.

AMF infection was observed by Xiao et.al., 2010 in the treatments that were inoculated with AMF, while no any AMF infected root was observed in the control and in the intercropping system without AMF inoculation. Biomass of mycorrhizal mungbean increased significantly by 146.8 and 69.3% in the monocropping and intercropping treatments more than that of the control and the intercropping treatment without AMFinoculation, respectively. Their study implied that mycorrhizal mungbean uptook more soil P than non-mycorrhizal mungbean.

Panneerselvam and P. Thamizhiniyan, 2011 have reported that application of AM fungi in loamy soils will result in improved growth of mungbean crops. Similarly, Habibzadeh 2014, reported Inoculated plants with *G. mosseae* showed more leaf phosphorus, plant height, leaf number, leaf dry weight, pod number, seed/pod, root dry weight, root length, root volume, and chlorophyll index than control. Their overall results showed that in low amounts of soil phosphorus (5 mg P Kg/soil), mycorrhiza can be functionally equivalent with 15 mg P Kg/soil non-mycorrhizal plants. Therefore, recommended in areas with low P soil content, *G. mosseae* of mycorrhizal species may be used as a biological fertilizer in mung bean plants.

The experiment on *Vigna radiata* L. with AM inocula of *Glomus fecundisporum* Schenck and Smith has shown benefits over control to the host plant at 50% P fertilization. For sustainable development of agriculture *Glomus fecundisporum* Schenck and Smith and some more species of AM fungi can be taken into account in near future.

Table – 1 – physico – chemical Analysis of soil sample

Site	PH	EC	Org. C %	P (kg/ha)	K (kg/ha)
S_1	7.53	0.7	0.39	12.63	380.22

Table-2 Effect of Glomus fecundisporum on growth parameters of *Vigna radiata*

			7 day Length in centimete				14 day Length in centimete				21 day Length in centimete				28 day Length in centimete			
	Most	Treatment	Root	Shoot	R/S	No.	Root	Shoot	R/S	No.	Root	Shoot	R/S	No.	Root	Shoot	R/S	No. Lvs.
	Radiat	Control	3.1cm	24.7	0.0125	2	2 cm	17.2cm	0.116	2	3.2 cm	29.1 cm	0.109	2	2.5cm	29.5	0.084	2
	(100%)	Only Seed	2.8cm	26.8	0.173	2	3.2cm	25.2cm	0.125	2	2.2 cm	28.2 cm	0.078	2	2.9cm	30	0.096	2
	(100%)	Only $P_2{}^03$	1.8cm	24.9	0.072	2	2.1cm	18.6cm	0.112	2	1.9 cm	30 cm	0.063	2	3cm	30.2	0.099	2
	(50%)	Only $P_2{}^0s$	1.2cm	23.7	0.05	2	3 cm	21.1cm	0.142	2	3 cm	30 cm	0.1	2	2.8cm	30.5	0.091	2
Sr.	(100%)	Only $P_2{}^0s$+ inocm																
1		Only $P_2{}^0s$+ inocm	3cm	19.2 cm	0.156	2	2.6cm	21.5cm	0.12.9	2	3 cm	30 cm	0.1	2	3.4cm	27.8	0.122	2
2		Only $P_2{}^0s$+ inocm	2.1cm	19 cm	0.11	2	1.8cm	2.3 cm	0.078	2	2.5 cm	29.1 cm	0.85	2	3.1cm	30.5	0.101	2
3		Only $P_2{}^0s$+ inocm	1.5cm	18.9 cm	0.073	2	1.5cm	21.3cm	0.0704	2	2.9 cm	29 cm	0.1	2	3.2cm	30.1	0.106	2
Sr.	(100%)	Only $P_2{}^0s$+ inocm																
1		Only $P_2{}^0s$+ inocm	1.4cm	19.1 cm	0.0732	2	2.1cm	26.8cm	0.078	2	2.9cm	21.9 cm	0.132	2	3.2cm	32.5	0.098	2
2		Only $P_2{}^0s$+ inocm	1.2cm	19.1 cm	0.0628	2	1.7cm	26.2cm	0.064	2	1.6 cm	25.3 cm	0.063	2	3.2cm	30	0.01	2
3		Only $P_2{}^0s$+ inocm	1cm	19 cm	0.0526	2	2 cm	18.3cm	0.1092	2	2.1 cm	24.1 cm	0.087	2	3cm	30.1	0.099	2

Table-3.Effect of different levels of phospharus & AM isolateon Fresh & Dry Wt. MIE(%) P, Uptake of vigna radiata				P-uptake(%)	MIE
28 DAS					
	Treatments	Fresh Wt. (gm)	Dry Wt. (gm)		
	P205(100%)	0.36	0.5	0.42	9.5
	P_20_5(50%)	0.24	0.3	0.21	16.36
	Control				
	Only Seed	0.14	0.05	0.15	
	Only inoculum	0.36	0.02	0.17	
	Only $P_2{}^{05(}$50%)	0.24	0.04	0.2	
	Only $P_2{}^{05}$(100%)	0.3	0.06	0.2	

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