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Survey on Mycorrhizal Colonization in Roots and Spore Population in Rhizosphere Soils of Different Cotton Varieties

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ABSTRACT

The present study reveals that the occurrence, distribution and colonization of mycorrhizal fungi in different cotton seed varieties collected from 25 places of Mahabubnagar District, Andhra Pradesh. Direct correlation was observed between the mycorrhizal colonization and the number of *Arbuscular mycorrhizal* spores. Mycorrhizal colonization was drastically effected by seed variety and not with the soil type. The maximum colonization was recorded with Mahyco seed variety from Jadcherla (Malleboinpally) and Achampet (uppununtala) samples which was cultivated in black and red soil and least infection was found in Kanak variety, which cultivated in red soil of Timajipet (Avancha). Qualitatively and quantitatively *Glomus species* was dominated in all type of soils. The combination of *Glomus* along with *Scutellospora* and *Gigaspora* has shown maximum mycorrhizal infection.

Key words: *Arbuscular mycorrhizal* fungi, Mycorrhiza, Cotton seeds, Cotton varieties, Rhizosphere soils, Spores

The role of *Arbuscular mycorrhizal* (AM) fungi has been described as a link between plant and soil (Bathlenfalvay and Linderman 1992, Miller and Jastrow 1994). Cotton is one of the most important commercial crops of Mahabubnagar District, being a major source of foreign exchange. Cotton-white gold is an important raw material for ginning and textile industry. Different cotton seed varieties are in use, to produce the best yield of cotton. Good growth in cotton plants is highly dependent on the establishment of a special relationship known as mycorrhizal symbiosis. Mycorrhizas are highly evolved associations between soil fungi and plant roots and symbiosis means they are living together. This mycorrhizal symbiosis forms when fungi in the soil colonise the roots of plants and both the plant and the fungus gain from the association (Bagyaraj and Varme 1995).

Many crops depend on mycorrhizal symbiosis and this is especially true for cotton, because the fungus as the primary means by which it obtains important elements, such as phosphorus, from the soil. The phosphorus is transferred to the plant via arbuscles microscopic, functional structures that develop inside individual cells of the plant root. Fungal thread grows into the soil surrounding the roots to absorb elements such as phosphorus and zinc. In effect, the fungi increase the volume of soil from which the root system can extract these elements. In return for the phosphorus, the plant provides the fungus with sugar produced by photosynthesis, which enable the fungus to grow. A general survey was done to evaluate the percentage of infection and occurrence of *Arbuscular mycorrhizal* fungal spores in different localities of Mahabubnagar District. According to the present survey Mahyco seed variety was grown best and produce good yield of cotton and it also had the maximum mycorrhizal colonization (Sutton 1973) of *Arbuscular mycorrhizal* fungi. *Glomus* and *Gigaspora* species were dominated in the rhizoshpere soil (Babu and Manoharachary 2003) of Mahyco seed variety.

MATERIALS AND METHODS

During present investigation 25 different samples of Mahabubnagar District were surveyed to study the Mycorrhizal colonization of *Arbuscular mycorrhizal* fungi (Abbott *et al*. 1992) in roots and distribution of *Arbuscular mycorrhizal* fungal spores in the rhizoshpere soils (Mishra 1968).

Preparation of roots for Arbuscular mycorrhizal assessment

Roots were carefully extricated from the plants and washed thoroughly with water in order to remove the soil attached to them roots fixed in FAA were washed thoroughly to remove FAA and observed under dissection microscope to examine *Arbuscular mycorrhizal* fungal spores attached to them. After examination, the roots were cut into 1cm bits, cleared in 2.5% KOH (Koske and Gemma 1989), acidified with 5N HCl and stained with trypan blue (0.05% in lacto glycerol) by keeping overnight immersed in the stain. The stained root bits were examined with a compound microscope (X 200-400) for *Arbuscular mycorrhizal* fungal structures developed inside and the % of root length colonization was estimated according to Gioventti and Mosse (1980).

Isolation NAD identification of AMF spores

One hundered gram soil was dispersed in 1L water and the suspension was decanted through a series of 10-50 µm sieves. The residues in the sieves were washed into beakers. The sievates were dispersed in water and filtered through gridded filter paper. Intact spores were transferred using a

wet needle to polyvinyl alcohol-Lacto glycerol with or without Melzer's reagent on a glass slide for identification. Spores were identified based on their morphology and sub cellular characters and compared with original descriptions of Schenck and Perez (1987).

RESULTS AND DISCUSSION

The distribution of AM fungal communities was altered by seed variety and type of spore combination and not with the soil type (Mosse 1972, Hayman 1982). A direct correlation was observed between percentage of infection and number of propagules in the rhizoshpere (Mago and Mukerji 1994). The results shown that mycorrhizal colonization in different seeds of cotton ranged from 45% to 89%, lowest was recorded in Kanak seed from Timajipet (Avancha), cultivated in red soil whereas highest colonization was recorded in Mahyco seed variety from Jadcherla (Malleboinpally) followed by Achampet (uppununtala) which were cultivated in black and red soils (Table 1). Mahyco seed variety from Jadcherla (Malleboinpally), Achempet (Uppununtala) and from Narayanpet (Kullampally) has shown maximum colonization i e 89%, 87% and 86%, cultivated in black and red soil. Ajeet seed from Talakondapally (Veljial) had shown the mycorrhizal colonization of 78% and Rakhi seed from Ghanpur (Malkapur) had shown the mycorrhizal colonization of 76%, which were cultivated in black soil. Mallika seed from Divitipally cultivated in sandy type of soil and Tualsi seed from Jadcherla (Chintaboinpally), Midjil (Rayvally, Mahabubnagar had shown the mycorrhizal colonization of 55%, 75%, 72%, respectively, which were cultivated in stony type of soil and red soil. Only one seed i e Chiranjeevi from Jadcherla (Malleboinpally) cultivated in clay type of soil has shown the mycorrhizal colonization of 60%. Among the 25 seed varieties most of the seeds were from the red soil (11), followed by the black soil (8), which was followed by the sandy type soil (3) and only one seed was from the clay type soil.

Table 1 Distribution of Mycorrhizal fungal species in different localities of Mahabubnagar District, Andhra Pradesh

Location	Seed variety	Soil type	Mycorrhizal colonization %	No. of Spores/ 100gm of Soil	Type of Spores					
					Gl	Ac	Sc	Scut	Gig	Ent
Jadcherla (Malleboinpally)	Mahyco	Black	89	302	+	-	+	+	+	-
Achempet (Uppununtala)	Mahyco	Red	87	292	+	-	-	+	+	-
Narayanpet (Kullampally)	Mahyco	Red	86	269	+	-	-	+	+	-
Talkondapally (Veljial)	Marvel	Black	80	190	+	-	-	+	+	+
Talkondapally (Veljial)	Ajeet	Black	78	185	+	-	-	-	+	-
Ghanpur (Malkapur)	Rakhi	Black	76	183	+	-	-	-	+	-
Nawapet	Tualsi	Black	75	170	+	-	-	+	+	-
Midjil (Reyvally)	Tualsi	Red	75	179	+	-	+	+	+	-
Divitipally	Mallika	Sandy	75	175	+	-	+	-	-	-
Mahabubnagar (Appanapally)	Tualsi	Red	72		+	-	-	-	+	-
Jadcherla (Chintaboinpally)	James	Red	70	159	+	-	-	+	-	-
Dhanvada (Chinnachintakunta)	Chiruta	Black	65	142	+	-	-	-	+	-
Mahabubnagar (Alipur)	James	Red	65	140	+	-	-	-	+	-
Nawapet (Fathepur)	Bunni	Red	62	130	+	+	-	-	+	+
Makthal	Biotech	Red	60	129	+	-	-	-	+	-
Gandid	Mallika	Sandy	60	125	+	-	+	-	-	-
Jadcherla (Malleboinpally)	Chiranjeevi	Clay	60	129	+	-	+	-	+	-
Midjil (Urkundapet)	Tagoore-2	Red	60	115	+	-	-	-	+	-
Balnagar (Peddarayvally)	Varsha	Black	60	110	+	-	-	+	-	-
Midjil (Veljial)	Obama	Black	60	109	+	+	-	+	+	-
Jadcherla (Chintaboinpally)	Tulasi	Stony	55	92	+	-	-	+	+	-
Balnagar	Tagoore-2	Red	50	89	+	-	-	-	+	-
Atmakur (Narwa)	Brahma	Sandy	50	85	+	-	+	-	+	-
Amisthapur (Siddhayapally)	Nuziveed	Sandy	49	89	-	+	+	-	+	-
Timajiet (Avacha)	Kanak	Red	45	75	+	-	+	-	+	-

Where Gl-*Glomus*, Ac-*Aculospora*, Sc-*Scelrocystis*, Scut-*Scutellopspora*, Gig-*Gigaspora*, Ent-*Entrophospora*.
'+'-Presence of spore, **'-'** –Absence of spore

Spore population varied from a minimum of 75 to 302 per 100g of soil. Mycorrhizal colonization and spore population were found to be more in Jadcherla (Malleboinpally), Achempet (Uppununtala) and Narayanpet (Kullampally). These soils supported *Glomus* (Paula *et al*. 1991), *Scutellospora* and *Gigaspora* species along with one combination of spore, *Scelerocystis*, which was found in Jadcherla (Malleboinpally) sample. The predominating spores from all 25 samples are *Glomus* and *Gigaspora*, which were found in 21 samples and least dominating spore was *Enterophospora*, which was found in only two samples i e Marvel and Bunni. There is a direct correlation between mycorrhizal colonization and spore population. The sample which was having more mycorrhizal colonization, was

having the maximum spore population i e Jadcherla (Malleboinpally) Mahyco seed variety sample has shown the 89% colonization and 302 spores per 100g of soil. The least mycorrhizal colonization was shown by Kanak seed from Timajipet (Avancha) i e 45% and 75 spores per 100g of soil. There is a direct correlation was observed between the mycorrhizal association with seed variety but not with the soil type. Spore distribution was not affected by soil type but the combination of spore propogules was shown a drastic effect on the % of infection with the seed variety.

The *Arbuscular mycorrhizal* colonization and spore number was varied according the seed variety but not with the soil type. Distribution of *Arbuscular mycorrhizal* spores was depended on the nature of soil. Effectiveness of *Arbuscular mycorrhizal* fungi is determined by their ability to colonize the root with the seed variety. This investigation will suggests that effectiveness of root infection directly correlate with type of spores and seed variety but not with the soil type.

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