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Screening of Brinjal Rhizosphere Soil for Assessment of AM Fungi

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Abstract

Arbuscular mycorrhiza (AM) is a symbiotic association between fungus and roots of plants and is primarily responsible for nutrient transfer. AM is one of the most common symbioses worldwide and about 80% of known plant species form AM. It is now widely accepted that climatic and edaphic factors can substantially influence AM association and its population. AM fungi promote water and nutrient uptake in plants, especially of insoluble soil phosphate (Pi) fraction. The Rhizosphere soil analysis was carried out to check contents of OC (%), P_2O_5 (Kg / ac), K_2O (Kg / ac), Zn (ppm), Cu (ppm), Fe (ppm), Mn (ppm) along with pH and EC from four different sites of Yeola taluka, Nasik district. The maximum number of AM propagules and 87 % root infection was reported from Savargaon locality (482 per 100 g of soil) and minimum number of AM propagules with 42 % root infection was reported from Nagarsol locality (136 per 100 g of soil). Three genera with seventeen species were found associated with rhizosphere soil of brinjal. The genus *Glomus* was dominant with ten species. The other genera reported were *Scutellospora* with five species and *Acaulospora* with two species.

Introduction

Mycorrhizae have been associated with vascular plants since the Paleozoic era (Taylor, 1990). Arbuscular mycorrhizae (AM), the most prevalent plant-fungus association, comprise about 150 species, belonging to the order Glomales of Zygomycotina (Myrold 2000). Redhead (1977) and Koske (1987) found that nutritional conditions of the soil played an important role in deciding the richness of the species and population density of AM fungi. Soil conditions such as pH, temperature, texture, and others also govern the diversity of AM fungi (Land and Schonbeck, 1991). Soil pH plays an important role in phosphorus availability in soil and uptake by plants (Wang *et al.*, 1985). Soil pH, thus, has significant importance in VA mycorrhizal symbiosis and distribution of AMF (Janardhanan, *et al.*,1994).

Aziz, *et al*., (2011) have studied response of *Solanum melongena* L. to inoculation with Arbuscular mycorrhizal fungi under low and high phosphate condition. Hayder, *et al.*, (2014) studied influence of mycorrhizal fungus and certain rhizobacteria on root-knot-nematode (*Meloidogyne incognita*) and growth of brinjal (*Solanum melongena* L). Irfan, *et al.*, (2011) stated application of arbuscular mycorrhizal fungal inoculant on growth enhancement of *Solanum melongena* Linn. at different phosphorous level. Srivastava, *et al.*, (2009) studied effect of integrated nutrient management on the performance of crops under brinjal (*Solanum melongena*) - pea (*Pisum sativum*) - okra (*Hibuscus esculentus*) cropping system. Vani, *et al.*,(2014) studied Arbuscular mycorrhizal fungi associated with rhizosphere soil of Brinjal cultivated in Andhra Pradesh, India. Gurumurthy, *et al.*, (1997) studied responses of eggplant (*Solanum melongena* L.) to VA Mycorrhizal Inoculation in Black Clayey Soil. Suchitra and Manivannan (2012) studied on the influence of organic inputs on the growth and fruit yield of brinjal in various seasons. Jagatheeswari and Ranganathan (2013) studied in vitro multiplication of vegetable crop in Brinjal (*Solanum melongena* L.). Jothi and Sundarababu (2002) studied nursery management of *Meloidogyne incognita* by *Glomus mosseae* in eggplant. Jagatheeswari (2013) studied the effect of vermicompost on growth and yield of eggplant (*Solanum melongena* L.).

Brinjal is cultivated in Maharashtra as one of the main vegetable crop. Survey of literature do not show any report on association of AM Fungi with brinjal in this area. This study will report the biodiversity of AM fungi associated with

brinjal plant in Yeola taluka of Nashik district and will definitely useful to all brinjal growers to increase yield and to improve fertility of soil.

Materials and Methods

In 2013-14, we collected rhizosphere soil samples of brinjal from four different localities of Yeola taluka, Nasik district. The latitude and longitude of Yeola, India is 20° 02' 0" N / 74° 30' 0" E. About 4- 8 samples were collected from selected localities like Savargaon, Nagarsol, Mukhed and Gavandgaon. From fresh soil sample fine roots were fixed in solution of FAA. Roots were autoclaved for 15 to 20 minutes in 10% KOH solution, cleared in distilled water and neutralized with 2% HCl and stained in 0.05% trypan blue in lactophenol. The percentage root infection was measured by Philli method. About 100 g air dried soil sample placed into with 1000 ml of tap water. The mixture was vigorously mixed with glass rod for half minute. After settling the soil the suspension was slowly poured through a set of 240, 170, 150,100 and 72 extracts were washed away from sieves to what man filter paper. Using trinocular research microscope, spores, aggregates and sporocarps were picked by means of needle (Gerdemann and Nicolson, 1963). To each drop of PVLG, 5- 10 spores were added. The mountant was allowed to set before adding a cover slip. Identification of isolated spores has been done with the help of key proposed by Schenck and Perez (1990). Physical and chemical characteristic of soil sample was carried out according to procedure of Jackson (1973).

Results and Discussion

The data obtained were mainly from the active growth stage and flowering period of the plants. The rhizosphere soil from Savargaon had the maximum number of AM propagules (482 per 100 g of soil) and that of Nagarsol showed the minimum 136 spores per 100 g of soil. The intermediate results were obtained from Mukhed and Gavandgaon. A similar gradation was observed in the percentage of root infection with 87% infection in plants from Savargaon, 42% from Nagarsol and with lesser differences in plants from other two localities. There was also increase in the number of Am propagules percentage infection with age of the plants there by indicating the rhizosphere effect (Table 1).

Table 1: No. of propagules /100 g of Rhizosphere soil and % Root Infection of Brinjal

Locality	No. of propagules /100 g of Rhizosphere soil	% Root Infection
Savargaon	482	87
Gavandgaon	274	58
Nagarsol	136	42
Mukhed	340	65

Three genera, *Glomus, Acaulospora* and *Scutellospora* were found associated with the roots of brinjal plants. Same results were obtained by Patale and Shinde (2010), while studying tomato. As a characteristic of tropical soil the genus *Glomus* was dominant with ten species, that of *Scutellospora* with five species and *Acaulospora* with two species. *Glomus constrictum, G. fasciculatum, G. globiferum* and *G. tenebrosum* were found in all four localities. Similar is the case with *Acaulospora elegans, Scutellospora heterogama* and *Scutellospora minuta*. *Scutellospora gregaria* was found only in one locality (Table 2). All sites showed lower diversity of AM fungi. The genus *Glomus* was dominant with maximum species as a characteristic of tropical soils. Soils used for agricultural production have a low diversity of AMF compared with natural ecosystems (Menendez *et al.*, 2001) and are often dominated by *Glomus* species (Sjoberg *et al.*, 2004). We have also got similar results.

The rhizosphere soil analysis of all localities was done (Table 3). The pH of soil at all sites was alkaline which did not affect mycorrhizal colonization. The present finding is in agreement with Singh (2000). At majority of sites P, K and Zn content in the soil was low which was influenced by the AM association.

The present finding is in agreement with Singh (2000). At majority of sites P, K and Zn content in the soil was low which was influenced by the AM association. These observations are in agreement with Smith and Read (1997); Clark and Zeto (2000). AM are present in most soils and are generally not considered to be host specific. However, population sizes and species composition are highly variable and influenced by plant characteristics and a number of environmental factors such as temperature, soil pH, soil moisture, P and N levels, heavy metal concentration (Boddington & Dodd 1999), the presence of other microorganisms, application of fertilizers and soil salinity (Barea & Azcon-Aguilar 1983).

Table-2: Arbuscular Mycorrhizal fungi reported from rhizosphere soil of Brinjal

Sr. No.	Name of Genus and species	L-1	L-2	L-3	L-4
1	*Acaulospora appendiculata*	-	+	+	+
2	*Acaulospora elegans*	+	+	+	+
3	*Glomus albidium*	+	-	-	+
4	*Glomus constrictum*	+	+	+	+
5	*Glomus dimorphicum*	-	-	+	+
6	*Glomus etunicatum*	+	+	-	-
7	*Glomus fasciculatum*	+	+	+	+
8	*Glomus globiferum*	+	+	+	+
9	*Glomus heterosporum*	-	+	+	-
10	*Glomus monospermum*	-	+	+	+
11	*Glomus tenebrosum*	+	+	+	+
12	*Glomus trimurales*	+	-	+	+
13	*Scutellospora dipurpurascens*	+	-	-	+
14	*Scutellospora gregaria*	-	-	+	-
15	*Scutellospora heterogama*	+	+	+	+
16	*Scutellospora minuta*	+	+	+	+
17	*Scutellospora persica*	-	+	+	+

+ Present; - Absent; L1: Savargaon; L2: Gavandgaon; L3: Nagarsol; L4: Mukhed

Table- 3 Soil analysis

Soil Parameter	pH	EC	OC%	P_2O_5 Kg/ac	K_2O Kg/ac	Zn ppm	Cu ppm	Fe ppm	Mn ppm
Savargaon	7.38	0.18	0.1	15	200	0.76	0.69	5.17	12.83
Gavandgaon	7.99	0.38	0.33	12	200	0.81	1.29	5.67	13.07
Nagarsol	8.81	0.22	0.16	12	158	0.17	0.38	6.49	8.58
Mukhed	8.61	0.25	0.1	14	173	0.49	0.65	4.57	14.56

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