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Seasonal Diversity of arbuscular Mycorrhizal Fungi Associated With the Rhizosphere of *Perseabombycina*K., in Sivsagar District of Assam (India)

KEYWORDS: AM fungi, *Persea bombycina*, diversity and root colonization.

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ABSTRACT *Assam has a unique position in the sericulture map of the world as all the four commercial types of natural silk (viz. Eri, Muga, Mulberry and Tasar) producing insects and their host plants are found here. 'Som' (PerseabombycinaKost, Family Lauraceae) is the primary food plant of Muga Silkworm (AntheraeaassamensisHelfer) that produces the golden yellow 'Muga' silk. The present investigation was carried out to study the prevalence of AM fungi in som plants growing in Sivsagar district of Assam by determining the extent of root colonization, spore density in the rhizospheric soil and the actual species composition associated with the host. Seasonal dynamics of arbuscularmycorrhizal (AM) fungal community composition in this particular plant species,from five different sites in Sivsagar district of Assam,India were investigated. In allthe sites species variation in AM fungal spore density was observed. Maximum spore density and AM species richness were recordedin the spring season, while minimum spore density and richness were observed during summer season in all the study sites. Atotal of 14arbuscularmycorrhizalfungal species representing four genera were recorded.Glomuscaledonium and Acaulosporalaeviswas recorded in all seasons.It has been revealed that the occurrence and distribution of VA-mycorrhizal fungi are largely governed by various physic-chemical properties of the soil as well as by the rhizospheric effect of the host plant.*

Introduction :

The golden silk muga has always been the pride of Assam. Over the years, muga silk has become a unique part of Assamese culture and tradition. With its richest tradition of rearing muga, Sivsagar District contributes approximately 22 % of the entire muga production in the state. Muga silkworm (Antheria assamensis Westwood) is a polyphagous insect which feeds on the leaves of several food plants. Among them som (Persea bombycina) and soalu (Litsea polyantha) are most common and important and are abundantly grown in the North Eastern region of India, particularly in the Brahamaputra valley, foot hills Naga, Khasi and Garo hills. Som and soalu are called as primary host plant of muga silkworm. Mycorrhizal fungi are widely distributed in agro-ecosystems (Smith and Read, 1997) and are good indicators of soil quality (Schloter, et al., 2003). They are the key factors for successful low-input farming (Johansson et al., 2004). AM fungi have long been known to enhance the growth/ yield of various crops (Gredemann, 1968; Smith and Read, 1997). Importance of AM fungi has received considerable attention in the recent years due to this reason (Delfin et al., 2003; Goswami et al., 2005). . In mulberry, significant improvement in plant growth, leaf yield and leaf quality was observed by VA-mycorrhizal inoculation. However, in those studies inoculations were possible only through nursery conditions. Absence of an appropriate technology for mycorrhizal inoculation to an established mulberry garden has been a long standing drawback for proper exploitation of the benefit of these organisms.

Material and methodology :

The present study was carried out in areas of Sivasaar district of Assam where muga food plants were extensively grown like Barahibari (named as Field I), Maut Chapori (named as Field II), Sapekhati (named as Field III), Lalim chapori (named as Field IV) and Patsaku (named as Field V) and muga host plant i,e 'som' (Persea bombycina King) cultivation are found. Rhizospheric soil samples were collected from the selected som plantation field of different ages in four different seasons namely Autumn. Summer, Spring and winter. Five samples were collected from each plantation field. The samples were collected. Soils supporting each of these plants were also collected. The samples were mixed thoroughly and the composite samples were brought to the Microbiology Laboratory, Department of Botany, Pub-Kamrup College, Baihata Chariali, Kamrup, for further studies. These samples were kept in a refrigerator at around 4°C until they were analysed.

Analysis of physico-chemical properties of soil :

P^H of the soil was measured on an electric digital P^H meter in 1:5 (w/v) soil water suspension. Soil moisture content was determined by drying 10 gm of fresh soil in a hot air oven at 150° c for 24 hrs. Organic carbon in the soil samples was studied by Walkley and Blacks wet digestion method was adopted to determine organic carbon (Jackson, 1973).Soil nitrogen was estimated by the Indophenols blue method described Allen (1974).The molybdenum blue method of Jackson (1973) was followed to determine the available soil phosphorous. Soil potassium was extracted from soil in an ammonium acetate solution (P^H=7) and was measured with a digital flame photometer (Systronics-121,India).

Vesicular arbuscular mycorrhizal fungal spores were isolated by using wet sieving and decanting technique as described by Gerdemann and Nicolson (1963). Estimation of mycorrhizal colonization in the Roots of som plants, at different seasons were collected and stained with trypan blue in order to determine the intensity of colonization by using the method of Phillips and Hayman (1970), and Kormanik and McGarity (1982). The collected roots were first washed in tap water and were cut into 1 cm length. The root segments were treated with 5% KOH and slightly heated or kept for 24 hours. After that, they were washed with tap

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water and treated with 1N HCl for 3 minutes. Then they were stained with 0.05 % trypan blue. Percentage of AM fungi infection was calculated by root slide technique of Read et. Al., 1976

Result and Discussion:

Occurrence and distribution of different AM fungi in the som rhizosphere:

A total 14 AM fungal species were isolated from the rhizospheric soil of som plants cultivated in the experimental fields of Sivsagar district of Assam. Out of these 6 species belongs to Glomus, 4 species belongs to Acaulospora, 3 species belongs to Gigaspora and one species belongs to the genus Scutellospora. The AM fungal species isolated from the som rhizosphere are: Acaulospora denticulate, Acaulospora delicate, A.laevis, A. sporocarpia, Gigaspora candida, G. decipiens, G. margarita, Glomus caledonium, G. etunicatum, G. fasiculatum, G. aggregatum, G. macrocarpum, G. ambosorum and Scutellospora sps. From the study it was observed that Glomus aggregatum was the most common AM fungal species in the rhizosphere of som which occurs in all the five experimental fields. On the other hand, Scutellospora spps was the less frequently occurred AM fungal species. From Field I, total 7 nos AM fungal species were isolated (Table 3). The number of AM fungal species isolated from Field II, III, IV and V were 9, 5, 7 and 6 respectively. So, maximum number of AM fungal species was isolated from Field II and minimum were isolated from Field III.

Occurrence of arbuscular-mycorrhizal spores in Som rhizosphere:

The total number of AM spore population varied from rhizospheric soil to soil and from season to season (Table 4). Highest numbers of AM spores were observed in spring season and lowest was observed during the summer season. Maximum number of AM spore was observed in spring season in Field IV while minimum was observed during the summer season in Field III. In Field I, the spore population varied from 68 to 101. In Field II, the spore population varied from 43 to 104. In Field III it varied from 39 to 116. In this way, the spore population varied from 51 to 132 and 77 to 111 in Field IV and V respectively.

Percentage of root colonization in Som plants:

The percentage of root colonization also varied from rhizospheric soil to soil and from season to season (Table 2). Highest percentage of root colonization was observed in spring season in Field II and lowest was observed during the summer season in Field III . In Field I, the highest percentage of root colonization was 45.5 during the autumn season and minimum was 32.9 during the winter season. In Field II, the highest percentage of root colonization was 54.1 during the spring season and minimum was 35.9 during the winter season. In Field III, highest was 22.5 during spring season and minimum was 17 during the summer season. In Field IV, highest was 34.3 during winter season and minimum was 24.6 during the summer season. In Field V, the highest was 51.2 during spring season while minimum was minimum was 37.7 during the summer season.

Table 1: Physico-chemical properties of soil samples collected from different som plantation field of Sivsagar District.

Source of variance	Field I	Field II	Field III	Field IV	Field V
pH	4.98	5.07	5.76	5.39	6.04
Moisture (%)	25.7%	29.81%	26.53%	27.26%	24.69%
Temperature (^{0}C)	29.27	29.47	30.13	31.49	30.62
Organic Carbon(%)	0.58	0.49	0.63	0.61	0.47
Nitrogen (%)	0.13	0.10	0.09	0.16	0.14
Phosphorous (mg/g)	0.029	0.025	0.031	0.030	0.027
Potassium (mg/g)	0.094	0.091	0.110	0.079	0.136

Table 2 : Percentage of root colonization of som plants.

Field	Autumn	Summer	Spring	Winter
Field I	45.5	34.8	37.6	32.9
Field II	36.9	47.8	54.1	35.9
Field III	19.8	17	22.5	21.7
Field IV	26.3	24.6	28	34.3
Field V	44.2	37.7	51.2	42

Table 3 : Distribution of different AM fungal species in different 'som' plantation fields.

Fungal species	Field I	Field II	Field III	Field Iv	Field V
Acaulospora denticulata	-	+	-	-	+
Acaulospora delicata	+	+	-	-	-
A. laevis	+	-	+	+	-
A. sporocarpia	+	-	-	-	+
Gigaspora candida	-	+	-	+	-
G. decipiens	-	+	-	+	+
G. margarita	+	-	+	-	+
Glomus caledonium	-	-	+	+	-
G. etunicatum	+	+	-	+	-
G. fasiculatum	-	+	-	-	+
G. aggregatum	+	+	+	+	+
G. macrocarpum	+	-	+	-	-
G. ambosporum.	-	+	-	+	-
Scutellospora spps	-	+	-	-	-

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Table 4 : Number of VAM spores (per 50g soil) in som rhizosphere

Field	Autumn	Summer	Spring	Winter
Field I	101	68	112	79
Field II	87	43	104	88
Field III	106	39	116	84
Field IV	81	51	132	92
Field V	83	77	111	106

The present study about the AM fungal status of som rhizosphere revealed that AM fungal status of som rhizosphere varies from field to field and season to season. Variation in arbuscular mycorrhizal root colonization and spore density in the rhizosphere of som plants in the fields suggest that the occurrence and distribution of arbuscular mycorrhizal fungi are largely governed by various physic-chemical properties of the soil as well as by the rhizospheric effect of the som plants. Similar observation was also made by Katiyar et al (1989) in case of mulberry plants. Hanumantha Gowda and Prakasha Rao (1993) also reported similar variation of VA-mycorrhiza in the rhizosphere of mulberry plants.

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