

Arbuscular Mycorrhizal colonization with *Litchi chinensis* in nursery and orchard

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A general survey of orchards and nurseries of four varieties of litchi (*Litchi chinensis*) viz. China, Desi, Purbi and Shahi, commonly cultivated in North east of India particularly Bihar state was conducted for association of AM fungi. All the four varieties had prominent AM fungal association. Percent root colonization and spore population were found to be high in nursery samples than that of the orchard. Of all, China variety exhibited affinity to promote AM population at maximum level. Altogether, four genera were identified as root symbiont of a litchi fruit trees, however, the species of *Glomus* constituted dominant mycoflora.

Key words : AM fungi, nursery, orchard, spore population, root colonization

INTRODUCTION

The litchi (*Litchi chinensis*) is an important, sub-tropical flavoured, luscious fruit rich in vitamin C and minerals. This plant is very sensitive to the climatic and edaphic factors and as a result cultivators have to face the problem of seedling mortality during the transfer of the plant from nursery to orchard. In order to overcome this problem it is suggested to add some soil drawn from the vicinity of old litchi tree during plantation of new young plant. It is now established fact that litchi tree is mycorrhiza dependent (Coville, 1912 ; Kadman and Slore, 1974 ; Marloth, 1947).

In general these fungi are known to increase activity of roots consequently providing better endurance to plants even to grow in stress condition. A number of investigations have been made earlier to confirm various beneficial role of mycorrhizae for plants of different habits (Koramanik *et al.*, 1979 ; Hall, 1980 ; Tiwari and Singh, 1998). However, particularly in case of litchi fruit trees reports are fragmentary (Pandey, 1992 ; Singh *et al.*, 1992).

It appears, therefore, essential to record the diversity of fungal symbionts in association with litchi fruit trees in Indian context so that their beneficial potentials may be exploited particularly for the lit-

chi plantation in this area as well as in other parts of the country. Spore population and per cent root colonization of indigenous AM fungi associated with 12-15 yrs. old mother plants and 2-3 years old plants from nursery of four varieties of *Litchi chinensis* have been examined in the present investigation.

MATERIALS AND METHODS

The litchi plantation on commercial scale is mainly confined to north-east part of India particularly UP and Bihar state due to favourable climatic and edaphic factors. Altogether five sites (Bhagalpur and Mazaffarpur) were surveyed for the present study. Four varieties (Desi, Purbi, Shahi and China) on the basis of their abundance were selected. Rhizosphere soil and root samples were collected from orchards (12-15 yrs. old plants) and nurseries (2-3 years old plants) on random basis. The samples were examined for mycorrhizal status by following the standard methods. Root samples were washed in water, cut into segments (1cm), cleared with KOH (10%), bleached in alkaline peroxide (0.5% NHOH_4 ; 0.5% H_2O_2 , v/v) to soften hard tissue (Karmanik and McGrow, 1982) and stained with trypan blue (0.5%) following the method of Philip and Hayman (1970). Per cent root colonization was determined on the basis of number of positive root segments colonized by VAM fungi.

Rhizosphere soil samples were screened for VAM spores following wet sieving and decantation method (Gerdemenn and Nicolson, 1963). Population of spores was recorded as their number per 10 g dry soil.

Identification of AM fungi was done on the basis of the morphology of spores, their attachment pattern to the subtending hyphae and spore wall layers as described in the Manual of Schenck and Perez (1987).

RESULTS AND DISCUSSION

Results are depicted in Tables 1 and 2. It was evident from findings that all the four varieties under study had prominent AM fungal association.

Table 1 : Spore population and root colonization in four varieties of *Litchi chinensis* growing in the orchard and nurseries.

Sites	*Spore population (No. of spores / 10 g soil)				*Root Colonization (%)			
	Shahi	China	Desi	Purbi	Shahi	China	Desi	Purbi
Site-I								
Orchard	51	59	23	28	69	48	49	50
Nursery	61	67	22	39	81	52	55	58
Site-II								
Orchard	20	71	27	21	42	48	51	49
Nursery	29	78	30	35	58	48	43	53
Site-III								
Orchard	17	41	19	25	52	40	47	53
Nursery	23	43	21	27	72	64	43	47
Site-IV								
Orchard	27	58	25	17	65	52	40	43
Nursery	55	63	31	18	65	59	48	48
Site-V								
Orchard	18	63	31	18	57	55	41	40
Nursery	44	49	30	26	63	53	51	45

* Data represents the average of five replicates

Table 2 : Species of VAM fungi associated with different varieties of *Litchi chinensis*.

Varieties	Associated VAM fungi
Shahi	<i>Glomus fasciculatum</i> , <i>G. aggregatum</i> , <i>Gigaspora margarita</i> , <i>Scutellospora nigra</i> , <i>S. persica</i>
China	<i>G. fasciculatum</i> , <i>G. aggregatum</i> , <i>G. multicauli</i> , <i>G. maculosum</i> , <i>G. albidum</i> , <i>G. margarita</i> , <i>S. nigra</i> , <i>Sclerocystis pakistanika</i> , <i>S. sinuosa</i>
Desi	<i>G. fasciculatum</i> , <i>G. aggregatum</i> , <i>G. albidum</i> , <i>G. leptotrichum</i> , <i>S. sinuosa</i>
Purbi	<i>G. fasciculatum</i> , <i>G. ambisporum</i> , <i>G. maculosum</i> , <i>G. margarita</i> , <i>S. clavispora</i>

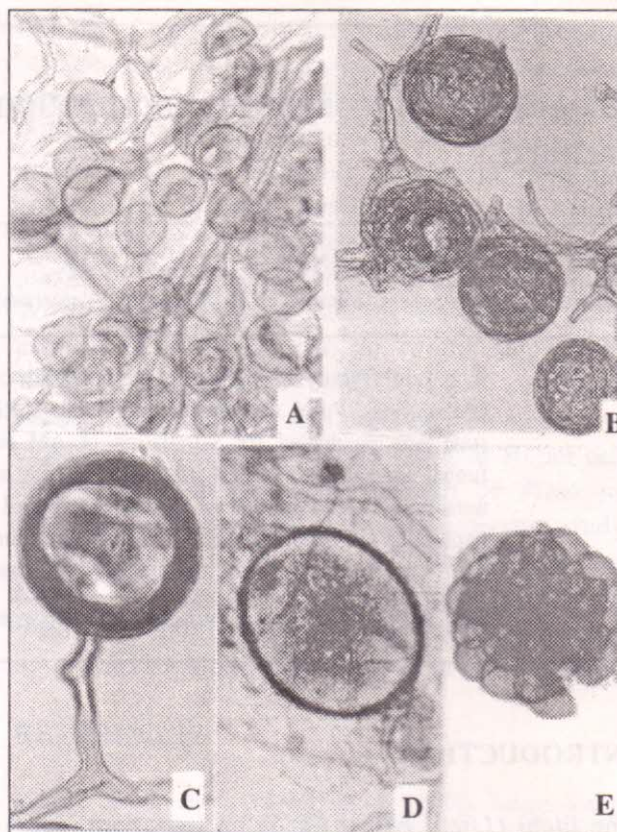


Fig. 1 : A-Spore cluster of *Glomus fasciculatum*; B-Spores of *G. maculosum*; C-Single mature spore of *G. fasciculatum*; D-Spore of *G. multicauli*; E-Sporocarp of *Sclerocystis*.

However, per cent root colonization and spore population (No./10 g dry soil) were varied with varieties of fruit trees and sites where they were growing. Of all, maximum range of spore population i.e. 41-78/10 g dry soil was recorded from rhizosphere of China variety both in orchard and nursery which was followed by Shahi with 17-61 spores/10 g dry soil and Purbi 17-39 and Desi 19-31 spores per 10 g dry soil. Moreover, this could not be correlated with per cent root colonization, as the maximum degree of colonization (range 40-69%) was observed in Shahi variety at all the sites in orchard, whereas it was noticed to range between 43-81% in nursery.

A comparative study showed that AM fungi were more active in association with nursery plants than that of orchard. This possibly attributes the fact that in nursery, plants are in active growth stage and produce new feeder roots as a result fungi get the additional area on root surface to colonize and also

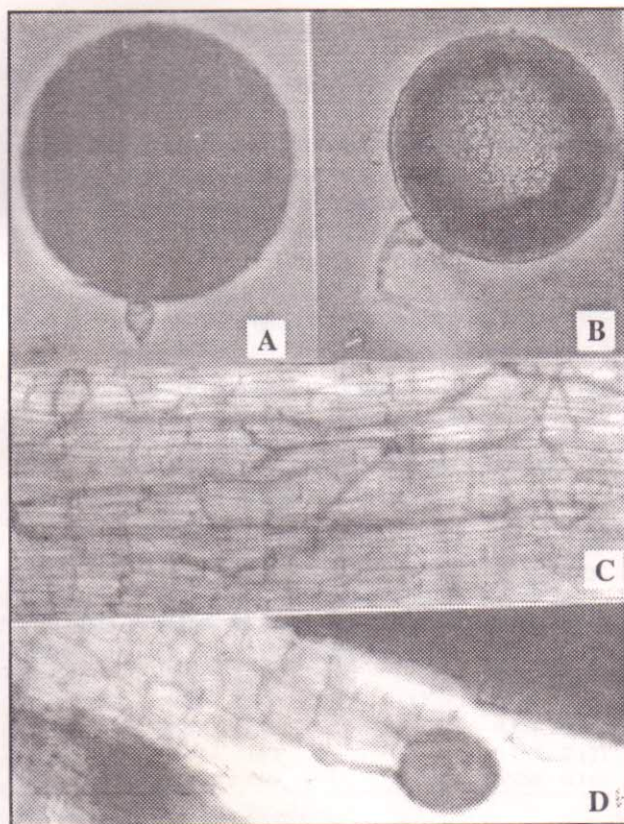


Fig. 2 : A-Sporocarp of *Scutellospora nigra* ; B-Sporocarp of *Gigaspora margarita* ; C-Mycelium of VAM fungi ramifying inter- and intra-cellularly in root cortex of *L. chinensis* ; D-Vesicle formation within root cortex of *L. chinensis*.

derive nutrition for the production of vesicles and spores. To the contrary in orchard the growth of plants is very slow and the nutrient requirement is also lowered, resulting decline in the activity of AM symbionts.

Several species of AM fungi were found in association with different varieties of litchi plants (Figs. 1,2). Altogether twelve species could be identified (Table 2). Species of *Glomus* was noticed to constitute dominant AM fungi as these were recovered from each and every sample examined.

A comparative account of the data indicated that AM fungi showed more fascination to var. China than the other varieties of litchi plants surveyed. It had highest number of species in its rhizosphere soil with maximum number of spores.

Host preference is the prime factor which deter-

mines growth of symbionts for colonization. Apart from the edaphic factor the root exudates have been reported to play significant role in deciding spore population and root colonization (Becard *et al.*, 1992 ; Chabot *et al.*, 1992 ; Bonfante and Perotto, 1992 ; Bel Rhlid *et al.*, 1993 ; Giovanetti *et al.*, 1993). The present report thus confirms that AM fungi are most common occurring on all the four varieties of litchi with varied population. Their potentials may be exploited for better growth and health of litchi plants from nursery to orchard particularly in nutritionally poor soil. However, it requires further investigation to select suitable indigenous AM fungal strains for the production of quality seedlings at the nursery stage which is under progress in this laboratory.

ACKNOWLEDGEMENT

The authors are thankful to Department of bio-technology, Govt. of India, New Delhi for financial assistance.

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(Accepted for publication August 20 2002)