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SEASONAL VARIATION IN VAM FUNGI ASSOCIATED WITH TWO VARIETIES OF LITCHI, *LITCHI CHINENSIS* (GAERTN.) SONN. PLANTS OF BIHAR

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Arbuscular mycorrhizal fungi (AMF) form a mutualistic symbiosis with majority of the higher plants and having a link between soil and host plants. AM symbiosis occurs in almost all habitats, climates and ecosystem. About 90% of the world's plant associated with the AM fungi and these fungi are known to promote phosphorus uptake and protect plants against various types of stress. *Litchi chinensis* (Gaertn.)Sonn is economically viable, ecologically beneficial for India and it is mycorrhizal dependent. The AMF density was varied with the season, sites and varieties. Basically variation in the season affecting the population of AMF either increases or decreases. AMF population was recorded higher in summer and lower in the winter season in litchi orchards of Bihar.

Key words: Arbuscular mycorrhizal fungi, *Litchi chinensis*, seasonal variation

VAM fungi are universally distributed in tropical (Brundrett *et al.*, 1999), temperate and artic regions (Bisht *et al.*,1995). They are symbiotically associated with almost all the land plants including Bryophytes (Newman and Reddell,1987), Pteridophytes (Cooper,1976) and Gymnosperms (Cazares and Trappe,1993). However, the survival, multiplication, distribution and diversity of these fungi are varied with biotic, abiotic and edaphic factors.

The litchi fruit trees are ecologically beneficial and economically viable for India. It is a popular, choicest, luscious and delicious fruit plant with high nutritive value and it is also occupying the prominent place among the fruits of the world. India is the second largest litchi producing country after China. As litchi is mycorrhizal dependent fruit tree (Coville,1912; Marloth,1947; Kadman and Slore,1974), it shows luxuriant growth in presence of VAM colonization in feeder roots. Its cultivation is mainly confined to north India in alluvial soil, sandy loam with sandy silt and calcareous with 30% $CaCO_3$, pH varied between 6.8 to7.3, 9.2 ^{0}C (min. temp) in the month of Jan., 36.5^{0}C (max. temp) in the month of July, the medium rainfall (average 103.65mm), and relative humidity ranging between 85.58–57.07%.

Several survey works have been conducted to assess the effect of seasonal variation in the incidence of AM fungi associated with crops and other plants species (Lopez and Honrubia,1992; Johnson-Green *et al.*,1995 and Siguenza *et al.*,1996). However, no report is available so far on variation in AMF population in association with litchi plants under the influence of seasons. Therefore, keeping this in view, the objective is aimed at AMF population varies with the seasonal changes in two varieties of litchi and their ecological significance.

MATERIALS AND METHODS

The marcots of two varieties of litchi (*L. chinensis*) viz., *Desi* and *China* were brought from Sabour Agriculture College, Sabour and planted in pits (1x1x1 m^3) at University Dept. of Botany, Bhagalpur, where the pH was found between 7.10 to 7.90 and the soil was rich in organic matter (7.07%) and organic carbon (4.10%), however, the nitrogen content was very low varied between 0.033% - 0.057% and phosphorus ranged between 0.27% to 0.79%. The calcium and sodium were also found ranging between 0.54%- 1.62% and 0.46% to 4.01% respectively.

The plants were left in pits (under control) for a year so as to obtain proper root colonization and

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development of microbial niche. After that rhizosphere soil and feeder roots were collected separately in polythene bags in every month upto one year for screening of VAM status. The triplicates of each sample were maintained. The spore population and root colonization were determined by the standard methods of Gerdemann and Nicolson (1963) and Phillips and Hayman's (1970) respectively and AMF species were identified with the help of Manual of Schenck and Perez (1989).

RESULTS AND DISCUSSION

Six species of *Glomus*, four species of *Gigaspora*, two species of *Sclerocystis* and one species of *Scutellospora* were found to constitute all together thirteen species of four AM fungal genera (Table-1). *Glomus* was found to be present dominantly in the litchi orchards. Several earlier workers (Lekha *et al.*, 1995; Mehrotra, 1998; Trimurthulu and Johri,1998) have also reported the dominance of *Glomus* in different plants.

Table-1. AMF species recorded in rhizosphere soil of two varieties of litchi plants

Varieties	Associated AMF species
DESI	*Glomus maculosum, Glomus multicauli, Glomus sp*[1]*, Glomus albidum, Glomus macrocarpum Gigaspora margarita, Sclerocystis pakistanica*
CHINA	*Glomus multicauli, Glomus sp*[1]*.* ***Glomus fasciculatum****, G. maculosum,* ***Gigaspora gigantea****, Gigaspora decipense, Gigaspora sp, Sclerocystis pakistanica, S.* ***sinuosa, Scutellospora sp***[1]

The seasonal variation in AMF status was recorded in two varieties (*Desi* and *China*) of litchi plants of university campus. The maximum affinity of VAM i.e., 92%, 81% and 92% root colonization was noticed in *Desi* and 85%, 90% and 58% in *China* varieties during June, July and August months respectively and minimum 53%, 62% and 60% root colonization in *Desi* and 46%, 54% and 42% in *China* variety were screened in the months of Dec. Jan. and Oct. respectively. Moreover, in the month of Feb., 75% -78% root colonization was noticed in Var. *Desi* and *China*. In case of spore population again maximum density was recorded in summer however, minimum in the month of Dec., Jan., and Aug., i.e., 37, 38 and 28 in *Desi* and 44, 42 and 48 /10g dry soil in *China* respectively. The results depicted in Table-2 and Text Figs.-1,2 indicates that spore population was highest in summer and lowest in winter season in both *Desi* and *China* varieties whereas during rainy season the spore numbers were comparatively low.

Table-2. Seasonal variation in %RC & SP of AMF in relation to two var. of litchi plants.

Months	Root colonization (%)		Spore population(10g/dry soil)	
	DESI	***CHINA***	***DESI***	***CHINA***
January	62%	54%	38	42
February	75%	78%	64	68
March	68%	63%	62	59
April	74%	71%	68	70
May	69%	68%	53	81
June	92%	85%	72	64
July	81%	90%	48	68
August	92%	58%	28	48
September	85%	52%	49	50
October	60%	42%	50	54
November	66%	65%	60	63
December	53%	46%	37	44

RC= Root Colonization, SP= Spore Population (10g/dry soil)

Fig.-1. Variation in % RC of AMF with the season in litchi orchards.

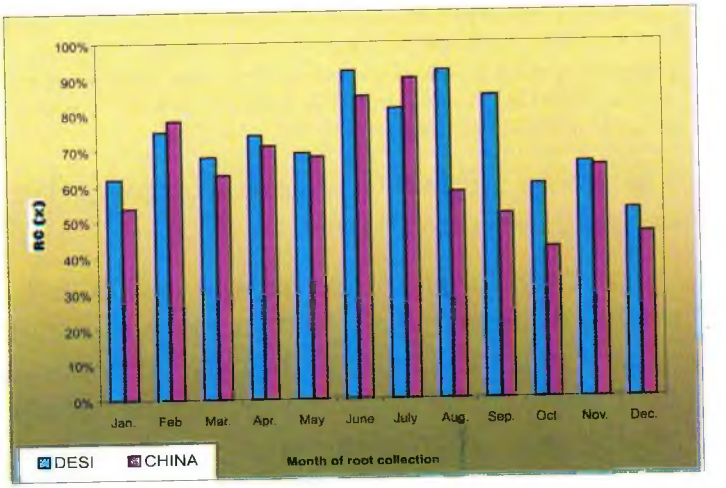
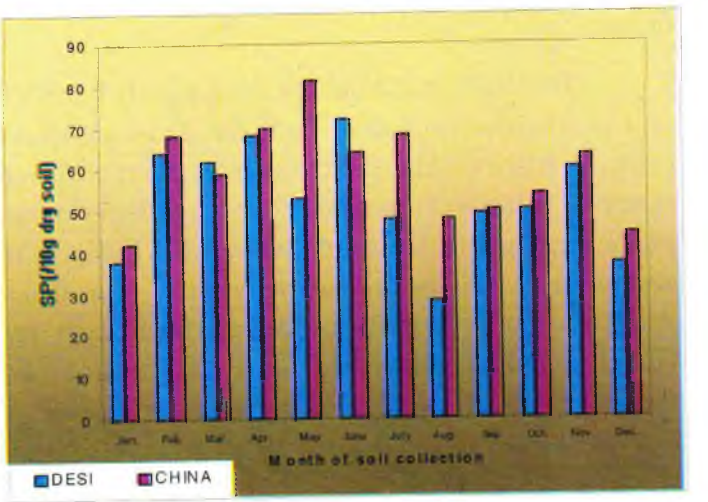


Fig.-2. Variation in SP (spores/10g dry soil) of AMF with the season in litchi orchards.



Studies on seasonal diversity AMF in association with roots of two varieties of litchi viz., *Desi* and *China* revealed that maximum colonization in summer season and lowest in winter season, where spore population and percent root colonization varied between 28-81/10g dried soil and 42-92% respectively. Similar observation have also been recorded by earlier workers including Mukerji *et al.*(1982), Hetrick Bloom (1983) and Letswaart *et al.*(1992). However, Mohankumar and Mahadevan (1988) observed that more number of spores were present in soil during summer whereas, least number in rainy season. Seasonal variation in AM population also affects the establishment of plants under field conditions (Boerner,1986; Ernst *et al.*,1984).

Sporulation of AMF preferred to multiply in summer season might be correlated with soil temperature below 30°C, which has been also observed by Chilvers and Daft (1982), Furlan and Fortin (1973), Schenck and Schroder (1974) and Hayman (1974). In general most of the fungi having a luxuriant growth between 20°C -30°C temp, therefore, it might be the reason that this symbiont fungus also prefers to multiply at those temperatures.

However, no definite relationship could be observed between VAM colonization and spore population. This possibly might be due to production of VAM spores in the rhizosphere vicinity of surrounding weeds and herbaceous species. Therefore, spore population normally cannot establish correlation with host species alone in nature (Kruckelmann,1975).

The result may be explained by this way, the VAM infection occurring in the roots of almost all host plants but is active in a successful manner under the influence of seasonal changes particularly temperature.

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