A Survey on VAM Status in Roots of Some Medicinal Plants of Alipurduar, West Bengal

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SUMMARY

Arbuscular mycorrhizal status of ten medicinal plants was studied. The AM colonization, spore population and diversity, altered with seasons as well as with plant species. The maximum mycorrhization was noted in *Eclipta alba* (82%) followed by *Sida cordifolia* (80%). The lowest mycorrhizal percentage was found in *Nymphea laba* (8%) followed by *Adhatoda vasica* (10%). Root colonization was found maximum during rainy season and spore population in rhizosphere soil in winter. The spore composition varied probably due to their variation in sporulation period. The high moisture and temperature evidently affected sporulation.

Key words : Arbuscular mycorrhiza, Medicinal plant, Mycorrhiza, VAM

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Mycorrhiza is a composite structure consisting of fungus and higher plant roots. Mycorrhizal fungi are the beneficial microorganisms that form symbiotic association with fine roots of plants (Aggarwal *et al.*, 2007). The role of vesicular arbuscular mycorrhizal (VAM) fungi in enhancing plant growth and improving host resistance against diseases is well documented (Akkopru and Demir, 2005; Chakraborty and Chatterjee, 2007). They play a significant role in plant growth under conditions of phosphorus limitation and also influence plant community development, nutrient uptake, water relations and productivity. They also influence ecosystem processes by modifying the structure of microbial populations in soil and are also essential components for both re-vegetation of the degraded lands and maintenance of soil structure (Mishra *et al.*, 2008). Medicinal plants are the potential source for discovery of new products and fine chemicals for drug development and the demand of medicinal plants has been increasing rapidly with the consumption of crude drugs. Keeping this in view, the present study reports the VA mycorrhizal association in some medicinal plants that grow naturally in and around Alipurduar, Jalpaiguri district of West Bengal.

MATERIALS AND METHODS

Roots samples of different medicinal plants *viz.*, *Ocimum sanctum*, *Catharanthus roseus*, *Adhatoda vasica*, *Eclipta alba*, *Andrographis paniculata*, *Scoparia dulcis*, *Sida cordifolia*, *Nymphea laba*, *Ipomea obscura*, *Euphorbia nerifolia* were collected from Alipurduar, Jalpaiguri district of West Bengal throughout the year.

Roots samples were washed thoroughly in water separately to free them of any soil particle. The roots were then cut into 1 cm long pieces. Only fine tertiary roots were taken. The root segments were boiled in 10% KOH solution and stained by tryphan blue solution following Philips and Hayman (1970). Five observations for each plant species were taken.

Percentage of VAM colonization, presence of vesicle, arbuscle and infected hyphae were recorded in each segment. Percentage colonization of AM infection of root was calculated as follows:

$$\text{\% of root colonization} = \frac{\text{Number of mycorrhizal root segments}}{\text{Total number of root segments observed}} \times 100$$

Rhizosphere soils taken from the roots of different individual species were used for estimation of spore population. Estimation of spore population was done by wet sieving and decantation technique (Gerdemann and Nicolson, 1963). One hundred gm of dry soil was mixed in 500 ml of water in large beaker with the help of a brush till all the soil aggregates dispersed to leave a uniform suspension. The heavier particles were allowed to settle for a few minutes and the liquid was decanted through a sieve fine enough to remove larger particles of organic matter, but coarse enough to allow the desired spores to pass through. The suspension that passed through the sieve

was stirred well. The heavier particles were allowed to settle for a few seconds and the liquid decanted again through the sieves of different sizes process was repeated. Six sieve of different pore sizes (300 µm, 150 µm, 100 µm, 90 µm and 35 µm) were used one after the other in decreasing order of the pore size. The spores were further filtered with filter paper and observed under stereomicroscope. The spore count was taken and the value expressed as number of spore/100 g of soil.

RESULTS AND DISCUSSION

Among the ten medicinal plants studies, all were found to be mycorrhiza (Table 1). The degree of colonization ranged in between 8% to 82%. The lowest mycorrhizal percentage was found in *Nymphea laba* (8%) followed by *Adhatoda vasica* (10%). Among the medicinal plants, significantly highest colonization (82%) was noticed in *Eclipta alba* followed by *Sida cordifolia* (80%). The distribution and occurrence of VAM fungi differed with change in edaphic factors and type of vegetation. The study revealed that colonization of native VAM fungi was enhanced during late summer months to rainy season than that of the winter. From the survey, it appeared that the species having low level of mycorrhizal association in roots were less abundant in distribution as observed in nature. The type of root system also appeared to influence the degree of colonization. Plants with fibrous root system showed higher degree of infestation than plants with tap root (Table 1).

The rhizosphere soil of the selected plants was found to harbour VAM fungi where *Glomus* remained as predominant genus throughout the year followed by *Gigaspora*. Number of spores of the AM fungi in the soil ranged from 9% to 84%. Highest spore count was recorded in the rhizosphere soil of *E. nerifolia* (84%) while the lowest was recorded in *N. laba* (9%). Host plants had a significant effect on AM colonization, composition and diversity by regulating carbon allocation to roots, producing secondary metabolites or changing soil environmental conditions. Every phase in the life cycle of AM fungi is influenced by plant roots. Actually, AM fungi are sensitive to environmental conditions especially soil pH, temperature, soil structure and nutrient level particularly phosphorus concentration plays an important role in the occurrence of AM fungi (Bagyaraj, 1991; Mishra *et al*., 2008). But several reports by different workers showed that there was no relationship between soil type and particular mycorrhizal species (Aggarwal *et al*., 2007). The successful establishment of a VAM infection in a particular soil is dependent on the presence of VAM spores but is also influenced by factors such as host-plant genetics, endophyte and soil condition (Jakobsen and Heidmann, 1989). So, VAM fungi may vary with spore germination and root colonization of the host and thus may play an important role in root formation, nutrient cycling, productivity and providing better adjustment to adverse conditions.

Table 1: VAM colonization percentage in roots of medicinal plants and AM fungal spore population in rhizosphere soil

Sr. No.	Plant species	Family	% of root colonization		Vesicle	Arbuscle	Mean spore count per 100g of soil	
			Summer	Winter			Summer	Winter
1.	*C. roseus*	Apocynaceae	46±4	42±3	+	Rare	44	48
2.	*A. vasica*	Acanthaceae	28.33±2	10±4	+	+	16	22
3.	*A. paniculata*	Acanthaceae	49.2±4	36±2	+	+	35.2	38.2
4.	*E. alba*	Asteraceae	82±3	69±2	+	+	42	45
5.	*S. dulcis*	Scrophulariaceae	38.52±4	78±2	+	+	28.9	33
6.	*S. cordifolia*	Malvaceae	80±2	38±3	_	+	68	72
7.	*N. laba*	Nympheaceae	12±2	8±2	+	Rare	9	17
8.	*I. obscura*	Convolvulaceae	43±4	28±2	+	Rare	19.2	33
9.	*E. nerifolia*	Euphorbiaceae	81±2	77±2	+	+	79	84
10.	*O. sanctum*	Lamiaceae	59.32±2	42.2±2	+	+	26.1	30.1

% of root colonization: SEM= ± 0.193; CD at 5% =0.614; Mean spore count: SEM= ± 0.118 ; CD at 5%= 0.375614
Summer =June to August; Winter=December to February; "+"=present; "-"=absent

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