



Research Paper

OCCURRENCE AND ASSESMENT OF VESICULAR ARBUSCULAR MYCORRHIZAL (VAM) FUNGI IN SOME MEDICINAL PLANTS OF APOCYANACEAE FAMILY

Jalander, V. and M. Mamatha

Department of Botany,
Telangana University, Dichpally, Nizamabad (T.S.).

Abstract

An investigation has been made about the vesicular arbuscular mycorrhizal fungi colonization in some medicinal plants *Catharanthus roseus*, *C. pusillus*, *Wrightia tinctoria*, *Thevetia peruviana*, *Nerium indicum* and *Alstonia scholaris* belongs to family Apocyanaceae were screened for the occurrence and association of VA mycorrhizal fungi. All the plants screened in the study harbored VA mycorrhizal fungi. Of the six medicinal plants *C. roseus* supported maximum number (19) of VA mycorrhizal followed by *C. pusillus*, *T. peruviana* and *W. tinctoria*. VA mycorrhizal fungi isolated from the medicinal plants belong to 5 different genera viz. *Acaulospora*, *Entrophspora*, *Gigaspora*, *Glomus* and *Sclerocystis*. *Acaulospora* and *Sclerocystis* were equally represented by 7 species of each in the rhizosphere of *C. roseus*. Only two species of *Glomus*, *Acaulospora* and *Sclerocystis* were encountered in the rhizosphere soils of *C. pusillus*.

Key words: VAM fungi, medicinal plants, Apocyanaceae.

INTRODUCTION

Vesicular Arbuscular Mycorrhizal fungi are ubiquitous in soils and are associated with roots of majority of plants [1] (Bowen, 1985). However families of Cruciferae, Chenopodiaceae, Commelinaceae, Cyperaceae, Fumaricaceae, Polygonaceae and Utricaceae recorded to be non-mycorrhizal [2]. Later mycorrhizal association was reported in certain members of Chenopodiaceae, Cyperaceae and Cruciferae [3, 4]. The association of VA mycorrhizal fungi has been recorded in almost all plants types like legumes, cereals, forage crops, oil seeds, forest plants, plantation crops and medicinal plants [5, 6, 7, 8, 9, 10, 11, 12, 13, 14]. There are conflicting reports on the occurrence of VA mycorrhizal association in medicinal plants. Many medicinal plants and essential oil yielding plants possessing secondary substances have been reported to harbor VA mycorrhizal fungi in their root system [15]. Govind Rao *et. al.* (1989) screened 25 medicinal plants belonging to different families for VA mycorrhizal association and reported that all the plants were mycorrhizal [16].

MATERIALS AND METHODS

Collection of soil samples: The rhizosphere soil samples of *Catharanthus roseus*, *C. pusillus*, *Wrightia tinctoria*, *Thevetia peruviana*, *Nerium indicum* and *Alstonia scholaris* were collected from Telangana University garden, Nizamabad at monthly intervals into sterile polythene bags. Rhizosphere soils were collected at a depth of 10 cm with sterilized widger. The samples were

transferred to laboratory and VA mycorrhizal fungal propagules were isolated. VA mycorrhizae of rhizosphere soil samples were studied for one year.

Isolation of VAM fungal propagules: VA mycorrhizal fungal propagules were collected from soils by wet-sieving and decanting method [17]. By these methods extra metrical chlamydospores, sporocarps and zygospores formed by mycorrhizal fungi were estimated.

Characterization and Identification: The isolated VA mycorrhizal fungi were observed under compound microscope and identified up to species level using the standard keys [18, 19, 20, 21, 22]. The characters observed for identification were the presence or absence of sporocarps, size, shape and colour of the spore, nature of the stalk attachment, wall thickness, wall layers and ornamentation. The mounted spores and sporocarps were micro photographed in the laboratory.

Assessment of vesicular-arbuscular infection in roots: The assessment of the amount of VA mycorrhizal infection and colonization in roots were studied [23, 24]. The percentage of VA mycorrhizal fungi was estimated by the root slide technique [25]. All infected and uninfected segments were counted. The percentage of infection was calculated as

$$\% \text{ of VA infection} = \frac{\text{No. of infected segments}}{\text{Total no. of segments examined}} \times 100$$

RESULTS AND DISCUSSION

Medicinal plants belonging to the family Apocynaceae were screened for the occurrence and association of VA mycorrhizal fungi were isolated from the rhizosphere soils. VA mycorrhizal fungi were identified to the species level and the results are presented in Table 1.

All the plants viz. *C. roseus*, *C. pusillus*, *W. tinctoria*, *T. peruviana*, *N. indicum* and *A. scholaris* screened in the present study harbored VA mycorrhizal fungi. Of the 6 medicinal plants, *C. roseus* supported maximum number (19) of VA mycorrhizal fungi followed by *C. pusillus*, *T. peruviana* and *W. tinctoria*. VA mycorrhizal fungi isolated from these medicinal plants belong to 5 different genera viz. *Acaulospora*, *Entrophospora*, *Gigaspora*, *Glomus* and *Sclerocystis*. *Acaulospora* and *Sclerocystis* were equally represented by 7 species of each in the rhizosphere of *C. roseus*. Only two species of *Glomus*, *Acaulospora* and *Sclerocystis* were encountered in the rhizosphere soils of *C. pusillus*. Rhizosphere soils of *Alstonia* and *Nerium* supported 5 different VA mycorrhizal fungi *Entrophospora* in frequent found found to be associated with the rhizosphere of *C. roseus* and *N. indicum*. *Sclerocystis pachycaulis* was associated with *C. roseus*. *Glomus aggregatum*, *Acaulospora bireticulata*, *Sclerocystis microcarpus* were predominantly associated with most of the medicinal plants.

Six plants of apocyanaceae members were screened in the present study were found to be infected by VA mycorrhizal fungi. Percentage mycorrhizal infection was abundant in *C. pusillus*, *C. roseus*, *A. scholaris* and *W. tinctoria*. The percentage of arbuscules and vesicles were more in *C. pusillus* and less number recorded in *N. indicum*. High incidence of mycelium was observed in *C. roseus* followed by *C. pusillus*, *W. tinctoria*, *T. peruviana* *A. scholaris* and *N. indicum* (Table 2)

Early reports are available on the occurrence of VA mycorrhizal fungi. The root system of many medicinal and aromatic plants possesses secondary substances [15, 26]. Mohankumar and Mahadevan examined 28 medicinal plants from 20 families for the presence of VA mycorrhizal fungi [27]. They reported the absence of mycorrhizal association in all the plants containing a spectrum of secondary substances like alkaloids, phenolics, terpenoids and tannins. They attributed the absence of VA mycorrhizal association to the presence of various secondary substances. Later on Bagyaraj and his group screened 25 different medicinal plants for the presence of VA mycorrhizal association and reported the mycorrhizal colonization in all the medicinal plants which include periwinkle and serpent wood of apocyanaceae [16]. Lakshman and Raghavendra have also screened 40 species of medicinal plants for mycorrhizal association [28]. They reported that all the species were susceptible to colonization by VA mycorrhizal fungi.

The present results on the occurrence of VA mycorrhizal fungi in apocyanaceae medicinal plants confirm the earlier observations made by different workers In spite of the presence of secondary substances of most of the medicinal and aromatic plants harbor VA mycorrhizal fungi

in their root system. Fluctuations in distribution and number of VA mycorrhizal propagules in soil is due to variation in season, growth stage of the host, pH, temperature, moisture, nitrogen, phosphorus and other macro and micronutrients [29, 30].

Table 1: Occurrence of VA Mycorrhizal fungi in some medicinal plants of Apocyanaceae family

S. No.	Name of VAM fungus	Plant species					
		1	2	3	4	5	6
1	<i>Acaulospora bireticulata</i> (Rothwell & Trappe)	+	+	-	+	+	+
2	<i>A. delicata</i> (Walker, Pfeitter & Bloss)	+	-	+	-	-	-
3	<i>A. dilatata</i> (Morton)	+	-	-	-	-	-
4	<i>A. laevis</i> (Gerdemann & Trappe)	+	+	-	-	-	-
5	<i>A. mellea</i> (Spin & Schenck)	+	-	-	-	-	-
6	<i>A. nicolson</i> (Walker, Reed & Sanders)	+	-	+		+	+
7	<i>A. spinosa</i> (Walker & Trappe)	+	-	-	-	-	-
8	<i>Entrophosora infrequens</i> [(Hall) Ames & Schneider]	+	+	-	-	+	-
9	<i>Gigaspora gigantean</i> [(Nicol. & Gerd.) Gerd. & Trappe]	+	+	-	+	-	-
10	<i>Glomus aggregatum</i> (Schenck & Smith)	+	+	+	+	-	-
11	<i>G. albidum</i> (Walker & Rhodes)	+	-	-	-	-	-
12	<i>G. convolutum</i> (Gerd. & Trappe)	+	-	-	-	+	-
13	<i>G. fesciculatum</i> [(Tharter Sensu Gerd.) gerd. & Trappe]	+	+	-	+	-	-
14	<i>G. fecundisporum</i> (Schenck & Smith)	+	-	-	-	-	-
15	<i>G. mosseae</i> [(Nicol. & Gerd.) Gerd. & Trappe]	+	-	+	+	-	+
16	<i>G. tortuosum</i> (Schenck & Smith)	+	-	-	-	-	-
17	<i>Sclerocystis microcarpus</i> (Iqbal & Bushra)	+	+	+	-	+	+
18	<i>S. pachycaulis</i> (Wu & Chen)	+	+	-	-	+	-
19	<i>S. sinuosa</i> (Gerd. & Baksh)	+	-	-	-	-	-
Total		19	08	05	05	06	04

Note: + = Present, - = Absent; 1. *C. roseus*, 2. *C. pusillus*, 3. *W. tinctoria*, 4. *T. peruviana*, 5. *N. indicum* and 6. *A. scholaris*

Table 2: Incidence of VAM infection in some medicinal plants of Apocyanaceae family

S. No.	Name of plant	% of colonization			
		Hyphae	Arbuscules	Vesicles	% of infection
1	<i>C. roseus</i>	96	16	72	96
2	<i>C. pusillus</i>	84	20	80	100
3	<i>W. tinctoria</i>	80	12	76	92
4	<i>T. peruviana</i>	76	12	72	80
5	<i>N. indicum</i>	72	08	68	84
6	<i>A. scholaris</i>	76	12	80	92

REFERENCES

- [1] Bowen, G. D., 1985, Physiological factors in infection and spread of VAM. In: Proceeding of the 6th North American Conference of Mycorrhizae, Forest Research Laboratory. (Molina, R. edr.). Corvallis. pp. 181-184.
- [2] Gerdemann, J. W., 1968, Vascular-arbuscular mycorrhizal and plant growth. *Ann. Rev. Phytopath.* 6: 397-418.
- [3] Mejsstrik, V. K., 1972, Vascular-arbuscular micorrhizas of a *Molineitum coeruleae* L. 1. Association: the ecology, *New Phytol.* 71: 883-890.
- [4] Ross, J. P. and Harper, J. A., 1975, Hosts of vascular-arbuscular micorrhiza on soybean yields. *Phytopath.* 60: 1552-1556.
- [5] Bloss, H. E., 1930, Vesicular arbuscular mycorrhizal in Guayule. *Mycologia.* 72: 213-216.

- [6] Gianinazzi, S., Morandi, D., Gianinazzi-Pearson, V. and Tronvelot, A., 1980, Endomycorrhizal development in the raspberry plant-its ecology effect on plantgrowth and advantages in the nursery. in : *Productions spontanees collonque colman*, 17-20.
- [7] Mohan Kumar, V. and Mahadevan, A., 1988, Ecological distribution of Vasicular-arbuscular micorrhizae in tropical forest. In: *Mycorrhiza Round Table. Proc. of Workshop*, (Varma, A.K., Oka, A.K., Mukerji, Tilak, K.V.B.R. and Janak Raj, eds.) 238-256.
- [8] Sharma, M. and Roy, A.K., 1989, Vasicular-arbuscular micorrhizae in hypoglycaemic plants. *Nat. Acad. Sci. Letters*. 14(2): 467-468.
- [9] Mukerji, K. G. and Ardery, J., 1985, Studies on Vasicular-arbuscular micorrhiza. 1. *Kalanchoe spicata* and *Eclipta alba*. *Acta Botanica India*. 13:101-103.
- [10] Manjunath, A. and Bhagyaraj, D. J., 1984, Response of pigeonpea and cowpea to phosphate and dual inoculation in vasicular-arbuscular mycorrhizal and Rhizobium. *Trop. Agric*. 61: 48-52.
- [11] Manjunath, A. and Bhagyaraj, D. J., 1986, Response of blackgram, chickpea and mungbean to vasicular-arbuscular mycorrhizal inoculation in an unsterilized soil. *Trop. Agric*. 63: 33-35.
- [12] Manoharachary, C., Rama Rao, P. and Sulochana, T., 1988, Preliminary survey of VA mycorrhizal fungi in some weeds. In: *Mycorrhiza Round Table. Proc. of Workshop*, (Varma, A.K., Oka, A.K., Mukerji, Tilak, K.V.B.R. and Janak Raj, eds.) 288-293.
- [13] Thaper, H. S. and Khan, S. M., 1985, Distribution of VA mycorrhizal fungi in forest soils in India. *Indian J. Forestry*. 8: 5-7.
- [14] Vijayalaxmi, M. and Rao, A. S., 1987, Development of Vasicular-arbuscular fungi in sunflower. *Proc. Indian Natl. Sci. Acad. B*. 53 (3): 279-281.
- [15] Abbott, L.K. and Robson, A.D., 1982, Infectivity of vesicular-arbuscular mycorrhizal fungi in agriculture soils. *Aust. J. Agric. Res*. 33:1049-1059.
- [16] Govind Rao, Y. S., Suresh, C. K., Suresh, N. S. Mallikarjunaiah, r. R. and Bhagyaraj, D. J., 1989, Vasicular-arbuscular micorrhizae in medicinal plants. *Indian Phytopath*. 42:476-478.
- [17] Gerdemann, J. W. and Nicolson, T. H., 1963, Spores of mycorrhizal endogone species extracted from soils by wet-sieving and decanting. *Trans. Bri. Mycol. Soc*. 46:235-246.
- [18] Walker, C., 1981, *Acaulospora spinosa* Sp. nov. with a ket to the species of *Acaulospora*. *Mycotoxan*, 12: 512-521.
- [19] Trappe, P. B. (1982). Mycorrhizas. The Present position. *Transections 12th Intl. Cong. Soil Science*, New Delhi, 155-166.
- [20] Berch, S. M. and Trappe, J. M., 1987, Revision of Trappe's 1982 synoptic keys to genera and species of Endogonaceae, *Mycotaxonomy*.
- [21] Schenck, N. C. and Perz, Y., 1987, *Manual for identification of VA mycorrhizal fungi*. 1453. Fifield Hall University, Florida, U. S. A.
- [22] Raman, N. and Mohan Kumar, V., 1988, *Techniques in Mycorrhizal Research*. Madras University of Madras. pp. 279.
- [23] Kormanic, P.P., Bryan, E.C. and Schuttz, R.C., 1980, Procedure and equipment for staining large number of plant roots for endomycorrhizal assay. *Canadian Jr. Microbio*. 26: 536-538.
- [24] Philips, J. M. and Hayman, D.S., 1970, Improved procedure for clearing roots and staining parasitic and vesicular arbuscular mycorrhizal fungi for rapid assessment of infection. *Trans. Br. Mycol. Soc*. 55: 158-161.
- [25] Read, D. J., Kouchekei, H.K. and Hodgson, J., 1996, Vasicular-arbuscular micorrhiza in natural vegetation systems. 1. The occurrence of infection. *New Phytol*. 77: 641-653.
- [26] Taber, A. R. and Trappe, J. M., 1982, vesicular-arbuscular mycorrhizal in rhizomes, scale-like leaves, roots and xylem of ginger. *Mycologia*. 74: 156-161.
- [27] Mohan Kumar, V. and Mahadevan, A., 1984, Do secondary substances inhibit mycorrhizal association. *Current Science*. 53: 377-378.
- [28] Lakshman, H.C. and Raghavendra, S., 1990, Occurrence of vasicular arbuscular mycorrhizal fungi in medicinal plants. *Mycorrhizal symbiosis and plant growth*. Peoc. of the Sec. Natl. Cf. on Mycorrhiza held at Banlore (D. J. Bagyaraj and A. Manjunath eds.) 21-23.

- [29] Jagpal, R. and Mukerji, K. G., 1988, Distribution of VA mycorrhizal association in old Delhi ridge. in : *Mycorrhiza Round Table. Proc. of workshop* (A.K. Varma, A.K. Oka, K.G. Mukerji, K.V.B.R. Tilak and Janak Raj, eds). 257-261.
- [30] Kandasamy, D., Rangarajan, M., Oblisami,G., Narayan, R. and Ponnaiah, C., 1988, Mycorrhizal occurrence and its effect on certain forest plant species. in : *Mycorrhiza Round Table. Proc. of workshop* (A.K. Varma, A.K. Oka, K.G. Mukerji, K.V.B.R. Tilak and Janak Raj, eds). 111-118.