exception of asparagine and glutamine in both rooting and non-rooting pea cuttings and that the level of free amino acids did not correlate well with root primordium initiation[15]. Amino acids are readily utilizable source of nitrogen and cuttings of *Vigna* prior to rooting have been shown to accumulate soluble nitrogen[16]. Thus, amino acids show variable effects on rhizogenesis. Their role could be as a general source of carbon and/or nitrogen[8,17]; for the formation of indoacetyl-amino acid conjugates[12,18–20] or as precursors for specific protein and nucleic acid synthesis[21,22] needed for the induction of rhizogenesis by auxins[23]. They may act as specific inducer/effector molecules in relation to other rooting cofactors. Thus their differential effects on rooting in hypocotyl cuttings might be related to their selective utilization for synthesis of rooting specific proteins.

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STUDIES ON NITRATE REDUCTION BY VAM FUNGAL SPORES

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VESICULAR-ARBUSCULAR mycorrhizal fungi are obligate symbionts which show less or no host specificity and are distributed in most of the Indian soils. Many of the higher plants are suceptible to mycorrhizal infection which in turn enhances the plant nutrition[1] especially of P. However, the metabolic ability of the spores of these fungi has not been studied in detail. Iwan Ho and Trappe[2] reported the nitrate-reducing capacity of *Glomus mosseae* and *G. macrocarpus* spores. Some ectomycorrhizal fungi were also shown to have nitrate reductase[3,4]. This paper reports the nitrate-reducing capacity of ten isolates of VAM fungi isolated from various parts of Tamil Nadu along with two known VAM fungi (*G. fasciculatum* and *G. aggregatum*).

Soil samples were collected from different ecological regions (table 1) and single spores were isolated by wet sieving and decanting methods[5]. Using the funnel technique, cultures were established and maintained with *Panicum maximum*

Table 1 *Habitat of various isolates of VAM fungi*

Isolates	Habitat	Rhizosphere of host
KK2	Low land soil	*Phaseolus mungo*
CK2	Dry land soil	*Cajanus cajon*
CK3	Low land soil	*Vigna unguiculata*
CK4	Low land soil	*Sorghum vulgare*
MKU4	Garden soil	*Zea mays*
MKU6	Sewage	*Typha* sp.
MKU7	Laboratory effluent	*Cassia* sp.
Tm2	Grass land	*Chloris* sp.
Tm6	Sand dune	*Pentanus* sp.
Tm8	Salt pans	*Prosopis* sp.

Jacq. as stock cultures. Viable spores were individually collected without organic debris and were surface-sterilized by chloramine T (2%) and streptomycin (0.2%) with a little of tween-80. Samples were put into individual Thunberg tubes to which 3 ml of phosphate buffer (pH 7.0), 1 ml of 0.1 M neutral succinic acid and 1 ml of 0.1 M KNO_3 were added. One ml of distilled water was added instead of KNO_3 to another set which served as control. Air was evacuated from the tubes and was sealed airtight. The tubes were kept in waterbath at 35°C in dark. Samples were taken at 2nd, 4th, 6th, 12th and 24th h and 2 ml of each were withdrawn to which 1 ml of 0.02% N-(1-napthyl)-ethylenediamine dihydrochloride plus 1 ml of 0.1% sulphanilamide were added. The amount of nitrite present in the sample was calculated colorimetrically with Baush and Lomb Spectronic 20 at 540 nm, using distilled water as blank. There were three replications for each treatment.

Table 2 shows the nitrate reduction of different VAM isolates. There were no reduction in controls whereas all the twelve VAM isolates reduced the nitrate to nitrite. The efficiency of reduction was maximum in three isolates viz. MKU7, KK2 and *G. fasciculatum;* moderate in three isolates designated as MKU4, MKU6 and *G. aggregatum* less in three isolates viz. CK2, CK3 and CK4 while isolates Tm2. Tm6 and Tm8 showed the least activity. The results showed the nitrate-reducing capacity of VAM fungi isolated from various areas. With the ability of reducing nitrate these fungi can have efficient symbiosis with the host by the assimilation and translocation of nitrogen. The earlier experiment on the screening of their efficiency in improving the nutrition of cowpea plants[6] also showed considerable increase in nitrogen uptake by the two VAM fungi (MKU7 and *G. fasciculatum*) which were shown to have efficient nitrate reducing capacity.

Table 2 *Nitrate reduction of various isolates of VAM fungi. Nitrite (μmol) formation after the treatment of KNO_3 at different incubation periods*

	Incubation hours				
VAM isolates	2	4	6	12	24
KK2	0.035	0.108	0.267	1.490	3.124
CK2	0.014	0.076	0.101	0.762	2.003
CK3	0.017	0.079	0.109	0.890	2.084
CK4	0.009	0.034	0.093	0.546	1.984
MKU4	0.024	0.096	0 173	0.986	2.701
MKU 6	0.024	0.088	0.156	0.998	2.563
MKU7	0.042	0.196	0.259	1.560	3.172
Tm2	0.003	0.056	0.093	0.634	1.224
Tm6	0.025	0.038	0.102	0.594	1.553
Tm8	0.034	0.045	0.125	0.532	1.758
G. fasciculatum	0.033	0.152	0.201	0.917	2.974
G. aggregatum	0.021	0.073	0.167	0.803	2.168

All the values reported here are means of three samples, and should be multiplied by 10^{-2}.

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MALE AND FEMALE GAMETOPHYTES OF *RAUVOLFIA SUMATRANA* JACK.

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THE genus *Rauvolfia* has attracted global attention due to its alkaloid-reserpine which is widely employed in the treatment of hypertension and mental disorders. *Rauvolfia serpentina* (India's wonder drug plant) is now extensively cultivated throughout India on account of its great export potential. Intensive search is going now, on the species of *Rauvolfia*, other than the *serpentina* to find out their alkaloid potential and to ascertain their medicinal values. *Rauvolfia sumatrana* Jack. is one such plant which was introduced into the Indian Botanic Gardens, Howrah. The present investigation focuses our attention on the development of male and female gametophytes of *R. sumatrana* Jack. and explains the causes of sterility in this interesting plant.

The development of the anther wall is of the Dicotyledonous type (figure 1A, B) and at maturity it consists of an epidermis, fibrous endothecium, a middle layer and an uniseriate secretory tapetum