THE IMPORTANCE OF BIO-FERTILIZERS AND STUDY OF THEIR APPLICATION IN MEDICINALLY IMPORTANT PLANTS.

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LAKE- 2010- ORGANIZED BY IISC BENGALURU
22ND DEC- 24TH DEC- 2010

INTRODUCTION

IMPORTANCE OF MEDICINAL PLANTS

- Primary health care system as Chemotherapeutics.
- Enormous demand by market and public, unscientific exploitation , leading to extinction and further to loss of genetic diversity.
- Cultivation and conservation by *in-situ* or *ex-situ* is increasing steadily to maintain a continuous supply and to support their Increasing demand
- Bio diversity convention is the key to International regulatory system for ensuring the conservation and sustainable use of biological resources.
- Bio diversity convention represents the most important International legal framework for the use of trade in medicinal plants.

Importance of Bio–Fertilizers

- Plants have developed numerous strategies during colonization of terrestrial ecosystem.
- One of the most successful strategies is the symbiotic relationship with the microorganisms " **MYCORRHIZAS"(AMF).**
- The fungi absorbs inorganic soil nutrients most notably Phosphorus which are translocated to the plant host in exchange for photosynthetically fixed CHO.
- This bi-directional transfer facilitates the initial movement of nutrients to the symbiotic partner, leading to enhanced plant growth, improves physiological status and also helps in completion of fungal life cycle.
- Mycorrhizal association in plants has been accredited with benefits Like disease resistance, drought tolerance of hosts, improved water relations, improvement of soil structure by improving the root health of the host plants.These are referred to as **"BIOFERTILIZERS"** and can be substantiated for the substantial amounts of chemical fertilizers.

OBJECTIVES

- Four important medicinal plants *viz., Andrographis paniculata, Adhatoda vasica, Gymnema sylvestre* and *Costus pictus* which have been extensively used in pharmacological composition, safety, efficacy and mechanism of action have been selected.

- Present studies is dealt with an investigation on application of biofertilizers(AMF) in these medicinal plants.

- Influence of AMF *viz*., *Glomus mosseae* and *Glomus fasciculatum* on morphological Growth parameters , the extent of root colonization,spore count, no of vesicles and arbuscules .

MATERIALS AND METHODS

- *Adhatoda vasica* Nees –Acanthaceae , Vasicine- widely used in the treatment of respiratory infections, diphtheria and Gonorrhea (Kapoor, 2001)
- *Andrographis paniculata* – Kalmegh- Acanthaceae , Andrographolide used as an important immunostimulant, in HIV, as hepatoprotective, anti inflammatory, anticancerous etc.,(Matsuda et al.,1994.)
- *Costus pictus* (D.Don)- Costaceae- Insulin plant. Diosgenin- widely used as a potent antidiabetic plant (Joshi,2000) also used in the treatment of asthma, eye complaints and snake bite.
- *Gymnema sylvestre* R.Br. Asclepiadaceae – Periploca of woods- Gymnemic acid. Total saponin fraction of the leaves , used as an antisweetening source (Suttisri,etal., 1995).

- Inoculum of *Glomus mosseae* and *Glomus fasciculatum* multiplied by using the host *Eleusine coracana*.

- Soil containing 10 spores/gm (approx) and infected roots was used as inoculum (25 gms/pot) and mixed with potting substrate.

- 3 treatments- 1. Control 2.AM inoculated with *Glomus mosseae* and
  3. AM inoculated with *Glomus fasciculatum.*

- Morphological parameters with reference to 1. Plant height in cms. 2. No of nodes.
  3. No of Branches – Main and lateral 4. No of leaves 5. Length and Breadth of the
  Leaf in cms 6. Surface area of the leaf in sq.cms 7. Stomatal index by using the
  Formula SI= $\frac{E + S}{E} \times 100$

8) Biomass – Fresh and dry weight in gms were studied periodically for 2, 4 and 6 months.

Establishment of plants in pots association with AM fungi for better growth performance

Arbuscular mycorrhizae (AM) inoculums

1.Glomus mosseae

2.Glomus fasciculatum

$$\% \text{ of mycorrhizal infection} = \frac{\text{No. of root bits having infection}}{\text{No. of root bits taken for observation}} \times 100$$

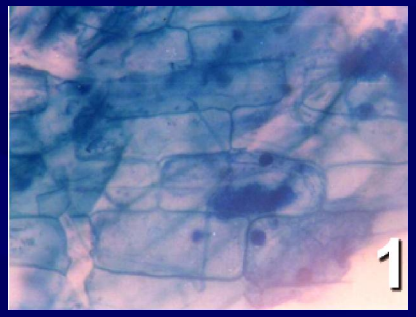
Estimation of Mycorrhizal Spores: Extrametrical chlamydospores produced by the mycorrhizal fungus were estimated by a wet sieving and decanting method outlined by Gerdman and Nicolson (1963).

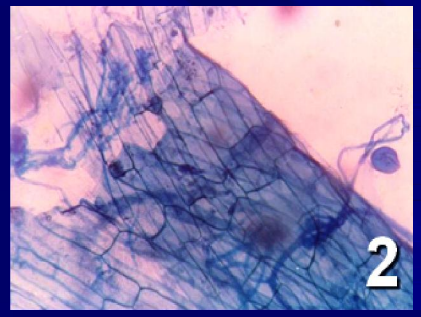
Statistical Analysis

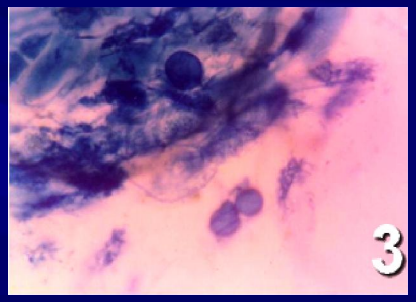
Data were represented as mean ± SE changes were analyzed by two way ANOVA. Significant 'F' ratios between groups means were further subjected to least significant differences (LSD) Probability (P) values < 0.05 were considered significant (George *et al.*, 1994).

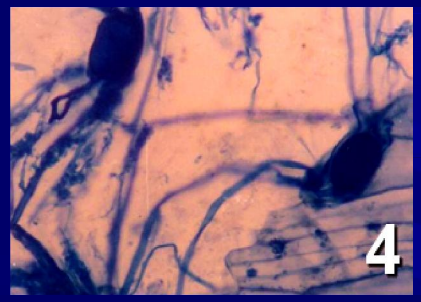
RESULTS:

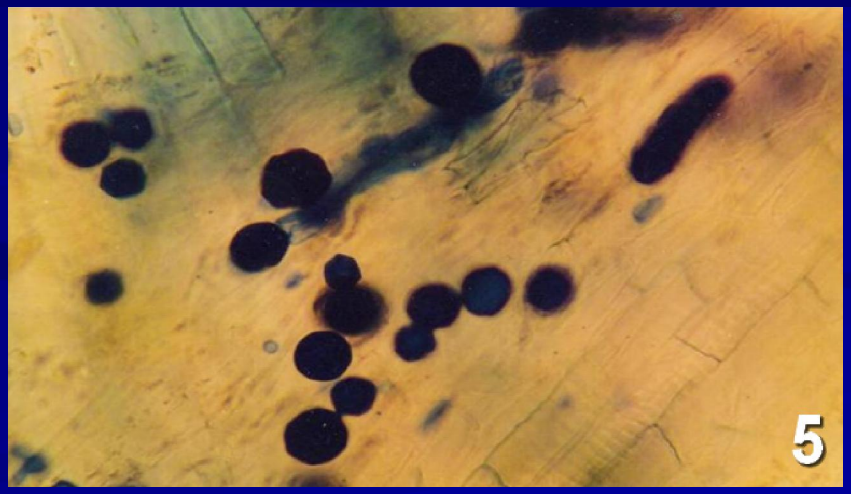
Establishment of plants in pots in association with AM fungi for better growth performance.











ANDROGRAPHIS PANICULATA:

ADHATODA VASICA

COSTUS PICTUS

GYMNEMA SYLVESTRE

Table 1: Influence of AM fungal association on Percent of colonization,spore count, number of vesicles, arbuscles after 6 months of treatment

***The mean differences are significant at P<0.05 as determined by Fisher's protected LSD test**

****The mean differences are highly significant at P<0.01 as determined by Fisher's protected LSD test**

Plant sps	Treatments	Percent of colonization	Spore count	No of vesicles	No of arbuscles	
Adhatoda vasica	Control	13.1±0.56	13±0.54	10.0±0.44	06±1.02	
	Treated with *Glomus mosseae*	78±0.48**	171±3.08**	37±0.66*	39±0.66*	
	Treated with *Glomus fasciculatum*	85±0.54**	195±1.72**	62±0.10	76±0.48**	
Andrographis paniculata	Control	10±0.44	10±0.50	07±0.37	06±1.02	
	Treated with *Glomus mosseae*	59±0.10**	89±1.99**	33±0.39*	35±0.72*	
	Treated with *Glomus fasciculatum*	75±0.54**	114±1.01*	42±0.74*	50±0.78*	
Costus pictus	Control	08±0.50	06±1.02	07±0.37	06±1.02	
	Treated with *Glomus mosseae*	66±0.10**	85±0.54**	32±0.36*	58±0.62**	
	Treated with *Glomus fasciculatum*	60±0.80**	73±0.48*	25±1.63*	46±0.35*	
Gymnema sylvestre	Control	05±0.50	06±1.02	04±0.05	05±0.31	
	Treated with *Glomus mosseae*	50±0.67**	65±0.20*	22±0.67*	32±0.39*	
	Treated with *Glomus fasciculatum*	56±0.58**	74±0.46*	29±0.58*	48±0.74	

Table 2: Influence of AM fungal association on growth performance after 6 months of treatment.
***The mean differences are significant at P<0.05 as determined by Fisher's protected LSD test**
****The mean differences are highly significant at P<0.01 as determined by Fisher's protected LSD test**

Plant sps	Treatments	Plant height (cm)	No of nodes	No of branches		Internodal length (cm)
				Main	Lateral	
Adhatoda vasica	Control	30.80±0.36	15.80±0.73	2±0.20	2±0.20	01±0.03
	Treated with *Glomus mosseae*	52.40±0.62**	19±0.70*	3±0.24	5±0.70*	02±0.20
	Treated with *Glomus fasciculatum*	87.40±1.99**	25±0.80*	3±0.24	5±0.70*	4.5±0.09**
Andrographis paniculata	Control	42±0.24	50.20±0.29	2±0.20	10±0.66	07±0.37
	Treated with Glomus mosseae	46±0.31	67.80±0.86*	2±0.20	11±0.20	07±0.54
	Treated with *Glomus fasciculatum*	60±1.05**	75±1.35**	2±0.20	13±0.37*	08±0.44
Costus pictus	Control	48.7±0.75	18±0.80	05±0.70	-	02±0.20
	Treated with *Glomus mosseae*	90±0.54**	27±0.58*	09±0.70*	_	2.5±0.10
	Treated with *Glomus fasciculatum*	78±0.54**	25±0.63*	08±0.37*	_	02±0.20
Gymnema sylvestre	Control	50±0.67	68.40±0.86	04±0.05	_	06±0.31
	Treated with *Glomus mosseae*	62.60±0.10*	78±1.30*	04±0.05	_	06.0.31
	Treated with *Glomus fasciculatum*	81.50±2.00**	80.50±2.00*	04±0.05	_	06±0.31

Table 3: Influence of AM fungal association on number of leaves, length and breadth of the leaf and surface area of the leaf after 6 months of treatment

***The mean differences are significant at P<0.05 as determined by Fisher's protected LSD test**

****The mean differences are highly significant at P<0.01 as determined by Fisher's protected LSD test**

Plant sps	Treatments	No of leaves	Length of the leaf	Breadth of the leaf	Surface area of the leaf
Adhatoda vasica	Control	30±0.44	19.5±0.09	7.5±0.20	295.4±2.02
	Treated with *Glomus mosseae*	38±0.58*	24±0.65*	9.5±0.31	503.8±3.86**
	Treated with *Glomus fasciculatum*	50±0.62**	27±0.58**	10.5±0.44	568.4±1.72**
Andrographis paniculata	Control	85±1.99	6.20±0.24	3.20±0.24	39.2±0.48
	Treated with *Glomus mosseae*	124±0.40**	6.50±0.24	2.40±0.24	40.8±0.58
	Treated with *Glomus fasciculatum*	150±0.15**	6.50±0.24	2.40±0.24	39.6±0.48
Costus pictus	Control	18±0.52	10±0.20	04±0.05	85.20±1.99
	Treated with *Glomus mosseae*	27.60±0.74**	15.5±0.24	08±0.44**	250.10±1.72**
	Treated with *Glomus fasciculatum*	25±0.63*	14±0.24	06±1.02	298.56±1.63**
Gymnema sylvestre	Control	136±0.44	02±0.22	1.5±0.04	8.10±0.50
	Treated with *Glomus mosseae*	176±1.01**	03±0.23	2.00±0.03	13.65±0.50*
	Treated with *Glomus fasciculatum*	184±3.86**	04±0.05	2.00±0.03	17.50±0.73

Table 4: Influence of AM fungal association on root and shoot length, biomass and stomatal index after 6 months of treatment.

***The mean differences are significant at P<0.05 as determined by Fisher's protected LSD test**

****The mean differences are highly significant at P<0.01 as determined by Fisher's protected LSD test**

Plant sps	Treatments	Root length	Shoot length	Biomass		Stomatal index
				Fresh weight	Dry weight	
Adhatoda vasica	Control	17.02±0.24	27±0.37	30.60±0.36	12.40±0.24	22.20±0.24
	Treated with *Glomus mosseae*	34±0.48**	44±0.54*	100.80±0.54**	49.90±0.48**	25.00±0.31*
	Treated with *Glomus fasciculatum*	74±0.54	83±0.83**	500.35±0.89**	200.58±0.58**	29.40±0.87*
Andrographis paniculata	Control	12.00±0.31	44±0.54	16.5±0.73	6.85±0.50	17.80±0.37
	Treated with *Glomus mosseae*	15.00±0.24	50.20±0.58*	19.20±0.80*	8.95±0.44*	21.90±0.44*
	Treated with *Glomus fasciculatum*	18±0.24*	54±0.58*	30.40±0.54**	12.34±0.73**	22.20±0.24*
Costus pictus	Control	12.20±0.31	35.20±0.48	125.48±0.44	50.6±0.58	12.40±0.31
	Treated with *Glomus mosseae*	22±0.44*	79±0.81**	450.60±0.37**	140.25±0.15**	17.85±0.24*
	Treated with *Glomus fasciculatum*	21.90±0.44*	66.40±0.80*	350.78±1.26**	180.86±3.86**	15.86±0.24
Gymnema sylvestre	Control	07±0.24	67±0.80	6.82±0.50	2.90±0.37	26.02±0.37
	Treated with *Glomus mosseae*	15±0.24*	78±0.58*	10.60±0.50*	4.60±0.06*	29.10±0.87
	Treated with *Glomus fasciculatum*	21±0.24**	90±1.99**	12.80±0.50*	5.62±0.31*	29.20±0.87*

CONCLUSION

In conclusion medicinal plants otherwise widely distributed faces threat of genetic depletion from over-exploitation due to their wide popularity as drugs to treat a variety of ailments. It is imperative that measures are initiated for the conservation of these species with their varied diversity as otherwise potential variants with highest productivity to be developed as cultivars may disappear once for all. It is well considered opinion that the two way approach viz., selection of an improved variant for development as a cultivar and isolation of a high yielding cultivar from the selected genotype through *in situ and ex situ* mutagenesis should be effectively pursued not only to conserve the existing genetic diversity but also to ensure sustainable utilization of Medicinal plants.

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