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Evaluating growing media and plant growth regulators on the establishment of rooting in Sirukurinjan (*Gymnema sylvestre* L.) in Southern Tamil Nadu

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Abstract

Plants are a great concern for drug discovery exploration and a major source of our modern medicine. About 25% of modern medicines are derived from a plant source and merely 5-15% of plants have been investigated for their medicinal use. Among them, Sirukurinjan (*Gymnema sylvestre* L.) has got an important role in curing diabetes. Keeping the importance of vegetative propagation in ensuring mass multiplication of cuttings of *Gymnema*, which are difficult to germinate through seeds and to multiply the cuttings of high viability, a systematic research trial was conducted during 2021 at Agricultural college and research Institute, Madurai to optimize the concentration of plant growth regulators and evaluate growing media to induce rooting under controlled conditions. Combinations of different soil medium viz., with red soil, farm yard manure (FYM), vermicompost, composted coco pith and bagasse-based medium were integrated with plant growth regulators such as IBA, IAA, NAA @750 ppm and in combination; and also, humic acid at 500ppm and water soaking kept as control. Results revealed that, among different growing media, bagasse media along with IBA @750 ppm as growth regulator exhibited the maximum root length, fresh weight and dry weight and root volume. Therefore, propagating Sirukurinjan in bagasse media with IBA as growth regulator can be considered as a suitable technology for commercial propagation.

Keywords: *Gymnema sylvestre* L., growing media, plant growth regulators, dry weight and root volume

Introduction

Gymnema sylvestre L., a climbing shrub indigenous to India, is referred to as “Gurmar” (sugar destroyer) belongs to the family *Asclepiadaceae*. Of the 25 species in this genus, 11 species including *sylvestre* L. have earlier been reported in India (Kirtikar and Basu, 1975) [5]. *Gymnema* is one of the highly traded medicinal plants sourced from the wild, with annual consumption of 500 – 1000 ton/year (Ved and Goraya, 2007) [12].

It is a native to the tropical forests of Southern and Central India. In India, it is *Gymnema sylvestre* L. has got an important place among these medicinal herbs growing in the forests of Andhra Pradesh, Bihar, Chattisgarh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal. *Gymnema* is also known by different names as Sirukurinjan and Sakkaraikolli in Tamil, Madhunashini and meshashringi in Sanskrit, Periploca of the woods in English, Kavali and Kalikardori in Marathi etc.

It is a therapeutic herb having multiple potentials as mentioned in folk medicine, Ayurveda, and Homeopathic systems of medicine (Parijat and Madhusudan, 2007) [8]. *Gymnema sylvestre* L. was considered as one of the major botanicals to treat diabetes in the Ayurvedic system of medicine and also is included in Indian Pharmacopoeia as an anti-diabetic plant (Singh *et al.*, 2008) [10]. In Ayurveda, the plant is prescribed for the treatment of dyspepsia, constipation, jaundice, hemorrhoids, renal and vesicle calculi, cardiopathy, asthma, bronchitis, amenorrhea, and leucoderma (Anis *et al.*, 2000 [2]; Mathew, 2004) [6]. Furthermore, different parts of the plant such as the roots, stem, and leaves have been used as cardiogenic, digestive, diuretic, laxative, stimulant, stomachic, and uterine tonic in traditional medicine systems (Mathew, 2004) [6].

Gymnema sylvestre L. can be mainly propagated through stem cuttings and rarely through seeds. The problems accounted are period of seed viability is very short, flower-shedding and low fruit-set (Chandrasekar *et al.*, 2003) [3]. Besides overcoming the problems in seed propagation, vegetative propagation is more effective for large scale multiplication of the plant

during lean periods of seed availability. There is a need to bring it under cultivation with suitable agro-techniques, as well as for developing propagation methods. Therefore, the present study was initiated to standardize the media and growth regulators for rooting of *Gymnema sylvestre* L.

Materials and Methods

The present studies on *Gymnema sylvestre* L. were carried out in the Agricultural College and Research Institute, Madurai during 2021. The research site was located at 9° 96' N and 78° 20' E with an altitude of about 141 m above mean sea-level.

Combinations of different soil media viz., red soil + sand + farm yard manure [FYM] (1:1:1); red soil + vermicompost (VC) + FYM (1:1:1); composted coco pith (CCP) + vermicompost (VC) + farm yard manure (FYM) + arbuscular mycorrhiza fungi [AMF] (1:1:1) and bagasse-based medium (BM) were assessed. Plant growth regulators viz., IBA @750 ppm, IAA @750 ppm, IBA @375 + IAA @375 ppm, humic acid (HA) @500 ppm, NAA @750 ppm and water soaking acts as a control. The experiment was laid out under Factorial Completely Randomized Design replicated thrice.

Softwood cuttings with a length of 15-20 cm with one to two nodes were selected with uniform thickness and 2-3 leaves per cuttings with half leaves. Growing media were filled into 20 × 12 cm sized perforated polythene bags. The basal ends upto 2.5 cm of cuttings were dipped in growth regulators for 30 mins and then it was planted in such a way that one basal node was inserted into the media and the medium around the cutting was gently pressed to exclude air pockets. Growing media were drenched by using carbendazim (2%) against

fungal diseases after 7 days after planting (DAP).

Ten polythene bags were maintained for each combination and observations on root length, root volume, fresh weight and dry weight of root after 90 DAP.

The data recorded were statistically analysed under Factorial Complete Randomised Design (FCRD) using analysis of variance (ANOVA) at 5% level of significance. The standard deviation was estimated using excel and analysis was conducted through Agres statistical software package version 3.01 (Agres, 1994) [1].

Results and Discussion

Root length

The effect of different soil media and different growth regulators significantly influenced the root length (Table 1). Maximum root length was observed in BM media (24.80±0.60) along with the cuttings dipped in IBA @750 ppm (22.68±2.34) followed by CCC+VC+FYM+AMF (22.72±1.00) along with IAA @750 ppm (22.19±2.64), while RS+S+FYM (18.69±0.45) with water soaking (21.00±2.22). The increase in the root length may be due to the effect of growth regulators IBA on the metabolites translocation and carbohydrates metabolism which may be involved in the roles of hormones on root length. Another reason might be the action of auxin activity, which may cause hydrolysis and translocation of carbohydrates and nitrogenous substances at the base of cuttings, and this resulted in accelerating cell elongation and cell division in suitable environment (Mewar and Naithani, 2016) [7].

Table 1: Effect of soil medium and plant growth regulators on the root length of *Gymnema sylvestre* L.

Root length at 90 DAP					
Treatment	RS + FYM + S	RS + VC + FYM	CCP + VC + FYM + AMF	BM	Mean
Control	18.01±0.33	20.45±0.33	21.30±0.42	24.22±0.80	21.00±2.22
IBA750	19.49±0.46	21.67±0.29	23.81±0.21	25.76±0.23	22.68±2.34
IAA750	18.74±0.19	20.69±0.75	23.82±0.00	25.51±0.34	22.19±2.64
IBA375 + IAA375	18.62±0.29	20.76±0.52	22.62±0.38	24.48±0.52	21.62±2.17
HA500	18.44±0.16	21.09±0.36	21.55±0.10	24.4±0.88	21.37±2.12
NAA750	18.87±0.11	20.45±0.48	23.20±0.73	24.43±0.65	21.74±2.20
Mean	18.69±0.45	20.85±0.42	22.72±1.00	24.80±0.60	
		T	S	T×S	
SEd		0.19	0.23	0.46	
CD (p=0.005)		0.38	0.46	0.92	
RS - Red soil	VC - Vermicompost		BM - Bagasse medium	HA - Humic acid	
FYM - Farmyard Manure	CCP - Composted coco pith		IAA - Indole acetic acid	NAA - Naphthalene Acetic acid	
S - Sand	AMF - Arbuscular mycorrhiza fungi		IBA - Indole butyric acid		

Root Dry weight

Maximum fresh weight was recorded in BM (1.53±0.36) combined with IBA @750 ppm (1.74±0.31) which was followed by CCC+VC+FYM+AMF (1.35±0.37) combined with IAA @375ppm+IAA @375ppm (1.70±0.12) (Table 2). While, lower fresh weight was found in RS+S+FYM

(1.26±0.37) with water soaking (1.09±0.45). Increased fresh weight of roots was attributed to the fact that auxins naturally occurring or exogenously applied for initiation and growth of roots. Similar findings are reported in Pasqual *et al.* (2001) [9] in fig cv. Roxo de Valinhos.

Table 2: Effect of soil medium and plant growth regulators on the fresh weight of *Gymnema sylvestre* L.

Fresh weight at 90 DAP					
Treatment	RS + FYM + S	RS + VC + FYM	CCP + VC + FYM + AMF	BM	Mean
Control	1.85±0.04	0.87±0.03	0.67±0.01	0.98±0.01	1.09±0.45
IBA750	1.23±0.03	1.97±0.01	1.76±0.02	1.99±0.07	1.74±0.31
IAA750	1.24±0.01	1.78±0.00	1.35±0.04	1.65±0.04	1.51±0.22
IBA375 + IAA375	1.55±0.05	1.65±0.02	1.74±0.04	1.87±0.04	1.70±0.12
HA500	0.89±0.03	1.36±0.04	1.13±0.00	1.15±0.03	1.13±0.17
NAA750	0.77±0.00	1.38±0.02	1.45±0.02	1.55±0.01	1.29±0.30
Mean	1.26±0.37	1.50±0.35	1.35±0.37	1.53±0.36	

		T	S	T×S	
SEd		0.01	0.02	0.03	
CD (P=0.005)		0.03	0.03	0.06	
RS - Red soil	VC – Vermicompost		BM - Bagasse medium		HA - Humic acid
FYM - Farmyard Manure	CCP - Composted coco pith		IAA -Indole acetic acid		NAA - Naphthalene Acetic acid
S – Sand	AMF -Arbuscular mycorrhiza fungi		IBA -Indole butyric acid		

Comparing the treatment combination, increased dry weight was observed in BM (0.75±0.08) along with IBA @750 ppm followed by (0.75±0.08), which is followed by CCC+VC+FYM+AMF (0.59±0.14) combined with the cuttings dipped in IAA @375 ppm + IAA @375 ppm (0.64±0.23) while RS+S+FYM (0.44±0.19) along with water

soaking (0.47±0.18) acts as a control recorded lower values (Table 3). Increase in dry weight of roots might be due to the fact that the increase in the root number and length of the roots resulted in high accumulation of dry matter. The present results are in accordance with the findings of Thota (2012) [11] in fig plant cv. Poona.

Table 3: Effect of soil medium and plant growth regulators on the dry weight of *Gymnema sylvestre* L.

Dry weight at 90 DAP					
Treatment	RS + FYM + S	RS + VC + FYM	CCP + VC + FYM + AMF	BM	Mean
Control	0.18±0.04	0.55±0.09	0.50±0.11	0.66±0.09	0.47±0.18
IBA750	0.71±0.02	0.65±0.07	0.76±0.07	0.87±0.09	0.75±0.08
IAA750	0.44±0.10	0.44±0.08	0.81±0.18	0.82±0.05	0.63±0.19
IBA375 + IAA375	0.38±0.05	0.99±0.03	0.50±0.02	0.69±0.13	0.64±0.23
HA500	0.28±0.02	0.38±0.13	0.58±0.02	0.79±0.03	0.51±0.20
NAA750	0.67±0.03	0.45±0.18	0.41±0.14	0.70±0.03	0.56±0.13
Mean	0.44±0.19	0.58±0.20	0.59±0.14	0.75±0.08	
		T	S	T×S	
SEd		0.01	0.01	0.01	
CD (P=0.005)		0.01	0.01	0.03	
RS - Red soil	VC – Vermicompost		BM - Bagasse medium		HA - Humic acid
FYM - Farmyard Manure	CCP - Composted coco pith		IAA -Indole acetic acid		NAA - Naphthalene Acetic acid
S – Sand	AMF -Arbuscular mycorrhiza fungi		IBA -Indole butyric acid		

Root volume

Maximum root volume was observed in BM (1.06±0.49) along with IBA @750 ppm (1.61±0.25) which is followed by CCC+VC+FYM+AMF (1.03±0.63) along with IAA @750 ppm (1.51±0.30) while RS+S+FYM and water soaking acts as

a control (0.76±0.31) and (0.47±0.08) respectively (Table 4). The increase could possibly be due to the fact that the auxins applied either as naturally or exogenously applied could have increased growth of roots (Deb *et al.*, 2009) [4] and thereby the root volume.

Table 4: Effect of soil medium and plant growth regulators on the root volume of *Gymnema sylvestre* L.

Root volume at 90 DAP					
Treatment	RS + FYM + S	RS + VC + FYM	CCP + VC + FYM + AMF	BM	Mean
Control	0.34±0.01	0.56±0.01	0.53±0.01	0.46±0.01	0.47±0.08
IBA750	1.23±0.03	1.56±0.03	1.88±0.06	1.78±0.02	1.61±0.25
IAA750	1.06±0.02	1.45±0.01	1.89±0.03	1.65±0.06	1.51±0.30
IBA375 + IAA375	0.67±0.02	0.78±0.02	0.85±0.01	0.98±0.03	0.82±0.11
HA500	0.46±0.01	0.65±0.02	0.26±0.01	0.67±0.01	0.51±0.17
NAA750	0.78±0.02	0.88±0.01	0.75±0.02	0.82±0.01	0.81±0.05
Mean	0.76±0.31	0.98±0.39	1.03±0.63	1.06±0.49	
		T	S	T×S	
SEd		0.01	0.01	0.02	
CD (p=0.005)		0.02	0.02	0.05	
RS - Red soil	VC – Vermicompost		BM - Bagasse medium		HA - Humic acid
FYM - Farmyard Manure	CCP - Composted coco pith		IAA -Indole acetic acid		NAA - Naphthalene Acetic acid
S - Sand	AMF -Arbuscular mycorrhiza fungi		IBA -Indole butyric acid		

Conclusion

From the above study, it may be confirmed that vegetative propagation of *Gymnema sylvestre*(L.) is most suitable through semi-hardwood cuttings(15 cm length) under Bagasse based medium treated with growth regulator IBA @750 ppm for better rooting and plant establishment.

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