J. Hortl. Sci.
Vol. 9(1):94-97, 2014

Short communication

Effects of type of cutting, IBA and bioinoculants on rooting in madhunashini (*Gymnema sylvestre* Retz.)

H.J. Akshitha, K. Umesha and T.H. Shankarappa[1]
Post Graduate Centre, University of Horticultural Sciences Campus
GKVK Post, Bangalore-560 065, India
E- mail: akshi.hosahalli10@gmail.com

ABSTRACT

An experiment was carried out to study the effect of type of cutting, IBA and bioinoculants on rooting in madhunashini. Among the three types of cuttings, hardwood cuttings registered higher values for fresh (0.790g/cutting) and dry weight (0.650g/cutting) of sprouts, per cent rooting (6.66 %), fresh and dry weight of roots (0.037 and 0.030g/ cutting) and biomass production (0.682g/cutting). Among IBA and bioinoculant treatments, *Azotobacter chroococcum* recorded higher values for percentage sprouting (26.66 %) and rooting (9.99 %) as also for other root parameters; whereas, maximum fresh weight (0.863g/cutting) and dry weight of sprouts (0.740g/cutting), and, biomass production (0.759g/cutting) was observed in IBA 1000ppm treatment. Interaction effect of type of cutting, IBA and bioinoculants on fresh and dry weight of sprouts (2.438g and 2.084g, respectively) and biomass production (2.123g/cutting) was found superior in hardwood cuttings treated with IBA 1000ppm. Percentage of rooting (13.33 %) was better in hardwood cuttings treated with *Azotobacter chroococcum*. Therefore, among the various treatments tested, hardwood cuttings treated with *Azotobacter chroococcum* are the best for propagation through cuttings.

Key words: IBA, *Azotobacter chroococcum*, madhunashini, vegetative propagation

Gymnema sylvestre Retz. is a medicinal woody climber belonging to the family Asclepiadaceae. It is native to the tropical forests of Southern and Central India. Leaves of this species yield acidic glycosides and anthroquinones which have antidiabetic, antisweetener and anti-inflammatory activities. Leaf extract from the plant is used in India as a stomachic, stimulant, laxative, diuretic and for curing diabetes (Alam *et al*, 1990). The herb stimulates the heart, increases urine secretion and is useful in the treatment of Type II diabetes.

Madhunashini is propagated through seeds in its natural habitat. But, there are problems like flower-shed, low fruit-set and a very short span of seed viability (Chandrasekar *et al*, 2003). Besides overcoming problems in seed propagation, vegetative propagation is helpful for large scale multiplication of the plant during lean periods of seed availability.

Gymnema is one of the highly traded medicinal plants sourced from the wild, with annual consumption of 500-1000t/year (Ved and Goraya, 2007). There is an urgent 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 propagation methods in this plant through cuttings.

The present study was carried out at Post Graduate Centre, University of Horticultural Sciences (Bagalkot), Gandhi Krishi Vignana Kendra Campus, Bengaluru. The experiment was laid out in Factorial Completely Randomized Design with three replications. Plant material required for the experiment was collected from Foundation for Revitalization of Local Health Traditions (FRLHT), Bengaluru, and the experiment was spanned January to April. Three main treatments were imposed, i.e., type of cutting with 6 sub-treatments, i.e., bio-inoculants and IBA. Each treatment was replicated thrice; in each replication, 10 cuttings were used. A slant cut was made at the basal end, whereas, a transverse cut was made at the top end of each cutting. Softwood cuttings 10-15cm long were prepared and leaves on the lower portion of the cutting were removed, while those on the upper part were retained. Semi hardwood cuttings 10-15cm long were prepared by retaining 2-3 leaves at the top. Hardwood cuttings were collected from the basal portion of the vine, and cuttings 10-15cm long were prepared by removal of all the leaves.

[1]Assistant Professor, Department of Agricultural Microbiology, College of Horticulture, Kolar, Karnataka,India

The basal portion of the cuttings (about 2.5-3cm) was dipped either in bioinoculants or in distilled water (Control) for 15 minutes, or, in growth regulator solution for one minute, and air-dried. Treated cuttings were planted in seed pans containing rooting media (soil, sand and FYM 2:1:2). Using a pointed stick, a hole was made in the media and the basal portion of the cutting was inserted into it. Cuttings were planted in such a way that one basal node of the cutting was inserted into the media, and medium around the cutting was gently pressed to exclude air pockets. The seed pans with cuttings were placed in the net-house. Observations on various shoot and root parameters were collected 90 days after planting.

For recording fresh weight of sprouts, cuttings were uprooted at 90 days after planting. Fifty per cent of the rooted cuttings, but not more than five cuttings in each treatment and replication, were utilized. The sprouts were separated from the cuttings and weighed. After recording fresh weight, the samples were dried in a hot air oven at 60°C until constant weight was attained.

Cuttings utilized for recording fresh weight of sprouts were used for recording fresh weight of roots as well. The root system was washed thoroughly in water and roots were separated from the cuttings and air dried. Their fresh weight and dry weights were recorded. Biomass was calculated by adding dry weights of the sprouts and the roots.

Data on various shoot and root parameters were tabulated and statistically analyzed using Factorial Completely Randomized Design (FCRD). Inference was drawn after comparing the F values calculated with table F values at 5% (P= 0.05) level of significance.

Cuttings treated with *Azotobacter chroococcum* recorded highest per cent sprouting (40%) (Table 1). This may be due to the fact that *Azotobacter chroococcum* is a nitrogen fixing bacterium which also produces the rooting hormone IAA which, in turn, may have helped produce more number of roots, and aided better uptake of water and nutrients. Similar results were obtained by Karthikeyan and Sakthivel (2011) in eucalyptus. Hardwood cuttings treated with IBA 1000ppm recorded higher fresh and dry weights of sprouts (2.438 and 2.084 g/cutting). Higher fresh weight may be related to the higher number of and longer sprouts in these treatments, as in *Jasminum sambac* (Singh, 2001). Similar response was recorded by Singh *et al* (2003) in long pepper.

Rooting percentage (13.33%), fresh weight (0.088g) and dry weight (0.064g) of roots were maximum in hardwood cuttings treated with *Azotobacter chroococcum* (Table 2). Superior rooting and rooting parameters could be due to production of plant hormones that stimulate root initiation. Production of IAA, an important hormone for rooting, by *Azotobacter chroococcum* was confirmed by Karthikeyan and Sakthivel (2011) while working on eucalyptus. Earlier studies have also shown that *Azotobacter chroococcum* species are able to produce IAA, GA and cytokinin-like substances, both under culture conditions and in the plant rhizosphere (Brown, 1976). This suggests that continuous release of small quantities of IAA can enhance root initiation over a single application of a root hormone. Sufficient amount (7.8µg/ml) of IAA, to promote root initiation and elongation, was produced even without supplementation with tryptophan (Karthikeyan and

Table 1. Influence of type of cutting, bioinoculants and IBA on various shoot parameters in madhunashini (*Gymnema sylvestre* Retz.)

Treatment	Per cent sprouting				Fresh weight of sprouts (g)				Dry weight of sprouts (g)			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_1- Control	20.00	13.33	6.66	13.33	0.015	0.037	0.060	0.037	0.012	0.035	0.046	0.031
S_2- *Azospirillum lipoferum*	26.66	20.00	26.66	24.44	0.049	0.066	1.389	0.501	0.047	0.064	1.020	0.377
S_3- *Azotobacter chroococcum*	26.66	13.33	40.00	26.66	0.571	0.430	0.648	0.549	0.536	0.368	0.584	0.496
S_4- *Pseudomonas striata*	13.33	13.33	16.66	14.44	0.195	0.074	0.079	0.116	0.048	0.058	0.062	0.056
S_5- *Pseudomonas fluorescence*	30.00	16.66	16.66	21.11	0.046	0.162	0.129	0.112	0.040	0.113	0.108	0.087
S_6- IBA 1000ppm	16.66	20.00	16.66	17.77	0.047	0.104	2.438	0.863	0.040	0.096	2.084	0.740
Mean	22.21	16.11	20.55		0.153	0.145	0.790		0.121	0.122	0.650	
	SEm±	CD	F test		SEm±	CD	F test		SEm±	CD	F test	
		(*P=0.05*)				(*P=0.05*)				(*P=0.05*)		
M	1.69	-	NS		0.114	0.328	*		0.095	0.273	*	
T	2.40	6.88	*		0.162	0.465	*		0.135	0.387	*	
M×T	4.15	-	NS		0.280	0.805	*		0.233	0.670	*	

*Significant at 5% NS - Non significant M_1 – Softwood cuttings; M_2 – Semi hardwood cuttings; M_3 – Hardwood cuttings

Table 2. Influence of type of cuttings bioinoculants and IBA on various root parameters in madhunashini (*Gymnema sylvestre* Retz.)

Treatment	Per cent rooting				Root fresh weight (g)				Root dry weight (g)			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_1- Control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)	(0.70)
S_2- *Azospirillum lipoferum*	0.00	0.00	6.66	2.22	0.00	0.00	0.019	0.006	0.00	0.00	0.010	0.003
	(0.70)	(0.70)	(1.07)	(0.82)	(0.70)	(0.70)	(0.72)	(0.71)	(0.70)	(0.70)	(0.72)	(0.71)
S_3- *Azotobacter chroococcum*	6.66	10.00	13.33	9.99	0.044	0.012	0.088	0.048	0.040	0.008	0.064	0.037
	(1.07)	(1.22)	(3.66)	(1.98)	(0.73)	(0.71)	(0.76)	(0.73)	(0.73)	(0.71)	(0.74)	(0.73)
S_4- *Pseudomonas striata*	0.00	0.00	6.66	2.22	0.00	0.00	0.020	0.006	0.00	0.00	0.017	0.006
	(0.70)	(0.70)	(1.07)	(0.82)	(0.70)	(0.70)	(0.72)	(0.70)	(0.70)	(0.70)	(0.71)	(0.70)
S_5- *Pseudomonas fluorescence*	0.00	0.00	6.66	2.22	0.00	0.00	0.053	0.017	0.00	0.00	0.050	0.016
	(0.70)	(0.70)	(1.07)	(0.82)	(0.70)	(0.70)	(0.74)	(0.71)	(0.70)	(0.70)	(0.74)	(0.71)
S_6- IBA 1000ppm	6.66	3.33	6.66	5.55	0.013	0.012	0.044	0.023	0.009	0.009	0.039	0.019
	(1.07)	(0.91)	(1.07)	(1.01)	(0.72)	(0.71)	(0.74)	(0.72)	(0.71)	(0.71)	(0.73)	(0.72)
Mean	2.22	2.22	6.66		0.009	0.004	0.037		0.008	0.003	0.030	
	(0.82)	(0.82)	(1.07)		(0.70)	(0.70)	(0.73)		(0.71)	(0.70)	(0.72)	
	SEm±	CD	F test		SEm±	CD	F test		SEm±	CD	F test	
		(*P=0.05*)				(*P=0.05*)				(*P=0.05*)		
M	0.04	0.11	*		0.004	0.013	*		0.003	0.010	*	
T	0.05	0.16	*		0.006	0.019	*		0.005	0.015	*	
M×T	0.10	0.28	*		0.010	-	NS		0.050	-	NS	

Note: Values in the parentheses are square root transformed values *Significant at 5%

M_1 – Softwood cuttings; M_2 – Semi hardwood cuttings; M_3 – Hardwood cuttings NS - Non significant

Table 3. Dry biomass production (g/cutting) in madhunashini (*Gymnema sylvestre* Retz.) cuttings as influenced by different type of cutting, bioinoculants and IBA

Sub-treatment (S)	Main treatments (M)			
	Softwood (M_1)	Semi hardwood (M_2)	Hardwood (M_3)	Mean
S_1- Control	0.012	0.035	0.046	0.031
S_2- *Azospirillum lipoferum*	0.047	0.064	1.030	0.381
S_3- *Azotobacter chroococcum*	0.576	0.376	0.648	0.534
S_4- *Pseudomonas striata*	0.048	0.058	0.079	0.062
S_5- *Pseudomonas fluorescence*	0.040	0.113	0.158	0.103
S_6- IBA 1000ppm	0.049	0.105	2.123	0.759
Mean	0.128	0.125	0.681	
	SEm±	CD @ 5%	F test	
M	0.100	0.288	*	
S	0.142	0.407	*	
M×S	0.246	0.706	*	

*Significant at 5%

Sakthivel, 2011). Similar response to *Azotobacter chroococcum* inoculation in mulberry (Das *et al*, 1990) and *Ocimum sanctum* (Vinutha, 2005) has been reported. Not much difference between fresh and dry weight of sprouts and roots was observed, which may be due to the small-sized, thin sprouts and roots; moisture content was also lower, hence, smaller difference was observed.

Interaction of type of cutting and IBA treatment had significant influence on biomass production (Table 3). Hardwood cuttings treated with IBA 1000ppm recorded higher biomass (2.123g) than semi hardwood and softwood cuttings with bioinoculant treatment.

This study clearly indicates that vegetative propagation in *Gymnema sylvestre* by hardwood cuttings treated with *Azotobacter chroococcum* and IBA 1000ppm gives best results, with good rooting and establishment.

REFERENCES

Alam, M.M., Siddiqi, M.B. and Husain, W. 1990. Treatment of diabetes through herbal drugs in rural India. *Fitoterapia*, **61**:240–242

Brown, M. 1976. Role of *Azotobacter paspali* in association with *Paspalum notatum*. *J. Appld. Bacteriol.*, **40**:341-348

Chandrasekar, A., Sankaranarayan, R., Balakrishnan, K. and Balakrishnan, A. 2003. Standardization of *Gymnema* (*Gymnema sylvestre* R. Br.) propagation. *South Indian Hort*., **51**:275 – 277

Das, P.K., Ghosh, A., Katiyar, R.S. and Sengupta, K. 1990. Response of irrigated mulberry to *Azotobacter* and *Azospirillum* biofertilizers under graded levels of nitrogen. *J. Gen. Microbiol*., **31**:255-261

Karthikeyan, A. and Sakthivel, K.M. 2011. Efficacy of

Azotobacter chroococcum in rooting and growth of *Eucalyptus camaldulensis* stem cuttings. *Res. J. Microbiol*., **6**:618-624

Singh, A.K., Rajesh Singh, Mittal, A.K., Singh, Y.P. and Shiva Jauhari. 2003. Effect of plant growth regulators on survival, rooting and growth characters in long pepper (*Piper longum* L.). *Prog. Hort*., **35**:208-211

Singh, A.K. 2001. Effect of auxins on rooting and survival of jasmine (*Jasminum sambac*) stem cuttings. *Prog. Hort.*, **33**:174-177

Ved, D.K. and Goraya, G.S. 2007. In: Demand and supply of medicinal plants in India. NMPB, New Delhi & FRLHT, Bangalore

Vinutha, T. 2005. Biochemical studies on *Ocimum* species inoculated with microbial inoculants. M.Sc. Thesis, University of Agricultural Sciences, Bangalore, India

(MS Received 11 December 2012, Revised 10 October 2013, Accepted 07 January 2014)