The Bioscan 10(4): 1645-1648, 2015
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

EFFECT OF PGR ON CLONAL PROPAGATION OF MADHUNASHINI (*GYMNEMA SYLVESTRE* R. BR.) THROUGH ROOTED CUTTING

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KEYWORDS
Gymnema sylvestre
Cutting
Auxin
Shoot length
Rooting

Received on :
17.08.2015

Accepted on :
13.12.2015

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ABSTRACT
Gymnema sylvestre is important medicinal plant having diverse medicinal potential. Under the present study effect of PGR was evaluated on growth and root quality of *G. sylvestre*. Auxin treatment had marked effect on all growth traits observed. IAA-1000 ppm showed the highest survival percentage (88.33 %) and took minimum days for 50% sprouting (19.67 days). Plant height at 30, 60, 90 and 120 DAP was also maximum in IAA-1000 ppm (8.67 cm, 47.83 cm, 111.07 cm and 117.91 cm, respectively). However, at 30, 60, 90 and 120 DAP, maximum number of branches / plant (0.50, 1.36, 2.27 and 3.67) and leaves / branch (2.67, 12.67, 30.27 and 38.87, respectively) found maximum in IBA 250 ppm + IAA 250 ppm. Maximum leaf area (24.09 cm^2) and root girth (7.69 mm) was recorded in IAA-500 ppm. T8 treatment i.e IBA 500 ppm + IAA 500 ppm recorded lengthiest main root length (25.69 cm). Overall IAA-1000 ppm showed better result for all observed parameters hence, it can be used for large scale propagation of *G. sylvestre* through cutting. Future research can be directed toward influence of auxin treatments on overall production of Gymnemic acid in rooted cutting.

INTRODUCTION

Gymnema sylvestre R. Br. commonly known as Gurmar or Madhunashini with chromosome complementation is 2n = 22; it is also called as sugar destroyer. Its leaves contain saponins i.e Gymnemic acid and Gymnemasides, which possess anti-diabetic property. Leaves of *Gymnema* is widely used to cure diabetes as a diuretic in Indian proprietary medicines (Saneja *et al*. 2010). It is one of the 32 medicinal plants prioritized by NMPB under NMMP mission, Govt. of India. Gymnemic acid has generated a steady demand in Japan and Europe for manufacture of drugs. *G. sylvestre* is the second bestselling medicinal plant in the world market requiring a cost-effective and simple method of cultivation to meet its growing demand.

The major bottleneck in *Gymnema* cultivate is low fruit state, short span of seed viability and rooting is also delayed due to exudation of latex (Madhavan and Manivanan, 2007). Furthermore, the availability of the species in the natural forests decreasing very fast due to over and unsustainable harvesting and present demand is met form wild collection (Pandey, 2012). Therefore, the only way to meet increasing demand and reduce pressure on wild collection of this species is its large scale propagation. Propagation of *G. sylvestre* through in vitro regeneration has been reported (Reddy *et al*., 1998; Sharma and Bansal, 2010; Komalavalli and Rao (2000). But major limitation of this technique is expertise manpower and established infrastructure. For the local community and nursery grower, clonal multiplication technique through cutting is more promising for production as well as conservation. Hence, present study was undertaken with the objective to evaluate PGR for the development of effective clonal propagation technique in *G. sylvestre*.

MATERIALS AND METHODS

The experiment was laid out at Model Nursery on Medicinal and Aromatic Plants, NAU, Navsari during July – December, 2014. Semi hardwood portion cuttings of *G. sylvestre* with 15-20 cm and 2-3 leaves per cuttings were excised and sterilized with Bavistin. The basal portions of cuttings were dipped in IBA (500 ppm, 1000 ppm and 1500 ppm) and IAA (500 ppm, 1000 ppm and 1500 ppm) alone or in combination (250 ppm IBA+ 250 ppm IAA, 500 ppmIBA + 500 ppmIAA and 750 ppmIBA + 750 ppmIAA) for 20-25 minutes. Control or untreated cuttings were also planted without any PGRs concentration. The rooting media consisted Red Soil, FYM and Vermicompost in the ratio of 2:1:1in 7′ × 9′ polythene bag. Before planting of cutting, media was drenched with Carbendazim (0.2%) as a prophylactic measures against fungal diseases. Polythene bags were kept under shade in a

greenhouse for 4 months and irrigated by water-cane daily. Observation were taken for days required for sprouting (50 %), plant height (cm) (at 30, 60, 90 and 120 DAP), branches / plant (at 30, 60, 90 and 120 DAP), leaves / branch (at 30, 60, 90 and 120 DAP), leaf morphology, survival percentage, main root length (cm) and root girth (mm). Leaf area (cm^2) was estimated by Image J software (Abramoff*et al.,* 2004).The data were analysedforANOVA of CRD design and means were compared by critical difference at 5 % significance (Panse and Sukhatme, 1967).

RESULTS AND DISCUSSION

Auxins have marked effect on the survival percentage and days required for sprouting of the cuttings of *G. sylvestre* (Table 1). IAA-1000 ppm showed the highest survival percentage (88.33 %); whereas, lowest survival percentage was recorded in the control or untreated cuttings (58.89 %).Minimum days required for sprouting (50 %) was observed in IAA-1000 ppm i.e 19.67 days whereas the maximum days required taken in Control i.e26.67 days. Auxins are well known PGR; it inhibits the apical growth of plants and initiates the early sprouting in plant earlier. Our study is in accordance with the findings of earlier workers in *G. sylvestre* (Madhavan and Manivanan, 2007; Karthik and Seshadri, 2009; Rani *et al*., 2012) and other medicinal plants (Sehrawat*et al*., 2001; Gbadamosi and Oni, 2005; Sevik and Guney, 2013 and Bisht and Bhatt, 2014).

G. sylvestre cuttings showed better performance for plant height when treated with different auxin concentrations. Highest plant height at 30, 60, 90 and 120 DAP was observed in IAA-1000 ppm with values of 8.67 cm, 47.83 cm, 111.07 cm and 117.91 cm, respectively. Whereas, lowest plant height was recorded in control with values of 6.43 cm, 14.42 cm, 52.20 cm and 58.20 cm), respectively (Fig 1). Auxins and especially IAA and IBA have potential to enhance rapid cell division and elongation (Christian *et al*., 2006); hence it may have increased the inter-nodal length of plants which ultimately increased the plant height. These results are line with earlier findings by Sehrawat *et al*. (2001) in *Rauvolfia serpentina,* Bhandari *et al*. (2009) in *Verbascum thapsus*, and Minakshi and Lingakumar (2011) in *Mentha arvensis*.

Auxins (IAA and IBA) also showed significant effect on number of branches / plant and number of leaves / branch. Findings revealed that the combinations of IBA + IAA i.e treatment IBA 250 ppm + IAA 250 ppm gave maximum number of branches / plant and leaves / branch at 30, 60, 90 and 120 DAP with a values of 0.50, 1.36, 2.27 and 3.67 and 2.67, 12.67, 30.27 and 38.87, respectively. However, minimum number of branches / plant and leaves / branch was recorded in Control (Fig. 2&3). Auxins have important physiological property to regulate shoot apical dominance in plants and it stimulates the lateral buds so ultimately it increases the number of branches / plant and number leaves / branch (Davies, 2010). These observations are similar with the earlier obtained results by Bhandari *et al*. (2009) in *Verbascum thapsus* and Minakshi and Lingakumar (2011) in *Mentha arvensis*.

Maximum leaf area was recorded in IAA-500 ppm with a value of 24.09 cm^2 whereas, minimum leaf area was obtained in

Table 1: Effect of PGR on Shoot growth of *Gymnema sylvestre* R. Br.

Treatments	Survival percentage(%)	Days required for 50% sprouting	Leaf area(cm^2)
T_1 : IBA 500 ppm	71.11	24.33	18.10
T_2 : IBA 1000 ppm	68.89	25.33	18.60
T_3 : IBA 1500 ppm	77.78	23.33	22.24
T_4 : IAA 500 ppm	80.00	20.67	24.09
T_5 : IAA 1000 ppm	83.33	19.67	21.51
T_6 : IAA 1500 ppm	66.78	24.33	22.36
T_7 : IBA 250 ppm + IAA 250 ppm	75.56	22.33	21.71
T_8 : IBA 500 ppm + IAA 500 ppm	67.78	23.67	19.56
T_9 : IBA 750 ppm + IAA 750 ppm	61.11	26.33	19.95
T_{10}: Control	58.89	26.67	17.90
S. Em. ±	2.189	0.380	0.565
C.D. at 5 %	6.45	1.12	1.68
C.V. %	5.33	2.78	4.75

Table 2: Effect of PGR on root growth of *Gymnema sylvestre* R. Br.

Treatments	Length of main root (cm)	Main root girth (mm)
T_1 : IBA 500 ppm	22.24	4.82
T_2 : IBA 1000 ppm	23.44	4.96
T_3 : IBA 1500 ppm	22.23	4.92
T_4 : IAA 500 ppm	23.45	7.69
T_5 : IAA 1000 ppm	24.96	6.75
T_6 : IAA 1500 ppm	21.55	6.29
T_7 : IBA 250 ppm + IAA 250 ppm	25.31	7.36
T_8 : IBA 500 ppm + IAA 500 ppm	25.69	6.27
T_9 : IBA 750 ppm + IAA 750 ppm	24.26	6.29
T_{10}: Control	19.51	4.32
S. Em. ±	0.764	0.158
C.D. at 5 %	2.25	0.46
C.V. %	5.68	4.60

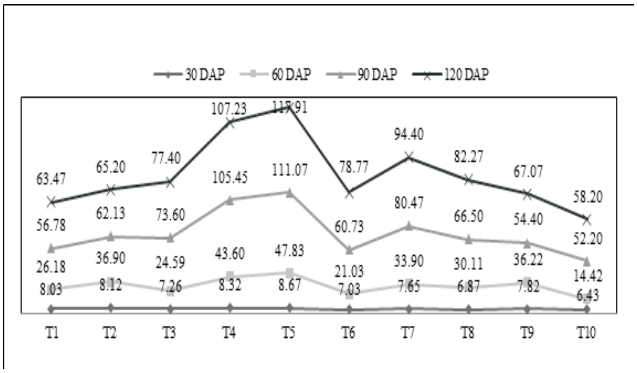

Figure 1: Effect of PGR on plant height at 30, 60, 90 and 120 DAP in *G. sylvestre* cuttings

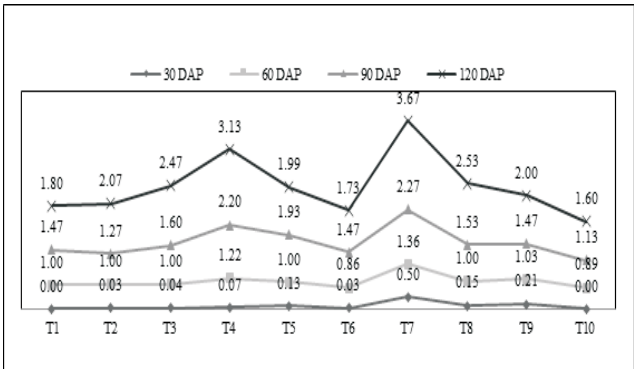

Figure 2: Effect of PGR on no. of branches/plant at 30, 60, 90 and 120 DAP in *G. sylvestre* cuttings

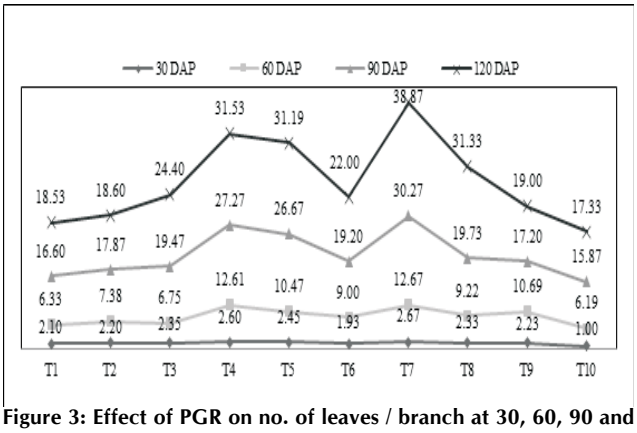

Figure 3: Effect of PGR on no. of leaves / branch at 30, 60, 90 and 120 DAP in *G. sylvestre* cuttings

Control *i. e.* 17.90 cm^2(Table1). Overall, IAA, when applied solely performed better than IBA and combinations of them. This result is similar with the earlier findings by Bhandari *et al.* (2009) in *Verbascum thapsus*L., Minakshi and Lingakumar (2011) in *Mentha arvensis* L. and Khan *et al*. (2015) in *Cymbopogon martini* Roxb.

Results showed that both the auxins used i.e IAA and IBA have positive effect on rooting behaviour of *G. sylvestre*. During the present study, application of combination of IBA + IAA gave better response over the IBA and IAA when used alone.Highest main root length was recorded in T_8IBA 500 ppm + IAA 500 ppm with a value of 25.69 cm; whereas, minimum root length was obtained in T_{10} Control *i.e* 19.51 cm. Maximum root girth was recorded in IAA-500 ppm with a value of 7.69 mm; whereas, minimum root girth was recorded in T_{10} Control *i.e.* 4.32 mm (Table 2). Among all auxins applied, IAA performed well over the IBA and combinations of them. Auxins have potential to increases the radicle growth in plants and also promote root initiation. It induces, both growth of the pre-existing roots and adventitious root formation, i.e branching of the roots (Davies, 2010). Hence, it may increase the uptake of essential nutrients and moisture from soil. Also auxins have marked effect on apical as well as horizontal growth of plants. Hence, it may have resulted in increase in root girth (Davies, 2010). These findings co-relates with earlier findings (Rani *et al*., 2012, Kansara *et al*., 2013 and Verma and Chauhan, 2015).

Overall, the present study showed thatauxin positively influences rooting, establishment and growth of *G. sylvestre* cuttings. Among treatments 1000 ppm IAA has better influence on plant growth. Hence, it can be conclude that the IAA-1000 ppm can be used for large scale propagation of *G. sylvestre* through cutting.Future research can be directed towards influence of auxin treatments on overall production of Gymnemic acid in rooted cutting. For further success in enhancement of rooting, influence of different potting mixture can also be studied.

ACKNOWLEDGEMENT

Authors are thankful to Principal, College of Forestry and Dean & Principal of ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari- 396 450. Gujarat, India.

REFERENCES

Abramoff, M. D., Magalhaes, P. J. and Ram, S. J. 2004. Image processing with Image *J. Biophotonics International*. **11(7):** 36-42.

Bhandari, S., Sajwan, M. and Bisht, N. S. 2009. Physiological effect of auxins on growth characteristics and productive potential of *Verbascum thapsus*- A medicinal plant. *Science Pub.* **1(5):** 47-51.

Bisht, A. S. and Bhatt, A. B. 2014. Effect of hormonal and soil treatment on the growth performance of valuable medicinal plant *Acorus calamus* Linn. *World J. Pharmacy and Pharmaceutical Sciences.* **3(5):** 1156-1168.

Christian, M., Steffens, B., Schenck, D., Burmester, S., Böttger, M. and Lüthen, H. 2006. How Does Auxin Enhance Cell Elongation? Roles of Auxin Binding Proteins and Potassium Channels in Growth Control.*Plant Biology*. **8(3):** 346-352.

Davies, P. J. 2010. The plant hormones: their nature, occurrence, and functions. *Plant hormones*Springer Netherland. pp. 1-15.

Gbadamosi, A. E. and Oni, O. 2005. Macro-propagation of an Endangered Medicinal plant *Enantia chlorantha* Oliv. *Journal of Arboriculture*. **31(2):** 78-82.

Kansara, R. V., Jha, S., Jha, S. K. and Mahatma, M. K. 2013. An efficient protocol for in vitro mass propagation of Fusarium wilt resistant castor (*Ricinus communis* L.) parental line Skp-84 through apical meristem. *The Bioscan*. **8(2):** 403.

Karthic, R. and Seshadri, S. 2009. Cost effective mass multiplication of *Gymnema sylvestre* in hydroponic system.*Nature precedings*:

hdl:10101/npre.2009.3770.1: Posted 16 Sep.

Khan, A. Z., Muzeeb, F., Aha, F. and Farooqui, A. 2015. Effect of plant growth regulators on growth and essential oil content in Palmarosa (*Cymbopogon martinii*). *Asian J. Pharm. Clin. Res.* **8(2):** 373-376.

Komalavalli, N. and Rao, M. V. 2000. *In vitro* micropropagation of *Gymnema sylvestre* - A multipurpose medicinal plant. *Plant Cell, Tissue and Organ Culture*, **61:** 97-105.

Madhavan, S. and Manivannan, K. 2007. Effects of plant growth regulators on rooting of *Gymnema* cuttings. *The Asian J. Horticulture*. **2(2):** 157-158.

Minakshi, V. and Lingakumar, K. 2011. The role of IAA and 2, 4-D on growth and biochemical constituents in vegetatively propagated *Mentha arvensis*L. *J. Biosci. Res.* **2(1):** 10-15.

Pandey, A. K. 2012. Cultivation technique of an Important Medicinal Plant *Gymnema sylvestre* R. Br. (Gurmar). Non Wood Forest Produce Division, TFRI, Jabalpur, (M.P.), India. *Academic Journal of Plant Sciences*. **5(3):** 84-89.

Panse, V. G. and Sukhatme, P. V. 1967. *Statistical Methods for Agricultural Workers*, ICAR, New Delhi, India. pp. 152-161.

Rani, A. S., Nagamani, V., Patnaik, S. and Saidulu, B. 2012. *Gymnema sylvestre*R. Br.: An important anti diabetic plant of India: A Review. *Plant Sciences Feed.* **2(12):** 174-179.

Reddy, P. S., Gopal, G. R. and Sita, G. L. 1998. *In vitro* multiplication of *Gymnema sylvestre*, an important medicinal plant. *Current Science*. **75:** 843-845.

Saneja, A., Sharma, C., Aneja, K. R. and Pahwa, R. 2010. *Gymnema sylvestre*R. Br. (Gurmar*):* A Review. Scholars Research Library, *Der Pharmacia Lettre*. **2(1):** 275-284.

Sehrawat, A. R., Uppal, S. and Punia, A. 2001. *In vitro* and *in vivo* multiplication of *Rauvolfiaserpentina*- a threatened medicinal plant Hissar.*Crop. Res.* **22(1):** 68-71.

Sevik, H. and Guney, K. 2013. Effects of IAA, IBA, NAA, and GA_3 on Rootingand Morphological Features of *Melissa officinalis* L. Stem Cuttings. *The Scientific World J.* pp. 1-5.

Sharma, B. and Bansal, Y. K. 2010. *In-vitro* propagation through apical bud from *Gymnema sylvestre*. *J. Medicinal Plants Research*. **4:** 1473-1476.

Verma, P. and Chauhan, P. S. 2015. Effect of storage conditions (growth chamber) andIBA treatments on rooting of cuttings of apple clonal rootstock merton 793 in net house conditions. *The Bioscan*. **10(3):** 1049-1052.