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EFFECT OF PHYTO-HORMONES ON PROPAGATION OF HIMALAYAN YEW (*TAXUS BACCATA* L.) THROUGH STEM CUTTINGS

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ABSTRACT

Taxus baccata Linn. is one of the important medicinal plants growing in Bomdila, Shergaon and Tawang forest Divisions of Arunachal Pradesh. It is under threat due to indiscriminate collection of leaves. This is used for yield of anti-carcinogenic drugs like Taxol , Baccatin etc. The restoration and restocking of this valuable plant can be done through vegetative propagation by woody stem cuttings treated with growth regulators in the months of February/ July. It has been found that the growth through seed raised plants is extremely slow. The experiments on vegetative propagation by applying various phyto-hormones carried out in the natural zone at 3-Km forest nursery in Bimdila Forest Division are discussed in the paper.

INTRODUCTION

Taxol, a precious drug for the treatment of ovarian and breast cancer, is obtained from *Taxus baccata* L. sub spp. *wallichiana* (Zucc.) Pilger. In recent years, the extensive and indiscriminate collection of *Taxus baccata* has posed a serious threat to this important Himalayan tree. (Nandi et al., 1996 and Khali and Sharma, 2003). This trend is effecting the genetic resource base of the species. Natural regeneration of *Taxus baccata* is poor and its growth rate is very slow. Therefore, to counter the continuous degradation of the valuable Himalayan tree species and augment its natural regeneration, attempts for its artificial regeneration are urgently called for. Moreover, since the species is valued for its "Taxol" content, it becomes essential that the plant seedlings be raised from elite plant stock that has higher active principle contents. Since seed germination in *Taxus baccata* , even after application of different techniques of breaking the dormancy (Khali, 2001) is very poor, vegetative propagation through stem cuttings may perhaps be the only viable option to improve and manage its natural stock as well as the regeneration process. The protocol developed will also help the farmers to thrive for large scale propagation and cultivation. This technique would potentially provide ad-

* The study was conducted during the year 1993-94, when the author was working as Forest Geneticist, in the State Forest Research Institute,Itanagar.

equate supply of superior quality planting material with desirable characters. Therefore the present study was conducted to develop the suitable vegetative propagation method for mass multiplication of *Taxus baccata*.

MATERIALS AND METHODS

The experiments were carried out in the environmental conditions of Bomdila Forest Division. New juvenile shoots from lower part of the canopy of mature *Taxus baccata* trees were used to obtain the cuttings. The experimental material was collected from the Sange village community forest of the Dirang Forest Range of Bomdila Forest Division in Arunachal Pradesh. Bomdila is situated at the altitude of 2400m msl. between 27° 15' 15? to 27° 16' 30? latitude and 92° 25' to 92°26' 30? longitude. The area experiences a wide range of temperature ranging from below 0°C in winters to a maximum of 35° C during summers and a mean rainfall of 1,600 mm per annum.

Treatments of cuttings **:** Fifteen to twenty centimeter (cm) long stem cuttings with 3-4 nodes and 0.5 to 1.0 cm in diameter were used in the present study. The cuttings were treated with different phyto-hormones viz., Indole-3-Acetic Acid (IAA), Indole Butyric Acid (IBA), Gibberelic Acid (GA3) and Naphthalene Acetic Acid (NAA) in different concentrations (1,000; 2,500; 5,000; 10,000 and 12,500 PPM) and two different modes of applications for induction of rooting. The mode -I consisted of dipping the cuttings in aqueous hormonal solution (s) for 18 hours prior to planting, while the mode-2 comprised of application of dry hormone(s) mixed thoroughly with talcum powder immediately at the time of planting.

The treated cuttings were planted in normal soil beds at the research extension nursery near Bomdila (at 5 km nursery on Bomdila to Dirang road) of State Forest Research Institute, Itanagar. Cuttings were watered regularly depending upon the weather conditions and soil moisture status. The beds were kept free of weeds manually. The cuttings were protected from direct sunlight and to maintain high humidity (70 percent) by a thatch covering. The cuttings were observed periodically (at 15 days interval) for initiation of rooting until rooting was completed.

RESULTS AND DISCUSSION

Analysis of data (Table-1) reveals that the cuttings responded differently to various phytohormones, their concentration levels and the modes of application. IBA induced higher rooting (percentage) irrespective of the mode of application. The highest rooting was achieved with 10,000 PPM of IBA (Mode-2) that was significantly higher compared to their corresponding values for Mode-1. IAA was the next suitable hormone (after IBA) followed by NAA and GA3 respectively. Control cuttings were observed to have lowest rooting percentage. Mode-2 was significantly superior to Mode-1 in the induction of higher rooting irrespective of the hormones and their concentration used.

Table. 1: Mean values of rooting percentage of *Taxus baccata* cuttings in response to various hormonal levels and modes of application.

Mode	Level(PPM)	Growth Regulation					
		IAA	IBA	GA_3	NAA	NAA	Mean
1.	12,500	30.02	38.39	16.68	23.34	27.09	18.34
	10,000	50.01	60.01	25.01	40.01	43.76	
	5,000	48.33	60.01	21.67	33.34	40.84	
	2,500	41.67	56.68	18.34	33.33	37.50	
	1,000	31.67	36.68	13.33	26.68	27.09	
	Mean	40.34	50.35	19.00	29.38	37.21	
2.	12,500	36.68	43.34	16.67	26.68	30.84	16.68
	10,000	58.34	76.68	33.33	46.68	53.75	
	5,000	50.01	63.34	28.34	43.34	46.25	
	2,500	46.68	63.34	23.34	41.67	43.75	
	1,000	40.01	58.34	16.68	30.00	36.26	
	Mean	46.34	61.00	23.67	37.67	42.17	

Effect of various hormones on number of primary roots: IBA was observed to be the best hormone for the induction of higher number of primary roots in the rooted cuttings . The highest number of primary root was observed in cuttings treated with 10,000 PPM of IBA (Mode-1) that was significantly higher compared to their corresponding values for Mode-2. IAA was the next best hormone followed by NAA and GA3 and respectively for the induction of higher number of primary root.

Control cuttings were observed to produce the lowest number of primary roots. Mode-1 was significantly superior to Mode-2 irrespective of hormone and their concentrations used for the successful induction of higher number of primary roots in the juvenile cutting of *Taxus baccata*.

Effect of various hormones on primary root length in rooted cuttings was induced by the application of IBA. The highest primary root length was observed in cuttings treated with 10,000 PPM concentration of IBA (Mode-1) that was significantly higher compared to their corresponding values for Mode-2. IAA was the second best hormone followed by NAA and GA3 respectively for the production of higher root length. Control cuttings were observed top produce the lowest root length. Mode-1 was significantly superior to Mode-2 irrespective of hormones and their concentrations used for the production of higher primary root length in the juvenile.

The results of the present investigations revealed that amongst all the phytohormones tried, IBA is the most effective hormone for the induction of higher rooting percentage in the juvenile cuttings of *Taxus baccata*. The present study further revealed that application of IBA at 10,000- PPM concentration is most suitable for the induction for a better rooting percentage, higher number and greater length of primary roots in the *Taxus baccata* cuttings.

A varying degree of success in induction of rooting by IBA in juvenile ex-plants and study woody cuttings of *Taxus baccata* has been reported from other temperate regions of the

country (Nandi et al., 1996; Mitter and Sharma, 1999; Dubbey, 1997). Though the rooting percentage in the present study is slightly lower compared to that reported by above authors. Number of primary root formation and also higher primary root length under the influence of IBA application has been obtained in the present trials, which are much higher compared to above mentioned studies. It must be borne in mind that a higher root to shoot is advisable for achieving a higher survival rate after field transplantation. It has also been suggested that optimum concentration of Auxins is favorable, while supra optimums auxins are toxic to the root regeneration (Chauhan and Reddy, 1974; Avanzato et. al., 1998). The differential response to varying concentrations of hormones observed in the present study could be due similar action of Auxin in *Taxus baccata* as well.

The results of the present study indicate that specific responses to hormonal induction of rooting and mode of application may be carefully used by the nursery managers to achieve genetically superior planting stock of *Taxus baccata* to enhance resource availability for meeting the market demand of the species.

SUMMARY

Like many other medicinal plants, *Taxus baccata* also has come to the phase of extinction in its natural habitats due to increased market demand and consequent excessive destructive harvesting. Vegetative propagation through stem cutting was tried for the species collected from the Shergaon and Sange village near Baishakhi camp of Bomdila forest division, with varying concentration of different phytohormones (IAA, IBA, NAA and GA3 and modes of application). IBA was the most suitable followed by IAA, NAA and GA3 respectively for the induction of higher rooting percentage, number of roots and length of roots. The stud reveled that IBA at 10,000-PPM is found to be optimum for induction of better rooting percentage, higher number and greater length of primary roots into juvenile stem cuttings of *Taxus baccata.*

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REFERENCES

Avanzato, D.G.,A.Couvillon and F.A. Pokorny (1998). The influence of p- IIB (Phenyl indole 3- thiolobutyrate) , Aryl ester of IBA, on the rooting of "Red haven" peach. *Acta. Hort.* 227: 197-201

Chauhan, K.S.and T.S. Reddy (1974). Effect of growth regulators and most on rooting in stem cuttings of plum. *Ind. J. Hort.* 32: 229- 231.

Dubey, K.P. (1997). Himalaya yew (*Taxus baccata*) conservation: A vegetative approach. *Ind. For.* 123 (12): 1150-1154.

Khali, R.P. (2001). *Ecological studies on Taxus baccata L. in relation to regeneration and conservation.* Ph. D. Thesis, FRI Deemed University, Dehra Dun.

Mitter, H. and A. Sharma (1999). Propagation of *Taxus baccata* Linn. by stem cuttings. *Ind. For.* 125 (2): 159- 162

Nandi, S.K., L.M.S. Palni and H. C. Rikhari (1996). Chemical induction of adventitious root formation in *Taxis baccata* cuttings. *Plant Growth Regulation* 19 (2): 117- 122.