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Biotechnological Approach of Threatened Species *Strychnos Nux-vomica* L. to Standardized Nursery Techniques

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Abstract

Strychnos nux-vomica belonging to family Loganiaceae. Carbohydrate, protein, oil, steroid, alkaloid, resin, strychnine and brucine were detected in phytochemical screening. It is anticipated that lipid peroxidation may provide scientific rationale for the use of S. nux-vomica as an antidiabetic plant. There is a need to develop bio-technological approach for raising nursery plants of S. nux-vomica as per International Union for Conservation of Nature and Natural Resources (IUCN) criteria. Different concentration of growth hormones to break seed dormancy, four pre treatments, different size of polythene bags, root trainer, and impact of potting mixture on the growth were adopted to determine the best treatments. The results indicated that the seed dormancy was broken when seeds were treated with 40 ppm concentration of GA_3 or 100 ppm concentration of IBA hormones and soaking with warm water, the best size of polythene bag was used as medium size of polythene (25x11 cm), the best size of root trainer was used as medium cup root trainer (187 cm^3), and the best potting mixture was found to be farm yard manure (FYM) with soil and sand in ratio of 1:1:1. Statistical analysis was also adopted to determine of significance levels.

Keywords: *Biotechnological approach, growth hormones, pretreatment, potting mixture, root trainer, Polythene bag*

1. Introduction

Of particular concern the fact that many forestry species were threatened by many reasons. It was estimated that between 60,000 - 1,00,000 plant species were threatened worldwide due to combination of factors such as over – collection, urbanization, unsustainable agriculture and forestry practices, pollution, land use changes and the spread of invasive alien species. Over 60,000 species were evaluated for conservation status according to internationally accepted criteria, of which, 34,000 were classified as globally threatened with extinction (IUCN, 2002).

The global strategy for plant conservation was proposed to address this challenge. The strategy has plant conservation as the entry point besides aspects of sustainable use and benefit sharing. The global strategy for biotechnological approach includes *in-situ* conservation. The strategy provides an opportunity to explore linkages between *in-situ* and *ex-situ* conservation including restoration programmes. *Strychnos nux-vomica* L. was locally known as Kuchla, and belonging to family Loganiaceae. Carbohydrate, protein, oil, steroid, alkaloid, resin, strychnine and brucine were detected in phyto-chemical screening. It was useful and found effective in the treatment of diabetes mellitus in various traditional systems of medicine. The antidiabetic effect produced by the extract of *S.nux-vomica* might be due to the presence of these active ingredients. It was anticipated that lipid per-oxidation may provide scientific rationale for the use of *S.nux-vomica* as an antidiabetic plant (Bhati *et. al.*, 2012). This was a perennial RET (vulnerable) tree species, due to loss of habitat and trading of seeds. The flowering period was from March to April and fruiting period from November to December. Its bark was used in epilepsy while

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leaves were used to cure wounds. Its wood extract was referred for dysentery and cholera. Keeping above in view, there was a need to develop bio-technological approach for raising nursery plants of *S.nux-vomica* as per International Union for Conservation of Nature and Natural Resources (IUCN) criteria's.

2. Materials and Methods

Various places were visited to identify the superior germplasm. The seeds were collected from Balaghat, Seoni, Shahdol districts of Madhya Pradesh and best germplasm was found in Shahdol district. Different concentration of growth hormones, *i.e.*, IBA (Indole Butyric Acid) and GA_3 (Gibberellic Acid) were used to break the seed dormancy. The Four treatments with five replications were laid for knowing the effect of growth hormone on seed dormancy. For this study, four pre treatments with five replications were laid for knowing the effect of seed pre-treatment.

Three different size of polythene bags were tried to know the impact of size of growing media on the growth of seedlings. In each replication, a total number of 60 germinated seeds were used. For this purpose, three different sizes (three treatments) of root trainer with six replications were used. In each replication, three treatments, *i.e.*, large cup (315 cc), medium cup (187 cc) and small cup (126 cc) were used. A total of 60 germinated seeds were raised in different size of root trainer in each replication. To know the impact of potting mixture on the growth of seedlings, three different potting mixtures viz; FYM, leaf litter, and vermi-compost were tried. These mixtures were tried in 1:1:1 ratio with soil, sand and organic manure. In each replication, a total number of 60 germinated seeds were used (ISTA, 1985).

3. Results and Discussions

In *Strychnos nux-vomica*, impact of hormone (GA_3) to break seed dormancy was also studied. Five treatments i.e. different concentrations of hormone T-0 (Control), T-1 (10 ppm), T-2 (20 ppm), T-3 (30 ppm) and T-4 (40 ppm) were applied. GA_3 40 ppm (T-4) was found the best (25.25 percent) over other treatments (Table-1).

Table 1. Impact of Hormones (GA_3) to Break Seed Dormancy of *Strychnos Nux-vomica*

Replicates	Treatments (germination percent)				
	T-0 Control	T-1 GA_3 (10 ppm)	T-2 GA_3 (20 ppm)	T-3 GA_3 (30 ppm)	T-4 GA_3 (40 ppm)
R1	18	18	22	24	30
R2	19	20	17	26	23
R3	17	19	23	20	21
R4	20	22	23	22	27
Mean	**18.5**	**19.75**	**21.25**	**23**	**25.25**

Table- 2 shows descriptive analysis, *i.e.*, number of cases, mean, standard deviation, lower and upper bound at 95% confidence interval for mean, minimum and maximum values. The perusal of descriptive results revealed that treatments do differ in mean and range (*i.e.*, maximum and minimum observation). The ANOVA test showed One-way analysis of variance test for each parameter taken for study. The table had given the information that treatment taken in the study is showing different effect on Impact of hormone (GA_3). The analysis was again done to find out the significance difference in treatments with respect to above parameters. The table also revealed that values for such parameter were 0.021 which was significant at 0.05 levels and indicates that there was

difference between the treatments. The Post hoc test (Multiple comparisons) shown all treatments were different. The study concluded that all the studied treatments were significantly differed. Thus, T-4 (40 ppm) treatment could be applied.

Table 2. Statistical Analysis to Break Seed Dormancy with Hormones (GA_3) of *Strychnos Nux-vomica*

DESCRIPTIVES: GERMINATION

Treatment	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
T-0	4	18.5000	1.29099	.64550	16.4457	20.5543	17.00	20.00
T-1	4	19.7500	1.70783	.85391	17.0325	22.4675	18.00	22.00
T-2	4	21.2500	2.87228	1.43614	16.6796	25.8204	17.00	23.00
T-3	4	23.0000	2.58199	1.29099	18.8915	27.1085	20.00	26.00
T-4	4	25.2500	4.03113	2.01556	18.8356	31.6644	21.00	30.00
Total	**20**	**21.5500**	**3.41012**	**.76253**	**19.9540**	**23.1460**	**17.00**	**30.00**

ANOVA: GERMINATION

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	113.700	4	28.425	3.976	.021
Within Groups	107.250	15	7.150		
Total	**220.950**	**19**			

MULTIPLE COMPARISONS

Dependent Variable: Germination

LSD

(I) treatment	(J) treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
T-0	T-1	-1.25000	1.89077	.519	-5.2801	2.7801
	T-2	-2.75000	1.89077	.166	-6.7801	1.2801
	T-3	-4.50000(*)	1.89077	.031	-8.5301	-.4699
	T-4	-6.75000(*)	1.89077	.003	-10.7801	-2.7199
T-1	T-0	1.25000	1.89077	.519	-2.7801	5.2801
	T-2	-1.50000	1.89077	.440	-5.5301	2.5301
	T-3	-3.25000	1.89077	.106	-7.2801	.7801
	T-4	-5.50000(*)	1.89077	.011	-9.5301	-1.4699
T-2	T-0	2.75000	1.89077	.166	-1.2801	6.7801
	T-1	1.50000	1.89077	.440	-2.5301	5.5301
	T-3	-1.75000	1.89077	.369	-5.7801	2.2801
	T-4	-4.00000	1.89077	.052	-8.0301	.0301
T-3	T-0	4.50000(*)	1.89077	.031	.4699	8.5301
	T-1	3.25000	1.89077	.106	-.7801	7.2801
	T-2	1.75000	1.89077	.369	-2.2801	5.7801
	T-4	-2.25000	1.89077	.253	-6.2801	1.7801
T-4	T-0	6.75000(*)	1.89077	.003	2.7199	10.7801
	T-1	5.50000(*)	1.89077	.011	1.4699	9.5301
	T-2	4.00000	1.89077	.052	-.0301	8.0301
	T-3	2.25000	1.89077	.253	-1.7801	6.2801

* The mean difference is significant at the .05 level.

In *Strychnos nux-vomica,* impact of hormone (IBA) to break seed dormancy was also studied. Five treatments i.e. different concentrations of hormone T-0 (Control), T-1 (25 ppm), T-2 (50 ppm), T-3 (75 ppm) and T-4 (100 ppm) were applied. IBA 100 ppm (T-4) was found the best (26 percent) over other treatments (Table-3).

Table 3. Impact of Hormones (IBA) to Break Seed Dormancy of *Strychnos Nux-vomica*

Replicates	Treatments (germination percent)				
	T-0 Control	T-1 IBA (25 ppm)	T-2 IBA (50 ppm)	T-3 IBA (75 ppm)	T-4 IBA (100 ppm)
R1	21	15	22	22	24
R2	18	20	23	20	31
R3	16	19	24	26	29
R4	19	19	23	23	20
Mean	**18.5**	**18.25**	**23**	**22.75**	**26**

Table- 4 showed descriptive analysis *i.e.,* number of cases, mean, standard deviation, lower and upper bound at 95% confidence interval for mean, minimum and maximum values. The perusal of descriptive results revealed that treatments do differ in mean and range (*i.e.,* maximum and minimum observation). The ANOVA test showed One-way analysis of variance test for each parameter taken for study. The Table had given the information that treatment taken in the study was showing different effect on Impact of hormone (IBA). The analysis was again done to find out the significance difference in treatments with respect to above parameters. The Table also revealed that values for such parameter were 0.007, which was significant at 0.05 levels and indicated that there was difference between the treatments. The Post hoc test (Multiple comparisons) showed all treatments were different. The study concluded that all the studied treatments were significantly differed. Thus, T-4 (100 ppm) treatment could be applied.

Table 4. Statistical Analysis to Break Seed Dormancy with Hormones (IBA) of *Strychnos Nux-vomica*

DESCRIPTIVES: GERMINATION								
Treatment	**N**	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
					Lower Bound	**Upper Bound**		
T-0	4	18.5000	2.08167	1.04083	15.1876	21.8124	16.00	21.00
T-1	4	18.2500	2.21736	1.10868	14.7217	21.7783	15.00	20.00
T-2	4	23.0000	.81650	.40825	21.7008	24.2992	22.00	24.00
T-3	4	22.7500	2.50000	1.25000	18.7719	26.7281	20.00	26.00
T-4	4	26.0000	4.96655	2.48328	18.0971	33.9029	20.00	31.00
Total	**20**	**21.7000**	**3.94835**	**.88288**	**19.8521**	**23.5479**	**15.00**	**31.00**

ANOVA: GERMINATION					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	173.700	4	43.425	5.317	.007
Within Groups	122.500	15	8.167		
Total	**296.200**	**19**			

MULTIPLE COMPARISONS

Dependent Variable: Germination LSD						
(I) treatment	**(J) treatment**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
					Lower Bound	**Upper Bound**
T-0	T-1	.25000	2.02073	.903	-4.0571	4.5571
	T-2	-4.50000(*)	2.02073	.042	-8.8071	-.1929
	T-3	-4.25000	2.02073	.053	-8.5571	.0571
	T-4	-7.50000(*)	2.02073	.002	-11.8071	-3.1929
T-1	T-0	-.25000	2.02073	.903	-4.5571	4.0571
	T-2	-4.75000(*)	2.02073	.033	-9.0571	-.4429
	T-3	-4.50000(*)	2.02073	.042	-8.8071	-.1929
	T-4	-7.75000(*)	2.02073	.002	-12.0571	-3.4429
T-2	T-0	4.50000(*)	2.02073	.042	.1929	8.8071
	T-1	4.75000(*)	2.02073	.033	.4429	9.0571
	T-3	.25000	2.02073	.903	-4.0571	4.5571
	T-4	-3.00000	2.02073	.158	-7.3071	1.3071
T-3	T-0	4.25000	2.02073	.053	-.0571	8.5571
	T-1	4.50000(*)	2.02073	.042	.1929	8.8071
	T-2	-.25000	2.02073	.903	-4.5571	4.0571
	T-4	-3.25000	2.02073	.129	-7.5571	1.0571
T-4	T-0	7.50000(*)	2.02073	.002	3.1929	11.8071
	T-1	7.75000(*)	2.02073	.002	3.4429	12.0571
	T-2	3.00000	2.02073	.158	-1.3071	7.3071
	T-3	3.25000	2.02073	.129	-1.0571	7.5571
* The mean difference is significant at the .05 level.						

Seed pretreatment was also carried out in *Strychnos nux-vomica.* Three treatments, *i.e.*, soaking with warm water (T-1), soaking with cold water (T-2) and soaking with normal water/control (T-0) were applied. Warm water treatment was found to be best (22.5 percent), followed by cold water treatment germination and control (Table-5).

Table 5. Impact of Seed Pretreatments on Germination Percent of *Strychnos Nux-vomica*

Replicates	**Treatments (germination percent)**		
	T-0 Control	**T-1 Treated with warm water**	**T-2 Treated with cold water**
R1	21	16	19
R2	20	27	23
R3	18	21	17
R4	18	26	25
Mean	**19.25**	**22.5**	**21**

Table- 6 shows descriptive analysis, *i.e.*, number of cases, mean, standard deviation, lower and upper bound at 95% confidence interval for mean, minimum and maximum values. The perusal of descriptive results revealed that treatments do differ in mean and range (*i.e.*, maximum and minimum observation). The ANOVA test showed One-way analysis of variance test for each parameter taken for study. The table had given the information that treatment taken in the study was showing different effect on germination percentage. The analysis was again done to find out the significance difference in treatments with respect to above parameters. The table also revealed that values for such parameter were 0.491 which was insignificant at 0.05 levels and indicated that there was no difference between the treatments. The Post hoc test (Multiple comparisons) shown all

treatments were similar. The study concluded that all the studied treatments were insignificant so, any one of the treatment can be applied. Soaking with warm water (T-1) was highest germination and it could be used as a seed pretreatment (Kumar and Bhanja, 1992; Shivkumar, *et al.,* 2006).

Table 6. Statistical Analysis to Seed Pretreatments on Germination Percent of *Strychnos Nux-vomica*

DESCRIPTIVES: GERMINATION

Treatment	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
T-0	4	19.2500	1.50000	.75000	16.8632	21.6368	18.00	21.00
T-1	4	22.5000	5.06623	2.53311	14.4385	30.5615	16.00	27.00
T-2	4	21.0000	3.65148	1.82574	15.1897	26.8103	17.00	25.00
Total	**12**	**20.9167**	**3.62963**	**1.04779**	**18.6105**	**23.2228**	**16.00**	**27.00**

ANOVA: GERMINATION

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	21.167	2	10.583	.770	.491
Within Groups	123.750	9	13.750		
Total	**144.917**	**11**			

MULTIPLE COMPARISONS
Dependent Variable: Germination
LSD

(I) treatment	(J) treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
T-0	T-1	-3.25000	2.62202	.247	-9.1814	2.6814
	T-2	-1.75000	2.62202	.521	-7.6814	4.1814
T-1	T-0	3.25000	2.62202	.247	-2.6814	9.1814
	T-2	1.50000	2.62202	.581	-4.4314	7.4314
T-2	T-0	1.75000	2.62202	.521	-4.1814	7.6814
	T-1	-1.50000	2.62202	.581	-7.4314	4.4314

* The mean difference is significant at the .05 level.

Three different sizes of polythene bags were tried to know the impact of size on the growth of seedlings. The sizes of polythene used for such study was big (T-1: 28x14 cm), medium (T-2: 25x11 cm) and small (T-3: 23.5x8 cm). In each replication, a total number of 60 germinated seeds were used. The impacts of size of polythene on growth of seedlings were given. The studied growth parameters of 5 seedlings were given on average basis. The best treatment was found to be T-2 with average girth 2.2 cm and height 35.8 cm followed by T-1 and T-3, respectively (Table-7).

Table 7. Impact of Sizes of Polythene Bag on Growth of *Strychnos Nux-vomica*

Replicates	Treatments					
	T-1		T-2		T-3	
	Girth (cm)	Height (cm)	Girth (cm)	Height (cm)	Girth (cm)	Height (cm)
R1	1.1	36.5	2.0	30.8	1.3	34.3
R2	1.6	32.9	2.3	39.7	1.8	37.7
R3	1.6	29.7	2.2	35.7	1.8	28.2
R4	1.5	24.0	2.5	37.2	1.6	25.5
Mean	**1.5**	**30.8**	**2.2**	**35.8**	**1.7**	**31.4**

Table- 8 showed descriptive analysis, *i.e.,* number of cases, mean, standard deviation, lower and upper bound at 95% confidence interval for mean, minimum and maximum values. The perusal of descriptive results reveals that treatments do differ in mean and range (*i.e.*, maximum and minimum observation). The ANOVA test showed One-way analysis of variance test for each parameter taken for study. The Table was given the information that treatment taken in the study was showing different effect of size of polythene on the basis of girth and height. The analysis was again done to find out the significance difference in treatments with respect to above parameters. The Table also revealed that values for such parameter were 0.002 and 0.332 for girth and height, respectively, in which girth was significant while height was insignificant at 0.05 levels and indicated that there was difference between the treatments through girth and no difference between the treatments through heights. The Post hoc test (Multiple comparisons) showed all treatments were different in respect of girth, while they were similar in respect of height. The study concluded that all the studied treatments were significant on the basis of girth so, medium size of polythene (T-2) was highest growth of seedling for girth and it could be used for better growth of seedlings in nursery.

Table 8. Statistical Analysis to Impact of Sizes of Polythene Bag on Growth of *Strychnos Nux-vomica*

DESCRIPTIVES									
	Treatment	**N**	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
						Lower Bound	**Upper Bound**		
Girth	T-1	4	1.4500	.23805	.11902	1.0712	1.8288	1.10	1.60
	T-2	4	2.2500	.20817	.10408	1.9188	2.5812	2.00	2.50
	T-3	4	1.6250	.23629	.11815	1.2490	2.0010	1.30	1.80
	Total	**12**	**1.7750**	**.41369**	**.11942**	**1.5122**	**2.0378**	**1.10**	**2.50**
Ht	T-1	4	30.7750	5.30244	2.65122	22.3376	39.2124	24.00	36.50
	T-2	4	35.8500	3.74922	1.87461	29.8842	41.8158	30.80	39.70
	T-3	4	31.4250	5.57218	2.78609	22.5584	40.2916	25.50	37.70
	Total	**12**	**32.6833**	**5.05134**	**1.45820**	**29.4739**	**35.8928**	**24.00**	**39.70**
ANOVA									

		Sum of Squares	df	Mean Square	F	Sig.
Girth	Between Groups	1.415	2	.707	13.620	.002
	Within Groups	.467	9	.052		
	Total	**1.882**	**11**			
Ht	Between Groups	61.012	2	30.506	1.250	.332
	Within Groups	219.665	9	24.407		
	Total	**280.677**	**11**			

MULTIPLE COMPARISONS

LSD

Dependent Variable	(I) treatment	(J) treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Girth	T-1	T-2	-.80000(*)	.16116	.001	-1.1646	-.4354
		T-3	-.17500	.16116	.306	-.5396	.1896
	T-2	T-1	.80000(*)	.16116	.001	.4354	1.1646
		T-3	.62500(*)	.16116	.004	.2604	.9896
	T-3	T-1	.17500	.16116	.306	-.1896	.5396
		T-2	-.62500(*)	.16116	.004	-.9896	-.2604
Ht	T-1	T-2	-5.07500	3.49337	.180	-12.9775	2.8275
		T-3	-.65000	3.49337	.857	-8.5525	7.2525
	T-2	T-1	5.07500	3.49337	.180	-2.8275	12.9775
		T-3	4.42500	3.49337	.237	-3.4775	12.3275
	T-3	T-1	.65000	3.49337	.857	-7.2525	8.5525
		T-2	-4.42500	3.49337	.237	-12.3275	3.4775

* The mean difference is significant at the .05 level.

For this purpose, three different sizes (three treatments) of root trainers with four replications were used. In each replication, three treatments, *i.e.*, T-1 (large cup 315 cc), T-2 (medium cup 187 cc) and T-3 (small cup 126 cc) were taken. A total of 60 germinated seeds were raised in different size of root trainer in each replication. The studied growth parameters of seedlings were given on average basis. The best treatment was found to be T-2 with average girth 1.2 cm and height 18.7 cm, followed by T-3 and T-1, respectively (Table-9).

Table 9. Impact of Sizes of Root Trainer on Growth of *Strychnos Nux-vomica* Seedlings

Replicates	Treatments					
	T-1		T-2		T-3	
	Girth (cm)	Height (cm)	Girth (cm)	Height (cm)	Girth (cm)	Height (cm)
R1	0.3	8.0	1.3	19.0	0.9	14.0
R2	0.6	12.0	1.5	21.8	1.0	17.1
R3	0.4	8.9	1.1	17.0	1.0	15.7
R4	0.4	8.9	1.1	17.0	1.0	16.7
Mean	**0.4**	**9.4**	**1.2**	**18.7**	**1.0**	**15.9**

Table- 10 showed descriptive analysis, *i.e.*, number of cases, mean, standard deviation, lower and upper bound at 95% confidence interval for mean, minimum and maximum values. The perusal of descriptive results revealed that treatments do differ in mean and range (*i.e.,* maximum and minimum observation). The ANOVA test showed One-way analysis of variance test for each parameter taken for study. The Table was given the information that treatment taken in the study was showing different effect of size of root trainer on the basis of girth and height. The analysis was again done to find out the significance difference in treatments with respect to above parameters. The Table also revealed that values for such parameter are 0.000 and 0.000 for girth and height, respectively, which were significant at 0.05 levels and indicated that there was difference between the treatments. The Post hoc test (Multiple comparisons) showed all treatments were different. The study concluded that all the studied treatments were significant so, medium cup root trainer (T-2) was highest growth of seedling for girth and height and it could be used for better growth of seedlings in nursery.

Table 10. Statistical Analysis to Impact of Sizes of Root Trainer on Growth of *Strychnos Nux-vomica* Seedlings

DESCRIPTIVES

	Treatment	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Girth	T-1	4	.4250	.12583	.06292	.2248	.6252	.30	.60
	T-2	4	1.2500	.19149	.09574	.9453	1.5547	1.10	1.50
	T-3	4	.9750	.05000	.02500	.8954	1.0546	.90	1.00
	Total	**12**	**.8833**	**.37859**	**.10929**	**.6428**	**1.1239**	**.30**	**1.50**
Ht	T-1	4	9.4500	1.75214	.87607	6.6620	12.2380	8.00	12.00
	T-2	4	18.7000	2.27156	1.13578	15.0854	22.3146	17.00	21.80
	T-3	4	15.8750	1.38173	.69086	13.6764	18.0736	14.00	17.10
	Total	**12**	**14.6750**	**4.37121**	**1.26186**	**11.8977**	**17.4523**	**8.00**	**21.80**

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Girth	Between Groups	1.412	2	.706	38.500	.000
	Within Groups	.165	9	.018		
	Total	**1.577**	**11**			
Ht	Between Groups	179.765	2	89.883	26.595	.000
	Within Groups	30.417	9	3.380		
	Total	**210.183**	**11**			

MULTIPLE COMPARISONS LSD

Dependent Variable	(I) treatment	(J) treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Girth	T-1	T-2	-.82500(*)	.09574	.000	-1.0416	-.6084
		T-3	-.55000(*)	.09574	.000	-.7666	-.3334
	T-2	T-1	.82500(*)	.09574	.000	.6084	1.0416
		T-3	.27500(*)	.09574	.018	.0584	.4916
	T-3	T-1	.55000(*)	.09574	.000	.3334	.7666
		T-2	-.27500(*)	.09574	.018	-.4916	-.0584
Ht	T-1	T-2	-9.25000(*)	1.29995	.000	-12.1907	-6.3093
		T-3	-6.42500(*)	1.29995	.001	-9.3657	-3.4843
	T-2	T-1	9.25000(*)	1.29995	.000	6.3093	12.1907
		T-3	2.82500	1.29995	.058	-.1157	5.7657

	T-3	T-1	6.42500(*)	1.29995	.001	3.4843	9.3657
		T-2	-2.82500	1.29995	.058	-5.7657	.1157
* The mean difference is significant at the .05 level.							

To know the impact of potting mixture on the growth of seedlings, three different potting mixture viz. T-1 (FYM), T-2 (Leaf Litter) and T-3 (Vermicompost) were tried. These mixtures were tried in 1:1:1 with soil and sand. In each replication, a total no. of 60 germinated seed was used. The studied growth parameters of seedlings were given on average basis. The best treatment was found to be T-1 with average girth 2.2 cm and height 40.3 cm, followed by T-2 and T-3, respectively (Table-11).

Table 11. Impact of Potting Mixture on Growth of *Strychnos Nux-vomica* Seedlings

Replicates	Treatments					
	T-1		T-2		T-3	
	Girth (cm)	Height (cm)	Girth (cm)	Height (cm)	Girth (cm)	Height (cm)
R1	2.3	44.0	1.5	27.5	0.7	16.3
R2	2.2	42.0	1.4	28.0	0.7	15.6
R3	2.2	43.4	1.4	26.6	0.7	16.0
R4	2.0	31.7	1.2	22.1	0.8	16.4
Mean	**2.2**	**40.3**	**1.4**	**26.0**	**0.7**	**16.0**

Table- 12 showed descriptive analysis, *i.e.*, number of cases, mean, standard deviation, lower and upper bound at 95% confidence interval for mean, minimum and maximum values. The perusal of descriptive results revealed that treatments do differ in mean and range (*i.e.*, maximum and minimum observation). The ANOVA test showed One-way analysis of variance test for each parameter taken for study. The table was given the information that treatment taken in the study was showing different effect of potting mixture on the basis of girth and height. The analysis was again done to find out the significance difference in treatments with respect to above parameters. The table also revealed that values for such parameter are 0.000 and 0.000 for girth and height, respectively, which were significant at 0.05 levels and indicated that there was difference between the treatments. The Post hoc test (Multiple comparisons) showed all treatments were different. The study concluded that all the studied treatments were significant so potting mixture of FYM with soil and sand in ratio of 1:1:1 (T-1) was highest growth of seedling for girth and height and it could be used for better growth of seedlings in nursery.

Table 12. Statistical Analysis of Potting Mixture for Better Growth of *Strychnos Nux-vomica* Seedlings

DESCRIPTIVES									
	Treatment	**N**	**Mean**	**Std. Deviation**	**Std. Error**	**95% Confidence Interval for Mean**		**Minimum**	**Maximum**
						Lower Bound	**Upper Bound**		
Girth	T-1	4	2.1750	.12583	.06292	1.9748	2.3752	2.00	2.30
	T-2	4	1.3750	.12583	.06292	1.1748	1.5752	1.20	1.50
	T-3	4	.7250	.05000	.02500	.6454	.8046	.70	.80
	Total	**12**	**1.4250**	**.62686**	**.18096**	**1.0267**	**1.8233**	**.70**	**2.30**
Ht	T-1	4	40.2750	5.77776	2.88888	31.0813	49.4687	31.70	44.00
	T-2	4	26.0500	2.69629	1.34815	21.7596	30.3404	22.10	28.00

	T-3	4	16.0750	.35940	.17970	15.5031	16.6469	15.60	16.40
	Total	**12**	**27.4667**	**10.89481**	**3.14506**	**20.5444**	**34.3889**	**15.60**	**44.00**

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Girth	Between Groups	4.220	2	2.110	185.268	.000
	Within Groups	.103	9	.011		
	Total	**4.323**	**11**			
Ht	Between Groups	1183.322	2	591.661	43.524	.000
	Within Groups	122.345	9	13.594		
	Total	**1305.667**	**11**			

MULTIPLE COMPARISONS

LSD

Dependent Variable	(I) treatment	(J) treatment	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Girth	T-1	T-2	.80000(*)	.07546	.000	.6293	.9707
		T-3	1.45000(*)	.07546	.000	1.2793	1.6207
	T-2	T-1	-.80000(*)	.07546	.000	-.9707	-.6293
		T-3	.65000(*)	.07546	.000	.4793	.8207
	T-3	T-1	-1.45000(*)	.07546	.000	-1.6207	-1.2793
		T-2	-.65000(*)	.07546	.000	-.8207	-.4793
Ht	T-1	T-2	14.22500(*)	2.60710	.000	8.3273	20.1227
		T-3	24.20000(*)	2.60710	.000	18.3023	30.0977
	T-2	T-1	-14.22500(*)	2.60710	.000	-20.1227	-8.3273
		T-3	9.97500(*)	2.60710	.004	4.0773	15.8727
	T-3	T-1	-24.20000(*)	2.60710	.000	-30.0977	-18.3023
		T-2	-9.97500(*)	2.60710	.004	-15.8727	-4.0773

* The mean difference is significant at the .05 level.

Peering and Farwell (1977) also adapted a proforma by noting down rate of decline, number of localities, attractiveness and usefulness of plants which are exposed to unethical collection, percentage of localities in nature reserve and non-accessibility of the terrain. BSI also suggested some criteria for assessing threat value of a species.

4. Conclusions

The conclusive remarks of *Strychnos nux-vomica* were as under:

1. The seed dormancy was broken when seeds were treated with 40 ppm concentration of GA3 or 100 ppm concentration of IBA hormones and soaking with warm water.
2. The best size of polythene bag was used as medium size of polythene (25x11 cm).
3. The best size of root trainer was used as medium cup root trainer (187 cm^3).
4. The best potting mixture was found to be farm yard manure (FYM) with soil and sand in ratio of 1:1:1.

References

[1] A. Bhati, H. Garg, A. Gupta, H. Chhabra, A. Kumari and T. Patel, "Omics of Cancer", Asian Pacific Journal of Cancer Prevention, vol. 13, **(2012)**, pp. 4229-4233.
[2] ISTA, "International rules for seed testing", Seed Science and Technology, vol. 13, **(1985)**, pp. 299-520.
[3] IUCN, 2000 IUCN red list of threatened species, IUCN, Gland, Switzerland and Cambridge, **(2002)**.
[4] S.V. Kumar and M. Bhanja, "Forestry Seed Manual of Andhra Pradesh", Andhra Pradesh Forest Department, Hyderabad, India, **(1992)**.

[5] F. H. Perring and L. Farwell, "British Red Data Book", Vascular Plants. Society for the Promotion of Nature Conservation, Lincoln, vol. 1, **(1977)**.
[6] V. Shivkumar, R. Anandlakshmi, R. R. Warrier, M. Tigabu, P. C. Oden, S. N. Vijayachandran, S. Geetha and B. G. Singh, "Effect of presowing treatments, desiccation and storage conditions on germination of Strychnos nux-vomica seeds, a valuable medicinal plant", New Forest, vol. 32, **(2006)**, pp. 121-131.

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