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Effect of Presowing Treatments and Growth Regulators on the Propagation of *Strychnos Potatorum* L.F. – Cleaning Nut Tree.

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ABSTRACT

Strychnos potatorum L.F. (family Loganiaceae) is a medium-sized tree, which have high demand in traditional medicine to cure the variety of diseases such as jaundice, bronchitis, diabetes, and their coagulant effect is frequently utilized to clean dirty water. Seed exhibits physiological and morphological dormancy. In order to break their seed dormancy, various pre-sowing treatments were performed. The seeds were subjected to nine treatments which includes GA_3 (100 ppm, 500 ppm, 1000 ppm, 1200 ppm, 1500 ppm), H_2SO_4 (5, 10 min) and cold stratification in three replications. Various parameters like germination and survival percentage, germination energy, germination period, root length, shoot length, number of leaves, collar diameter, dry weight of shoot and root, shoot: root for seedlings were studied. Highest germination percentage, germination energy, germination period, shoot length, Root length, number of leaves, collar diameter were observed in the seeds of *Strychnos potatorum* when the seeds are treated with GA_3 of 1000 ppm for 24 h while dry weight of shoot and root and shoot: root ratio was maximum with GA_3 of 1200 ppm for 24 hrs treatment.

Keywords Dormancy, Growth regulators, Morphological parameters, Physiological parameters, Pre-sowing treatment, Stratification.

INTRODUCTION

Strychnos potatorum Linn (family Loganiaceae) – is a medium-sized tree native to southern and central India, Sri Lanka, and Myanmar, known as Nirmali. It is a well-known plant found in tropical moist deciduous forests and scrub lands of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Odisha, Madhya Pradesh, Chhattisgarh, and West Bengal up to the height of 1200 metres above sea level (Behera *et al.* 2018). Fruits mature in around 7-8 months, with 1-2 seeds per fruit being common. Nirmali is a medicinal herb used in Ayurveda, Unani, Siddha, and folk medicine to treat a variety of diseases (Behera *et al*. 2018). Seeds are widely used to clean water due to

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their coagulant function. Despite significant demand for the seeds, the species is found in the wild and there is no large-scale cultivation (Malik *et al.* 2012, Warrier *et al.* 2017). This species is restricted to specific pockets of tropical and subtropical forests due to unscientific excessive exploitation, habitat destruction, climate change, and inadequate natural regeneration and another key source of low recruit density is the self-non-generative mechanism of seeds in fruits (fungal destruction of seeds as soon as they fall) (Behera *et al.* 2018). This reduces the number of propagules available for establishing new seedlings in the wild (Warrier *et al.* 2017). *S. potatorum* seeds are physiologically and morphologically dormant (Muthuthanthirige *et al.* 2020) which hinder the natural regeneration (Warrier *et al.* 2017). Despite the fact that research has been done to determine the species' medicinal importance more information on nursery practices with regard to seed germination is needed (Muthuthanthirige *et al.* 2020). Hence the objective of the present investigation was planned to study the effect of pre sowing treatments on seed germination rate, seedling parameters and standardize some pre-sowing treatments for propagation of *S. potatorum* in Telangana region.

MATERIALS AND METHODS

The present study was conducted in Forest College and Research Institute, Mulugu, Siddipet, Telangana. The geographical location of the experimental site is 17.728544°N, 78.63296°E. Seeds were sown in the nursery beds of size 10 m x 1 m which were prepared well before sowing the seeds using soil, sand and FYM in the ratio of 2:1:1. Seeds of *S. potatorum* were collected from the plus trees from nearby forest area of Telangana region.

Experimental design and treatment details

A Completely Randomized Block (CRD) Design with three replicates was adopted for the experiment. 30 seeds per replication was used. Hence, a total of 810 seeds were subjected to nine different pre-sowing treatments. Treatments used in the experiment are as follows:

T_1 - GA_3 of 100 ppm for 24 hrs, T_2 - GA_3 of 500 ppm for 24 hrs, T_3 - GA_3 of 1000 ppm for 24 hrs, T_4 - GA_3 of 1200 ppm for 24 hrs, T_5 - GA_3 of 1500 ppm for 24 hrs, T_6 - 25% Sulphuric acid for 10 min, T_7 - 25% Sulphuric acid for 5 min, T_8 - Cold stratification @ 4˚C for 48 hrs, T_9 –Control.

Observations recorded

Germination period (Days)

The germination period was calculated as the difference between initial and final emergence (number of days) recorded.

Germination energy

The germination energy was calculated by dividing total number of seeds germinated when daily germination reaches its peak value to total number of seeds sown and multiplied by 100.

Germination percent

Germination percentage was calculated by number of germinating seedlings divided by the total number of seeds sown in poly bags and multiplied by 100.

Survival percentage

Total number of survived seedlings was counted from each treatment which was calculated by number of seedlings survived divided by the total number of seeds germinated and multiplied by 100.

Root length (cm)

Root length was taken at the end of germination period and the mean was recorded as root length in centimeter. For this observation seedlings from each treatment were uprooted and root length was measured from the collar region to the tip of the taproot.

Shoot length (cm)

Shoot length of five randomly selected seedlings were measured in centimeters from the ground level to the grown tip with the help of scale.

Collar diameter (cm)

The diameter of the observational seedlings were measured in millimeters at 2 cm above the ground level with the help of vernier calliper and after computing the mean, it was recorded as stem diameter.

Number of leaves per seedling

Number of leaves per seedling were counted from the randomly selected plants and after computing the mean, it was calculated as an average number of leaves per plant.

Shoot to root ratio

Shoot: root ratio of observational seedlings was calculated by dividing the fresh weight of shoot by fresh weight of root of respective observational plant and after computing the mean it was recorded as shoot: Root on fresh weight basis.

Dry weight of shoot

The shoots of observational plants were dried separately in an oven at 65°C till constant weight. Average dry weight of shoot per plant was worked out and recorded as dry weight of shoot per plant in gram.

Dry weight of root

Roots of observational plants were dried separately in an oven at 65°C till constant weight. Average dry weight of root per plant was worked out and recorded as dry weight of root in gram.

RESULTS AND DISCUSSION

Germination parameters

Germination parameters are summarized in Table1. Treatments T_8 and T_9 didn't showed any response on the seeds of *Strychnos potatorum.* Germination of *Strychnos potatorum* started after 56 days of sowing. The highest germination percentage (82.2 %) was recorded in T_3 GA_3 of 1000 ppm for 24 hrs and the lowest germination percentage (45.5 %) was recorded in T_6 25% sulphuric acid for 10 min whereas T_8 cold stratification @ 4˚C for 48 hrs and T_9 control recorded no germination. The highest survival percentage (90.1 %) was recorded in T_2 GA_3 of 500 ppm for 24 hrs and the lowest survival percentage (70.8 %) was recorded in T_6 25% sulphuric acid for 10 min whereas T_8 cold stratification @ 4 ˚ C for 48 hrs whereas T_9 control didn't respond to any treatments. Germination energy was significantly influenced by various treatments, where T_3 GA_3 of 1000 ppm for 24 hrs (54 %) recorded highest germination energy followed by T_2 GA_3 of 500 ppm for 24 hours (42.2 %). The lowest was observed in T_6 25% sulphuric acid for 10 min (22.2 %). While highest germination period was observed in T_3 GA_3 of 1000 ppm for 24 hrs (60 days) recorded longer followed by T_2 GA_3 of 500 ppm for 24 hrs (49 days) and shorter was recorded in T_6 25% sulphuric acid for 10 min (30 days).

Growth parameters

Growth parameters are summarized in Table 2. Maximum root length of *Strychnos potatorum* was seen (17 cm) in T_3 GA_3 of 1000 ppm for 24 hrs and lowest

Table 1. Effect of pre-sowing treatments on germination parameters of *Strychnos potatorum.*

Treatment details	Germination percentage	Survival percentage	Germination energy	Germination period (days)
T_1	60	83.3	40	31
T_2	78.8	90.1	42.2	49
T_3	82.2	81	54	60
T_4	60	87	28.8	38
T_5	61.1	83.6	37.7	45
T_6	45.5	70.8	22.2	30
T_7	53.3	78	28.8	42
SEm ±	0.328	0.338	0.667	1.047
CD @ 5%	1.003	NS	2.042	3.205

Table 2. Influence of different pre-sowing treatments on growth parameters of *Strychnos potatorum.*

Treatments	Shoot length (cm)		Root length (cm)		Number of leaves		Collar diameter (cm)		Dry weight of shoot (g)	Dry weight of root (g)	Shoot : Root
	45 Days	90 Days	45 Days	90 Days	45 Days	90 Days	45 Days	90 Days			
T_1	6.58	7.3	12.83	15.9	5	6.33	0.58	0.72	0.2	0.26	0.73
T_2	6.83	8.08	13.38	16.1	4.33	4.83	0.58	0.71	0.23	0.26	0.73
T_3	8.75	9.45	14.33	17	5.5	7.16	0.6	0.76	0.16	0.21	0.84
T_4	7.58	8.38	13.5	14.8	5	6	0.41	0.6	0.31	0.45	0.87
T_5	7.83	8.7	13.25	14.6	5.33	6.83	0.55	0.7	0.13	0.28	0.58
T_6	5.3	6.03	6.9	8.13	3.83	4.66	0.4	0.52	0.2	0.26	0.72
T_7	7.83	8.4	9.48	10.4	4.83	5.83	0.43	0.61	0.24	0.28	0.86
SEm ±	0.482	0.510	0.882	0.887	0.658	0.598	0.069	0.070	0.033	0.027	0.118
CD @ 5%	1.477	1.562	2.701	2.717	NS	NS	NS	NS	0.102	0.083	NS

was found in T_6 25% sulphuric acid for 10 min (8.13 cm). The highest shoot length (9.45 cm) was recorded in T_3 GA_3 of 1000 ppm for 24 hrs while lowest was found in T_6 25% sulphuric acid for 10 min (6.03 cm). T_3 GA_3 of 1000 ppm for 24 hours reported maximum collar diameter (0.76 cm) and number of leaves (7.16) whereas lowest was found in T_6 25% sulphuric acid for 10 min (0.52 cm and 4.66). In case of dry weight of shoot and root, highest was recorded in T_4 GA_3 of 1200 ppm for 24 hrs (0.31 gm and 0.45 gm) and lowest dry weight of shoot was observed in T_5 GA_3 of 1500 ppm for 24 hrs (0.13 gm) while lowest root dry weight was seen in T_3 GA_3 of 1000 ppm for 24 hours (0.21 g). The shoot: Root of *Strychnos potatorum* was significantly not influenced by various pre-sowing treatments where highest was recorded in T_4 GA_3 of 1200 ppm for 24 hrs (0.87) and lowest was observed in T_5 GA_3 of 1500 ppm for 24 hrs (0.58). The root: shoot ratio is the ratio of fresh weight of root and shoot. It also indicates the roots' ability to maintain above-ground biomass, not just for anchoring but also for nutrient and water absorption from the soil. A high root: shoot ratio indicates a high-water absorption and storage capacity, which is beneficial in dry conditions (Takoutsing *et al.* 2016).

The results of our study reveal that gibberellic acid treatment was best suitable for improving seed germination and growth parameters. Gibberellins have an important role in seed germination, flower and fruit development, and early embryo growth by mobilizing endosperm reserves (Gupta and Chakrabarty 2013). Gibberellins promote germination by triggering hydrolytic enzymes that degrade barrier tissues like the endosperm or seed coat, mobilizing seed storage reserves, and accelerating embryo growth. Results of the present study are in accordance with the work done by Warrier *et al.* (2017) on potatorum where the highest germination percentage (81%) was reported with GA_3 1000 ppm treatment. Soliman and Abbas (2013) have reported that shorter germination period was recorded with Sulphuric acid treatment. Thounaojam and Dhaduk (2020) observed in his study on *Buchanania lanzan* which revealed maximum shoot length (10 cm) with GA_3 @900 mg/l for 24 hrs treatment, while Hemalatha and Chandari (2021) conducted a study on *Santalum album* where GA_3 treated seeds reported maximum collar diameter (2.23 mm). Sajana *et al.* (2018) in a study on *Semicarpus anacardium* reported that maximum dry weight of shoot and root (2.86 and 6.96 g) was recorded in GA_3 @ 400 ppm treatment which was also supported by Pawar *et al.* (2010) on *Jatropa*.

CONCLUSION

Pre-sowing treatments significantly influenced the germination and growth of *Strychnos potatorum* seedlings where treatment with GA_3 improved all attributes compared with other treatments. Seeds treated with T_3 GA_3 of 1000 ppm for 24 hrs has improved maximum attributes of germination and growth parameters. Hence it is advisable to treat *Strychnos potatorum* seeds with T_3 GA_3 of 1000 ppm for 24 hs for better germination and seedling growth.

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