International Journal of Genetics
ISSN: 0975-2862 & E-ISSN: 0975-9158, Volume 10, Issue 10, 2018, pp.-522-525.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000226

Research Article

EFFECT OF POTTING MEDIA AND PRE-TREATMENTS ON GERMINATION OF *Ailanthus excelsa* Roxb.

RAMA KANT*, BHANDARI M.S. AND MEENA R.K.
Genetics & Tree Improvement Division, Forest Research Institute, Dehradun, 248195, Uttarakhand, India
*Corresponding Author: Email- rgbp_82@rediffmail.com

Received: October 01, 2018; Revised: October 22, 2018; Accepted: October 23, 2018; Published: October 30, 2018

Abstract- Fresh seeds were collected from various places of Northern India to study the effect of potting media and pre-treatments on germination of *Ailanthus excelsa*. Germination and mortality were recorded up to 60 days after sowing. The results of pre-treatment of seeds showed the highest germination (%) was found in alternate wetting and drying (93.85±0.52%) followed by hot water (92.31±0.16%) and mechanical scarification (90.00±0.38%) treatments. However, Minimum germination was recorded in nitric acid (76.92±0.34%) followed by boiled water (83.85±0.85%). Hundred percent seed mortality was observed in sulphuric acid. Whereas, maximum seedling mortality was recorded in potassium hydroxide (18.67±0.58%) followed by alternate wetting and drying, and mechanical scarification (13.33±0.58%) treatments. Effect of the composition of potting media on seed germination was also observed. Highest germination (92±1.73%) was observed in the potting mixture (I) ratio of 2:1:1 (Sand:Soil:Compost), followed by potting mixture (E) (86±1.73%; 18:1:1) and potting mixture (K) (85±1.73%; 6:7:7). Minimum germination was recorded in compost (63±2.00%) and coco-peat (65±1.00%). However, maximum seedling mortality (%) was recorded for potting media (E) (70±4.36%) followed by potting media K (69±3.00%; 6:7:7) and I (67±2.00%; 2:1:1). Minimum seedling mortality was observed in compost (2±1.00%) and coco-peat (16±4.36%), respectively. It could be concluded that the seeds with untreated, mechanical scarified, cold water treatment had very good germination percentage and were better than those pre-treated with chemical methods.

Key words- *Ailanthus excelsa*, germination percentage, seed and seedling mortality, Pre-treatments

Citation: Rama Kant, *et al*., (2018) Effect of Potting Media and Pre-treatments on Germination of *Ailanthus excelsa* Roxb. International Journal of Genetics, ISSN: 0975-2862 & E-ISSN: 0975-9158, Volume 10, Issue 10, pp.-522-525.

Introduction

Ailanthus excelsa Roxb. (Ardu), belongs to family Simaroubaceae and order Sapindales is a fast-growing species described first time by the William Roxburgh in 1795 for the Circas of the eastern parts of India [1]. Ardu is also famous as Mahanimba probably because of its very much similarity with neem (Azadirachta indica) and Maharukha because of its large size[2]. The term '*Ailanthus*' derived from ailanto, an Ambonese word probably meaning "tree of the gods" or "tree of heaven". In India, it is common in Rajasthan, Haryana, Punjab, Bihar, Gujarat, Madhya Pradesh, Orissa, and South India. It grows well in arid, semi-arid and semi-moist region with varied soil types. Flowering period of *Ailanthus* is February-March and fruiting period is April-May. In the month of may-June seeds are ready to collect. The seeds are very light and are dispersed far and wide by the wind [3]. Seeds showed orthodox storage behaviour as viability period increased with the decrease in storage temperature and seed moisture content [4]. The germination is epigeous, started within a week and completed in about 25-30 days. It is salt-tolerant species. Growth of seedling is affected due to heavy rain, heavy watering and susceptible to insect attack or fungal infection. Some seed fall on bare ground and germinate in the following rainy season but the seedlings rarely survive due to the sensitiveness of the seedlings and their intolerance to heavy weeds growth [5]. *Ailanthus* seeds are usually picked at physiological maturity when they turned light yellow before drying, because mature fruits are light weight and winged; and hence, may liable to lose by wind dispersal. Seeds are orthodox and viability could be maintained up-to one year [2]. *Ailanthus excelsa* also has been recognised as one of the multipurpose native tree species used for production of matches, pencil, boxes, crates, poles, fishing floats, tool handles, moisture proof plywood, planks, door frames and drums.

Being a quick growing species, it is most suitable or social forestry programmes, for restoration of degraded lands and to mitigate air pollution. Besides above enumerated economical uses, it's also used in the Indian school/system of medicine for treatment of variety diseases / ailments in humans [6]. An inferior quality gum called BASSORA is being produced by *Ailanthus* bark and used to treat various ailments. Leaves of the trees are best for small ruminants as they possesses nutritious and quality fodder. The wood is sainty, yellowish white and well suited for cabinet making [7]. The work on genetic improvement of *A. excelsa* is going on at FRI Dehradun. The fresh seeds from selected CPT's (Candidate Plus Trees) were collected from various places of Northern India. It felt very indispensable that first we should have an idea of its germination behavior and response to the media and pre-treatments of the seeds at the nursery level in climatic conditions of Dehradun before starting to work on mass multiplication of selections through the seeds. Proper nursery establishment of planting stocks is essential to meet the quality seedlings demand and establishment of multilocation testing of germplasm in a successful manner [8]. Therefore, proposed preliminary research was conducted to know the best potting mixture and suitable seed treatment method for enhancing the germination percentage. The experiment is essential for producing different planting material at FRI Dehradun and further use to establish evaluation trials across different geographical locations all over India.

Material and Methods

Description of Study Area

The study was conducted at the Nursery of Genetics and Tree Improvement Division, Forest Research Institute, Dehradun (N 30° 20' 39.87"; E 78° 0'43.66" and 688m amsl).

The area falls under humid subtropical climate with average annual rainfall 2073 mm.

Seed Collection

Seeds were collected from all over Northern India i.e., Punjab, Haryana, Uttar Pradesh and Uttarakhand in the month of April and May, 2016. Hundred Candidate Plus Trees (CPTs) was selected through intensive field work and seeds were harvested with tree pruners. Standard packing for storage of seeds were practised to bring seed samples from far-flung places to FRI Dehradun.

Experimental Setup

Two nursery experiments were carried out during July-August, 2016 (Fig-1 and Fig-2). First experiment was performed with thirteen pre-treatment methods involving various mechanical and chemical agents for treating the seeds before showing (Table-1). Similarly, second experiment comprises of 13 various combinations and ratio of soil, sand, compost and coco-peat for making potting media / cultures (Table-2). Both the experiments were laid out in Randomised Block Design with three replications. Each replication consisted of 100 seeds of each treatment / potting mixture. A total of 3000 seeds in experiment-I and 3900 seeds in experiment-II were sown in the nursery. Standard package of practices was followed to raise the healthy seedlings in the nursery. Data were recorded on germination (%), seed mortality (%) and seedling mortality (%) in both the experiments. These data were subjected to Analysis of Variance (One-Way ANOVA) for the design of experiment and DMRT test using software SPSS (Version 16.0) computer program (SPSS Inc. 233 S. Wacker Drive, 11th Floor, Chicago, Il 60606-6307).

Results and Discussion

Experiment-I

ANOVA showed significant difference ($p > 0.00$) among treatments for germination (%) and mortality of seedling (%) (Table-3). The results of pre-treatment of seeds were presented in Table-4. The Maximum germination (%) was found in alternate wetting and drying (93.85±0.52%) followed by hot water (92.31±0.16) and mechanical scarification methods (90.00±0.38), respectively. However, Minimum germination was observed in nitric acid (76.92±0.34) followed by boiled water (83.85±0.85%). This was observed as contrary to the earlier reports which revealed the highest percentage of seed germination (98%) when treated with hot water at 600C for 15minutes [9]. They have also reported with the same experiment, that the mechanical treatment results showed 93% germination which is very similar to our results. Hundred percent mortality was observed in case of sulphuric acid treatment. All the chemical methods of pre-treatment showed quit higher percentage of mortality as compared to mechanical and physical methods. However, minimum seed mortality was recorded in case of alternate wetting and drying method of pre-treatment (Table-4). The Duncan Multiple Range Test (DMRT) was used to know significant difference between treatments. Alternate wetting and drying method of treatment ($p > 1.0$) showed significant difference from the others treatments. Similarly, treatment soaking in hot water ($p > 1.0$), mechanical scarification ($p > 1.0$), boiled water ($p > 83.85$), nitric acid ($p > 76.81$) and sulphuric acid ($p > 0.0$) also showed significant difference among themselves and from other treatments. Soaking in cold water showed significant difference ($p > 0.991$ with other treatments except potassium hydroxide treatment. Hydrochloric acid ($p > 0.0$) and sodium hydroxide showed non-significant difference between them but both showed significant differences ($p > 0.338$) with other treatments. After 60 days of sowing, mortality was recorded in seedlings. Maximum mortality was observed in potassium hydroxide treatment (18.67±0.58%) followed by mechanical scarification (13.33±0.58%) and alternate wetting and drying methods (13.33±0.58%). Minimum mortality was recorded in soaking in cold water (2.67±0.58%) followed by boiled water treatment (7.00±1.00%) and hydrochloric acid (10.33±0.58%). The DMRT revealed that the treatment with potassium hydroxide showed ($p>1.0$) showed significant difference from the others treatments. Similarly, alternate wetting and drying ($p>0.078$) and mechanical scarification ($p>0.542$) were at par with each other and showed significant difference from other treatments. Alternate wetting and drying and sodium hydroxide were at par with each other ($p>0.078$) and showed non-significant difference from other treatments. Soaking in hot water, nitric acid, sodium hydroxide was at par with each other ($p>0.254$) and showed non-significant difference from other treatments. Hydrochloric acid ($p>1.0$), boiled water ($p>1.0$), mechanical scarification ($p>1.0$) and soaking in cold water ($p>1.0$) also showed significant difference from all other treatments.

Experiment-II

ANOVA showed significant difference ($p > 0.00$) among the potting mixture for germination (%) and mortality of seedling (%), respectively (Table-5). The results for the effect of potting mixture on seeds germination, seeds mortality and seedling mortality were presented in Table-6. Highest germination percentage was found in the potting mixture I (92±1.73%) followed by E (86±1.73%) and K (85±1.73%), respectively. Minimum germination was recorded in compost (63±2.00%) followed by coco-peat (65±1.00%) and SSC (M) (74±1.00%). Similar results were investigated on seed germination and germination value of *Ailanthus excelsa* at Jodhpur, Rajasthan and concluded that seeds being light weighted and winged performed well at depth of 0.5 cm [10]. The potting mixture was sown in root trainers containing sand (1:1), soil + FYM (2:1) and soil + sand + FYM (1:1:1). The collection time of *Ailanthus excelsa* in North-East India was June-July; seeds per Kg (approx.) was 9,500, viability for 8 months; germination period recorded was 15-25 days with 36% germination [11]. The Duncan Multiple Range Test (DMRT) was again used for knowing effect of different composition of potting mixture and any significant difference among all the treatments. Treatment I showed significant difference ($p > 1.0$) from other treatments. Treatment E, F, G and K was at par with each other and showed significant difference ($p > 0.065$) from other treatments. Treatment F, G, J and K were at par with each other and showed significant difference ($p > 0.065$) from other treatments. Treatments B, H and L were at par with each other and showed significant difference ($p>0.057$) from other treatments. Treatment A, B and H were at par with each other and showed significant difference ($p > 0.057$) from other treatments. Treatment A, B and M were at par with each other and showed significant difference ($p > 0.198$) from other treatments. Treatment C and D were at par with each other and showed significant difference ($p > 0.174$) from other treatments. ANOVA showed significant difference ($p > 0.00$) among all the treatment taken up for the study. After 60 days of growth of seedlings, mortality was recorded in progenies. Maximum mortality of seedlings was observed in E (70±4.36%) followed by I (69±2.00%) and K (69±3.00%). Minimum mortality of seedlings was recorded in Compost (2±1.00%) followed by coco-peat (16±4.36%) and soil (42±2.65%). The DMRT was again used for knowing effect of different potting mixture and any significant difference among all the treatments. E, I and K are at par with each other while showed significant difference ($p > 0.197$) from other treatments. Treatment F, G, H, J and L were at par with each other and showed significant difference ($p > 0.221$) from other treatments. Treatment F ($p > 0.0$), G ($p > 0.0$) and K ($p > 0.0$) was at par with each other and showed significant difference ($p > 0.0$) from other treatments. Treatment B and M were at par with each other and showed significant difference ($p > 0.359$) from other treatments. Treatment A ($p > 1.0$), D ($p > 1.0$) and C ($p > 1.0$) showed significant difference from other treatments. Although, experiments to optimize concentration of hormone in rooting of stem cuttings of *Ailanthus excelsa* Roxb. was conducted at Nizamabad, Telangana and it was reported that ideal concentration for inducing maximum rooting was found to be 3500 ppm of IBA [12]. Apart from the study, it is also that the depths of sowing have also greatly influencing the seed germination in tree species [13]. Reports are also revealing the existence of considerable variation in germination with respect to the provenance and genotypes for germination percentage, mean germination time and germination index when subjected to different pretreatment methods. Although pretreatment is not very relevant to reach high final germination percentage in *F. albida* provenances as indicated by reduced mean germination time and increase germination index of *F. albida*. However, acid treatments and mechanical scarification are found to be the most effective methods in improving seed germination. It is also pertinent that untreated seeds and treatment by mechanical scarification and cold water significantly higher germination [14]. Kumar, 2016 reported that the various germination parameters in *T. bellirica* seeds were significantly influenced by pre-sowing

Table-1 Pre-treatments of seeds

SN	Treatments	Timing	Date of Treatment and Sowing
1.	Soaking in Cold Water	24 hours at room temperature	Bed 1 to 10 (29/7/2016) and 11 to 13 (3/8/2016)
2.	Soaking in Hot Water	60 ° C for 5 min	Bed 1 to 10 (29/7/2016) and 11 to 13 (3/8/2016)
3.	Alternate Wetting and Drying	30 min wetting & 45 min drying	Bed 1 to 10 (29/7/2016) and 11 to 13 (3/8/2016)
4.	Scarification Mechanical	With the help of surgical blade	Bed 1 to 10 (29/7/2016) and 11 to 13 (3/8/2016)
5.	Boiled Water	100 °C for 2 min	Bed 1 to 10 (29/7/2016) and 11 to 13 (3/8/2016)
6.	Sulphuric Acid (H_2SO_4)	2 min	04/08/2016
7.	Hydrochloric Acid (HCl)	2 min	04/08/2016
8.	Nitric Acid (HNO_3)	2 min	04/08/2016
9.	Potassium Hydroxide (KOH)	2 min	04/08/2016
10.	Sodium Hydroxide (NaOH)	2 min	04/08/2016

Table-2 Potting media used in nursery

SN	Potting Media / Mixture	Ratio
1.	Soil (A)	Pure (100%)
2.	Sand (B)	Pure (100%)
3.	Compost (C)	Pure (100%)
4.	Coco-peat (D)	Pure (100%)
5.	Soil: Sand: Compost (E)	18:1:1
6.	Soil: Sand: Compost (F)	8:1:1
7.	Soil: Sand: Compost (G)	14:3:3
8.	Soil: Sand: Compost (H)	3:1:1
9.	Soil: Sand: Compost (I)	2:1:1
10.	Soil: Sand: Compost (J)	4:3:3
11.	Soil: Sand: Compost (K)	6:7:7
12.	Soil: Sand: Compost (L)	1:2:2
13.	Soil: Sand: Compost (M)	1:4.5:4.5

Table-3 Effect of pre-treatments on seed germination and seedling mortality

Source of Variation	df	Seed Germination	Seedling Mortality
Between Pre-treatments	9	2352.38*	91.50*
Error (Within pre-treatments)	20	0.460	0.433
Total	29	730.37	28.70
F value		5124.7573	211.1538

Table-4 Seed germination, mortality of seeds and seedlings in percent

SN	Treatments	Germination (%)	Seed Mortality (%)	Seedling Mortality (%)
1.	Soaking in Cold Water	86.15 ± 1.02^{e}	13.85	2.67 ± 0.58^{h}
2.	Soaking in Hot Water	92.31 ± 0.16^{b}	7.69	11.67 ± 0.58^{d}
3.	Alternate Wetting and Drying	93.85 ± 0.52^{a}	6.15	13.33 ± 0.58^{bc}
4.	Mechanical Scarification	90.00 ± 0.38^{c}	10.00	13.33 ± 0.58^{b}
5.	Boiled Water	83.85 ± 0.85^{f}	16.15	7.00 ± 1.00^{f}
6.	Sulphuric Acid (H_2SO_4)	0.00 ± 0.00^{h}	100.00	0.00 ± 0.00^{g}
7.	Hydrochloric Acid (HCl)	88.46 ± 0.93^{d}	11.54	10.33 ± 0.58^{e}
8.	Nitric Acid (HNO_3)	76.92 ± 0.34^{g}	23.08	12.00 ± 1.00^{d}
9.	Potassium Hydroxide (KOH)	86.15 ± 0.87^{e}	13.85	18.67 ± 0.58^{a}
10.	Sodium Hydroxide (NaOH)	87.92 ± 0.80^{d}	12.08	12.33 ± 0.58^{d}

**Superscript in the table followed by the same letter (a, b, c, d, e, f, g, h) showing non-significant values according to Duncan Multiple Range Test (DMRT)*

Table-5 Effect of various combination of potting mixture on seed germination

Source of Variation	df	Seed Germination	Seedling Mortality
Between Potting Mixture	12	198.81*	1242.58*
Error (Within Potting Mixture)	26	3.08	6.87
Total	38	64.89	397.10
F value		64.61	180.83

Table-6 Germination (%), mortality of seeds (%) and mortality of seedlings (%) as results of potting mixture

SN	Treatment Name	Potting Mixture Composition	Germination (%)	Mortality of Seed (%)	Mortality of Seedling (%)
1.	A	Soil	75±1.73ef	25	42±2.65d
2.	B	Sand	76±2.00def	24	49±1.73c
3.	C	Compost	63±2.00g	37	02±1.00f
4.	D	Coco-peat	65±1.00g	33	16±4.36e
5.	E	Sand: Soil: Compost (18:1:1)	86±1.73b	14	70±4.36a
6.	F	Sand: Soil: Compost (8:1:1)	83±1.73bc	17	59±2.00b
7.	G	Sand: Soil: Compost (14:3:3)	83±1.00bc	17	60±2.65b
8.	H	Sand: Soil: Compost (3:1:1)	78±3.00de	22	57±2.65b
9.	I	Sand: Soil: Compost (2:1:1)	92±1.73a	08	67±2.00a
10.	J	Sand: Soil: Compost (4:3:3)	81±1.00c	19	60±2.00b
11.	K	Sand: Soil: Compost (6:7:7)	85±1.73bc	15	69±3.00a
12.	L	Sand: Soil: Compost (1:2:2)	79±2.00d	21	57±1.53b
13.	M	Sand: Soil: Compost (1:4.5:4.5)	74±1.00f	22	47±1.73c

**Superscript in the table followed by the same letter (a, b, c, d, e, f, g, h) showing non-significant values according to Duncan Multiple Range Test (DMRT)*

treatments and soaking of the seeds in cold water enhanced the seed germination [15].

Application of research: The nursery and plantations of *Ailanthus excelsa*. As much information on this aspect is not available that the how and why pretreatment and potting mixture is to be used for raising nursery and to get good germination without mortality in seedling stage. However, we have cover following broad area under this research work:
Seed storage and viability analysis
Role of potting media and pre-treatments in seed germination

Research Category: Seed germination and viability

Abbreviations:
CPT: Candidate Plus Trees
ANOVA: Analysis of Variance
Duncan Multiple Range Test (DMRT)
FYM: Farm Yard Manure
ICFRE: Indian Council of Forestry Research and Education

Acknowledgement / Funding: Author thankful to Indian Council of Forestry Research and Education, Forest Research Institute, Dehradun, 248195, Uttarakhand, India for financial support. Author also thankful to Dr. Shailesh Pandey, Scientist-D, Forest Protection Division, FRI Dehradun for his valuable suggestions and providing input through software SPSS (Version16.0).

***Research Guide or Chairperson of research: Dr RK Meena**
Institute: Forest Research Institute, Dehradun, 248195, Uttarakhand, India
Research project name or number: PhD Thesis

Author Contributions: All author equally contributed

Author statement: All authors read, reviewed, agree and approved the final manuscript

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

References

[1] Sandhu S.S. (1984*) Indian Journal of Forestry*, 7(3), 253-4.
[2] Kumar D., Bhat Z.A., Singh P., Shah M.Y. and Bhujbal, S.S. (2010) *International Journal of Pharmacology*, 6(5), 535-550.
[3] Vogt K. (1995) *SOS Sahel International, Oxford, UK,* ISBN: 1901459152.
[4] Rawat M.M.S., Naithani K.C. and Thapliyal R.C. (2001) *Indian Forester*. 119(9), 973-979.
[5] Troup, R.S. (1921) *The Silviculture of Indian Trees. Vol. III, 107-117, Clanrendon Press Oxford.*
[6] Kirtikar K.R. and Basu B.D. (1995) *Indian Medicinal Plants. International Book Distributors, Dehradun, India.* Vol 1, 371-372.
[7] Bhandari B.S. and Gupta M.L. (1972) *Indian Vet. J.,* 49, 512-516.
[8] Krishnan P.R., Kalia R.K., Tewari J.C. and Roy M.M. (2014) *Plant Nursery Management: Principles and Practices. Central Arid Zone Research Institute, Jodhpur*, 40.
[9] Sarwade P.P. and Sarwade K.P. (2014) *International Journal of Allied Practice, Research and Review*, 29-32.
[10] Gehlot A., Tripathi A., Rathore A., Arya I.D. and Arya S. (2014) *Indian Forester*, (8), 763-768.
[11] Bisht N.S. and Ahlawat S.P. (1999) *Seed Technology, SFRI, Information Bulletin No. 7. State Forest Research Institute. Department of Environment & Forests. Government of Arunachal Pradesh. Itanagar* - 791 111 (India), 13.
[12] Mamatha M. and Rao B.V. (2014) *International Journal of Multidisciplinary and Current Research*, 2.
[13] Ahirwar R. K. (2015) *International Research Journal of Biological Sciences*, 4(2):45-47.
[14] Fredrick C., Muthuri C., Ngamau K., and Sinclair F. (2016) *Agroforest Systems*, 90 (3).
[15] Kumar V. (2016) *Indian Journal of Ecology*, 43 (1): 233-238.