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Effect of seed storage on germination and seed vigour of *Tecomella undulata*

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ABSTRACT

The present study was carried out at the forestry research area of Lovely Professional University, Phagwara (Punjab) to evaluate the optimum temperature for seed germination and seed vigour of *Tecomella undulata.* Seeds from 150 candidate plus trees (CTPs) were placed at three different substrata, *i.e.* top of paper, between the paper and sand at different temperature viz. 20 °C, 25 °C and 30 °C, respectively in a seed germinator and the data for the optimum temperature for seed germination was recorded after 10 days. The data pertaining to standard germination, root length, shoot length, seedling dry weight, seedling vigour index-I and seedling vigour index-II were recorded to evaluate the performance of the fresh Rohida seeds. Results revealed that during storage, there was a loss of viability in the seeds. However, non-significant decrease was observed in seedling length and seedling dry weight after six months of storage. Therefore, the findings of the present study reveal that six months after storage, quality planting stock can be produced by increasing the seed rate.

Key words : *Seed, Storage, Vigour, Germination and Tecomella undulata*

Introduction

The bignoniaceae family is considered as one of the most important plant families for its dicotyledons which have attracted the attention of taxonomists due to high economic values throughout the globe. Similarly, *Tecomella undulata*, the state flower of Rajasthan commonly known as Rohida, a nearly evergreen medium heighted tree with dropping branches found in the Thar deserts of India and Pakistan is one of the important member of this family (Kritikar and Basu, 1935; Nadkarni, 2000 and Mathus *et al*., 2010). The species grows upto a height 4 to 8 m with an average circumference ranging from 50-80 cm having a very slow growing habit with a deep root system. It grows as one of the co-dominant trees in the arid and semi-arid ecosystem of western Rajasthan and the adjoining plains of Haryana and Punjab, alongside *Prosopis cineraria* (Kumar and Tamilarasan, 2017). Rohida can grow successfully in the arid regions with an average rainfall of 250-400 mm (Jindal *et al.,* 1987).

The species is known for its high quality timber used for the manufacturing of furniture's, agricultural implements, cots, doors etc. and is a main source of timber amongst the indigenous tree species of desert regions of Shekhawati and Marwar in Rajasthan hence, it is also locally known as 'Desert Teak' or 'Marwar Teal' due to its very hard and high quality timber (Meena and Yadav, 2019). The leaves are an important source of protein (12.20 per cent), minerals and crude fibers (15.80 per cent) hence, are many time provided as a feed supplement to the cattle's (Bhandari, 1978). Beside this the species is

also known for its huge medicinal properties such as in curing urinary disorders, enlargement of spleen, gonorrhea, leukoderma and liver related problems. Traditionally, the flowers of Rohida are used as a cure for hepatitis in Pakistan (Dhir and Shekhawat, 2012; Kalia *et al.,* 2014).

However, this versatile tree became threatened due to large scale felling for its high priced timber coupled with slow growth and poor germination. Seed is the only propagating material for the regeneration of Rohida however, the seed viability declines very rapidly such that it may decline to zero just after one year of harvest (Arya *et al.,* 1992). Therefore, taking into view the importance and significance of such a versatile species for its conservation and improvement, the present study was planned to determine the effect of storage on seed germination and seed vigour of *Tecomella undulata.*

Materials and Methods

The present study was carried out at the Forestry research area of Lovely Professional University, Phagwara (Punjab) located at 31.2560° N latitude and 75.7051° E longitude at an elevation of 234 m above the mean sea level (MSL). The climate is subtropical monsoonic with an average annual rainfall of 350-400 mm, 70-80 per cent of which occurs during July to September. The fully mature seeds were collected from the ten superior plus trees of *Tecomella undulata* during the month of May and June and were evaluated for various seed and pod parameters such as pod length, seeds per pod, etc.

To evaluate the optimum temperature for seed germination, approximately 150 seeds from all the candidate plus trees (CTPs) were placed at three different substrata *i.e.* top of the paper, between the paper and sand at different temperature viz. 20 °C, 25 °C and 30 °C, respectively in a seed germinator and the data for the optimum temperature for seed germination was recorded after 10 days. The data pertaining to standard germination, root length, shoot

Table 1. Standardization of temperature and substrata for germination test of Rohida

Treatment/ Temperature	20 °C	25 °C	30 °C
Top of paper	42.66 %	60.66 %	57.33 %
Between paper	38.00 %	50.00 %	38.66 %
Silica Sand	37.33 %	52.66 %	44.00 %

Table 2. Effect of storage on different Characteristics of seedlings and seeds of Rohida.

Characters	Standard Germination (%)		Seedling dry wt. (mg)		Seedling length (cm)		Vigour Index I		Vigour index II		Tetrazolium test (%)	
Genotype	Fresh	Stored	Fresh	Stored	Fresh	Stored	Fresh	Stored	Fresh	Stored	Fresh	Stored
T1	62.67	12.67	319.30	326.60	8.17	7.76	511.79	97.94	19983.02	4132.30	67.67	21.33
T2	54.67	11.33	322.80	331.60	6.93	6.14	378.47	69.69	17619.53	3715.47	60.00	22.67
T3	60.67	14.67	355.96	302.78	7.65	6.48	464.05	94.93	21520.76	4440.93	66.67	24.67
T4	62.00	15.33	336.53	322.40	8.02	7.64	497.05	116.61	20873.80	4929.77	68.00	24.67
T5	66.00	18.00	335.83	335.68	9.18	8.26	605.61	148.74	22168.93	6042.30	71.33	26.00
T6	57.33	10.67	309.03	334.73	7.00	6.51	401.57	69.33	17715.67	3545.53	61.33	18.67
T7	64.67	15.33	311.53	332.217	8.54	8.13	551.93	124.51	20141.47	5092.77	70.00	26.67
T8	62.67	14.00	455.08	329.77	8.45	8.05	529.35	112.65	28404.72	4616.73	67.33	25.33
T9	61.33	14.67	323.50	316.92	7.95	7.42	487.54	109.05	19819.17	4650.33	63.33	24.67
T10	69.33	20.00	366.07	337.48	9.34	8.50	647.61	169.93	25353.27	6749.67	77.33	32.67
Mean	62.13	14.67	343.56	327.02	8.12	7.49	507.50	111.34	21360.03	4791.58	67.30	24.74
Range	54.67 - 69.33	10.67 - 20.00	309.3 - 455.08	302.78 - 337.48	6.93 - 9.34	6.14 - 8.50	378.47 - 647.61	69.33 - 169.93	17619.53 - 25353.27	3545.53 - 6749.67	60.00 - 77.33	18.67 - 32.67
CV %	6.34	18.29	11.95	3.07	9.40	10.55	15.51	26.93	14.77	19.61	7.12	14.08

length, seedling dry weight, seedling vigour index-I and seedling vigour index-II were also recorded to evaluate the performance of the fresh Rohida seeds. The same data were again recorded for the seeds collected from all the ten CPTs after six months of storage to evaluate the loss in seed viability and vigour after the six months of storage and the data obtained were statistically analyzed using the procedures given by Panse and Sukhtame (1989).

Results and Discussion

The study of seed and pod characters of the natural population is often considered to be useful step in the study of genetic variability. Highly significant differences in mean values were established for seeds per pod and pod length during this study. Bangarwa (1993) recorded high variability among seeds per pod, pod length. Solanki *et al.* (1985) also reported phenotypic variation in pod and seed size in natural stands of *Acacia Senegal* in western Rajasthan. Bagchi *et al.* (1990) also observed high variability for seed characters in *Acacia spp.*

To standardize the substrata and optimum temperature standard germination was conducted on three substrata, i.e. top of paper, between paper and silica sand in laboratory conditions on different temperature viz., 20 ºC, 25 ºC and 30 ºC. The maximum germination percent (60.66 %) was recorded at 25 ºC on top of the paper. Hence, further all observations were taken on the top of paper at 25º.

During storage, there was loss of viability in the seeds of Rohida in the present study. This loss of viability and variation among different genotype was because of many reasons such as seed type, genetic variation and seed moisture content. Standard germination and Tetrazolium tests are excellent measure of seed viability. In the present study, lot of variation was observed among trees for standard germination, seedling dry weight, seedling length, vigour index I, vigour index II and tetrazolium test. Loss of germination and reduction in vigour I, vigour index II and tetrazolium test was highly significant and very high. The reduction was from one-third to one-sixth. Non-significant decrease was observed in seedling length and seedling dry weight after six months of storage which suggested that reduction in vigour index I and vigour index II was due to loss in germination percent and not because of seedling length and seedling dry weight respectively. These results suggested that six months after storage, quality planting stock can be produced by increasing the seed rate. Similar results were reported by various workers in different crops such as okra (Narwal, 1995), cotton (Meena *et al.,* 1994), carrot (Maskri *et al.,* 2003), onion (Kumari, 1994), turnip (Khan *et al.,* 2005). Barton, (1961) found that seeds of high initial viability were more resistant to unfavourable storage humidity and temperatures then those of low initial viability and that seed deterioration once started proceeds rapidly under the unfavourable storage conditions until the death of all seeds, although it was not marked under favourable conditions. Perry, (1969) found a little loss in viability of seeds which were stored for one or two years before sowing. In order to minimize the loss of viability during storage, Agrawal *et al.* (1976) emphasized the seed to select a proper place for bulk seed storage. Several places in different states of India have been classified as good, moderate and poor on the basis of all India coordinated studies. A poor place was not recommended for seed storage. However, with proper insulation and some precautions for moisture management in the seed storage a moderate place could be converted in to good one. This helped in minimizing the loss of viability during seed storage. Seed possesses highest viability and vigour at physiological maturity (Meena *et al.,* 1994). Thereafter, the seed gradually ages and decline in viability and vigour. Seed deterioration leads to reduction in seed quality, performance and stand establishment (Christiansen and Rowland, 1981).

Table 3. Paired t-Test for various characters of seedling and seeds of Rohida

Characteristics	Paired t- Test		
	Df	t-cal	Significance
Germination %	9	17.06	S
Seedling dry wt.	9	3.77	NS
Seedling length	9	0.94	NS
Vigour index I	9	236.72	S
Vigour Index II	9	12664.86	S
Tetrazolium test	9	40.18	S

References

Agarwal, R.K. 1976. Studies on soil physico-chemical and ecological changes under twelve years old five desert tree sspecies of Western Rajasthan. *Indian Forester*. 102: 863-872.

Arya, S. 1992. *Tecomellaundulata* (Rohida): A valuable tree of the Desert. *International Tree Crops Journal.* 7(3): 141-148.

Bagchi, 1990. Variation in seed size of *Acaca spp. Silvae Genetica.* 39(3-4): 107-110.

Bangarwa, K.S. 1993. *Studies on provenance variation, progeny testing and reproductive biology in Dalbergia sissoo Roxb*. Ph.D. Thesis, CCS HAU, Hisar, Haryana, India.

Barton, L.V. 1961. *Seed Preservation And Longevity*. Leonard Hill, London, and Interscience Publishers, N.Y. pp: 216.

Bhandari, G. 1978. Evaluation of fodder tree leaves for sheep and goats in semi-arid area of Rajasthan. *J. Nuclear Agric. Bio*. 7: 110-113.

Christiansen, R. 1981. Cotton physiology: seed and germination. *In: Proceeding of bultwide cotton production research conference*, Brown, J.M. (ed.), L.A. Publ. Natl. Cotton Counc., Memphis, T.N. 4-8 Jan, 1981, New Orleans.

Dhir, R. and Shekhawat, G.S. 2012. Critical review on *Tecomellaundulata*: a medicinally potent endangered plant species of Indian Thar desert. *International Journal of Current Research*. 4(6): 36-44.

Jindal, R.K. 1987. Germplasm collection and genetic variability in Rohida (*Tecomellaundulata* (Sm.) Seem) in Western Rajasthan. *Ind. J. For*. 10(1): 52-55.

Kalia, R.K., Rai, M.K., Sharma, R. and Bhatt, R.K. 2014. Understanding *Tecomellaundulata*: an endangered pharmaceutically important timber species of hot arid regions. *Genetic Resources and Crop Evolution*. 61: 1397-1421.

Khan, P.S. 2005. Loss of viability correlates with membrane damage in aged turnip (*Brassica rapa*) seeds. *Seed Sci. Technol*. 33(2): 517-520.

Kirtikar, K.R. and Basu, B.D. 1935. *Indian Medicinal Plants*, Vol. II. Lalit Mohan Publication, Allahabad. 1347-1348.

Kumar, M. and Tamilarasan, R. 2017. Kinetics, equilibrium data and modeling studies for the sorption of chromium by *Prosopis juliflora* bark carbon. *Arabian Journal of Chemistry.* 10: 1567-1577.

Kumari, P. 1994. *Seed deterioration studies in onion (Allium cepa L.)* Ph.D. Thesis submitted to CCS Haryana Agricultural University, Hisar.

Maskri, 2003. Effects of accelerated ageing on viability, vigour (RGR), lipid peroxidation and leakage in carrot (*Daucus carota* L.) seeds. *International J. Agric. Biol*. 5(4): 580-584.

Mathur, N., Singh, J., Bohra, S., Bohra, A., Mehboob, Vyas, M. and Vyas, A. 2010. Phytoremediation Potential of Some Multipurpose Tree Species of Indian Thar Desert in Oil Contaminated Soil. *Adv. Environ. Biol.* 4: 131-137.

Meena, R.K. 1994. Seed development and maturation in cotton. *Indian J. Agric. Sci.* 64: 111-113.

Meena, K.L. and Yadav, B.L. 2019. Studies onethnomedicinal plants conserved by Garasia tribes of Sirohi district Rajasthan India. *Indian J. Nat. Product Res.* 1: 500-506.

Nadkarni, K.M. 2000. *Indian Materia Medica.* Popular prakashan: Mumbai, India. 1: 56-57.

Narwal, 1995. *Studies on seed viability of okra (Abelmoschus mesculentus L. Moench).* Ph.D. Thesis submitted to CCS HAU, Hisar.

Panse, V.C. and Sukhatme, P.V. 1989. *Statistical Methods for Agricultural Workers.* 4th Edition, ICAR Publication, New Delhi, India.

Perry, 1969. Vigour test for peas based on seedling evaluation. *Proc. of ISTA.* 34 : 265-270.

Solanki, 1985. Performance of *Acacia senegal* and *Prosopis cinerar*ia in Western Rajasthan. *Nitrogen Fixing Tree Research Reports*. 3: 27-28.