Tropical Plant Research
An International Journal
© Society for Tropical Plant Research

ISSN (E): 2349 – 1183
ISSN (P): 2349 – 9265
2(3): 224–229, 2015

Research article

Variability and germination divergence in seed traits of *Stereospermum chelonoides* DC.

Anita Tomar

Centre for Social Forestry and Eco-rehabilitation, 3/1, Lajpat Rai Road, New Katra, Allahabad, U.P, India

*Corresponding Author: anitatomar@icfre.org

[Accepted: 24 October 2015]

Abstract: The investigation was carried out in two different seed sources viz. Uttarakhand and Uttar Pradesh of *Stereospermum chelonoides*. The aim of the study was to determine variability and germination divergence in seed traits of *Stereospermum chelonoides* collected from two states. A variation was observed in germination percent, mean daily germination, peak value, germination energy and germination value and seed growth parameters (capsule/seed length, capsule/seed width and seed weight) of two states. The seeds from Uttarakhand found better as per selected parameters in comparison to the seeds from Uttar Pradesh.

Keywords: Seed sources - Peak value - Mean daily germination - Germination value.

[**Cite as:** Tomar A (2015) Variability and germination divergence in seed traits of *Stereospermum chelonoides* DC. *Tropical Plant Research* 2(3): 224–229]

INTRODUCTION

Stereospermum chelonoides, DC. is a large sized tree, deciduous, branches and usually 9 to 10 m tall and distributed in sub Himalayan tract, central parts of India. It is commonly called as "Patla and "Padri" and belongs to the "Bignoniacea" family (Troup 1986, Masoumeh & Deokule 2013).The decoction of the root is antipyretic and it is useful in asthma, cough and excessive thirst. The bark and all parts contain a napthaquinone and lepachol (Sandermann & Dietrichs 1957, Joshi *et al*. 1977). Flowers are used in bleeding disease, sore throat and diarrhoea; fruits are useful in blood diseases. The root-bark is an ingredient of Dashmoola (Tomar *et al*. 2013) and Chywanprash (Yashoda *et al*. 2004). It is regarded as cooling, astringent cardio tonic, bitter, diuretic and generally used in combination with other medicine; the ashes of this plant are used in the preparation of alkaline water and caustic pastes. Fruits are useful in hic cough and blood diseases (Negi 2000).

Seeds of different species and of the same species from different provenances behave differently in their germination response. Similarly a species may be found in a wide variety of climatic regions, but the germination behaviour may differ according to provenance. Germinability is a measure of the ability of population of seeds to germinate or the maximum percentage of seeds that will germinate under favourable conditions. (Bewley & Black 1978). Variation in seed germination is due to a complex of environmental and genetic factors during seed formation and subsequent handling of treatments (Wang *et al*. 1982).

Destructive harvesting practices have seriously reduced seed production and caused gradual erosion of its natural populations. The species is mainly propagated through seeds and collecting them becomes a laborious process as their pericarps are winged. Another difficulty it faces is poor germination rate and thus propagation through seeds in the wild is limited (Baul 2006). Hence, steps have to be taken to conserve this tree of great economic value therefore, its planting and conservation is recommended for future conservation. Keeping this in view the present study was conducted to study the variability and germination divergence in seed traits of *Stereospermum chelonoides.*

MATERIALS AND METHODS

A reconnaissance field survey was carried in five sites (Lakhimpur Kheri, Faizabad, Chitrakoot, Allahabad and Mirzapur) bearing *Stereospermum chelonoides* trees in the state of Uttar Pradesh for undertaking the present study (Fig. 1). The Uttarakhand collection was done from only one site which falls in Dehradun. The latitudinal and longitudinal ranges of all the six sites have been given in table 1.

Received: 05 August 2015 Published online: 31 October 2015

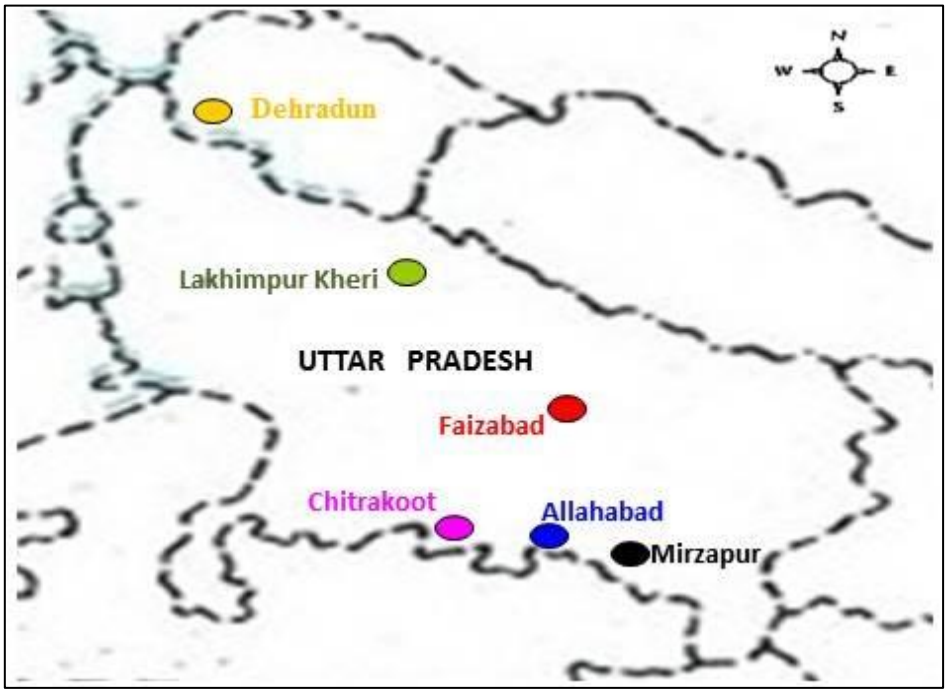

Fig. 1: studied sites of *Stereospermum chelonoides.*

Mature capsules were collected during 2012–2013 from all the six sites from minimum eight to ten selected plants of each seed sources and packed in marked polythene bags. For Uttar Pradesh, a composite sample of seed was drawn by mixing the seed collected from different sites for seed studies. Capsule and seeds were randomly drawn from the pool in order to determine their size and shape. For each individual seed, three principal dimensions: length, width, and weight were measured.

Table 1. Geographic information of the studied sites of *Stereospermum chelonoides* forests.

State	Forest Divisions	Altitude (m)	Latitude	Longitude
Uttar Pradesh	Lakhimpur Kheri	174.0	28° 28′ 29.94″ N	80° 41′ 56.32″ E
	Faizabad	113.0	26° 47′ 00.00″ N	82° 12′ 00.00″ E
	Chitrakoot	92.1	25° 14′ 00.00″ N	81° 28′ 00.00″ E
	Allahabad	102.6	25° 15′ 53.90″ N	81° 37′ 18.20″ E
	Mirzapur	167.0	24° 49′ 16.88″ N	82° 18′ 57.71″ E
Uttarakhand	Dehradun	640.0	30° 19′ 48.00″ N	78° 03′ 36.00″ E

Germination test were conducted in 10 cm diameter petri dishes lined with Whatman filter papers. Distilled water was added whenever moisture loss was detected. There were 4 treatments in this experiment including the control. The experiment was undertaken in completely randomized block design with four replication in each treatment and twenty five seeds per replication. Results were expressed as germination percentage which was the percentage of live seeds that had germinated at the end of test. The seeds were inspected every day and were considered to be germinated when the radicle penetrated the seed coat and reached about 1mm in length (Teketay 1996). The data of seed germination was recorded and quantified as per ISTA (1976). The parameters studied were germination percent (%), germination value (GV) calculated as per Czabator (1962) procedure, mean daily germination (MDG) according to Bonner (1983), germination energy and germination value (Grouse & Zimmer 1958).

RESULT AND DISCUSSION

Seed traits, namely seed length, width, weight, and germination parameters vary significantly among both the state seed sources. The capsule and seed characteristics of *Stereospermum chelonoides* from Uttarakhand state have been described in table 2. The highest coefficient of variation (CV) of 38.19% was observed in the capsule length as the capsule length varies from 14.40 to 49.20 cm with mean value 33.91 cm. The number of seeds per kg varied from 25,641–40,000 as this depends on size of the capsules. Lowest coefficient of variation

was observed in seed length with and without wings (6.60–6.09%). However seed width shared a variation 10.12%.

Table 2. Variation in Capsules, seed traits of *Stereospermum chelonoides* of Uttarakhand state.

	No. of seeds /capsule	No. of seeds /kilogram	Capsule Character			Seed Character		
			Length (cm)	Width (mm)	Weight (gm)	Length with wings (cm)	Length without wings (cm)	Width (mm)
Mean ±SD	49.71 ±16.60	33080±5320.06	33.91 ±12.95	12.21±3.42	32.43±7.09	3.09±0.20	1.83±0.11	4.42±0.45
Range	22–65	25,641–40,000	14.40–49.20	7.32–16.24	24–42	2.9–3.5	1.7–2.0	3.88–5.03
C.V.	33.39	16.08	38.19	28.00	21.9	6.60	6.09	10.12

Note: S.D. = Standard deviation; C.V. = Coefficient of variation. (n = 25 x 4)

The characteristics of *Stereospermum chelonoides* capsule and seed from Uttar Pradesh have been provided in table 3. The highest coefficient of variation (CV) of 31.9 % was observed in no. of seeds /capsule. This is due to the fact that the actual values varied from a minimum of 21 seed in one capsule to a maximum of 56 seeds per capsules.

Capsule length varies from 34.3–50.0 cm with mean value 43.64 cm. The lowest co-efficient of variation observed in number of seeds per kg (0.2) as it varied from 25870–26000. The variation in seed size may be due to both internal (maternal, hereditary) and external (environmental) conditions operating at the time of seed development (Harper *et al*. 1970) and advantageous for wide range of adaptability. Seed size has been found to regulate germination and subsequent seedling growth in many species (Baldmin 1942, Langdon 1958, Williams 1967, Kandya 1978, Devagiri 1997, Singh 1998). Both seed sources of *S. suaveolens* varied significantly in respect of capsules and seed traits.

Comparatively wider variations were observed in case of capsule characters, number of seeds per capsule and seed weight. Such genetic variations have been reported in *Acacia catechu* (Ramachandra, 1996), *Acacia nilotica* (Bagchi & Dobriyal, 1990), *Dalbergia sissoo* (Gera *et al*. 2000).

Table 3. Variation in Capsules, seed traits of *Stereospermum chelonoides* of Uttar Pradesh state.

	No. of seeds /capsule	No. of seeds /kilogram	Capsule Character			Seed Character		
			Length (cm)	Width (mm)	Weight (gm)	Length with wings (cm)	Length without wings (cm)	Width (mm)
Mean ±SD	42.43±13.55	25906 ± 43.51	43.64±5.50	18.60± 0.93	55.57±13.21	3.34 ±0.60	1.1 1±0.12	10.07±0.85
Range	21–56	25870–26000	34.3–50.0	17.11–19.75	41.6–83.1	2.1–3.9	0.98–1.30	8.20–10.75
C.V.	31.9	0.2	12.6	5.00	23.8	17.9	11.0	8.4

Note: S.D. = Standard deviation; C.V. = Coefficient of variation. (n = 25 x 4)

The commencement of germination in Uttarakhand started eight day onwards after sowing and continued up to 15 days. The seed germination varied significantly (ANOVA; $p < 0.01$) during the study period. The peak germination (11.0%) was observed on 10th day and the total germination under laboratory conditions recorded was 90.0%. (Table 4). Seeds sown achieved 2.43 peak value and 2.33 as mean daily germination, 45.0 germination energy and 5.66 as germination value (Fig. 2).

In Uttar Pradesh the peak germination was observed on 12th day and total germination under laboratory conditions recorded was 65% (Table 4). Seeds sown achieved 1.73 as mean daily germination, 1.75 peak value, 42.5 germination energy and 3.02 as germination value (Fig. 2).

Table 4. Variation in Uttarakhand and Uttar Pradesh Germination.

States	Seed germination %								Germination			
	8th day	9th day	10th day	11th day	12th day	13th day	14th day	15th day	Total %	Period (days)	Energy	Value
Uttarakhand	3	3	11	7	5	3	3	1	90 ±1.41	8–15	45.0	5.66
Uttar Pradesh	4	4	4	4	5	1	0	4	65 ±0.58	8–15	42.5	3.02

Note: The values refer to mean ± Standard deviation, (n = 25 x 4).

Germination energy is a measure of speed of germination and is assumed to given an idea of the vigour of seed and seedlings which it produces (Willan 1985). Germination value, an index combining speed and completeness of germination was influenced by seed size and weight (Baldwin 1942, Czabator 1962, Dunlop & Barnett 1984). Differences observed for germination percent, germination value and germination energy could

be genetic in nature because environmental deviations are negligible for experimental conditions and seeds of both states were stored in similar conditions. This is supported by the reports of Gera *et al*. (2000) and Vakshasya *et al*. (1992) for *Dalbergia sissoo* and Arya *et al*. (1995) for *Prosopis cineraria*. Since the seeds were germinated under similar condition, variations among the seed sources may be attributed to genetic differences. Such variations in nursery performances have reported in *Acacia albida* (Sniezko & Stewart 1989), *Acer rubrum* (Townsend 1977) and *Prosopis cineraria* (Hooda & Bahadur 1996).

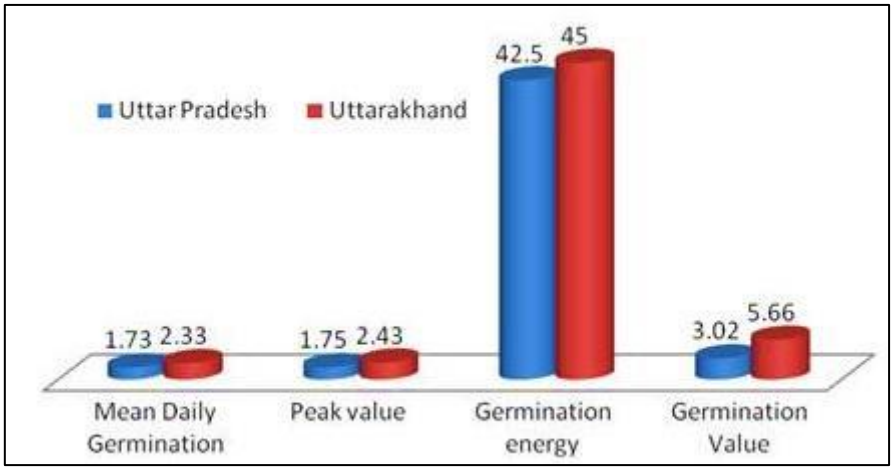

Figure 2. Germination values *of Stereospermum chelonoides* under laboratory conditions.

Variation in germination of seed sources has been reported in *Acacia mangium* (Salazar 1989), *Pinus brutia* (Isik 1986), *Betula ermanii* (Shembreg & Protemkin 1987*), Pinus greggi* (Dvorak *et al.* 1996) *Acacia catechu* (Ramachandra 1996) and *Pinus roxburghii* (Roy *et al.* 2004). In general pod, seed and germination traits are supposed to be inherited characters influenced by age, growth, micro and macro habitats of the parent tree (Isik 1986). Larger seed germinate faster and more completed than smaller one probably due to more endosperm nutrient pool (Kandya 1978). Aldhous (1972) opined that only those seeds which germinate rapidly and vigorously under favourable conditions, are likely to be capable of producing vigorous seedlings in field conditions which is of immediate interest, whereas, week or delayed germination is often fatal. Isik (1986) stated that populations with high germination rate are more vigorous in terminal and root growth. Khalil (1986) also recommended the detection of fast growing provenances based on germination traits.

CONCLUSION

It emerged from the present study that a large variability exists in the *Stereospermum chelonoides* growing naturally in Uttar Pradesh and Uttarakhand particularly for number of seeds/capsule, capsule character and seed character. The variability of different characters could be utilized for selection of genotypes suitable for the plantation and utilization. In this study, Uttarakhand seed source had shown better germination as compared to Uttar Pradesh. However, more comprehensive survey of *Stereospermum chelonoides* habitat areas of Uttarakhand is required to select some promising forms of *Stereospermum chelonoides.*

This study helps to identify the better seed source of *S. chelonoides* having better yield therefore, the best seed source selected may improve the poor sites for agroforestry systems and energy plantations in the wastelands.

ACKNOWLEDGEMENTS

This work was financially supported by Indian Council of Forestry Research and Education (ICFRE), Dehradun, India.

REFERENCES

Aldhous JR. (1972) Nursery Practice. *Forestry Commission Bulletin* 43: 184.

Arya S, Kumar N & Toky OP (1995) *Khejri (Prosopis cineraria* L. Druce*) its value, research and extension*. HDRA-ODA Project, India.

Bagchi SK & Dobriyal JD (1990) Provenance variation in seed parameters of *Acacia nilotica*. *Indian Journal of Forests* 116(12): 958–961.

Baldwin HI (1942) *Forest tree seed of the north temperate region with special reference to North America*. Chronica Botanica Co. Waltham, Mass.

Baul T K (2006) *Propagation and growth performance of three important wild tree species of medicinal values*. Dissertation for the Master Degree. Chittagong, Bangladesh: Institute of Forestry and Environmental Sciences, University of Chittagong. Bangladesh.

Bewley JD & Black M (1978) *The Physiology and Biochemistry of Seeds*. V. 1, Berlin, Springer-Verlag, pp. 306.

Bonner FT (1983) Germination responses of loblolly pine to temperature differentials on a two - way thermo gradient plate. *Journal of Seed Technology* 8(1): 6–14.

Czabator FJ (1962) Germination Value: an index combining speed and completeness of pine germination. *Forest Science* 8: 386–396.

Devagiri GM (1997) *Evaluation of seed source variation in seed and seedling traits in Dalbergia sissoo Roxb.* Ph.D. Thesis. Forest Research Institute University, Dehra Dun, India.

Dunlap JR & Barnett JP (1984) Influence of seed size on germination and early development of loblolly pine (*Pinus taeda* L.) germinants. *Canadian Journal of Forest Research* 13: 40–44.

Dvorak WS, Kietzka JE & Donahue JK (1996) Three year growth of provenances of *Pinus gregii* in the tropics and subtropics. *Forest Ecology and Management* 83(1–2): 132–137.

Gera M, Gera N & Ginwal HS (2000) Seed trait variations in *Dalbergia sissoo* Roxb. *Seed Science Technol*ogy 28: 467–475.

Grouse RJ & Zimmer WJ (1958) Some laboratory germination responses of the seeds of river red gum, *Eucalyptus camaldulensis* Dehn. *Australian Journal of Botany* 6(2): 129–153.

Harper JL, Lovell PH & Moore KG (1970) The shapes and sizes of seeds. *Annual Review of Ecology and Systematics* 11: 327–356.

Hooda MS & Bahadur Raj (1996) *Genetic variability in half -sib progenies of Prosopis cinerarie* (L.) Druce. Proc. QFRI-IUFRO conference on *"*Trees Improvement for sustainable tropical forestry*"*, Queensland, Australia, pp. 275.

Isik K (1986) Altitudinal variation in *Pinus brutia* Ten: seed and seedling characteristics. *Silvae Genetica* 35(2–3): 58–67.

ISTA (1976) International Rules for Seed Testing, *Seed Science and Technology* 4: 23–28.

Joshi KC, Bansal RK & Patni R (1977) Chemical examination of the roots of *Stereospermum chelonoides* DC. *Journal of Indian Chemical Society* 54: 648–649.

Kandya AK (1978) Relationship among seed weight and various growth factors in *Pinus oocarpa* seedlings. *Indian Forester* 104(8): 561–567.

Khalil MAK (1986) Variation in seed quality and some juvenile characters of white spruce (*Picea glauca*). *Silvae Genetica* 35: 78–86.

Langdon OG (1958) Cone and seed size of South Florida Slash Pine and their effect on seedling size and survival. *Journal of Forestry* 56: 122–127.

Masoumeh R & Deokule SS (2013) Deterioration of chemical constituents in roots of drug *Stereospermum chelonoides* DC. under storage. *Asian Journal of Plant Science and Research* 3(1): 111–114.

Negi SS (2000) *Himalayan Forests and Forestry*. Indus publishing Comp., pp**.** 106.

Ramachandra NG (1996) *Provenance variation in seed and seedling parameters in Acacia catechu Will*. Ph.D. Thesis, Forest Research Institute, Deemed University Dehra Dun.

Roy MS, Thapliyal RC & Phartyal SS (2004) Seed source variation in cone, seed and seedling characteristics across the natural distribution of Himalayan low level pine *Pinus roxburghii* sarg. *Silvae Genetica* 53(3): 116–122.

Salazar R (1989) Genetic variation of 16 provenances of *Acacia mangium* at nursery level on Turrialba. Costa Rica. *Commonwealth Forest Review* 68(4): 263–272.

Sandermann HH & Dietrichs W (1957) *Untersuchungen u"ber termitenresistente Ho"lzer Holz als Roh-und Werkstoff*.

Shembreg MA & Protemkin DN (1987) Individual variation in the seed quality of *Betula ermanii*. *Lasivedenie* 3: 33–38.

Singh O (1998) Seed maturity indices in Silver fir (*Abies pindrow* Spach.). *Indian Journal of Forests* 124(3): 243–246.

Sniezko RA & Stewart HTL (1989) Renge wide provenance variation growth and nutrition of *Acacia albida* seedlings propagated in Zimbabwe. *Forest Ecology and Management* 27(3–4): 179–197

Teketay D (1996) Germination ecology of twelve indigenous and eight exotic multipurpose leguminous species from Ethiopia. *Forest Ecology and Management* 80: 209–223.

Tomar A, Tripathi S & Kumar A (2013). Relationship of Pods and Seeds traits in medicinal value tree *Stereospermum suaveolens***.** *International Journal on Applied Bioengineering* 7(1): 1–3.

Townsend AM (1977) Characteristics of red maple progenies from different geographic areas. *American Society for Horticultural Science* 28(1): 33–36.

Troup RS (1986) *Silviculture of Indian Trees Volume 2: Leguminosae (Caesalpinieae) to Verbenaceae*. International Book Distributors, Dehradun, India, pp. 1196.

Vakshasya RK, Rajora OP & Rawat MS (1992) Seed seedling traits of *Dalbergia sissoo* Roxb. Seed source variation studies in India. *Forest Ecology Management* 48: 265–279.

Wang BSP, Pitel A & Webb DP (1982) Environmental and genetic factors affecting tree and shrub seeds. In: Thomson JR (ed) *Advances in Research and Technology of Seeds*. Part 7, Centre for Agriculture Publishing and Documentation, Wageningen, Netherlands, pp. 87–135.

Willam WA (1967) Seedling growth of a hypogeal legume, *Vicia dasycarpa* in relation to seed weight. *Crop Science* 7: 163–164.

Willan RL (1985) A guide to forest seed handling with particular reference to tropics. *FAO Forestry Paper* 20(2): 217–218.

Yasodha R Sumanthi R & Gurumurthi K (2004) Micropropagation for quality propagule production in plantation forestry. *Indian Journal of Biotechnology* 3: 159–170.