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

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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.

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 naphthaquinone 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.
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.

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

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.

<table>
<thead>
<tr>
<th>Capsule Character</th>
<th>No. of seeds /capsule</th>
<th>No. of seeds /kilogram</th>
<th>Seed Character</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (cm)</td>
<td>Width (mm)</td>
<td>Weight (gm)</td>
<td>Length with Length without wings (cm)</td>
</tr>
<tr>
<td>Mean ±SD</td>
<td>Range</td>
<td>C.V.</td>
<td>Mean ±SD</td>
</tr>
<tr>
<td>49.71 ±16.60</td>
<td>22–65</td>
<td>33.39</td>
<td>14.40–49.20</td>
</tr>
<tr>
<td>33080±5320.06</td>
<td>25–64</td>
<td>16.08</td>
<td>14.00–49.20</td>
</tr>
<tr>
<td>32.43±7.09</td>
<td>24–42</td>
<td>21.9</td>
<td>4.42±0.45</td>
</tr>
</tbody>
</table>

**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 coefficient 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 (Baldwin 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.

<table>
<thead>
<tr>
<th>Capsule Character</th>
<th>No. of seeds /capsule</th>
<th>No. of seeds /kilogram</th>
<th>Seed Character</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length (cm)</td>
<td>Width (mm)</td>
<td>Weight (gm)</td>
<td>Length with Length without wings (cm)</td>
</tr>
<tr>
<td>Mean ±SD</td>
<td>Range</td>
<td>C.V.</td>
<td>Mean ±SD</td>
</tr>
<tr>
<td>42.43±13.55</td>
<td>21–56</td>
<td>31.9</td>
<td>43.64±5.50</td>
</tr>
<tr>
<td>25906±43.51</td>
<td>25870–26000</td>
<td>26000</td>
<td>18.60±0.93</td>
</tr>
<tr>
<td>55.57±12.95</td>
<td>24–42</td>
<td>21.9</td>
<td>55.57±12.95</td>
</tr>
</tbody>
</table>

**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%) 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.

<table>
<thead>
<tr>
<th>States</th>
<th>8th day</th>
<th>9th day</th>
<th>10th day</th>
<th>11th day</th>
<th>12th day</th>
<th>13th day</th>
<th>14th day</th>
<th>15th day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uttar Pradesh</td>
<td>3</td>
<td>3</td>
<td>11</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

**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 (Snieszko & 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**

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