Research Article

Effect of some Ecophysiological Stresses on Germination Behaviour of *Caesalpinia Pulcherrima* (L.) Swartz

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**ARTICLE INFO**

<table>
<thead>
<tr>
<th>Article No.</th>
<th>031513526</th>
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<tbody>
<tr>
<td>DOI</td>
<td>10.15580/GJAS.2013.6.031513526</td>
</tr>
</tbody>
</table>

**Submitted:** 15/03/2013  
**Accepted:** 22/06/2013  
**Published:** 29/06/2013

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**ABSTRACT**

*Caesalpinia pulcherrima* (L.) Swartz (family Caesalpiniaeae) is introduced and cultivated in Pakistan as an ornamental plant. It has medicinal values as well. Laboratory studies revealed that whole of seeds did not germinate up to 60 days with any of the treatment. At control seeds germinated 40%, while 60% and 70% at presoaking for 12 and 24 hours respectively. 40% germination occurred at one hour acid treatment and no germination at three hours acid soaking and combination of acid and water. Mechanical scarification and 12 hours water soaking showed best results with 80% germination. There were no satisfactory results with mechanical scarification and chemical scarification combination. Similarly, mechanical scarification, chemical scarification and water combination gave poor results.

**Keywords:**  
Ecophysiology, Caesalpinia pulcherrima germination, Water soaking, Sulphuric acid, Mechanical scarification and 12 hours water soaking 80% germination
INTRODUCTION

*Caesalpinia pulcherrima* (L.) Swartz (family Caesalpiniaceae) is a beautiful ornamental 2 m high shrub with slightly prickly branches. It has medicinal values and its roots are used for infantile convulsions, flowers for intestinal worms, cough and catarrh while the leaves are reputed to have purgative action and abortifacient (Papilionaceae, Ali & Qaiser, 1996). Germination is an important event in life history and establishment of a plant. Studies were made by different researchers on the germination of some medicinal plants including *Datura* (Hussain et.al. 1980), *Acacia* (Hussain & Ilahi, 1988), *Withania* (Hussain & Ilahi, 1988) and *Dodonaea* (Hussain et.al.1991) and suggested that the germination strategies of these plants differ from each other. The growth, productivity and chemical composition of plants are controlled by variety of factors including edaphic, climatic and local conditions. Various types of environmental stresses such as soil salinity, light, water and nutrients affect the overall productivity of plants. Delfine et al. (2001) reported reduction in normal growth, leaf area, stomatal conductance and photosynthesis of Bell pepper (*Capsicum ver annum*) due to water stress. Ibrar et al. (2003) reported decreased germination and seedling growth height, reduced number of branches, leaves, fruits and seeds, and reduction fresh and dry weight in *Brassica junca* at salinity.

Due to lack of such information on *Caesalpinia pulcherrima* (L.) Swartz, the present study was conducted to standardize the methods of rapid and enhanced germination.

MATERIALS AND METHODS

The seeds collected from Karachi were thrashed and cleaned. Each treatment had ten replicates and each with ten seeds placed on two folds of Whatman No.1 filter paper in a petri dish. The effect on germination of *Caesalpinia pulcherrima* (L.) Swartz of the different temperatures, soaking hours, mechanical and chemical stratification and different combined effects of the above mentioned treatments were studied. The emergence of radicle from seed coat was taken as the index of germination. The dishes were watered whenever needed. The data was recorded after maximum possible germination. Treated and non-treated seeds were set for germination at 30°C. The result was statistically analyzed by using ANOVA test.

RESULTS AND DISCUSSIONS

1. **Effect of different temperature**

Maximum germination of 60% was recorded at 30°C followed by 50% at 25°C. Therefore, further experiments were set at 30°C.

2. **Effect of soaking in water**

Seeds were soaked in water for 12 and 24 hours and then placed in petridish to check the effect of soaking hours. 24 hours soaked seeds showed 70% germination, while 12 hours soaking provided 60% germination.

3. **Effect of mechanical scarification**

Mechanically stratified seeds gave 60% germination.

4. **Effect of mechanical scarification and water soaking**

Mechanically scarified seeds were soaked in water for 12 and 24 hours separately and then set for germination. The stratified and 12 hours water soaked seeds showed the best results of 80% germination as compared to all the treatments including the control.

5. **Effect of Chemical Scarification**

Chemically scarified seeds with Sulphuric acid for one hour showed 60% germination while three hours soaked seeds gave 40% germination.

6. **Combined effect of chemical scarification and water soaking**

Seeds were scarified with Sulfuric acid for one hour and then water soaked for 12 hours and in another case scarified for three hours and then water soaked for 24 hours. Both the conditions showed no germination.

7. **Combined effect of Mechanical and Chemical scarifications**

30% germination was showed by mechanically and one hour chemically scarified seeds while mechanically and 3 hours chemically scarified seeds yielded no germination.
Table: Effect of various ecophysiological stresses on the germination of *Caesalpinia pulcherrima*. Each treatment had ten replicates with ten seeds each.

<table>
<thead>
<tr>
<th>S. #</th>
<th>Treatment</th>
<th>% Germination</th>
<th>Mean (% germination)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control (Non-treated)</td>
<td>40</td>
<td>40.0 D</td>
</tr>
<tr>
<td>2</td>
<td>Effect of 25 °C</td>
<td>30</td>
<td>26.6 EF</td>
</tr>
<tr>
<td></td>
<td>Effect of 30 °C</td>
<td>50</td>
<td>40.0 D</td>
</tr>
<tr>
<td>3</td>
<td>Effect of 12 hrs soaking</td>
<td>60</td>
<td>46.6 CD</td>
</tr>
<tr>
<td></td>
<td>Effect of 24 hrs soaking</td>
<td>60</td>
<td>53.3 BC</td>
</tr>
<tr>
<td>4</td>
<td>Effect of mechanical scarification</td>
<td>70</td>
<td>60.0 B</td>
</tr>
<tr>
<td>5</td>
<td>Combine effect of mechanical scarification and 12 hours soaking</td>
<td>60</td>
<td>73.33 A</td>
</tr>
<tr>
<td></td>
<td>Combine effect of mechanical scarification and 12 hours soaking</td>
<td>80</td>
<td>36.6 DE</td>
</tr>
<tr>
<td>6</td>
<td>Effect of chemical scarification with H2SO4 for one hour</td>
<td>40</td>
<td>40.0 D</td>
</tr>
<tr>
<td>7</td>
<td>Combine effect of mechanical scarification and one hr scarification with H2SO4</td>
<td>40</td>
<td>20.0 F</td>
</tr>
</tbody>
</table>

Mean 50.91 A

LSD Value for treatment at α 0.05 = 13.16

LSD Value for days to germination at α 0.05 = 6.872

ANOVA table

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>Degree of freedom of sum of squares</th>
<th>Mean of squares</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments</td>
<td>10</td>
<td>6578.88</td>
<td>658.788</td>
<td>11.04</td>
</tr>
<tr>
<td>Days to germination</td>
<td>2</td>
<td>2806.06</td>
<td>1403.030</td>
<td>23.50</td>
</tr>
<tr>
<td>Error</td>
<td>20</td>
<td>1193.94</td>
<td>59.697</td>
<td>0.62</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>10587.88</td>
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</tr>
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</table>

Various factors of the environment simultaneously react upon the seeds to germinate in nature. Germination occurs when most of these factors such as light, temperature, water, soil chemical and internal seed factors fall within the optimal range.

The present study suggests that *Caesalpinia pulcherrima* seeds are specific with reference to their requirement. Various treatments tried gave different germination results. Mubarak and Hussain (1980) reported that soaking the seeds in water promoted the germination of Datura. It agrees with our observation for Caesalpinia. It was found that temperature effects germination. Seeds placed at 25 °C and 30°C showed 50% and 60% germination respectively. This agrees with Ilahi, et al. (1987), who reported delayed and poor germination of Erianthus griffithii at low temperature. Therefore, further experiments were carried out at 30°C. The mechanical scarification showed 60% germination and hence enhanced germination. Acid scarification for one hour showed 40% germination equal to control condition, but for three hours acid scarification gave no germination. This result agrees with Siddiqi (1984) who reported burning of small seeds of Erianthus griffithii during acid scarification. Mechanically scarified seeds soaked in water for 12 hours showed maximum germination of 80% and hence it was a best way to get maximum germination of seeds of *Caesalpinia pulcherrima*. But chemically scarified seeds for one and three hours and then soaked in water for 12 and 24 hours respectively showed no germination.

The rising temperature of spring and summer triggers the germination by stimulating the hormones. It is the time when the temperature lies within the optimal range and other conditions favoring germination. A close correspondence in the phenology of the species with the climatic cycle is must. The lack of such coincidence leads to failure of the seeds to germinate and establish. The present study reveals that it is very difficult to precisely predict the specific factors controlling germination, yet the present findings suggest that might be expected under natural conditions.

REFERENCES


