SHORT COMMUNICATION

Dormancy Breaking Treatments to Improve Seed Germination in *Delonix regia* Ref.

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Delonix regia (Bojer ex Hook.) Ref. of family Leguminosae commonly known as flame tree or gulmohar is a popular ornamental medium-sized tree planted in avenues and gardens. The tree is usually grown from seed during rainy season and can also be raised from cuttings. The seed germination is generally poor. The major reasons of poor germination include empty seeds, agro-ecological conditions, time of seed collection and age of mother tree, etc. Further, high degree of dormancy exhibited by seeds is a problem for undertaking plantation work in this species. The primary reason for dormancy is the presence of hard seed coat which makes the seed impermeable to water and hinders the exchange of gases causing mechanical impediment to the growth of embryos. The success of any plantation work, therefore, requires maximum germination thereby necessitating treatments for breaking dormancy.

Removal of hard seed coat or its softening results in enchanced germination. Several physical and chemical treatments have been suggested for breaking the seed dormancy for leguminous species (Rolston, 1978). The present study was undertaken to investigate the response of various physical and chemical seed scarification treatments for improving the germination.

Fresh seeds of *Delonix regia* were procured from forestry college, Sirsi, Karnataka (IC 424910). Seeds were checked for health, insect damage and other physical purity parameters. The seeds were given dormancy breaking treatments. One set of untreated seeds served as control.

Sulphuric Acid (SA): Seeds were immersed in 98 per cent sulphuric acid for 10, 20, 30, 40 and 60 min.(referred as SA_1, SA_2, SA_3, SA_4, SA_5 respectively). The treated seeds were thoroughly washed in running water before the germination test.

Hot Water (HW): Seeds were immersed in a hot water bath at 60°C for one hour, 70°C for 45min, 75°C for 30 min, 80°C for 15min and 100°C for 5min (referred as HW_1, HW_2, HW_3, HW_4, HW_5 respectively) and allowed to cool for 30 min at room temperature.

Boiling Water (BW): Boiling water (at 100°C) was poured over the seeds and allowed to cool down at room temperature for 24 hrs.

Direct Burning (DB): The chalazal end of the seed was carefully charred for one minute directly on flame of Bunsen burner and allowed to cool at room temperature.

Dry Heat (DH): The seeds were subjected to dry heat in an air circulated oven at 65 $\pm$1°C for 16$\pm$1hr

Mechanical Scarification (MS): Seeds were uniformly rubbed for five minutes by a coarse sand paper (No.100).

Mechanical Abrasion (MA): Inner surface and the lid of the petri plates were lined with sand papers (No.100). These petri plates containing seeds were placed over a mechanical shaker set at 240 rpm.

Germination Test: Three replications of 25 seeds each were tested for germination by rolled towel method. Seeds were kept in the dark in a germinator maintained at 30°C and evaluated for germination on the seventh day.

Speed of Germination: The speed of germination as a vigour test was measured by counting the number of seeds that germinated every day and expressed as Mean Germination Time (MGT) in days using the formula $MGT = \sum nd / n$ where n denotes the number of seeds germinating on day d. The reciprocal of MGT (1/MGT) was calculated as germination per day (GPD).

The data was subjected to statistical analyses and means were compared using critical difference values.

Table 1. Effect of various dormancy breaking treatments on germination and mean germination time of *Delonix regia* seeds

Treatment*	Germination (%)	Hard Seeds (%)	Dead Seeds (%)	Mean Germination Time (days)
Control	10	90	0	8.7
Sulphuric acid treatment for 10 min	54	44	2	8.4
Sulphuric acid treatment for 20 min	62	30	8	7.2
Sulphuric acid treatment for 30 min	64	24	12	7.0
Sulphuric acid treatment for 40 min	76	10	14	5.9
Sulphuric acid treatment for 60 min	84	4	12	5.5
Hot water treatment 60°C for one hr	70	26	4	8.0
Hot water treatment 70°C for 45 min	76	14	10	7.1
Hot water treatment 75°C for 30 min	80	20	0	6.2
Hot water treatment 80°C for 15 min	82	14	4	5.8
Hot water treatment 100°C for 5 min	28	12	60	4.6
Boiling water treatment	86	0	14	2.08
Direct burning treatment	70	10	20	1.33
Dry heat treatment	30	60	10	6.83
Mechanical scarification	24	76	0	7.41
Mechanical abrasion	90	10	0	2.36
CD	**6.26**	**4.7**	**2.1**	**0.72**

All the treatments tried in the experiment resulted in decreasing hard seeds and an increase in germination percentage as compared to the control (Table 1). Sulphuric acid treatment resulted in softening of the seed coats thus decreasing hard seeds and consequently increasing the germination percentage. This may be due to the activation of the hydrolytic enzymes present in the seed due to accelerated imbibition resulting in enhanced germination. These observations confirmed the finding of Zodap (1991) and Sudarsan Rao *et al.* (1999). A progressive increase in the germination percentage of the seed with the duration of acid treatment was observed in the present study and treatment for 60 minutes was found to be the best. The Mean Germination Time (MGT) showed a gradual decrease with duration of acid treatment, thus indicating a faster rate of germination in seeds treated for longer duration. Duarte (1974) reported improved germination in *Delonix* seeds after a concentrated sulfuric acid soak for 0.5 to 5 hours.

Hot water treatments break in seed coat dormancy in several legumes has been reported by Rehman *et al.* (1999). Immersing the seeds in hot water at higher temperature for less duration was more effective in increasing germination percentage as compared to longer duration at lower temperature. However, treatment with hot water at 100°C for 5 minutes decreased the germination percentage as the number of dead seeds increased. The optimum germination test result among hot water treatments was obtained for the seed lot treated at 80°C for 15 minutes where the percentage of germination was significantly high (82%), as well as the MGT lower than the other combination of treatments reflecting a higher speed of germination. In another study Millat-E-Mustafa (1989) recommended 90°C water for 10 seconds followed by 24 hour imbibition as a dormancy breaking treatment in *Delonix*.

The treatment with boiling water and mechanical scarification also resulted in increased germination percentage. Maximum germination improvement was achieved with manual scarification with sand paper. These treatments had the lower MGT indicating faster germination. These observations support the finding of Padma *et al.* (1993) in some hard coated acacias. Hot-wire scarification was reported to improve seed germination. Direct burning improved the seed germination rate as well as germination percentage significantly as compared to other treatments in the present study (Sandiford, 1988). The dry heat treatment at a constant temperature of 60°C for 16 hrs and mechanical abrasion treatments also significantly increased germination as compared to the control but were not as effective as other treatments.

Thus, of the several treatments applied to break the seedcoat imposed dormancy in the seeds of *Delonix regia* (Fig. 1) mechanical scarification using sand paper was found to be the best followed by boiling water treatment, sulphuric acid treatment for 60 minutes and hot water treatment at 80°C for 15 minutes. The germination per day was better in direct burning, followed by boiling water and mechanical scarification treatments.

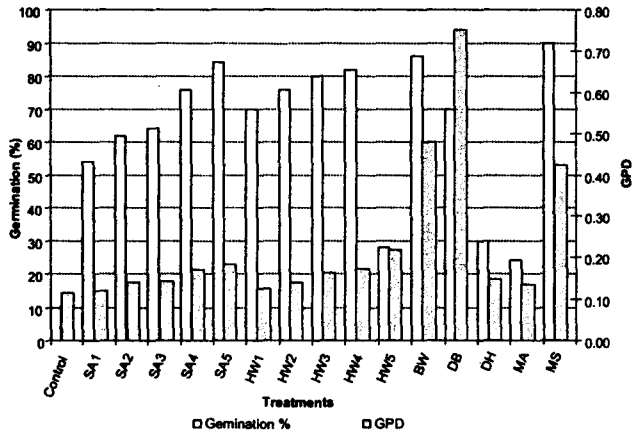

Fig1. Effect of various treatments on germination percentage and germination per day in Delonix regia *seeds (SA_1, SA_2, SA_3, SA_4, SA_5: Sulphuric acid treatment for 10, 20, 30, 40 and 60 min respectively; HW_1, HW_2, HW_3, HW_4, HW_5: Hot water treatment 60°C for one hour, 70°C for 45min, 75°C for 30 min, 80°C for 15min and 100°C for 5min respectively; BW: Boiling water treatment; DB: Direct burning treatment; DH: Dry heat treatment; MS: Mechanical scarification; MA: Mechanical abrasion)*

Of these however, boiling water treatment is simple and requires no special skills and can be easily adopted by nursery men for bulk treatment of seeds for seedling production. Sulphuric acid treatment on the other hand requires special skills and involves risk. Mechanical scarification although is safe is most time consuming treatment especially when large quantities of seeds are to be treated.

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