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Scarification Treatments Employed for Breaking Impervious Status in Seeds of "Honey locust "(*Gleditsia* SPP.)

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Abstract
The valley of Kashmir is witnessing continuous introduction of exotic plant and animal species. The high-tech cross border transport and migration of humans has provided easy pathway to plant species to Witness a wide spread on the world map. *Gleditsia* spp. is deciduous a multipurpose tree species (MPTS) that is useful for wind breaks, shelter belts, erosion control, wildlife food. It can be successfully grown in areas with air pollution, poor drainage, salty soils and drought. Honey locust has also become highly valued as an Agroforestry species in other parts of the world. The soaking of seeds in boiling water for 15 minutes and keeping them in the same water until the water cooled. Treatment (T_1) resulted the maximum germination of 79.00 per cent with corresponding values of germination value and germination energy as 60.32 and 35.32 per cent, respectively. The treatment (T_1) was statistically found significant with all other treatments. The treatment (T_1) was followed by (T_7) treatment i.e. dipping of seeds in concentrated H_2SO_4 for 45 minutes which resulted in germination percentage of 75.41 per cent with corresponding values of germination value and germination energy as 86.23 and 40.21 per cent respectively. The control (no pre-sowing treatment) T_0 recorded lowest values for germination percentage (38.92%), germination value (1.71) and germination energy (8.54%). The seeds possess exogenous dormancy due to its hard stony seed coat which can hampered the germination years together, so to release the dormancy, in seeds of *Gleditsia triacanthos* variety inerrmis collected after the maturity stage, by dint of the present investigations. It can be recommended that boiling water treatment for 15 minutes followed by acid treatment of H_2SO_4 for 45 minutes was best proven treatment in terms of acquiring highest germination percentage

Keywords: Honey locust, dormancy, hard seed coat, seed germination, scarification

Introduction
Forests occupy a place of considerable importance in the economy of the Jammu and Kashmir State and are more popularly known as green gold. The average income generate from the forest of Jammu and Kashmir is about 4269.01 lakhs (Anonymous, 2012). They restore ecological balance of all ecosystems, maintain biological diversity, act as catchments for soil and water conservation and prevent floods also. The state of Jammu and Kashmir is very famous all over the world for its lofty mountains, fascinating valleys, lakes, streams and lush green forests. The State is located in the north-western extremity of India between 32º-17′ and 38º-58′ north latitude and 73º-35′ and 80º-36′ east longitude with an average altitude of 1,586 metres from the mean sea level and annual precipitation of about 794.7 mm. From north to south, it extends over 640 kilometres in length and from east to west over 480 kilometres in breadth (Anonymous, 2003) [1].

The Kashmir Himalaya, known for its indigenous and endemic flora, also provides home to a large number of exotic plants, which exhibit a wide taxonomical and distributional stretch. The inventorization and documentation of its exotic ornamentals has received a little or negligible attention. There is a lot of scope for these exotic ornamentals in the Floriculture and Forestry industry of Kashmir, but lack of authentic identification has been as big hurdle in their scientific management. Exotic ornamentals grown in Kashmir show better performance in both quality and quantity attributes as compared to other regions of India (John *et al*., 2007) [18].

Gleditsia spp. (Honey locust) is a valuable legume tree is well suited for cooler climates. It is very tolerant to lower temperatures ranging from 15 to 24 ºC. The honey locust has deep tap roots and can survive on all but the driest soil, good growth occurs with 500 – 1500 mm of rainfall. It can be successfully grown to elevations of 1,500 meters in temperate areas and has survived at 2,500 metres in subtropical highlands. In addition to fuelwood, this species produces pods with a sweet tasting pulp that are edible by people. The pods can also be used to make high quality feed for animals (Anonymous, 2005) [2].

Physical dormancy is imposed upon the seed from factors outside the embryo including the seed coat and/or parts of the fruit. This type of dormancy is commonly referred to as physical dormancy or hard seeds (Hartmann *et al*., 2002) [16]. Seeds with physical dormancy fail to germinate because the seed is impermeable to water. The outer layer is composed of macrosclereid cells that are responsible for preventing water uptake. Scarification treatments that physically abrade the seed coat or exposure to sulphuric acid are commonly used to alleviate physical dormancy (Geneve, 2003) [12].

Materials and Methods

The investigations conducted on "Honey locust (*Gleditsia* spp.): its distribution, nursery raising and uses in Kashmir" were carried out in the Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar during the year 2009 and 2010.In order to release the seed dormancy, freshly harvested seeds were collected and divided into six seed lots. Each seed lot of 100-seeds were placed in the germinator at an interval of 15 days. Taking first test and the date of collection, germination test for all the six seed lots were conducted accordingly in the seed germinator.

Treatments employed for breaking the dormancy of seeds as follows:

1)	T_0	= Control
2)	T_1 =	Boiling water treatment for 15 minutes
3)	T_2 =	Boiling water treatment for 10 minutes
4)	T_3 =	Cold water treatment for 5 hours
5)	T_4 =	Cold water treatment for 24 hours
6)	T_5 =	Concentrated H_2SO_4 for 20 minutes
7)	T_6 =	Concentrated H_2SO_4 for 30 minutes
8)	T_7 =	Concentrated H_2SO_4 for 45 minutes

Results and Discussion

In order to improve the germination the seeds collected after 1st November were subjected to various pre-sowing treatments as shown in the Table -2 and Fig.1 and plate-1 The perusal of the Table showed that the seeds of the *Gleditsia triacanthos* variety inermis behaved differently under different pre-treatments. It was observed that the treatment (T_1) boiling water treatment for 15 minutes was most effective pre-treatment which enhanced the germination percentage upto 79. The germination value and germination energy for boiling water treatment of 15 minutes were recorded as 60.32 and 35.32 per cent, respectively. This might have happened because immersing seeds in boiling water softened the hard seed coat thereby increasing the permeability of the hard seed coat to water and gases (Kelly *et al.*, 1992) [19]. Azad *et al.* (2010) [3] reported 83 per cent germination in case of *Acacia auriculiformis* when seeds were pre-treated with hot water treatment for 10 minutes. Azad *et al.* (2009) [4] reported that the germination of *Melia azedarch* was enhanced by immersing seed for the duration of 10 minutes in hot water. Similar findings were reported by several authors. Doran and Gunn (1986) [8] reported that the germination of some *Australian acacias* was enhanced by immersing seed for 15 minutes in boiling water (Plate-1).

The acid scarified seeds also gave encouraging results which enhanced the germination percentage upto 75.41. The germination value and germination energy for such seeds were recorded as 86.23 and 40.21 per cent respectively.

The acid scarification may have improved the germination by creating the weak spots on the seed coat through its decomposing action on the seed coat components. These weak spots acted as a passage through which the water entered into the seed and caused expansion of embryonic parts thereby inducing germination (Goncalves *et al.*, 2011) [13]. Barton and Crocker (1957) reported that sulphuric acid treatment improves germination by increasing permeability of the seed coat. Soaking in sulphuric acid have been reported to enhance germination of most African acacias (Doran *et al.*, 1983) [9].

Conclusion

The seeds possess exogenous dormancy due to its hard stony seed coat which can hampered the germination years together, so to release the dormancy, in seeds of *Gleditsia triacanthos* variety inerrmis collected after the maturity stage, by dint of the present investigations. It can be recommended that boiling water treatment for 15 minutes followed by acid treatment of H_2SO_4 for 45 minutes was best proven treatment interms of acquiring highest germination percentage

Table 1: Dormancy in *Gleditsia triacanthos* variety inermis (mean of two years data viz., 2009 and 2010)

Sowing intervals (15 days)	Germination percentage
1st sowing (1st December)	39.10
2nd sowing (15th December)	38.98
3rd sowing (1st January)	38.90
4th sowing (15th January)	38.91
5th sowing (1st February)	38.92
6th sowing (15th February)	38.92
CD(0.05)	NS
SEm±	0.35

NS = Non-significant

Table 2: Pre-sowing treatments for dormancy release of seeds of *Gleditsia triacanthos* variety inermis (mean of two years data viz., 2009 and 2010)

Treatments		Germination percentage	Germination value	Germination energy (%)
T_0	Control	38.92 (38.55)*	1.71	8.54
T_1	Boiling water treatment for 15 minutes	79.00 (63.01)	60.32	35.32
T_2	Boiling water treatment for 10 minutes	71.22 (57.53)	59.19	44.47
T_3	Cold water treatment for 5 hrs	42.15 (48.46)	24.10	22.35
T_4	Cold water treatment for 24 hrs	46.11 (42.75)	27.18	28.13
T_5	Concentrated H_2SO_4 for 20 minutes	58.40 (49.82)	72.31	30.10
T_6	Concentrated H_2SO_4 for 30 minutes	68.10 (55.59	75.29	32.32
T_7	Concentrated H_2SO_4 for 45 minutes	75.41 (60.25)	86.23	40.21
	CD(0.05)	1.06	1.12	1.09
	SEm±	0.36	0.38	0.37

*Figures in parenthesis are arc sine transformed values

Control

Boiling water treatment for 15 minutes

Concentrated H_2SO_4 for 45 minutes

Plate 1: Effect of treatments on dormancy release in seeds of G*leditsia triacanthos* variety inermis

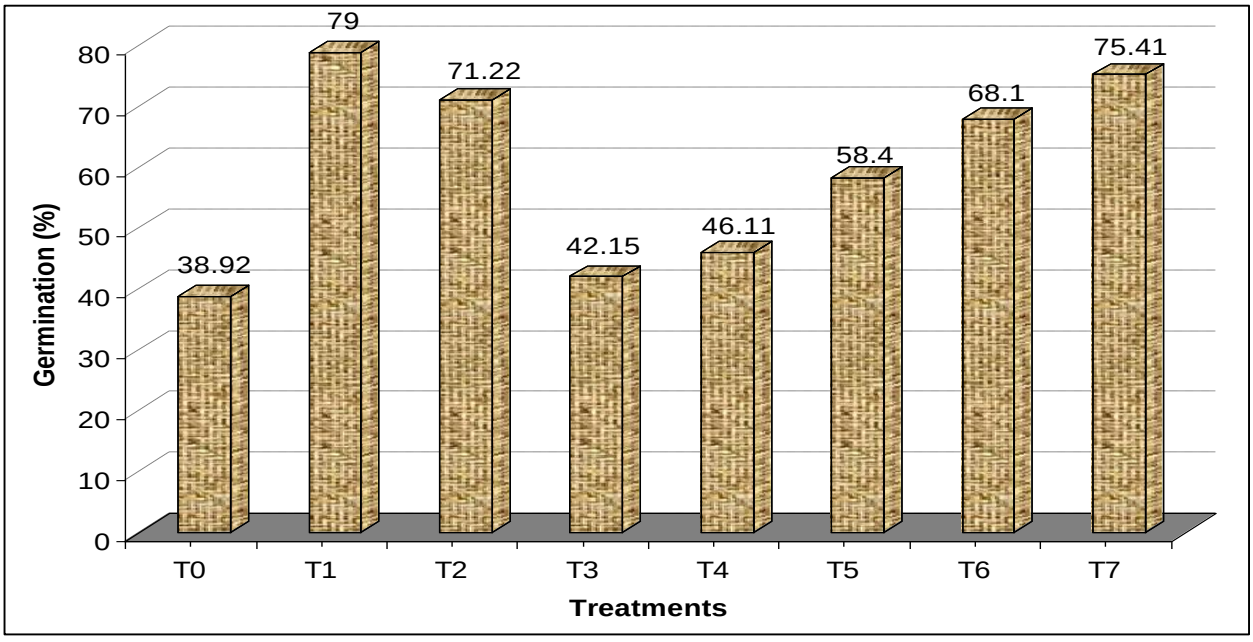

Fig 1: Effect of different treatments for dormany release in seeds of *Gleditsia triacanthos* variety inermis

T_0-Control; T_1-Boiling water treatment for 15 minutes; T_2-Boiling water treatment for 10 minutes; T_3-Cold water treatment for 5 hr; T_4-Cold water treatment for 24 hrs; T_5-Concentrated H_2SO_4 for 20 minutes; T_6-Concentrated H_2SO_4 for 30 minutes; T_7-Concentrated H_2SO_4 for 45 minutes

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