

## Effect of Mechanical and Chemical Treatments on Seed Germination in *Pongamia glabra* L.

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**ABSTRACT** Seeds of *Pongamia glabra*, a medicinally important ornamental tree were subjected to various types of treatments for enhancing seed germination. Mechanical treatments enhanced seed germination upto 85%. On the other hand, treatments with  $H_2SO_4$  and HCl also enhanced seed germination and the seeds treated with concentrated HCl just for a minute showed 91.3 % germination, while seeds treated with hot water (50°C) exhibited highest germination (98%). Scarified seeds kept at 25°C showed 82% germination, while seeds sown at the depth of 3 cm exhibited 86% germination.

**Keywords :** *Pongamia glabra*, mechanical treatment, chemical treatment, seed germination.

*Pongamia glabra* L. (Fabaceae) is a medium sized evergreen tree with short bole and spreading shade crown, bright green glossy leaves. The tree is utilized as fodder and for its pharmaceutical properties. The seed oil of *Pongamia glabra* is used for burning and skin disease. The juice of leaves is prescribed in flatulence dyspepsia, diarrhoea, gonorrhea, cough and remedy for leprosy. It is also planted on road side as well for ornamental purposes. It is propagated either vegetatively or by seeds. However, raising plants from cuttings is quite difficult. The seeds sown in the nursery exhibit only 40-50% germination. Pre-sowing treatments are known to improve 60-65% seed germination in *Pongamia glabra* [1, 2]. Present paper deals with some pre-sowing treatments on seed germination in *Pongamia glabra* L.

### MATERIALS AND METHODS

For present investigation, seeds were collected from 7-8 years old superior *Pongamia glabra* L. trees growing at Agra in the month of July, 2002 and 2003. The seeds were treated mechanically as well as with various chemicals. Effect of temperature was also studied on seed germination. Various pre-sowing treatments made are summarised as under:

1. A small piece (approximately 1mm) of the seed coat from distal end of cotyledon was removed

mechanically using a nail clipper. Such seeds were sown immediately.

2. Seeds were treated with concentrated  $H_2SO_4$  for 15-30 minutes washed in running tap water and sown.
3. Seeds treated with concentrated HCl for 0.5 to 2 minutes washed in running tap water and sown.
4. Seeds were immersed in hot water (50-52°C) for 5-30 minutes and sown.
5. Scarified and unscarified seeds were kept at different temperatures (5°C-45°C) in incubator for 5-10 minutes and sown.
6. The untreated seeds were sown at different depths (2-5 cm).

The treated and untreated seeds were sown in prepared seed beds at Botanical Garden, R.B.S. College, Agricultural Farm, Agra. The experiment was set up in completely randomized design and replicated twice. Data on germination percentage was collected after twenty one days of sowing and statistically analyzed.

### RESULTS AND DISCUSSION

The seeds of *Pongamia glabra* L. were subjected to various pre treatments for enhancing germination

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Table 1. Effect of Seed treatment on seed germination in *P. glabra*.

| Medium                 | Time (minutes) | Seed germination (%) |
|------------------------|----------------|----------------------|
| Concentrated $H_2SO_4$ | 15             | 85.0                 |
|                        | 20             | 87.2                 |
|                        | 25             | 90.0                 |
|                        | 30             | 71.0                 |
| Concentrated HCl       | 0.5            | 89.0                 |
|                        | 1.0            | 91.3                 |
|                        | 1.5            | 84.6                 |
|                        | 2.0            | 80.2                 |
| Hot water              | 5              | 94.0                 |
|                        | 15             | 98.0                 |
|                        | 30             | 93.0                 |
| Control                | —              | 65.0                 |
| C.D (P=0.05)           |                | 2.8                  |

Table 2. Effect of temperature on the seed germination of *Pongamia glabra*.

|                   | Seed germination (%) |      |      |      |      |
|-------------------|----------------------|------|------|------|------|
|                   | Temperature (°C)     |      |      |      |      |
|                   | 5                    | 15   | 25   | 35   | 45   |
| Scarified seeds   | 15.0                 | 30.0 | 82.0 | 65.0 | 17.0 |
| Unscarified seeds | 10.0                 | 15.0 | 71.4 | 57.8 | 10.0 |

Table 3. Effect of depth of sowing on seed germination of *Pongamia glabra*.

| Depth of sowing (cm) | Scarified seeds | Unscarified seeds |
|----------------------|-----------------|-------------------|
| 2.0                  | 64.0            | 55.0              |
| 3.0                  | 86.0            | 63.0              |
| 4.0                  | 77.0            | 47.5              |
| 5.0                  | 74.0            | 42.1              |
| CD (P=0.05)          | 3.76            | N.S.              |

percentage. It is interesting to note that all of the treatments were quite effective in enhancing seed germination percentage. These have been described separately:

#### Mechanical treatment

Removal of small part of seed coat from distal end before sowing enhanced seed germination (85%) as compared to 65% germination with intact seed coat (control).

#### Effect of acid treatment

Treatments with concentrated  $H_2SO_4$  enhanced seed germination (Table 1) significantly. High germination (90 %) was obtained by treatment with the acid for 25 minutes. However, with the increase in the treatment period, germination percentage decreased and there was only 71% germination in seeds treated for 30 minutes.

Similarly, treatments with concentrated HCl showed significant increase. High seed germination percentage (91.3 %) was recorded on treating seeds with concentrated HCl just for a minute. However, with the increase in the treatment time, the seed germination percentage decreased as there was only 80.2 % germination in seed treatment for 2 minutes (Table 1). This may be due to the damage caused by the acid to the embryo.

Acid scarification with concentrated  $H_2SO_4$  for 30 minutes improved seed germination to the extent of 83 % in *Acacia* [3]. However,  $H_2SO_4$  treatments for 60 minutes in *Acaia nilotica* seeds improved germination up to 90% [4]. During the course of present investigation treatment with concentrated  $H_2SO_4$  for only 25 minutes was found to be much effective and enhanced seed germination up to 90%.

#### Effect of hot water treatment

It is evident from the Table 1 that hot water (50°C) treatment enhanced seed germination up to 94 to 98 % and highest germination percentage was observed when seeds were soaked in water for 15 minutes at 50°C.

Soaking of seeds in water at 20°C for 24 hours resulted in maximum seed germination in *Cassia angustifolia* [5]. The increase in germination percentage is probably due to softening of seed coat and making it permeable to water. The lower germination percentage in untreated seeds could be attributed to existence of hard impermeable seed coat or may be due to the presence of inhibitory substances on it [6, 7].

#### Effect of temperature

The data presented in Table 2 indicate that the temperature also plays an important role in seed germination in *Pongamia glabra*. Unscarified seeds kept at low temperature (5°C) showed only 10%



germination while, scarified seeds at the same temperature showed 15% germination. On the other hand, with the increase in the temperature (up to 25°C), the germination percentage increased. Maximum germination in scarified and unscarified seeds at 25°C was 82 and 71.4% respectively. However, germination percentage decreased on keeping the seeds at higher temperatures (35°C-45°C). On the other hand, unscarified seeds kept at 45°C showed only 10% germination. High temperature seems to cause damage to embryo in the seed.

Seeds of various species of *Acacia* were subjected to different temperatures and 30°C was most suitable for effective germination [7]. The effect of temperature on seed germination in some medicinal plant species showed that temperature between 20-30°C was more appropriate for seed germination in different species of *Withania somnifera* [5].

#### Effect of depth of sowing of seeds

Effect of depth of sowing of both scarified and unscarified seeds is shown in Table 3. The scarified seeds exhibited better germination percentage as compared to unscarified seeds sown at different depths. Both unscarified and scarified seeds exhibited highest germination on sowing at the depth of 3.0 cm and it was 86 and 63% respectively. Sowing of seeds at higher depths (4 to 5 cm) resulted in the decrease in germination percentage. This may in all probability be due to the poor aeration and poor moisture availability.

Thus, from the foregoing observations it is clear that treatment of seeds with hot water (50°C) enhances seed germination to the maximum (94-98%), followed by treatment with concentrated HCl for just one minute (91.3%). Similarly, treatment with concentrated H<sub>2</sub>SO<sub>4</sub> and mechanical removal of part of seed coat also enhanced seed germination up to 90 and 85% respectively.

#### REFERENCES

1. VENKATESH, A., M. VANANGAMUDI, K. VANANGAMUDI, R. UMARANI & K.T. PARTIBHAN (1997). Improving seed germination and seedling growth of *Pongamia pinnata* (L) Pierre through pre-sowing seed treatment. *J. Tree Sci.* 16 (2) : 75-80.
2. NAGABHUSHNAM, P. & S.M. REDDY (1999). Impact of Bioinoculants on the growth of *Pongamia* (*Pongamia pinnata*). *J. Ind. Bot. Soc.* 78: 171-172.
3. NATARAJAN, N. & R.S. V. RAI (1998). Studies on maximization of germination in *A. auriculiformis*. *Indian J. Forestry* 11(4) : 304-306.
4. ZODAPE, S.T. (1991). The improvement of germination of some forest species by acid scarification. *Indian Forester* 117(1) : 65-67.
5. CROOKER, W. (1953). Physiology of seed. *Cronica Botanica*, Co Walton.
6. SURYAWANSHI, Y.V., R.B. PATIL & N.D. MOHOLKAR (2001). Study on seed germination procedures in some medicinal plant species. *Seed Res.* 29(2): 141-144.
7. GIRASE, U.S., N.D. JAMBHALE & Y.B. SURYAWANSHI (2002). Germination and Seed dormancy studies in *Acacia* species. *Seed Res.* 30(1): 39-42.