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BRIEF NOTE

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Do pre-sowing treatments affect seed germination in *Albizia richardiana* and *Lagerstroemia speciosa*?

Abstract In this paper, seed morphology and effects of pre-sowing treatments were studied. Matured seeds of the species were collected from healthy trees in the National Botanical Garden, Bangladesh, and treated with five pre-sowing treatments. The average length, breadth and thickness were found to be 0.56±0.03 cm, 0.44±0.009 cm and 0.26±0.008 cm in *Albizia richardiana* King and Prain, and 1.32±0.02 cm, 0.55±0.04 cm and 0.11±0.002 cm in *Lagerstroemia speciosa* L., respectively. Germination was carried out in polybags with a mixture of topsoil, coconut husk compost, coarse sand and fine sand in a ratio of 3:4:1:1. Results revealed that the germination rates of seeds in different pre-sowing treatments were significantly increased compared to those in cold-water treatment in both species. The highest germination rate was found to be 96% in hot-water treatment followed by 87%, 83% and 49% in treatments with scarification, H_2SO_4 and control in *A. richardiana*, respectively. However, the highest germination rate (79%) was found in H_2SO_4 treatment followed by 64%, 62% and 25% in treatments with hot water, scarification and control in *L. speciosa*, respectively. The lowest germination (35% in *A. richardiana* and 20% in *L. speciosa*) was found in cold-water treatment in both cases. Analysis of variance (ANOVA) showed the significant difference among the treatments for both species. It is concluded that hot-water treatment is recommended for seed germination of both species in rural Bangladesh.

Keywords seed dormancy, seed-coat, pericarp, *Albizia richardiana*, *Lagerstroemia speciosa*

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1 Introduction

Pretreatment methods have to be adjusted to individual species and seed lots depending on experiment, knowledge, practices and experience (Schmidt, 2000). Knowledge of biology and physiology of a variety of seed dormancy and the incident in relation to regeneration biology may often recommend the nature of specific seed problems and probable pretreatment methods (Bhardwas and Chakraborty, 1994). There are various kinds of dormancy in which mechanical dormancy restricts to the development of embryo may be overcome by regularly softening either enclosing seed coat or pericarp (Bachelard, 1967). Physical dormancy is caused due to water-resistant seed coat or fruit enclosure, which stops imbibitions and sometimes also gaseous exchange. Physical dormancy differs between species, stage of maturity and degree of drought; pretreatment must be adjusted consequently. Physical dormancy may be overcome by manual scarification of the seed coat by piercing, nicking, chipping, filing or burning with the aid of knife, needle, hot wire burner, abrasion paper (Catalan and Macchiavelli, 1991), hot-water treatment (Kobmoo and Hellum, 1984; Khasa, 1992) or acid treatment (Kobmoo and Hellum, 1984). Among the pioneer forest tree species, photo dormancy is a common phenomenon, which, in practice, can be overcome not by pretreatment but by seed germination under appropriate light conditions (Teketay, 1996). For thermo-dormancy, seeds need exposure to a temperature regime that is often different from that required for definite germination process. Thermo-dormancy can be partially or completely overcome by chemical treatments in some cases (Palani et al., 1995). Seed treatment by soaking in stagnant or running water can leach out chemical inhibitors in fruits and seeds (Yadav, 1992)

In Bangladesh, *Albizia richardiana* and *Lagerstroemia speciosa* are widely used in home gardening and road-side plantation both for public and private greening programs. *L. speciosa* can also grow along the banks of the rivers and streams and in low-lying swampy lands (Zabala, 1990). *A.*

richardiana can alleviate the fuel wood crisis in Bangladesh (Troup, 1921). This tree species is often planted as ornamental trees in Bangladesh and is used for boat building in the country. The attractive form of the tree makes it suitable for shading and as an ornamental species, and *L. speciosa* is one of the most important timber species used for general construction, boat building, carts, furniture, and other purposes. But seed germination rates of these species are usually very low due to seed dormancy (personal contract with the nursery owners). Seed treatment is to ensure that seeds will germinate fast and uniformly with high germination rates (Azad et al., 2006a). The effects of pre-treatments on seed germination of some tropical forest tree species were ever reported by Ahamed et al. (1983), Matin and Rashid (1992), Ali et al. (1997), Koirala et al. (2000), Khan et al. (2001), Alamgir and Hossain (2005), Azad et al. (2006a, 2006b) and Matin et al. (2006). But information on the effect of *Albizia richardiana* and *Lagerstroemia speciosa* seed pretreatment is scant. Low rate of germination and delayed nursery establishment restrict the wide cultivation of the species in both forestry and homestead plantation programs (Alamgir and Hossain, 2005; Azad et al., 2006a, 2006b). A good planning and profitability of forest nurseries depend on the proper techniques that gear up the germination process and attain a more dependable germination seed sown (Koirala et al., 2000; Alamgir and Hossain, 2005). Thus, the objective of our study was to determine the optimum pre-treatment methods to maximize germination rates.

2 Materials and methods

The seeds of *A. richardiana* and *L. speciosa* were collected from mature, healthy, and 25 to 35 years old trees from the National Botanical Garden at Mirpur, Dhaka, Bangladesh, in April 2005. The seeds were then air-dried for 5 to 6 days in the open to reduce their moisture. Afterward, the seeds were separated from the pods manually and dried again in the sun for another week. The collected seeds were checked to remove the discolored and damaged seeds. Healthy dry seeds were used in the following experiments. The germination test was done by sowing the seeds in poly-bags (4 cm × 6 cm). The media of the poly-bags was topsoil, coconut husk compost, coarse sand and fine sand in the ratio of 3∶4∶1∶1. There were five treatments in the experiment, i.e., Treat-1: control, Treat-2: immersion in cold water (room temperature) for 12 h, Treat-3: immersion in hot water (80°C) for 10 min, Treat-4: scarification with sand paper and Treat-5: immersion in concentrated H_2SO_4 (80%) (Azad et al., 2006a, 2006b) for 20 min. A single seed was sown in each polybag. Polybags were kept in shade throughout the experiments. The seeds were sown at a depth of 0.5–1.5 cm, and watering was done manually once a day. Randomized Block Design (RBD) was used in the experiment. There were five treatments including control with four replicates for each treatment. Analysis of variance (ANOVA) and Duncan Multiple Range Test (DMRT) (Duncan, 1955) were carried out to analyze the collected data. The collected data were also treated using MS Excel and Statistical software (version 7.0.61.0.EN). Our experiments were done in April to May 2005. The temperature in the polybags was 33.42°C, and humidity in the working environment was 88.60%. The number of seeds germinated in each treatment was recorded every other day. The starting and finishing dates of germination were also recorded.

3 Results

3.1 Morphological characteristics of seeds

The seeds of *Albizia richardiana* were dark reddish brown in color; its seed shape was elliptical. And the seeds of *Lagerstroemia speciosa* were light brown, fairly hard, with a stiff brittle wing. The average length, breadth and thickness of the seeds were 0.56±0.03 cm, 0.44±0.009 cm and 0.26±0.008 cm, respectively, for *A. richardiana* and 1.32±0.02 cm, 0.55±0.04 cm and 0.11±0.002 cm, respectively, for *L. speciosa*. Dry weight of seeds of *A. richardiana* and *L. speciosa* was $0.037\pm0.006\ g\cdot seed^{-1}$ and $0.012\pm0.006\ g\cdot seed^{-1}$, respectively.

3.2 Seed germination

The highest germination rate (96%) was found in hot-water treatment in *A. richardiana* and 79% in H_2SO_4 treatment in *L. speciosa*. The lowest was found to be 35% and 20%, respectively, in cold-water treatment in both cases. About 87%, 83% and 49% of germination rates were found in scarification with sand paper, immersion in H_2SO_4 (concentrate) for 10 minutes and control condition, respectively, in *A. richardiana* and 64%, 62% and 25% of germination rates were found in immersion in hot water (80°C) for 5 minutes, scarification with sand paper, and control condition in case of *L. speciosa* (Fig. 1), respectively. The cumulative germination rate (%) was shown in Figs. 2 and 3. Germination started 3 days after treatment in control, 2 days in scarification with sand paper, 3 days in hot-water treatment, 4 days in immersion in H_2SO_4 (concentrate) treatment and 4 days in cold-water treatment in case of *A. richardiana.* On the other hand, it started 10 days after treatment in control, 7 days in scarification with sand paper, 9 days in hot-water treatment, 8 days in immersion in H_2SO_4 (concentrate) treatment and 9 days in cold-water treatment in case of *L. speciosa*. In all treatments, germination was completed within 19 days and 22 days, respectively, in *A. richardiana* and *L. speciosa.*

Analysis of variance showed significant difference

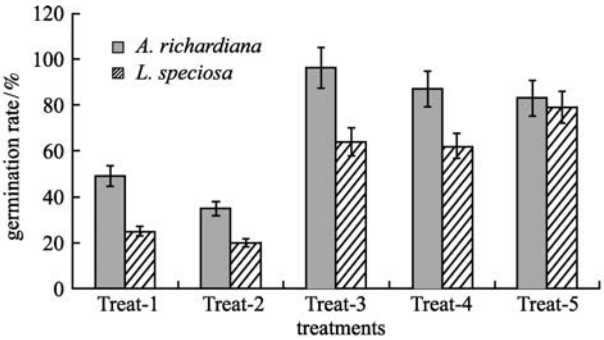

Fig. 1 Comparative germination rate of seeds of *A. richardiana* and *L. speciosa* under five pre-sowing treatments in poly-bag

($P < 0.01$) in germination rates (%) among the treatments of both species. From the Duncan Multiple Range Test (DMRT), in case of *A. richardiana*, it was found that there was no significant difference among hot-water treatment, scarification with sand paper treatment and H_2SO_4 treatment. But they differed significantly with control and cold-water treatment. It also showed that there was no significant difference between control and cold-water treatment (Fig. 2).

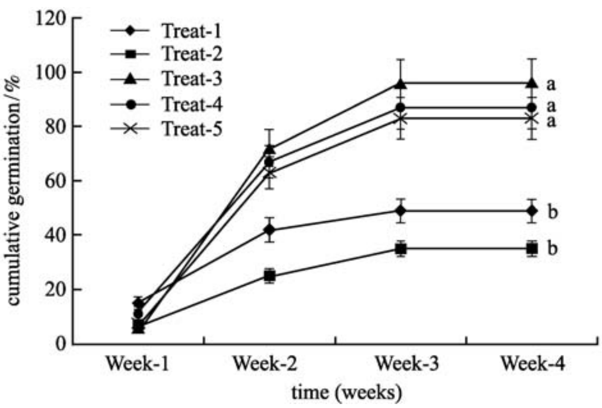

Fig. 2 Cumulative germination rate throughout the germination period of *A. richardiana* under five pre-sowing treatments in poly-bag

Note: Alphabets (a, b) indicate the rank of different treatments from DMRT (Duncan Multiple Range Test).

In case of *L. speciosa*, it was found that there was a significant difference of H_2SO_4 treatment with others. It also showed that there was no significant difference between scarification with sand paper and hot-water treatment, and control and cold-water treatment, but there was a significant difference between hot-water treatment and control; hot-water treatment and cold-water treatment; scarification with sand paper and control; and scarification with sand paper and cold-water treatment (Fig. 3).

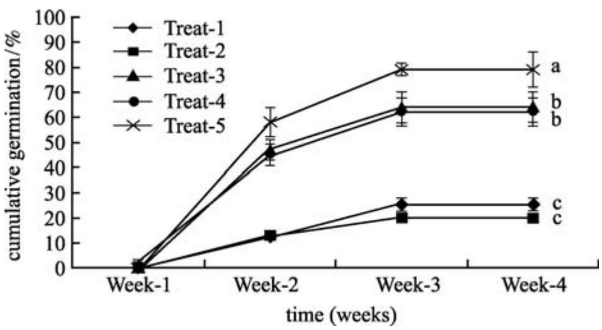

Fig. 3 Cumulative germination rate throughout the germination period of *L. speciosa* under five pre-sowing treatments in poly-bag

Note: Alphabets (a, b, c) indicate the rank of different treatments from DMRT (Duncan Multiple Range Test).

4 Discussion

In case of *A. richardiana*, among the five treatments of seeds, hot water (80°C) immersion (10 min) showed the best germination rate of 96%, followed by 87%, 83% and 49% in scarification with sand paper, concentrate H_2SO_4, and control condition. The lowest germination (35%) was found in cold-water treatment. It was also found from DMRT that there were no significant differences among hot-water treatment, scarification treatment and H_2SO_4 treatment. This may be due to the fact that the outer coat of the seeds was easily and more or less equally thinned, so that germination took place at a similar pattern. Ali et al. (1997) carried out an experiment on hot-water treatment (50°C and boiling for 3 minutes) on *A. procera* and found a 43% seed germination rate. The difference of germination rate may be due to the difference of temperature applied and the boiling time. It showed very clearly that the seed coat of *A. richardiana* was thinned very well at 80°C for a period of 10 minutes. Our previous work (2006a) on the seed germination of *A. lebbeck* indicated that the highest germination was 52% in hot-water treatment, which may be due to the variation of seed coat thickness. Anyhow, it is not difficult to measure the temperature of the boiling water for commercial purposes for the nursery owners. And, it will also be convenient for the local people if it is boiled at 100°C where they need not measure the temperature.

In case of *L. speciosa*, among the five treatments of seeds, concentrated H_2SO_4 showed the best germination (79%). The second, third and fourth highest germinations were found in hot-water immersion at 80°C for 10 minutes (64%), scarification with sand paper (62%), and control condition (25%). The lowest germination (20%) was found in cold-water treatment. From DMRT, it was also found that there were significant differences of H_2SO_4 treatment with others but no significant difference between hot-water treatment and scarification with sand-paper treatments. It may be due to the fact that the softening ability of seed coat by H_2SO_4 was better than hot water and scarification because of the thick and fibrous seed coat. Banik (1992) studied the morphological characteristics of the seeds of *Lagerstroemia speciosa* and found it difficult to separate the seed from the fruit without damaging it. The pericarp is tightly attached to the seed and thinner at the base, but thicker and fibrous towards the apex. In our previous experiment on pre-sowing treatment effect on the seed germination of *Xylia kerrii* in Bangladesh, we found a similar result in 80% concentrated H_2SO_4 treatment for 20 minutes (84%).

5 Conclusion

Among the five pre-sowing treatments, hot-water immersion, scarification with sand paper and acid treatment performed very well for both species, and there was no significant difference among the three treatments in *A. richardiana*, but there was significant difference of acid test with other two treatments in *L. speciosa*, even though no significant difference was found between hot water and scarification test. However, the use of sulphuric acid and scarification techniques is somewhat risky and troublesome. Therefore, it is suggested to apply hot-water treatment at 80°C for a period of 10 min for both species in Bangladesh to get high seed germination rates.

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