Pertanika J. Trop. Agric. Sci. 25(1): 35 - 37 (2002)
ISSN: 1511-3701

Effect of Methanol and Ethanol Pre-Treatments on Seed Germination and Seedling Development of *Dichrostachyscinerea* (L.) Wight and Arn. (Fabaceae)

IDU, M & A.C OMONHINMIN
Department of Botany, University of Benin
PMB 1154, Benin City, Nigeria
E-mail: mcdonald@uniben.edu.

Keywords: Seed germination, methanol and ethanol pre-treatments, seedling

ABSTRAK

Bagi memperbaiki percambahan sebaik mungkin untuk mencapai pemerolehan pembenihan anak benih yang berkualiti, biji benih Dichrostachys cinerea *didedahkan kepada penggemburan tanah dengan alkohol dalam masa pendedahan yang berlainan. Biji benih direndam dalam metanol selama 10 minit mencapai peratus percambahan (72%) dan tenaga percambahan (65%) yang paling tinggi. Begitu juga, prarawatan metanol 5 minit memberi keputusan-keputusan yang baik. Hasil keputusan anak benih daripada rawatan-rawatan tersebut adalah kebanyakannya kelas tenaga tinggi apabila dibandingkan dengan prarawatan alkohol yang lain. Prarawatan metanol dan etanol 2 minit memberi percambahan yang rendah dalam peratusan dan tenaga percambahanm dan anak-anak benih tersebut kebanyakannya adalah dalam kategori tenaga rendah.*

ABSTRACT

To improve germination as well as achieve high nursery recovery of good quality seedlings, seeds of Dichrostachys cinerea *were subjected to alcohol scarification for different exposure times. Seeds soaked in methanol for 10 min achieved the highest percentage germination (72%) and germination energy (65%). Similarly, 5 min methanol pre-treatment gave good results. Seedlings resulting from these treatments were mostly of the high vigour class when compared to other alcohol pre-treatments. The 2 min methanol and ethanol pre-treatments gave low germination in percentages and germination energies, and the resultant seedlings were mostly in the low vigour category.*

INTRODUCTION

Dichrostachys cinerea (L) Wight and Arn. Sub-sp *africana* Brenan and Brummitt (Fabaceae), belongs to a small genus of the sub-family Mimosoideae widespread in the tropical savanna of Africa. It is the ony known member of the genus in Nigeria.

The plant commonly grows as a tree or sometimes as a shrub, often with low branches and dense canopy of branchlets (Keay 1989). This indigenous multipurpose, but under-exploited tree species is important for its fodder and fuel uses, as well as its sand-stabilization ability. Seeds of *D. cinerea* have hard seed coats, which are impermeable to water and gases thereby inhibiting germination.

The interaction between pre-treatments and the degree of hard seededness varies between seeds of the same or different species, and within the same seedlot (Gill *et al.* 1982). The difference in response to dormancy breaking pre-treatments by the seed depends on environmental conditions, the degree of maturation of the seeds and the duration of storage (Gunn 1990). Various methods have been employed in terminating dormancy in seeds with hard seed coats. Alcohol pre-treatments have been reported to be effective in the breakage of dormancy and improvement of germination in seeds, particularly those of the Fabaceae (Etejere *et al.* 1982; Mayer and Poljakoff-Mayber 1989; Gill *et al.* 1990; Idu 1995). However, not much has been reported on the effect of such pre-treatments on germination energy of the seeds and development of the resultant seedlings.

The present study evaluates the effect of various alcohol pre-treatments on germination and seedling vigour of *D. cinerea.*

MATERIALS AND METHODS

Seeds for the study were collected from Gieri, Adamawa State, Nigeria (12°, 20'E, 90°, 14'N). Seeds were removed from ripe pods and stored at constant temperature 28 ± 3°C throughout the experimental period.

Six hundred seeds were divided into two sub-samples of 300 seeds for the methanol and ethanol treatments. Each sub-sample was further divided into one hundred seeds for 3-treatment groups (2,5 and 10 min) exposure period with 5 replicates of 20 seeds each. 100 seeds of 5 replicates served as controls for each pretreatment.

Cleansed seeds were subjected to 70% concentrated methanol and ethanol pre-treatments for 2, 5 and 10 min. respectively and continually stirred. After the designated exposure period, the alcohol was drained and the seeds rinsed thoroughly (five times) in several changes of distilled water before being put up for germination.

Germination technique was as outlined by Dasgupta *et al.* (1976) and Marunda (1990). Treated and untreated (control) seeds were placed on moist filter paper in Petri-dishes under continuous fluorescent light at 10cm above bench level at room temperature. Three (3) mm radicle emergence served as criterion for germination (Idu & Omonhinmin 1999).

Germination was recorded daily for 30 days. After germination and following a randomized design, 10 seedlings were transplanted into segmented wooded trays (240 x 120 x 30cm) filled with sterile soil (pH=6.90) at a planting depth of 2 cm.

Watering was done daily with Harris culture medium. Seedling height measurements were done at 3-day intervals. Seedlings were grouped into vigour categories based on germination and seedling height data. The vigour index of germination was estimated by calculating the daily germination energy percentage maximum (Seward 1980). Seedling height measurement was stopped after 10 weeks.

Analysis of variance for a complete randomized design was carried out on the height data for seedlings grown from ethanol and methanol pre-treated seeds and to test for difference in treatment effect. A comparison of treatments' effect on mean height was carried out using the least significance difference (LSD).

TABLE 1
Germination % and 30 days, germination energies after 8 days and vigour categories based on germination height after 30 days for alcohol pre-treatment

Pre-treatment	*% Germ	Germ En.	HV	LV
Methanol 2 min	31	15	22	9
Methanol 5 min	56	35	32	24
Methanol 10 min	72	65	48	24
Ethanol 2 min	22	9	9	13
Ethanol 5 min	16	6	8	8
Ethanol 10 min	33	15	15	18
Control	12	5	6	8

(Data are average of five replicates)
*% Germ – Percentage germination
Germ. En-P – Germination Energy
Experimental mean height – 6.45 cm after 30 days

NG – Non-germinated seeds
HV – High Vigour above mean
LV – Low Vigour below mean

TABLE 2
Comparison of treatment mean height for *D.cinerea* seedling raised from alcohol pre-treated after 10 weeks

Pre-treatment	Ranked mean	LSD(H)+Mean
Control	5.80 a	7.00
Ethanol 2 min	7.40 b	8.60
Ethanol 5 min	7.60 bc	8.80
Ethanol 10 min	8.60 c	9.80
Methanol 5 min	8.87 d	–
Methanol 2 min	8.90 d	–
Methanol 10 min	9.10 d	–

** Mean followed by the same letter are not significantly different at 5% (LSD)

RESULTS AND DISCUSSION

Table 1 shows the percentage germination achieved after 30 days, germination energies after 8 days and vigour categories after 30 days.

The methanol treatment for 10 min achieved the highest germination percentage of 72% and germination energy of 65%. Five min soaking of seeds in methanol gave 56% germination and germination energy of 35%. The majority of the seeds germinated within the first 9 days. Two min of methanol treatment and 2, 5 and 10 min ethanol pre-treatments gave lower percentage germination and energies. The vigour categories show the methanol pre-treated seeds (2, 5 and 10 min) to be in a higher vigour class than the ethanol pre-treated seeds.

Alcohol stimulates germination in hard coat seeds, particularly those of the Fabaceae, by softening the waxy seed coat, thereby allowing the inflow of water, gaseous exchange and unrestricted expansion of embryonic parts (Mayer and Poljakoff-Mayber 1989). The pre-treatments with high germination energies (5 and 10 min methanol) can be applied in nursery settings to produce uniform planting stock to ensure maximum nursery recovery of high quality seedlings. Poor germination percentage and energies recorded for the ethanol and 2 min methanol pretreatment may be due to reduced severity of the treatment, which did not render the seed coat soft and permeable to water (Marunda 1990; Idu 1995). Such treatments produce seedlings of variable height in the nursery, resulting in poor recovery of good quality planting stock.

The control treatment produced seedlings with the lowest mean height, which suggests poor germination energy from the start of the experiment. This is a further indication that the seeds of *D. cinerea* require pre-treatments before better seedling performance can be achieved.

In conclusion, it is evident that methanol and ethanol pre-treatments had different effects on germination and vigour of *D.cinerea* seeds. The methanol at 10 minutes treatment gave better results and will be an ideal pre-treatment for effective germination of high quality seedlings of *D. cinerea.*

REFERENCES

DASGUPTA, M., R. BASU and R. BASU. 1976. Seed treatment. *Indian Agriculture* **20**: 265-273.

ETEJERE, E.O., M.O. FAWOLE and A. SANNI. 1982. Studies on the seed germination of *Parkia clappertoniana. Turrialba* **32**: 181-185.

GILL, L.S., S.W.H. HUSSAINI and A.H. MUSA. 1982. Germination biology of Mimosa pigra (Leguminosae). *Nigerian Journal of Weed Science* **3**: 11-18.

GUNN, B.V. 1990. Germination pre-treatment of selected Acacia species from the Pilbara region of Western Australia. In *Tropical Tree Seed Research* ed. Turnbull J.W. p. 56-60.

IDU, M. 1995. Seed development and germination responses of two Cassia 1 species. *Org. Int. and Env.* **2**: 65-68.

IDU, M. and A.C. OMONHINMIN. 1999. Effect of oven heat and boiling on the germination and seedling development of *Dichrostachys cinerea* (L.) *Agronomie* **19**: 671-676.

KEAY, R.W.J. 1989. *Treees of Nigeria.* 476p. London: Oxford Science Publ.

MARUNDA, C.T. 1990. Effect of seed pre-treatments on the Development of Acacia auriculiformis and *A. holoserea seedlings.* In *Tropical Tree Seed Research* ed. Turnbull J.W. p. 33-36.

MAYER, A.M. and A. POLJAKOFF-MAYBER. 1989. *The Germination of Seeds.* 207p. London: Pergamon Press Ltd.

SEWARD B.R.T. 1980. The production, handling, testing of forest trees in Zimbabwe. A review of methods and results. *The Zimbabwe Bulletin of Forestry Research:* 8-19.

(Received: 6 January 2000)
(Accepted: 3 October 2001)