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GERMINATION BIOLOGY OF *BAUHINIA MONANDRA* KURZ : EFFECT OF CHEMICAL AND GROWTH PERFORMANCE IN DIFFERENT SOIL TYPES

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Abstract: Germination studies on the seeds *Bauhinia monandra* Kurz were carried out. Seeds were subjected to various treatments like scarification with sand paper, treatment with boiling water, 70% H_2SO_4, HC1, HNO_3, methanol and seed extract. Effect of soil depth, and soil types on germination %, relative growth rate and biomass were also studied. The germination was found to be epigeal. Chemical treatment with methanol and scarification with sand paper resulted in 100% germination. Soil depth of 4 cm and sandy soil with a pH of 7.5 i 0.1 were found to be ideal for high percentage germination of *B. monandra* (60 ± 9.9 and 60 ± 11.5 respectively). Seedling abnormalities like curled and knotty roots were recorded. There was a definite correlation between pod-length and number of seeds per pod.

INTRODUCTION

Increasing demand for forest products, diminishing acreage of forest lands, and increased atmospheric CO2 levels, with attendant concern about global warming, have increased the need for multipurpose tree species with rapid growth rate. *Bauhinia monandra* Kurz (butterfly flower) is a fast growing and stress tolerant species with desirable qualities for urban forestry, bee forage and biomass. It is an introduced species in Nigeria and is now widely planted along roadsides. However, research on the seed germination of this species has been minimal and very little information is available in the literature. The present study is a part of an ongoing project on the germination biology of some multipurpose agroforestry leguminous trees. Earlier contributions in the series are Gill and Bamidele (1981) and Gill *et al.* (1986). The present paper reports on the effect of chemicals and different soil types on germination %, growth performance and biomass production of *Bauhinia monandra.*

MATERIALS AND METHODS

Seeds were obtained from 100 randomly collected mature pods. The parameters such as seed colour, shape, weight; moisture content and viability were studied following Gill *et al.* (1981). Prior to subjecting the seeds to various germination treatments, seeds were surface sterilised with 0.1 % mercuric chloride for one minute and rinsed with distilled water before putting them up for germination. The seeds were subjected to various treatments as listed in Table 1 and techniques are as outlined by Gill *et al.*(1990).

Table 1 Description of the presowing treatments for *Bauhinia monandra*

Treatment
Soaking in 70% conc.H_2SO_4 for 5, 10, 15, 20 min
Soaking in 70% conc.HNO_3 for 5, 10, 15, 20 min
Soaking in 70% conc.HCl for 5, 10, 15, 20 min
Soaking in 95% methanol for 5, 10, 15, 20 min
Soaking in water for 1, 6, 12, 18, 24 h
Soaking in seed water extract for 24 h
Scarification with sand paper for 5 and 10 revolutions

Seeds were placed in boiling water for 1, 2, *3,* 4 and 5 min before putting up for germination.

Soil types and soil depths: Seeds were sown in four different types of soil viz., garden soil, white sand, clay soil and loamy soil. The pH of the different soil types was determined following Chapman (1976).

Seeds were sown at various soil depths of 3, 4, 6, 8 and 10 cm in plastic pots measuring 20 cm x 15 cm containing 2 kg of soil of each type. Surface sowing was carried out by broadcasting the seeds on the soil surface in plastic pots. Sets of 10 seeds with three replicates per treatment were allowed to imbibe in Whatman No.1 filter paper saturated with distilled water throughout the experiment in 9 cm petridishes at room temperature. One of the replicate sets was control in all cases. These seeds were untreated.

The emergence of 1 mm of radicle was used as criterion for germination. Germination records were subsequently taken on a three day interval up to 30 days of sowing.

Biomass estimation: Plants were grown in four different soil types contained in plastic pots in triplicate. Total dry weight of the plants, from each soil type was taken every fortnightly and relative growth rate (RGR) was calculated according to Gregory (1926) which is as follows:

$$RGR = \frac{\log_e W_2 - \log_e W_1}{t}$$

where W_1 = dry weight of first harvest
W_2 = dry weight of second harvest
t = time interval between the first and second harvest

The seedling evalution was done following Bekendem and Grob (1979).

RESULTS AND DISCUSSION

Characteristics of *Bauhinia monandra* seeds are presented in Table 2. The germination was found to be epigeal.

Table 3 shows the effect of mechanical scarification on the germination of *Bauhinia monandra.* It is apparent that the seeds scarified with sand paper (5 and 10 revolutions) resulted in 100% germination which was significant as compared to control at p = 0.01.

Chemical scarification of seeds with 70% conc H_2SO_4, HNO_3 and HC1 acids gave contrasting results (Table 4) with different duration of treatment. The germination percentage was better in H_2SO_4 (43.3 ± 6.6) and HNO_3 (50 ± 11.5) when seeds were treated for five min. However, germination % of seeds treated with HC1 for 15 min after 31 days (40 ± 5.7) was not better than the control (40 ± 17.3) as extrapolated from Table 3. Gill *et al*. (1990) obtained 96.5% germination when seeds of *Mimosa pigra* was scarified with H_2SO_4 for 20 min. Longer exposure of seeds to HC1 (20 min) resulted in no germination. Similar results were recorded by Evanari (1957).

Treatment with methanol for 20 min gave the best result and after 4 days

Table 2, Phenological data of *B. monandra*

Pod length (cm)	20.26
No. of seeds per pod	16.62
Seed shape and colour	Oval and black
Mean weight (g/seed)	0.23
Moisture content of seed (%)	16.4

Table 3. Germination percentage of B. *monandra* seeds scarified with sand paper

Scarification revolution	Days 4	7	10	13	16	19	22	25	28	31
0	10	20±5.7	20±5.7	26.6± 11.7	30± 11.5	30± 11.5	30± 11.5	30± 11.5	40± 17.3	40± 17.3
5	53.3± 8.8	86.6± 8.8	100	100	100	100	100	100	100	100
10	93.3± 6.6	96.6± 3.2	100	100	100	100	100	100	100	100

of sowing 10% germination was obtained (Table 4). This could be due to the dissolution of the waxy layer present on the seed which might have been a potential inhibitor to germination. Seed treatment with methanol for 5 min also resulted in 100% germination after 7 days (Table 4), whereas the control was 40% after 30 days of sowing. The effect of methanol and mechanical scarification with sand paper proved that any method of increasing the permeability of the seed coat to water and gases would result in breaking the seed dormancy and thus increase the percentage seed germination. Though the results obtained with chemical and mechanical scarification were similar, the chemical scarification is preferable over mechanical as it reduces the chances of any physical damage to the embryo which is quite possible during mechanical scarification.

Seed extract treatment on seed germination seemed to have had negligible effect on percentage germination of seeds of *Bauhinia monandra* . The % germination was only 23.3 whereas control was 40%. Similar result was reported by Gill *et al.*(1986) for *Acacia farnesiana*.

Soaking of *Bauhinia monandra* seeds in water for 24 h enhanced the rate and % germination (33.3 ± 6.6). This value was better than the other soaking times (1, 6, 12 and 18 h) at p = 0.01 but not better than the control (40 ± 17.3). According to Berrie & Drennan (1971) hydration improved germination due to increase in hydrolytic enzyme activity by pretreatment.

Table 5 shows the results of the effect of soil types on the % germination of *Bauhinia monandra* seeds and the total biomass production of the plants. It is apparent that sandy soil with pH of 0.7 ± 0.1 gave the best % germination (60 ± 11.5). It is clear that the relative growth rate for sandy soil is better (0.05 g/day) than the others. This result is expected because sandy soil has higher porosity than loamy soil and the % germination (60 ± 11.5) thus was highest in sandy soil. Similar results were recorded for *Celosia argentia* (Pandya and Baghela, 1973).

Total dry weight in g/plant depends on the water holding capacity as well as mineral content in the soil. Relative growth rate (RGR) of the plants studied in the differept soil types showed some fluctuations. The relative growth rate (Table 5) was more in sandy soil (0.05 g/day) and least in garden soil (0.02 g/day). This may be due to the porous nature of the sandy soil by which

Table 4. Germination percentage of *B.monandra* seeds treated with 70% H2SO4, HNO_3, HC1 and 95% methanol

Treatment	Period of soaking, min			
	5	10	15	20
70% conc. HC1	33.3	28.6	40±5.7	0
70% conc .H_2SO_4	43.3±6.6	20	20	16.6±3.3
70% conc. HNO_3	50±11.5	33.3±6.7	30±9.9	36±6.6
95% methanol	100	100	100	100

Table 5. Effect of soil types on the % germination of seeds and growth of *B.monandra*

Soil types	Germination	Dry weight, g		Relative growth rate, g/day
		1st harvest	2nd harvest	
Garden	30	0.1	0.07	0.02
Clay	43±3.3	0.09	0.05	0.04
Loamy	33±16.6	0.07	0.04	0.04
Sandy	60±4.5	0.1	0.08	0.05

they store more photosynthates. Though the garden soil is relatively porous and contains humus it did not promote higher percentage germination (40%) and that could be the reason for the low relative growth rate. The RGR in the other two types of soil (clay and loamy) were very close (0.04) to that of sandy soil. RGR is also dependent on nutrient status of the soil.

Seeds given boiling water treatment failed to show any sign of germination. Failure of seeds of *Bauhinia monandra* to respond to boiling water treatment may be due to loss of viability.

The seed emergence studies in various soil types indicated that the soil depth of 4 cm was the best for *Bauhinia monandra* seed germination. This might be due to the action of soil microbes which aid the decay of the sed coat enabling seedling emergence. Similar results were reported for *Calliandra portoricensis* by Gill *et al.* (1992). However, 94.5% of sed germination at a depth of 2 cm for *Mimosa pigra* was recorded by Gill *et al.* (1990). Soil depth of 10 cm gave 53.3% seed germination but the seedlings were weak and lean as compared to those obtained when seeds were sown at the depth of 4 cm.

Surface broadcasting resulted only in 16.6 % seed germination only after 25 days of sowing. Gill *et al.* (1992) reported no germination during surface sowing in *Calliandra portoricensis.*

Seedling evaluation is very important from the horticultural point of view. Eventhough the seeds may be capable of germinating but they may not produce healthy seedling if abnormal seedlings are transplanted in the field. They may fail to mature into healthy trees. In this study, 71.6% ± 2 seedlings were normal while 28.4 % ± 2 showed abnormal growth. The abnormal seedlings included 3.4 % with missing primary roots, 21.5% bent primary roots and 3.5% missing cotyledon. So far seedling evaluation has been neglected by plant scientists. Among the leguminosae multipurpose trees, only *Robenia pseudoacacia* has been studied from this point of view (Beckendem and Grob, 1979).

In conclusion, we can suggest that chemical treatment of seeds using methanol for up to 5 min, sowing at soil depth of 4 cm, or sowing in sandy soil with a pH of 7.5 are ideal for germination of this species.

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