GERMINATION BEHAVIOUR OF GUIZOTIA ABYSSINICA (L.F.) CASS. (NIGER) AS INFLUENCED BY SOME SPECIAL TREATMENTS

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Abstract

Purpose: The purpose of this paper is to investigate the germination behaviour of *Guizotia abyssinica* (L.f.) Cass. (Asteraceae) commonly known as Ramtil (H) and Niger (E). It is an important oil-yielding plant, known for its medicinal as well as commercial value and special treatments.

Design/methodology/approach: Various phyto-hormones and NPK were used to determine the germination profile of the species.

Findings: The seed germination increased after pre-sowing treatments and a remarkable increase in germination percentage was recorded. The findings reveal that maximum germination percentage (90%) was noticed in phyto-hormones and NPK treatments; germination percentage was comparatively poor in dark conditions and sand.

Originality/value: The species is endangered and will disappear from the Indian sub-continent very soon, therefore the need to increase the germination profile and to increase the productivity of the plant is a great challenge.

Keywords: *Guizotia abyssinica, Seed dormancy, Germination, Seedling growth, Phyto-hormones, NPK*

Paper type: Research paper

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INTRODUCTION

Growth has been considered the most critical event in the life cycle of plants. Varied germination needs are definite expressions of adaptations of the species so that it can cope with environmental condition (Datta, 1980; Srivastava, 2002). In the majority of medicinally important plants various treatments during pre-treatment of seeds play a significant role in their growth and yield (Kivadasannavar *et al.*, 2007; Kumar and Chaudhary, 1991; Laddha *et al.*, 2008; Singh, 1991; Tiwari and Bajpai, 2004; Getinet and Sharma, 1996).

Guizotia abyssinica (L.f.) Cass. is an oil yielding plant cultivated in some parts of India. The growth and yield of the species is greatly influenced by a number of physical and chemical factors including bio and chemical fertilizers (Getinet and Sharma, 1996).

The present study is related to the scientific evaluation and efficacy determination of *Guizotia abyssinica* (L.F.) Cass. The selected plant is either used by traditional practitioners for its effects or cultivated in large quantities for its oil. This study was designed to develop the germination profile of the plant using various pre-treatments with seeds and to evoke the seed dormancy, which confirms and provides a scientific basis to establish and explore some new effects of germination profiles. So far, no systematic work has been carried out on the germination profile of this plant as influenced by various pre-treatments of seeds. Therefore, the present work was undertaken.

MATERIALS AND METHODS

COLLECTION AND AUTHENTICATION OF SEEDS

The seeds of the selected plant were collected in the month of August 2012 from the Jawahar Lal Nehru Krishi Vishwavidhalay (JNKVV) Agriculture University, Jabalpur, M.P., and identified and authenticated in the Department of Pharmacognosy, Ujjain Institute of Pharmaceutical Sciences, Ujjain, M.P. They were deposited in our laboratory as voucher specimen No. PCog/GA/001.

SEED VIABILITY TEST

The seed was tested for its quality before sowing into the field. A viability test was performed for this purpose (Misra, 1968). The methods used to test seed viability are noted below:

Method I: The seed was cut at one side and the embryo was dissected out. The embryo was placed between two pieces of filter paper in a petri dish for a few days; if the embryo develops within 2–3 days, this implies that the seed is viable.

Method II: The viable seeds respire, which causes colourless tetrazolium dyes to change into highly coloured compounds by chemical reduction. The reaction does not occur if the seed is dead. A 0.1 % solution of TTC (2,3,5-triphenyl tetrazolium chloride) was prepared in distilled water. The seeds were cut in half longitudinally through the centre of the embryo. The halves were immersed in the above solution in a petri dish and put in the dark for a few hours at pH 6–7.

DETERMINATION OF SEED MORPHOLOGY

Seed size: The seeds were measured on a scale and an average of 10 seeds was recorded to determine the seed size of the selected plant.

Seed shape: The seed shape was studied as per the standard of Mukherjii (2001).

Seed weight: The seeds were measured using a balance and an average of 10 seeds was recorded to determine the seed weight of the selected plant.

SOWING OF SEEDS

Ten seeds were sown in petri dishes with special treatments and various parameters were recorded as per method described. The following treatments were done with the seeds:

DETERMINATION OF GERMINATION DAYS

After the germination of seeds in each treatment, the duration of seed germination was recorded (Misra, 1968).

DETERMINATION OF GERMINATION PERCENTAGE

The germination percentage is the proportion of seeds that germinate from all seeds subject to the right conditions for growth. Germination percentage can be calculated by the formula given below:

S/No.	Abbr.	Treatments
1.	C=Control	Seeds germinated in petri dish with cotton using water
2.	T1=G1	Seeds germinated in petri dish with cotton using IAA (Indole acetic acid) conc. 0.02 M
3.	T2=G2	Seeds germinated in petri dish with cotton using IAA (Indole acetic acid) conc. 0.04 M
4.	T3=5% NaCl	Seeds germinated in petri dish with cotton using 5% NaCl solution
5.	T4=NPK	Seeds germinated in petri dish with cotton using NPK solution
6.	T5=Sand	Seeds germinated in petri dish with sand
7.	T6=Black soil	Seeds germinated in petri dish with black soil
8.	T7=Light	Seeds germinated in petri dish with cotton in light condition
9.	T8=Dark	Seeds germinated in petri dish with cotton in dark condition

Table 1. Pre-treatments on seeds of *Guizotia abyssinica* (L.f.) Cass

$$\text{Germination \%} = \frac{\text{Total no. of seeds germinated}}{\text{Total no. of seeds sown}} \text{ X } 100$$

DETERMINATION OF SEEDLING GROWTH (RADICLE/PLUMULE LENGTH)

Seedling growth is the total length of radicle and plumule after the germination of seeds. The length of radicle and plumule was measured after seven days and the length of seedling growth is recorded in cm (Misra, 1968).

RESULTS AND DISCUSSION

Plant species propagate through seeds. Normally they are considered easy to propagate and are very persistent because of the abundance of their seeds, which continue to germinate and grow fast until conditions become unfavourable. The survival of plant species depends upon the production of sufficient numbers of viable seeds to survive the hazards faced by the species in the environment. Production of abundant and small seeds is a common adaptation that ensures a high probability of dispersal and re-infestation. Seeds possess a variety of special germination mechanisms adapted to changes in temperature, soil moisture, aeration, exposure to light, depth of burial of seeds, etc. When conditions are unfavourable

for germination, seeds can remain dormant and delay germination. The ability to recognize seeds was always important and has become even more essential in the modern scientific world. Without it, there would be little merit in perfecting plant-growing methods.

Guizotia abyssinica (L.f.) Cass. (Niger) belongs to the family Asteraceae and is a fixed oil-yielding medicinal plant. The scanty availability of information on this plant prompted its study following pre-sowing seed treatment. In the present study, pre-sowing seed treatment of the selected plant *Guizotia abyssinica* (L.f.) Cass. with various treatments was found to produce significant results in all the considered parameters and appreciably enhanced all parameters studied. However, certain treatments failed to bring about any significant effects. Before sowing, the seeds were tested for their viability in order to check the quality of the seeds. The seeds passed the viability test. Before sowing into the field, the seeds were test for quality, for which a viability test was performed. The results showed that the procured seeds were viable as both tests were positive (Table 2). Seed morphology (seed shape, size, weight and colour) were studied and are presented in Table 3.The results indicate that the average length of the seeds is 0.57cm and the average width is 0.12cm. They have a needle-like shape and are light brown to black in colour, with an average weight of 2.52 mg. The results of the percentage germination, radicle length and plumule length are given in Tables 4–6 and are also shown in Graphs 1– 3.

Table 2. Seed viability test for *Guizotia abyssinica* (L.f.) Cass

S/No.	Methods	Result
1.	I	The seeds were germinated within 3 days
2.	II	Colour changed to dark brown

Table 3. Seed morphology for *Guizotia abyssinica* (L.f.) Cass

S/No.	Parameters	Result
1.	Seed size	
	Seed length	0.57 cm
	Seed width	0.12 cm
2.	Seed shape	Needle-like
3.	Seed weight	2.52 mg
4.	Seed colour	Light brown to black

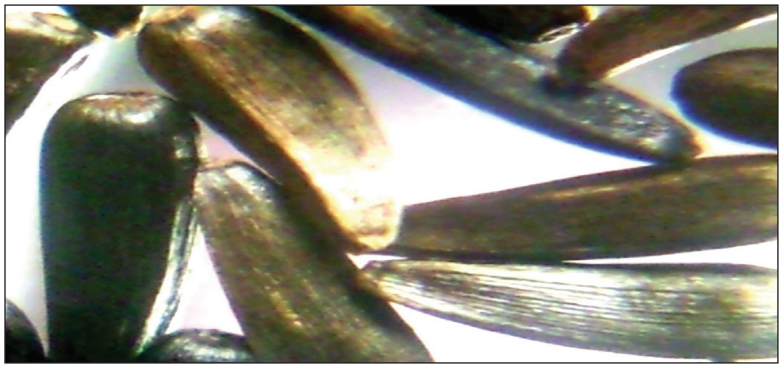


Fig. 1 Morphology of seeds

S/No.	Treatments	No. of seeds sown	Duration of germination (in days)	No. of seeds germinated	Germination percentage
1.	C=Control	10	3	7	70
2.	T1=G1	10	1	9	90
3.	T2=G2	10	4	5	50
4.	T3=5% NaCl	10	2	8	80
5.	T4=NPK	10	1	9	90
6.	T5=Sand	10	4	2	20
7.	T6=Black soil	10	3	4	40
8.	T7=Light	10	2	8	80
9.	T8=Dark	10	5	1	10

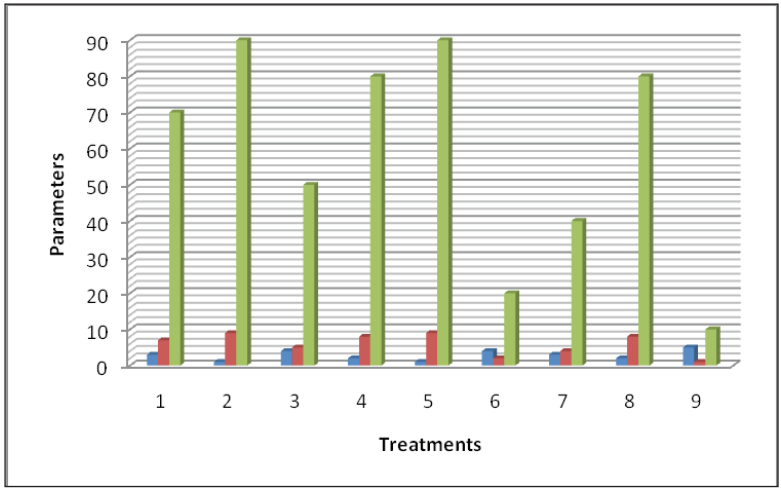
Table 4. Effect of special treatment on germination behaviour of *Guizotia abyssinica* (L.f.) Cass.

S/No.	Treatments	No. of seed sown	Radical length (cm)										
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	X
1.	C=Control	10	4.6	4.6	4.0	6.9	4.0	3.1	3.0	-	-	-	4.31
2.	T1=G1	10	5.7	4.3	4.9	4.7	5.6	5.8	2.5	5.1	4.9	-	4.83
3.	T2=G2	10	3.1	5.7	4.5	5.5	3.2	-	-	-	-	-	4.40
4.	T3=5%NaCl	10	5.1	2.9	6.9	4.9	5.9	4.3	4.9	6.2	-	-	5.13
5.	T4=NPK	10	4.4	4.7	3.4	1.0	4.2	2.5	3.7	4.1	4.5	-	3.61
6.	T5=Sand	10	2.1	1.9	-	-	-	-	-	-	-	-	2.0
7.	T6=Black soil	10	3.4	3.4	1.9	2.4	-	-	-	-	-	-	2.77
8.	T7=Light	10	1.9	2.3	2.9	3.1	3.7	4.6	2.7	5.5	-	-	3.33
9.	T8=Dark	10	1.7	-	-	-	-	-	-	-	-	-	1.7

Table 5. Effect of special treatment on radical length of *Guizotia abyssinica* (L.f.) Cass.

Table 6. Effect of special treatment on plumule length of *Guizotia abyssinica* (L.f.) Cass.

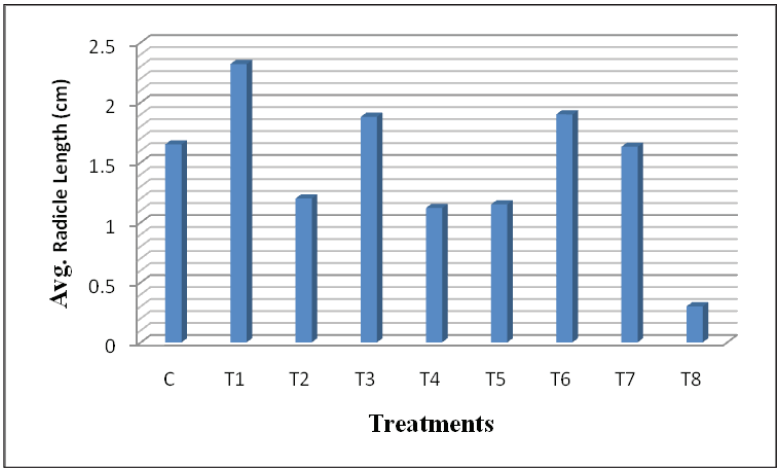
S/No.	Treatments	No. of seed sown	Plumule length (cm)										
			S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	X
1.	C=Control	10	1.5	1.2	1.4	2.6	1.8	1.6	1.5	-	-	-	1.65
2.	T1=G1	10	1.9	2.6	2.5	3.6	2.1	2.1	2.2	2	1.9	-	2.32
3.	T2=G2	10	1.5	1.7	0.9	0.7	-	-	-	-	-	-	1.20
4.	T3=5%NaCl	10	1.4	2.4	2.1	1.4	1.7	1.1	1.0	2.1	-	-	1.88
5.	T4=NPK	10	1.5	1.0	1.2	0.8	0.6	3.5	0.1	0.3	1.1	-	1.12
6.	T5=Sand	10	1.2	1.1	-	-	-	-	-	-	-	-	1.15
7.	T6=Black soil	10	1.4	2.8	1.7	1.7	-	-	-	-	-	-	1.90
8.	T7=Light	10	1.1	2.1	2.1	2.0	1.9	2.3	0.7	0.9	-	-	1.63
9.	T8=Dark	10	0.3	-	-	-	-	-	-	-	-	-	0.30



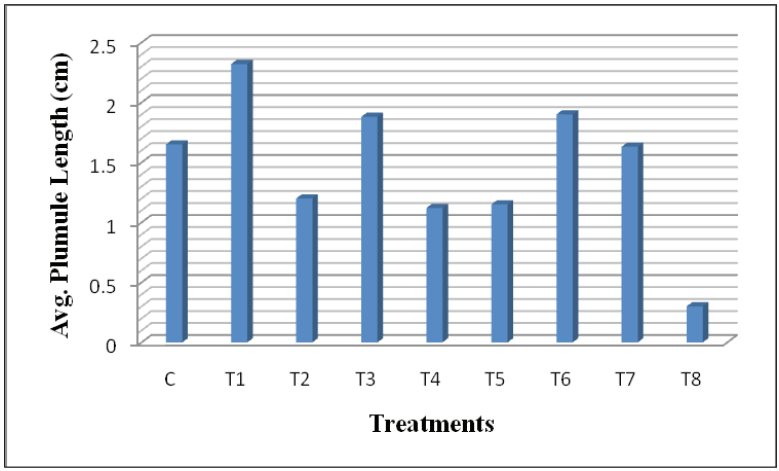
Graph 1. Germination behaviour of *Guizotia abyssinica* (L.f.) Cass. as influenced by special treatments

CONCLUSION

The external morphological characters can be used as a key for the identification of the taxa based on seed characters. The data can also be used in the construction of a key to the species. These morphological characters are helpful to identify the seeds of medicinal plants. The analysis revealed that germination behaviour differed in all the treatments. The germination percentage was found to be a maximum of 90% in two treated groups T1 and T4 while the minimum was found



Graph 2. Effect of special treatments on radical length of *Guizotia abyssinica* (L.f.) Cass.



Graph 3. Effect of special treatments on plumule length of *Guizotia abyssinica* (L.f.) Cass.

to be 10% in T8 followed by 20% in T5 as compared to the control at 70%. Germination was noticed in all treated seeds. Germination was found to be very poor in dark, sand and black soil, as was the duration of germination, i.e., seed dormancy was found to be very poor in these treatments as compared to other treated groups. The radicle length was found to be a maximum of 5.13 cm in T3 followed by 4.83 cm in T1, whereas the control had an average length of 4.31 cm. Similarly, the plumule length was found to be a maximum of 2.32 cm in T1 followed by 1.88 cm in T3, whereas for the control the length was

Fig. 2. Effect of special treatments on germination of *Guizotia abyssinica* (L.f.) Cass.

1.65 cm. The analysis revealed that the eight pre-treatments differed in germination behaviour. In general, it was found that seeds germinated faster in growth hormone treatment than other treatments, indicating the positive response of phyto-hormones in hastening the germination process. Again, the germination increased with the increase in germination percentage.

Hence, it was concluded from the present investigation that phyto-hormone treatments will enhance the germination percentage and other parameters studied, which will play a key role in developing the germplasm of the selected species and help to save the biodiversity of the species via cultivation.

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