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Effect of Sulphuric Acid (H_2SO_4) on the Germination and Growth of Castor (*Ricinus communis* L.) Seed

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ABSTRACT

Laboratory trials were carried out to evaluate the corrosive effect of sulphuric acid upon the seed coat of castor seed. Different concentration of sulphuric acid solution were prepared and the castor seeds were treated for different time period in varying concentration. Castor seed treated for 2 minutes at 70% H_2SO_4 solution gave the result of highest germination (84%) percentage. Germination percentage was found very less for the seeds treated with 70% concentrated H_2SO_4 solution for 5 minutes and 10 minutes. Length of the radicle found to be highest in 50% H_2SO_4 solution treated for 2 minutes and lowest in 70% H_2SO_4 solution treated for 10 minutes. Length of the plumule is found to be highest in 50% H_2SO_4 solution treated for 2 minutes and lowest in 30% H_2SO_4 solution for 10 minutes.

Keywords Seed, Treatment, Germination, Radicle, Plumule.

INTRODUCTION

Castor is the primary food plants of eri silkworm. The silkworm name 'Eri' itself derived from the word 'Era' which means castor, the main food plants of eri silkworm. Castor is a warm season crop and is favorable for cultivation in northeast India due to its climate and acidic nature of the soil. Castor (*Ricinus communis* L.) is a species of annual or perennial flowering plant and belongs to the family *Euphorbiaceae*. It is a fast growing tree and grows up to 5–12 meter. The seeds of castor posses a hard coat which rendered the germination period. Poor germination due to seed dormancy is one of the major constraints for its large scale production. The castor seeds mature sequentially within and between the racemes, leading to a variation in maturity stages at harvest (Severino and Auld 2013). Castor capsule contains three seeds which are oval, square or elongated in shape. The seed has a tiny and brittle testa (seed coat) enclosing a white kernel (Bolaji *et al.* 2012). Color of the seeds may be white, dark brownish-red, brown, dark chocolate, red or black but usually several colors occur as very attractive mottle on the testa.

Seed dormancy in castor is manifested in slow,

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Table 1. Data showing the germination percentage of castor seeds at different concentrations and control.

		70% H_2SO_4			50% H_2SO_4			30% H_2SO_4			10% H_2SO_4		
Days	Con-trol	2 min	5 min	10 min	2 min	5 min	10 min	2 min	5 min	10 min	2 min	5 min	10 min
2	5	15	2	-	5	6	5	7	-	1	6	1	-
3	8	17	2	1	15	8	7	9	8	10	8	9	6
4	10	20	3	-	18	10	9	13	13	10	16	12	6
5	12	23	2	-	20	11	12	17	14	11	18	14	7
6	12	23	1	-	24	12	13	17	16	11	18	14	7
7	13	24	-	-	24	12	11	18	18	12	18	16	8
8	14	25	-	-	25	12	11	19	18	12	19	16	8
Total	74	147	10	1	131	71	67	100	87	67	103	82	42
Germina-tion %	42	84	6	0.57	75	40	38	57	50	38	59	47	24

erratic and low germination (Lago *et al.* 1978). Treatments like scarification and stratification are needed to overcome external and internal dormancy (Baskin and Baskin 1998). In spite of the seed germination biology of many plant species has been studied (Nikolaeva and Rasumova 1985) but still there is shortage of available literature concerning that of castor. The effect of various seed treatment on imbibition, germination and growth have been investigated in this study to evolve a suitable method for breaking seed coat dormancy to achieve maximum growth and germination in castor seed. The studies on the effect of sulphuric acid on the growth and germination of castor seed is very scanty. Therefore, an attempt has been done to determine the effects of sulphuric acid on castor seed germination.

MATERIALS AND METHODS

Distilled water was added to the concentrated sulphuric acid accordingly for preparation of dilute sulphuric acid of different concentrations. Healthy seeds of Non-bloomy red1(NBR1), most preferred variety of eri silkworm were collected from Boko area of Kamrup district for the experiment. The experiment was conducted in the Sericulture Training Institute, Titabor. Seeds were surface sterilized through distilled water as this is found to be effective. Floating test was done to determine the healthy and unhealthy seed. The seeds of castor were soaked in distilled water and the filter papers were capped moist during the experimental period. The base of the each petri dish was placed with round germinating paper, moistures with water and a little amount of the extract of sulphuric acid in dilute form. The control seeds and the treated seeds were placed in the petri dish separately. All conditions that are necessary for germination were provided. The seeds were treated with control solution (distilled water), 70%, 50%, 30%, 10% H_2SO_4 solution in different periods to observe the effect of acid on the percentage of germination and length of radicle and plumule of seeds in the interval of 2 days to 8 days. Twenty five numbers of seeds were taken per treatment. Germination percentage was calculated by the following formula :

Germination percentage = Number of seeds germinated /total number of seeds sown for germination × 100

RESULTS AND DISCUSSION

Castor seeds treated in acid solution and in control solution is showed in Table 1. The percentage of germination in control solution were 42% and it was followed by 84% in 70% acid solution for 2 minutes treatment, 6% in 5 minutes treatment and 0.57% in 10 minutes treatment, 75% in 50% solution for 2 minutes, 40% for 5 minutes and 38% for 10 minutes. In 30% solution the percentage of germination were 57% for 2 minutes, 50% for 5 minutes and 38% for 10 minutes treatment. In case of 10% H_2SO_4 solution, 59% for 2 minutes, 47% for 5 minutes and 24% for 10 minutes periods respectively. It was noted that the seeds treated with the acid for 2 minutes in 70% solution showed the highest percentage (84%) of germination. This may be due to the corrosive effect

Table 2. Effect on average growth of length (in mm) of radicle and plumule in different concentrations of sulphuric acid solution at different levels.

	Length of radicle in mm			Length of plumule in mm		
Solution	2 min	5 min	10 min	2 min	5 min	10 min
Control	-	-	3.58	-	-	2.10
70%	2.20	2.24	1.25	3.37	2.60	2.52
50%	4.03	3.01	1.63	4.01	2.76	2.32
30%	2.77	2.57	2.00	2.37	2.25	2.05
10%	1.70	1.80	1.55	2.90	2.90	2.70

of acid acted upon the seed coat resulted in quick germination.

Table 2 clearly indicates that the length of radicle and plumule were adversely affected at high concentration of H_2SO_4 solution. The adverse effect was seen when treated with 70% H_2SO_4 solution for 10 minutes. Growth of the radicle is very much suppressed in all concentrations when treated for 10 minutes. Length of the radicle found to be highest in 50% H_2SO_4 solution treated for 2 minutes and lowest in 70% H_2SO_4 solution treated for 10 minutes.

Harrington (1916) reported that the acid treated seeds were found to be permeable to water quickly. Treatment of seed for long duration is harmful to cotyledon as well as to embryo (Amalraj 1986). Chemical scarification is an effective way of breaking dormancy resulting from seed coat. Dipping seeds in to strong acid such as sulphuric acid and then ringing the seeds with water can break the seed dormancy (Devlin and Witham 1997). Pego *et al.* (2016) reported that sulphuric acid treated *Canna edulis* seedlings have hypogeal germination with development of fasciculate roots with root axes differentiated at 4 days after sowing. Nourmohammadi *et al*. (2019) found that *Gleditsia caspica* seed immersion in sulphuric acid for 60 min was the best treatment for both improving the germina¬tion factor and producing healthy, high quality seedlings. Salazar and Ramirez (2019) revealed that *Schizolobium parahyba* seeds soaked in 10% sulphuric acid for 1 and 5 minutes exhibited higher germination values than seeds soaked in 20% for 10 minutes. Seeds soaked in 75% and 50% chloridric acid solutions for 5 and 10 minutes had an overall higher and faster germination than seeds soaked in 25% for 1 minute. Rusdy (2016) reported that sulphuric acid treatments increased germination and improved early seedling growth of *Leucaena leucocephala*. Ito *et al*. (2011) found that scarification with concentrated sulphuric acid and matric priming improved the strawberry seed germination performance under unfavorable temperature conditions.

CONCLUSION

Sulphuric acid (H_2SO_4) has direct effect in the growth and germination of castor seeds. With the increasing concentration and duration of H_2SO_4 treatment the effect in growth and germination became much adverse. From the experiment it was observed that in control solution the percentage of germination was average and it was highest in 70% H_2SO_4 solution treated seed for 2 minutes. Marked reduction and even total suppression of emergence of plumule and radicle was seen at 70% H_2SO_4 solution in 10 minutes which may be due to the adverse effect of sulphuric acid in metabolism of seed germination and growth. It may be concluded that the pre-treatment with concentrated sulphuric acid would bring good results in castor seed germination.

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