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Effect of chemical pre-treatments (HCL AND H_2SO_4) on seed germinability in *Jatropha Curcas* (L.)

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ABSTRACT

Seed propagation studies were carried out on percent germination, shoot length and root length of *Jatropha curcas*. Seeds were treated with different chemical treatments and effect of seed age. Seeds of *J. curcas* treated with HCL, H_2SO_4 and hot water showed significantly more germination and shoot length. Similarly the chemical treatment H_2SO_4 (50%) at different time period worked significantly better than other treatments.

Key words: Seed Propagation, chemical treatment, *Jatropha curcas.*

INTRODUCTION

Jatropha curcas L., known as Physic nut, is a drought resistant perennial plant belonging to family Euphorbiaceae (Kaushik and Roy 2007).The plant grows well on poor soils. It has a long history of cultivation in tropical and subtropical regions of the world. *Jatropha curcas* is a succulent that sheds its leaves during the dry season and well adapted to arid and semi-arid condition and often used for erosion control. It is truly a multipurpose tree species fit for agro forestry and other afforestation programme (Kaushik et.al 2006). Extract from the plant is known for their effect on the wide range of organisms including mouse, nematodes and insect pests, (Kumar et.al 2007). Most of the species of Jatropha are capable of producing seeds with high oil content, but only few species of Jatropha particularly *Jatropha curcas* found highly suitable for large scale cultivation because of its high oil content about 30-40 % which can be combusted as fuel without being refined. *Jatropha curcas* is mainly cultivated for the production of oil (27 – 40 %) that has fuel substitute (Achten *et al* 2007). The seeds of *J. curcas* have highly potentials as a fuel substitution. However, the seeds in general, are toxic to human and animals. Curcin is a toxic protein isolated from the seeds and also contains a high concentration of phorbol esters (Adolf *et al*., 1984; Makkar *et al*., 1997). Two new esterases (JEA and JEB) and a lipase (JL) were isolated from the seeds (Staubmann *et al*., 1999). In Egypt, the seed is used for the treatment of gout jaundice and arthritis (Khafagy *et al*., 1977). The seed of *J. curcas*

has also been used traditionally for the treatment of many ailments including inflammation, burns and convulsions (Osoniyi and Onajobi, 2003). The seed oil can be applied to treat skin diseases and eczema and to sooth rheumatic pain (Heller, 1996).

The oil is also used externally for the treatment of dropsy, sciatica and paralysis (Mujamdar *et al*., 2000). The 36% linoleic acid (C18:2) content in *J. curcas* kernel oil is used for skin care. The oil has a strong purgative action and also is commonly used for skin diseases and to sooth pain such as pain caused by rheumatism. In South Sudan, the seeds as well as the fruits are used as a contraceptive or as abortifacient (List and Horhammer, 1979).

The problem of great concern regarding this plant is a number of seeds produced per plant is very low. Besides, the plant produces seeds after 2-3 years approximately, depending on environmental conditions and seeds have a limited viability (50%) within 15 months (Palanivelu et.al 2005). *Jatropha curcas* oil is a strong alternative for diesel replacement (Reddy and Ramesh, 2005). Among various bio-diesel plants listed above the species of *Jatropha* in general and *Jatropha curcas*. in particular have become popular for the cultivation in the region of Maharashtra.
Looking to its question of low seed viability, to improve the seed germination, have need of healthy, quick growing of seedlings in short span of time from their sowing time. Keeping this in view, the aim of this study was to investigate the effects of chemical pre-treatments on germination behavior of the seed.

MATERIALS AND METHODS.

1) Collection of seed material

In the present study, seeds of the germplasm JS – 12 of *Jatropha curcas* were obtained from Jain Irrigation System Ltd., Jain Agri Park, Jain Hills Jalgaon (M.S) .

2) Sowing of treated seeds

The seeds were sown during the months of February to March and September to October. The seeds were sown in polybags. The preferred polybags having size of 22.5 x 12.5 cm were used for sowing. Polybags were filled with mixed soil and well decomposed Farm Yard Manure in equal proportion in the ratio (1:1:1). The drainage holes were provided at the bottom of polybags. The treated as well as untreated seeds were sown in each polybags at a depth of 1.5 to 2.0 cm (Kaushik and Kumar, 2003), (Paramathma *et al.,* 2004) and (Gurunathan, 2006).

RESULTS AND DISCUSSION

In order to understand the effect of seed age on the germinability. The seeds of *Jatropha curcas* of different age were used for germinability in pot soil and results are given in table 1.It is clear from table 1 that the seeds with age 1-6 month shows maximum germinability in case of *Jatropha carcus*. The seeds germinability was constant up to 12 month in *J. curcas* Similarly after 6 to 24 months there was reduction in percent germiniabilty in *J. curcas* .

Table 1: Effect of seed age on seed germinability in *Jatropha curcas* .

	Species of Jatropha		
Seed age (month)	*Jatropha curcas*		
	Percent Germination	Shoot length (cm)	Root length (cm)
1-6 Month	60	22.88	15.72
12 Month	60	21.32	13.42
24 Month	40	18.96	11.69
S.D.	11.55	1.97	2.02
S.E. ±	6.67	1.14	1.17
C.D.(P=0.05)	17.13	2.93	3.00

In order to study the effect of HCL, H_2SO_4 and Hot water on seed germinability , the seeds of *J. curcas* were treated with 50% of both acid concentration and hot water at (50ºc ± 2ºc), percent germinability, shoot length and root length in cm were observed. The results are mentioned in table 2. It is clear from result summarized in table 2 that seeds of *J. curcas* treated with 50% HCL, 50% H_2SO_4 for four minutes were proved favourable to express maximum germinability, while same treatment found highly effective for shoot and root length. Seed treated with hot water for 6, 10 ,15 and 20 minutes showed equally more or less effective.

It is also interesting to mentioned that as there was increase in time of treatment of HCL and H_2SO_4, reduction in percent germinability was seen. As the time of treatment of HCL and H_2SO_4 was maintained about 6 minute there was reduction in present germinability in *J. curcas.*

It is clear from table 3 that the seeds of *J. curcas* treated by HCL showed 05 different types of fungi namely *Alternaria alternata, Aspergillus flavus, A. fumigatus, Aspergillus niger, Fusarium moniliforme, F. oxysporum, Mucur* spp, *Rhizopus stolonifer.* The seeds of *J. curcas* treated by H_2SO_4 showed 06 different types of fungi namely *Alternaria alternata, A. fumigatus, Aspergillus niger, F. oxysporum, Mucur* spp, *Rhizopus stolonifer similarly* the incidence on seeds treated by Hot water showed 06 different types of fungi namely *Alternaria alternata, Aspergillus flavus, Aspergillus niger, F. oxysporum, Mucur* spp, *Rhizopus stolonifer.* Gaikwad and borkar (2018) studied and concluded that the seeds treated by KOH showed 09 different types of fungi namely *Alternaria alternata, Alternaria tenuis , Aspergillus niger, A. fumigatus, Aspergillus flavus, Fusarium moniliforme, F. oxysporum, Mucur* spp, *Penicillium* spp,. *Rhizopus stolonifer* and seeds treated by NaOH showed 08 different types of fungi namely *Alternaria alternate, Aspergillus niger, A. fumigatus, Aspergillus flavus, F. oxysporum, Mucur* spp, *Penicillium* spp., *Rhizopus stolonifer.* Gaikwad Rajesh (2019) concluded that the seeds treated by IAA+ IBA for 600 ppm, showed 07 different types of fungi namely *Alternaria alternata, Aspergillus niger, Aspergillus flavus, A. fumigatus , F. oxysporum, Mucur* spp, and *Rhizopus stolonifer.* Seeds treated by IAA+ NAA for 400 ppm showed 07 different types of fungi namely *Alternaria alternate, Aspergillus niger, A. fumigatus, Aspergillus flavus, F. oxysporum, Mucur* spp, *Rhizopus stolonifer .* It is clear from literature that during the course of association of micro-organisms with seeds either in the field during storage the microbes utilize and deteriorate seeds contents in many cases as reported in case of *Arachis hypogea* (Lalitha Kumari *et.al.,* 1970).Similar to oil seeds degradation of medicinally important chemicals from the seeds of medicinal plants have been reported to be degraded by the seed mycoflora as reported by (Sinniah *et al* 1983)., in case of *Strychnos nux vomica* seeds.

Table 2: Effect of HCL, H_2SO_4, Hot water on seed germinability in *Jatropha curcas*

Time (min)	*Jatropha curcas*								
	HCL (50%)			H_2SO_4 (50%)			Hot water (50ºc ± 2)		
	Percent Germination	Shoot length (cm)	Root length (cm)	Percent Germination	Shoot length (cm)	Root length (cm)	Percent Germination	Shoot length (cm)	Root length (cm)
0.5	50	19.21	16.33	80	20.51	16.37	--	--	--
2	100	27.55	17.07	100	26.38	17.34	--	--	--
4	100	28.69	19.96	100	29.62	17.71	40	16.10	12.98
6	40	17.55	12.07	80	18.32	12.67	100	18.77	12.67
10	20	12.42	10.11	20	16.53	10.18	100	24.48	16.22
15	--	--	--	--	--	--	100	28.88	18.16
20	--	--	--	--	--	--	80	22.91	14.52
S.D.	42.37	11.73	8.05	45.77	11.77	8.37	46.19	11.58	7.51
S.E. ±	16.01	4.43	3.04	17.30	4.45	2.92	17.46	4.38	2.84
C.D. (P=0.05)	41.16	11.40	7.82	44.46	11.43	7.51	44.87	11.25	7.30

Table 3: Incidence of fungi on infected seeds of *Jatropha curcas*

Fungi	***Jatropha curcas***		
	Incidence on seeds treated by HCL	**Incidence on seeds treated by H_2SO_4**	**Incidence on seeds treated by Hot water**
Alternaria alternata	+	+	+
Aspergillus flavus	+	-	+
Aspergillus fumigatus	+	+	-
Aspergillus niger	+	+	+
Fusarium moniliforme	-	--	--
Fusarium oxysporum	-	+	+
Mucur spp	-	+	+
Rhizopus stolonifer	+	+	+

-- =Absent + = Present.

The information regarding the identification of seed mycoflora which was found to be responsible for spoilage of seeds is available in the literature (Jain *et.al.,* 1982) isolated *Fusarium oxysporum* from the seeds of mustard. (Heller 1992) isolated Julus spp. from total loss of seedlings of *Jaropha curcas*. Chavan and Danai (1993) isolated *F. moniliforme*, *F. dimerum*, *F. roseum*, *F. semitectum* from seeds of groundnut. Gaikwad 2019) studied that the different chemical treatments as (IAA+ IBA and IAA+ NAA) on seed germination and seedling growth of *Syzygium cumuni*. It was observed that IAA + IBA at 600 ppm favoured maximum seed germination. On the other hand shoot length and root length was maximum at IAA+ NAA at 400 ppm. (Paramathma *et.al* 2004) suggested that healthy and bold seeds sown at 1.5 to 2.0 cm depth showed maximum germination. While Swamy and Singh (2006) reported maximum percent germination in *J. curcas* seeds soaked 24 hours in cold water for 2-3 minute in boiling water. Gaikwad and Borkar (2018) Pre-sowing treatment of seed plays vital role to enhance the seed germination under nursery conditions. Among the pre-sowing treatments, the best treatment for the sowing of seeds is 10% KOH and 10% NaOH for 10 minutes favored maximum seed germination of *Syzygium cumuni*.

CONCLUSIONS

Pre-sowing treatment of seed plays significant role to enhance the seed germination under nursery conditions. Among the pre-sowing chemical treatments, seeds of *J. curcas* treated with HCL, H_2SO_4 and Hot water showed significantly more germination and shoot length .Therefore, pre-sowing treatments of seeds with HCL, H_2SO_4 and hot water may be recommended for plantation scheme.

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