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ORIGINAL ARTICLE **OPEN ACCESS**

Effects of Gamma Rays on Cotyledonary Leaves of *Jatropha curcas* L.

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ABSTRACT
Under a petro-crop improvement programme seeds of Jatropha curcas have been treated with different doses of gamma rays and sown in randomized block designed beds along with control. Different types of morphological abnormalities as well as delay in seed germination were recorded in treated populations. The effect of gamma rays on initial development of Jatropha curcas especially on the cotyledonary leaves is discussed in this research paper.
Keywords: Gamma Rays, Cotyledonary Leaves, Jatropha curcas

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INTRODUCTION

Since the oil crisis in 1974, most oil-importing countries have been highly motivated to develop alternative source of energy to meet their natural energy needs. The issue of looming energy crisis around the world,has prompted researchers to pay more attention to research in an alternative energy resources[1&2].*Jatropha curcas* Linn.(Family –Euphorbiaceae) tree or under shrub grows practically allover India under a variety of agro-climatic conditions and it is commonly found in most of the tropical and subtropical regions of the world. Physic nut (*Jatrophacurcas* L.), an energy plant that has high oil content in seed, is one of the prime targets under investigation by various researchers. Apart from its high oil content, physic nut is also capable of growing in infertile soil making it one of the ideal trees which should be promoted for planting to provide non edible oil for domestic use. However, one of its shortcoming trait is that these seeds with high oil yield do not reach maturity synchronously, contributing to a low yield of fresh nut per plant during harvesting and requiring high labour. In recent years systematic efforts have been made by several research workers to use vegetable oils as fuel in engines [3-10].

A number of options for alternative liquid fuel production have been considered in many countries. Some are based on processing of fossil fuels such as coal, shale and natural gas reserves while others are based on biomass, a renewable source of fuel.

Jatropha curcas L (family Euphorbiaceae) is a shruby plant commonly grown in semi-wild condition as a hedge plant around cultivated fields and in the vicinity of villages. 'Curcas oil' extracted from *Jatropha curcas* seed has been tested as an efficient substitute fuel for diesel engine [11&12]. Systematic efforts have not been made so far for increase in oil production by using present day knowledge of plant breeding and increased agronomic experiences. This plant was included in the crop improvement programme through induced mutation and polyploidy breeding. The present communication reports the effects of different doses of gamma rays on cotyledonary leaves of *Jatropha* curcas to assess its sensitivity to mutagens.

MATERIAL AND METHOD

Dry seeds of *Jatropaha curcas* Linn. (Euphorbiaceae) were exposed to 6, 12 and 18 Krad gamma rays (Cobalt-60, radiation source) at National Botanical Research Institute Lucknow and sown in randomize block designed beds. Equal number of un-irradiated seeds were sown which served as control. Data were recorded on germination, growth and characters of cotyledonary leaves just after appearance and other morphological and seed characters.

RESULT AND DISCUSSION

Effect of gamma rays on cotyledonary leaves is given in table-1.Generally in all the conditions seedlings had two cotyledons, each of which were opposite in position. However, development of few tricotyledonary seedlings were also observed in some control and gamma ray treated population. The frequency of tricotyledonary leaves bearing plants were 5.88, 7.54, 10.86 and 5.00 % in control and 6, 12 and 18 Krad gamma ray treated population respectively. Different types of abnormalities were also recorded in cotyledonary leaves. The abnormalities included changes in position, shape and size of cotyledonary leaves. Different types of fission and fusion of cotyledonary leaves were also recorded. The length and width of cotyledonary leaves were reduced after irradiation with gamma rays and the reduction in most of the cases were significant. A maximum reduction of 41.24 and 61.87 per cent of control was recorded in length and width respectively after the highest exposure of 18 Krad. Petiole length of cotyledonary leaves were also significantly reduced except in 6 Krad where it was significantly increased.

Radiation induced changes in cotyledonary leaves and stomata have been reported earlier in different crops[13&14]. Such abnormal nature of cotyledonary leaves and stomata may be due to disturbances in the metabolic pathway or damage to the actively dividing cells due to irradiation. Increase in the number of stomata in both lower and upper surfaces at low dose exposure may be due to the stimulatory action of the gamma radiation. Such type of stimulatory action of gamma rays on some other characters of *Jatropha curcas* has already been reported [15]. Spontaneous mutation may be responsible for the appearance of tricotyledonary leaves in control population. The frequency of tricotyledonary leaves varied pattern lessly in the present treatment. The initial effects of gamma rays, assessed on the basis of cotyledonary abnormalities, indicate positive attribute for inducing other variability in desired character.

Table-1.Effect of gamma irradiation on cotyledonary leaves of *Jatropha curcas*

Character		Krad- Gamma Rays			
		Control	6	12	18
Tricotyledonary plants(%)		5.88 ±3.29	7.54 ±3.63	10.86 ±4.59	5.00 ±3.44
Size of cotyledonary leave (cm.) ± S.E.	- Length	7.25 ±0.12	7.11 ±0.14	5.48*** ±0.11	4.26 ±0.17
	- Width	5.35 ±0.08	5.09 ±0.09	3.70*** ±0.08	2.04 ±0.12
	- Length of petiole	3.10 ±0.09	3.34* ±0.08	2.19*** ±0.09	1.52*** ±0.10
Number of stomata in mm^2 area (±S.E)	- Upper epidermis	16.58 ±1,09	26.03*** ±1.09	30.47*** ±1.67	17.55 ±0.93
	- Lower epidermis	67.97 ±3.11	96.65*** ±2.47	114.33 ±3.62	66.88 ±2.47
Abnormal stomata(%)	- Upper epidermis	0.00	1.56	1.58	3.33
	- Lower epidermis	0.00	4.96	2.30	5.43
Number of chloroplast per guard cell (±S.E.)	- Upper epidermis	12.77 ±0.24	13.45 ±0.26	12.40 ±0.19	12.55 ±0.21
	- Lower epidermis	13.64 ±0.39	14.08 ±0.36	13.80 ±0.29	13.55 ±0.21
Length of Stomata (µm±S.E.)	- Upper epidermis	38.60 ±0.68	39.00 ±0.67	39.20 ±1.28	37.70* ±0.63
	- Lower epidermis	38.39 ±0.75	37.50 ±0.71	35.60*** ±0.34	34.70* ±1.85
Width of Stomata (µm±S.E.)	- Upper epidermis	28.70 ±0.76	28.80 ±0.61	28.54 ±1.15	29.30 ±1.00
	- Lower epidermis	28.90 ±0.76	27.70 ±0.52	26.30** 0.42	26.60* ±0.84

*=P<0.05, **=P<0.001, ***P<0.0001

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