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GAMMA IRRADIATION INDUCED PHYSIOLOGICAL VARIABILITIES IN *CANAVALIA GLADIATA* (Jacq.) DC. (Swordbean)

B. F. RODRIGUES

Department of Botany, Goa University, P. O. Bambolim
GOA-403 202, INDIA.

ABSTRACT

The effect of gamma irradiation on plant attributes were recorded at 4, 8, 12, 16, 24 and 32 KR in *Canavalia gladiate*. Plant attributes recorded were germination percentage, survival percentage, seedling height, chlorophyll content, yield and various morphological abnormalities encountered.

INTRODUCTION

Gamma irradiation has since been widely used for producing mutations in crop plants. However, there are differences in the radiation tolerance among species and even among verieties of the same species (Sparrow, 1966). In the present investigation, effect of gamma irradiation on germination percentage, survival percentage, seedling height, chlorophyll content and yield have been studied. Besides these characteristics, various morphological abnormalities in vegetative plant parts of gamma irradiated plants have also been recorded.

MATERIAL & METHODS

Matured seeds of *C gladiata* were irradiated with gamma rays from a Cobalt 60 source at a dose rate of 5.48 KR per minute. The seeds were then soaked in water and were allowed to germinats in petri dishes at 28°–30°C. Germination percentage and survival percentage (at maturity) was recorded. The seeds were planted in pots (26cm in diameter, one seed/pot). Seedling height was recorded on the 15th day after sowing. Chiorophyll content in the leaves was estimated on the 60th day after sowing to the method of Arnon (1949). Various morphological abnormalities were recorded. Yield characteri tics were recorded at maturity.

RESULTS & DISCUSSION

Gamma irradiation affected germination percentage in *C. gladiata*. Lower doses of gamma irradiation (4KR &8 KR) increased germination percentage, while higher doses (12KR 32KR) showed a gradual decline in percent germination. Although plants treated with 32 KR showed germination (36.6%), none of them could survive (Table 1). Similar observations have been recorded earlier in other plant species (Rajput, 1973. Torne & Bhandari, 1976). The retardation in germination percentage at higher doses may be possibly due to the mutagen interference in the metabolic pathways. The mutagen may cause disturbance in genetic and physiological processes leading to death of cells. Except for the lower doses (4KR & 8KR) seedling height

Tabie 1. Effect of gamma irradiation on growth characteristics (Germination %, Survival % & Seedling growth), Cholorophyll content and yield characteristics of *C. gladiata*.

Dose rate in KR	Germination percentage	Survival percen-age	Seedling* height in cm	Chloro-phyll-a mg/gm	Chloro-phyll-b mg/gm	Total Chloro-phyll	Average No. of pods/ plant	Average pon length in cm	Average No. of Seeds/pod
0	53.3	36.7	15.1±1.16	0.865	1.085	1.950	4.6±1.21	19.8±1.09	6.3±0.76
4	73.3	53.3	26.4±2.15	1.194	1.835	3.029	8.6±1.14	27.3±2.86	9.4±0.84
8	60.0	42.8	18.0±1.35	0.974	1.184	2.158	5.7±1.09	23.6±2.36	7.6±0.57
12	50.4	28.6	13.1±1.02	0.743	0.997	1.740	4.4±0.57	14.2±1.21	4.3±0.45
16	46.6	21.2	12.7±0.97	0,706	0.049	1.655	4.1±0.45	12.3±1.58	3.8±0.39
24	43.3	13.3	2.3±0.16	0.693	0.929	1.622	3.2±0.36	10.8±1.03	3.7±0.36
32	36.6	00.0	—	—	—	—	—	—	—

*Readings taken after 15 days of sowing.

± Indicates standard deviation.

Table 2. Effect of gamma irradiation on plant organs of *C. gladiaia.*

Dose rate in KR	Plant part	Irradiation effect
0	Stem	—
	Leaf	—
4	Stem	Well developed fasciations; Excessive branching.
	Leaf	Larger in size as compared to control.
8	Sttm	—
	Leaf	Showed mosaic-like colour changes; Distorted venation; Puckering between the veins: Abnormal curvatures and most commonly reduced lamina with one or two leaflets often missing.
12	Stem	—
	Leaf	Much smaller as compared to control.
16	Stem	—
	Leaf	Showed mosaic-like colour changes; Distorted venation; Puckering between the veins; Abnormal curvatures; Fusion; Reduced lamina with one or two leaftets often missing.
24	Stem	Dwarfing and excesive branching; Woody, brownish in colour.
	Leaf	Showed mosaic-like colour changes; Smaller in size as compared to control.

showed a gradual decrease with increasing amount of gamma irradiation (Tabie 1). The decrease in seedling growth could be attributed to the destruction of auxins caused by ionizing radiations. Gordon (1957) has opined that the radiation which induced physiological changes may involve a number of inter-related non-specific factors, such as inhibition of DNA-synthesis and variation in the auxin level.

The effect of gamma irradiation on chlorpohyll metabolism was measured in terms of chlorophyll content mg/gm fresh weight of leaf.

Chlorophyll-b was recorded to be more in amount than in chlorophylla-a in all the casses investigated. The data presented in Table I indicates that lower doses (4KR & 8KR) of gamma irradiation stimulated chlorophyll synthesis. However a gradual decrease in chlorophyll content was observed at higher doses of gamma irradiation.

Various morphological abnormalities in the vegetative plant organs of gamma irradiated plants have been recorded. (Table II) Similar observations have been made earlier (Gunckel, 1957).

Increased yield was observed in plants irradiated with lower doses (4KR & 8KR) of gamma irradiation, as compared to control plants, while a gradual decreaes in yield was observed in plants treated with higher doses of gamma irradiation (16KR-24KR) (Table I).

Genetic variability increased with the increase in radiation doses in treated population due to imbalanced genes or chromosomal aberrations or both at post radiation stages as also reported by Burnham & Hageberg, (1959). The differences in the intensity of variation in the different plant attributes at the same dose level in irradiated population might be explained on the basis that the different characters of plants are governed by different genes or set of genes Similar findings were reported by OKA *et al*, (1958).

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