

THE EFFECT OF GAMMA RADIATIONS ON SEED GERMINATION & SURVIVAL RATE IN *CHRYSANTHEMUM CARINATUM*

¹Reena Modi* and ²Gunmala Gugalia

¹Department of Botany, Sangam University, Bhilwara, Raj. (India)

²SDM P.G. Girls College, Bhilwara (Raj.)

*Author for Correspondence: reenamodi018@gmail.com

ABSTRACT

Dry seeds (moisture 6.6%) of *Chrysanthemum carinatum* (2n=18) were irradiated with different doses (5KR, 10KR, 15KR, 20KR, 25KR, 30KR, 35KR, 40KR, 45KR) of Gamma radiation at BARC Mumbai in January 2023. The aim of the study is to determine the induction of some physiological variations like seed germination and plant survival rate. Maximum reduction of seed germination were observed at 40 KR and 45KR. Result showed that the gamma irradiation affected germination and plant survival rate. The Germination rate increased with increased doses of gamma radiations. On 18th DAG 58.5% for 15KR, 60% for 20KR, 58% for 25 KR, 33.5% for 30KR, 31.5% for 35KR and lowest 20.5% for 40KR. The stimulating effect of gamma radiation was observed on 14 DAG; these are 54% for 5KR and 50% for 10 KR with compare 49% for Control group. At the lethal dose 45 KR exposers, 100% germination inhibition was found whereas all seedlings are caused death on 18th DAG.

Keywords: Gamma radiations, Seed germination, Plant survival, *Chrysanthemum*

INTRODUCTION

Chrysanthemum is a valuable ornamental plant worldwide, *Chrysanthemum* flowers bloom in various forms, can be daisy like, decorative buttons. *Chrysanthemum* blooms come in a hedge variety of shapes and sizes, wide range of colors in addition to (traditional) yellow, white purple and red. They are very popular in floral bouquet and flower arrangements gift and several of its species are used as herbal tea, medicinal plants, and dietary supplements among others.

Chrysanthemums are tropical flowering plant, originally grown in the Eurasian region this belongs to the Asteraceae family. This is largest families of flowering plants with over 1,000 genera and about 20,000 species. Plants of *Chrysanthemum carinatum* were be irradiate with γ -Gamma Rays at dose rate varying between 5KR to 45KR. Gamma radiations are most prominent ionizing radiations that cause some disruption of normally cell processes, then affecting crop yielding. These all effects of radiation is dependent on different doses of different intensity. These rays stimulate growth in crop plants at low dose (Safadi and Simon, 1990). According to (Kim *et al.*, 2004) radiations cause changes in morphology, physiology, anatomy and biochemistry of the Plants. Gamma rays also can be used for alteration of some physiological characters (Kionget *al.*, 2003). Present investigation performed to determine the effect of γ -gamma radiations on seed germination and plant survival and others some physiological characteristics.

MATERIALS AND METHODS

2.1 Material

Dry seeds of *Chrysanthemum carinatum* was used as study material collected from horticulture department Sangam University

2.2 Method

2.2.1 Germination Evaluation; In Laboratory condition

Dry seeds of *Chrysanthemum carinatum* (6.6% Moisture) were irradiated by 5 KR, 10KR, 15KR, 20KR, 25KR, 30KR, 35KR, 40KR & 45 KR of gamma rays at BARC Trombay Mumbai in January 2023. Seeds

were allowed to germinate on a moist filter paper in petriplates at room temperature ($25^{\circ}\text{C} \pm 15^{\circ}\text{C}$) on 10 January 2023. Hundred gamma irradiated seeds for each doses were used for experiment and non irradiated seeds were used as control group. Blotting papers were soaked with distilled water to observe germination rate under laboratory condition temperature ($25^{\circ}\text{C} \pm 15^{\circ}\text{C}$) and humidity $39\% \pm 2$ on 10 January 2023. Filter paper were maintained moist condition continuously with distilled water. The seed germination rate were observed for duration 4th DAG to 18 DAG (Day after Germination). Germination percentage was recorded for each dose from 4th DAG to 18th DAG.

2.2.2 Plant survival percentage; Field Experiment

The experiment was established at the field of Basic and Applied Sciences, Sangam University, Bhilwara (Raj.). Germination percentage was recorded for each dose at 10 DAG to 18 DAG. After 15 days seedling were transplanted in different pots (12 inches) and established experiment in the field. After completion of one month (30 DAG) plant survival of each dose were recorded. Plant survival percentage of each dose was recorded for measure the physiological effect. Calculate % of field survival as follow:

Percentage of plant survival = No. of survived seedlings 30 DAG / Total no. of seedlings transplanted at 18 DAG $\times 100$

RESULTS AND DISCUSSION

3.1 Effect on seed Germination

The results of experiments on the effects of gamma radiation on the seed germination of *Chrysanthemum carinatum* is given in table- 1. It was shown that the exposure of seeds to various Gamma dose such as 5KR to 45 KR compared with the control.

Data of seed germination were recorded on 0-18 DAG. It was observed that germination percentage decrease with increase of gamma radiations doses on 14th DAG and 18th DAG. The percentage of germination of non-irradiated control group was 96.5% at 18th DAG, while for the treated group was 66.5% for 5KR, 62.5% for 10KR are decreased with increased intensity of doses. Verma and Purbiya (2017), Kah and Verma (2015). Lamseenjan *et al.*, (2000) also reported that germination rate of seeds also decreased when used treatment of gamma radiations.

Stimulative effect also observed at 14th DAG are 54% on 5KR and 50% on 10 KR respectively as compare to 49% on Control group. The stimulative effects of gamma radiation on seed germination and plant survival were also reported by Ahmed and Qureshi, (1992); Majeed *et al.*, (2010); Borzouei *et al.*, (2010); Cemalettin *et al.*, (2006). On 18th DAG 58.5% for 15KR, 60% for 20KR, 58% for 25 KR, 33.5% for 30KR, 31.5% for 35KR and lowest 20.5% for 40KR. The lethal dose at 45 KR where the 100% germination was inhibited on 18th DAG where seedlings were dead. According to Tarar and Dnyasagar (1979) in *Turnera ulmifolia*, there appears linear relationship between the dose administered and reduction in seedling height. The same result was observed in the present study that where doses of gamma radiation are increased, germination

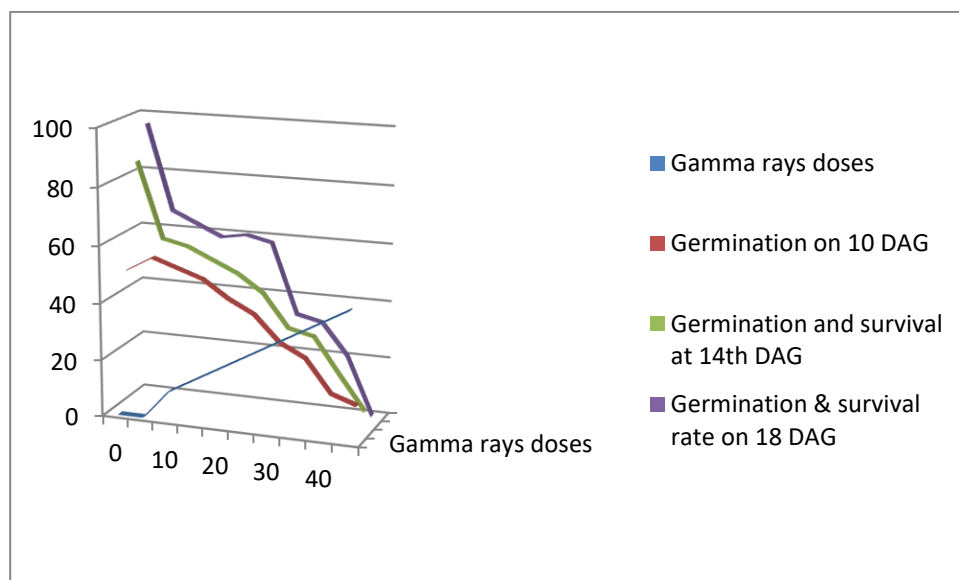
rate reduced with limited number of plants and doses. Reduction in the survival was also found to be doses dependent.

3.1.1 Effect on plant survival

Table-2 showed the effect of gamma radiation on plant survival of *Chrysanthemum carinatum* Survival percentage was observed at 30 DAG in treated plants as well as control. In present investigation observed that the survival percentage decreased when doses increased. According to Kiong *et al.*, (2008) have been reported that plant survival depends on nature and extent of chromosomal damage. When frequency of chromosomal damage increased with increased doses of radiations may be responsible for less ability to seed germinate and also reduction in plant survival and growth.

Table 1: Effect of Various Doses (KR) of Gamma Irradiation on Percentage of Seed Germination on 0-18 DAG (Humidity 39% Temperature $15 \pm 25^{\circ}\text{C}$)

Sample Radiation Dose- KR	Germination not successful, % on 10 th Day	Germination <u>successful</u> , % on 10 DAG	Germination not successful, % on 14 th Day	Germination <u>successful</u> , % on 14 th DAG	Germination not successful, % on 18Day	Germination <u>successful</u> , % on 18 th DAG
Control	51	49	15	85	35	96.5
5KR	46	54	41.5	58.5	33.5	66.5
10	49	51	43.5	56.5	37.5	62.5
15	52	48	47.5	52.5	41.5	58.5
20	58	42	51.5	48.5	40	60
25	62.5	37.5	57.5	42.5	42	58
30	71.5	28.5	69	31	66.5	33.5
35	76	24	71	29	68.5	31.5
40	87.5	12.5	83.5	16.5	79.5	20.5
45	90.5	9.5	95.5	4.5	100	All dead



Effect of Various Doses (KR) of Gamma Irradiation on Percentage of Seed Germination on 0-18 DAG

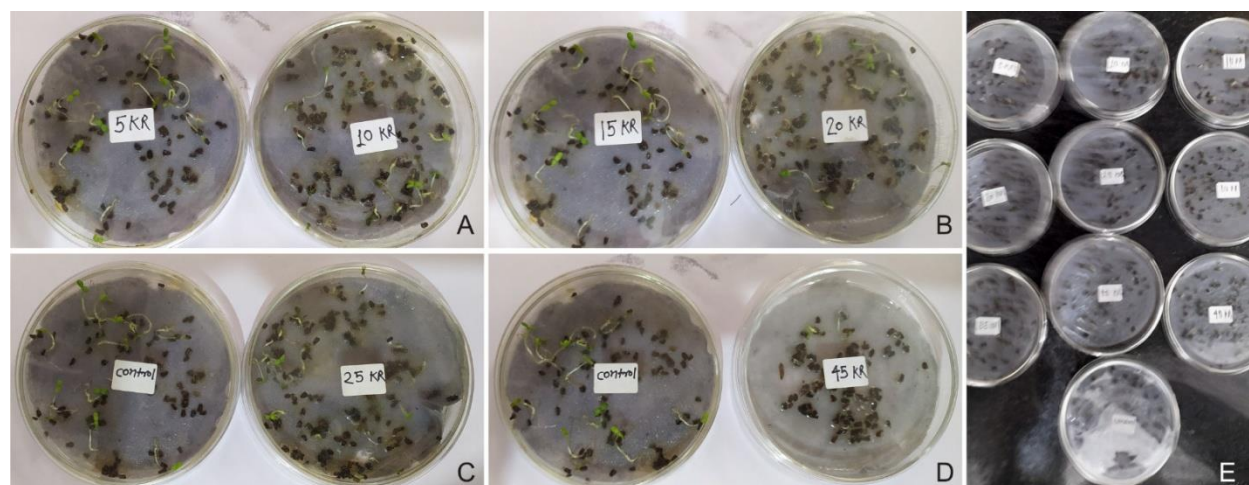
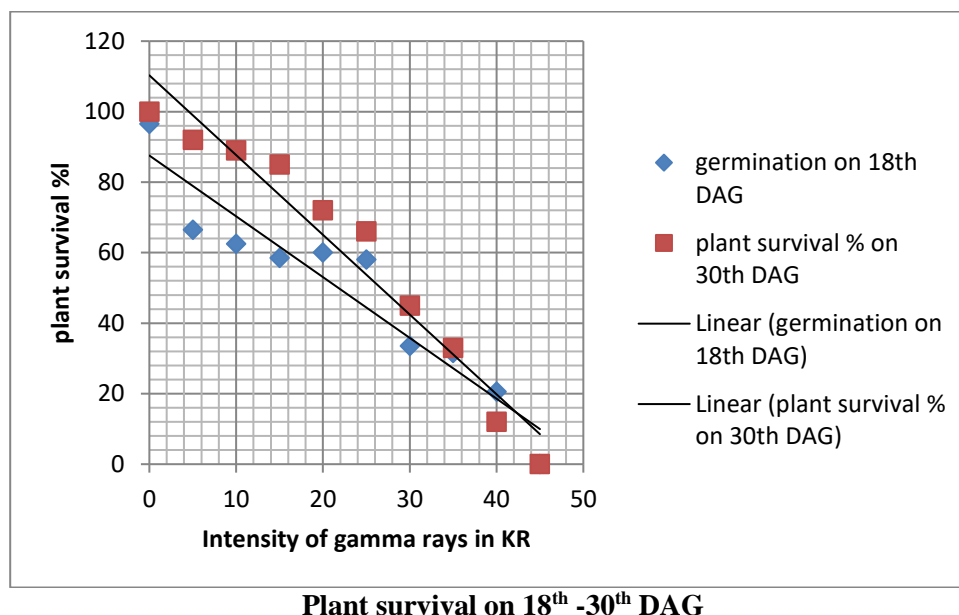


Figure A-E: (A) Germination of 5KR & 10KR (B) Germination of 15KR & 20KR (C) Germination of 25 KR & Control (D) Germination of 25K & Control E Germination of 5KR-45KR compare with Control.

1-Effect of Various Doses (KR) of Gamma Irradiation on Plant survival at 18th-30th DAG.

Sample Radiation Dose- KR	Missed % of seedlings on 18 th DAG	Germination successful, % on 18 th DAG	Missed /dead % of seedlings not survived on 30 DAG	Plant survival percent on 30 DAG
Control	3.5	96.5	00	100
5KR	33.5	66.5	08	92
10	37.5	62.5	11	89
15	41.5	58.5	15	85
20	40	60	36	72
25	42	58	48	66
30	66.5	33.5	66	45
35	68.5	31.5	69	33
40	79.5	20.5	88	12
45	100	All dead	Dead	00



Plant survival on 18th -30th DAG

CONCLUSION

Present investigation has shown that the effect of gamma radiation on seed of *Chrysanthemum carinatum* had positive results. When the doses are increased, it gives a decline in germination and plant survival rate. Higher doses of gamma rays (30-40 KR) affected the germination and plant growth showed very slow. However, the impact of lowest doses of gamma rays such as 5KR, 10 KR led to the fact that the seeds of *Chrysanthemum carinatum* had 54% and 50% on 10 DAG showed better germination and increase length of seedlings. It was observed that may be due to stimulatory effect of gamma radiations.

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