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Mutagenic effect of gamma rays and EMS on seed germination, seedling height reduction and survivability of Chick pea (*Cicer arietinum* L.) Var. Co – 4.

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ABSTRACT

The effect of gamma irradiation and EMS treatment on seed germination and seedling height of Chick pea (*Cicer arietinum*. L.). In this regard Co-4 variety of chick pea was subjected to different doses/concentrations of gamma rays (20, 30, 40, 50, and 60 kR) and EMS (10, 20, 30, 40 and 50 mM) for inducing mutation. The effect of mutagen was observed on the basis of percentage of seed germination, seedling height reduction at 15th day and survivability. From the result it was observed that, the percentage of seed germination, seedling height reduction at 15th day and survivability were significantly decreased with increasing doses/concentrations of mutagen. The effective doses/ concentrations which caused 50 % growth reduction were 40kR in gamma rays and 30 mM in EMS.

***Keywords*:** Gamma rays; EMS; Germination; Seedling height; Survivability

1. INTRODUCTION

Food legumes are of prime important in human diet and animal feed contributing the major source of vegetable protein. They are an economic source of not only protein but also carbohydrate, minerals and B- Complex vitamins particularly in vegetarian diet (salunkhe et al., 1985). On an average, pulses contain 20-25 per cent of protein in their dry seeds, which is almost 2.5 -3.0 times the value normally found in cereals. Thus, the food legumes ensure nutritional seedily to the poor masses of the Country (Chaturvedi and Ali, 2002).

Pulses occupied and area of about 68-31 million hectare contributing 57.32 metric tones of production to the world food basket. India shared 35.2 per cent of area and 27.65 per cent of global pulses production (Chaturvedi and Ali, 2002). Thus India is the largest producer of pulses in the world occupying an area of about 23.81 million hectares, with annual production of 15.11 million tones (Project coordinators report (2007-2008), 11PR, Kanpur). The commonly grown pluses in India are Chick pea, Pigeon pea, Cow pea, Field pea, Green gram,

Urd bean Lentil, Moth bean and French bean. Among them Chick pea is the second largest grown food legume of the world (Gaur et al., 2008).

It ranks third among pulses after beans and peas. Fifth among grain legumes and 19th among grain crops of the world. The traditional varieties of chick pea have low potentiality and restricted variability with respect to economic characters. Broadening the genetic base for crop improvement can be quickly achieved through induced mutagenesis. Since chick pea is a self pollinated crop, mutation breeding could be rewarding for broadening the genetic base of total plant yield, yield contributing traits.

Photo 1. *Cicer arietinum*

2. MATERIALS AND METHODS

Mutagenic treatment: Seeds of Chick pea, CO-4 variety from Tamilnadu Agricultural University, Coimbatore was used for the present study. For EMS treatment, the seeds wer pre- soaked in distilled water to 6 hrs, were subjected to different concentrations of ethyl

methane sulphonate ranged from 10 to 50 mM. For gamma rays treatment, the seeds were irradiated with different doses (20-60 kR) from ^{60}Co gamma cell in Indira Gandhi Atomic research Centre, Kalpakkam.

Raising M_1 generation: For raising M_1 generation, the seeds were treated with different doses/concentrations of gamma rays and EMS and were sown along with controls at the Botanical Garden, Department of Botany, Annamalai University in a complete Randomized Bloch Design (CRBD).

2. 1. Seed germination (%)

The total number of seeds germinated on the 7th day was counted for each treatment along with control and data was expressed in percentage.

$$\text{Germination (\%)} = \frac{\text{No. of seeds germinated}}{\text{No. of seeds sown}} \text{ X } 100$$

2. 2. Seedling height (cm/plant) on 15th day

Plant height on 15th day injury was measured for all the mutagenic treatment along with control. This measurement indicates the height reduction of the plants with effect of mutagens.

2. 3. Seedling survival (%)

Seedlings survived on 30th day after sowing were counted. Survival percentage was calculated by using the following formula.

$$\text{Seedling survival (\%)} = \frac{\text{No. of seedlings survived}}{\text{No. of seeds germinated}} \text{ X } 100$$

3. RESULTS

The data presented in Table 1. Indicate the effects of gamma rays and EMS on germination percentage and seedling height and survivability. The results obtained were discussed in detail under the following heads.

3. 1. Germination

There was a significant reduction in germination of seeds with increase the dose/concentrations of mutagens was observed (Table 1 and Fig. 1). It was noted that the percentage of germination decreased in all the genotypes than the control. In 40 kR of gamma ray and 30 mM of EMS, the germination percentage was observed as 50 per cent and 48 per cent respectively.

Table 1. Effect of gamma rays and EMS on germination percentage, seedling height reduction at 15th day and survivability.

Mutagens	Treatments	Germination (%)	Seedling height (cm)	Survivability (%)
Control	-	98	12.03	96
Gamma rays	20 kR	74	10.99	72
	30 kR	60	10.17	58
	40 kR	50	9.32	49
	50 kR	44	9.30	40
	60 kR	36	6.76	35
Ethyl methane sulphonate	10 mM	64	11.93	64
	20 mM	60	11.50	60
	30 mM	48	11.31	48
	40 mM	38	8.78	36
	50 mM	28	8.06	27

3. 2. Seedling Heights

The data on the plant height on 15th day are observed (Table 1 and Fig. 1). The heights of seedlings were decreased with increasing dose / concentration of mutagens. The plant height was ranged between 11.21 – 13.40 cm in control. In treated populations, maximum height was observed in 20 kR (10.99) of gamma rays and 10 mM (11.93) of EMS.

3. 3. Survival of Seedlings

The data on survival of seedlings were recorded on 30th day are presented in (Table 1 and Fig. 1). Highly considerable differences were observed among the different doses or concentrations of mutagens. The survival percentage of seedling was reduced while increasing the doses/concentrations of mutagens. The highest survival percentage was observed in 20 kR of gamma rays and 30 mM of EMS.

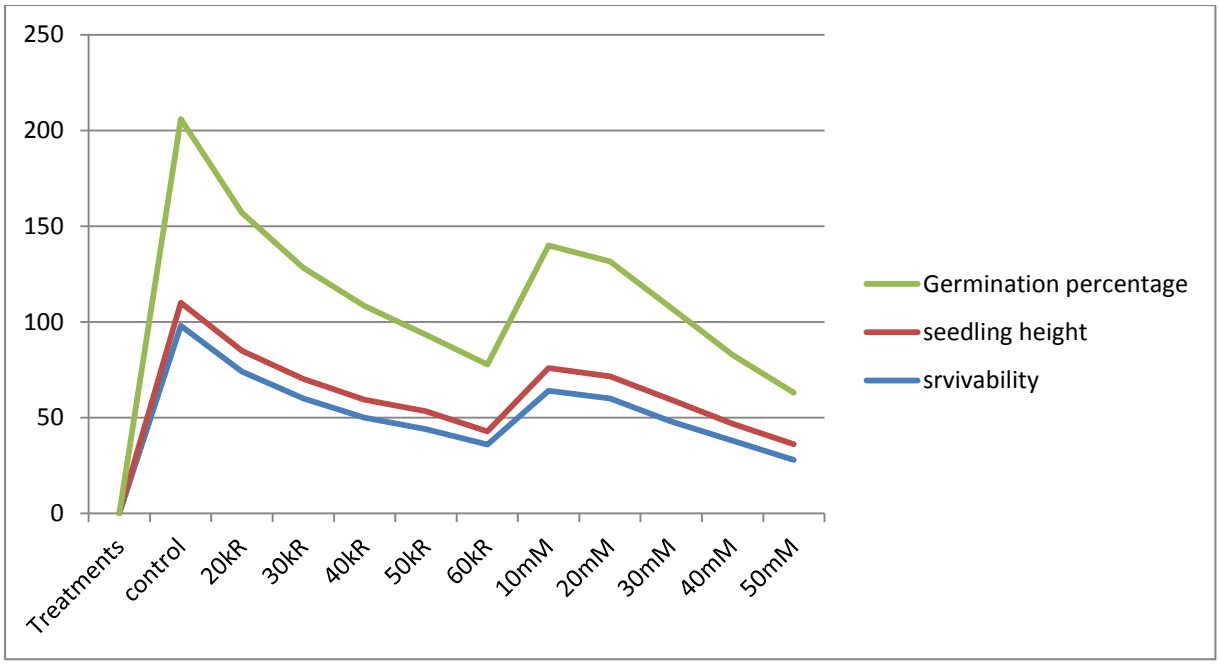

Fig. 1. Effect of gamma rays and EMS on germination percentage, seedling height reduction at 15th day and survivability.

4. DISCUSSIONS AND CONCLUSIONS

Mutagens have the ability to cause biological damage and it can be measured based on the seed germination and survival reduction in M_1 generation. The percent of seed germination was decreased with increasing doses/concentration of gamma rays and EMS in chick pea. This clearly indicates that the mutagens have exerted an inhibitory effect on seed germination. Such dose dependent inhibition of germination was reported earlier by Athwal (1963) in *Cicer,* Sharma (1965) in peas, Alikhan et al. (1973), Sivafsamy (1976) and Chadurvedi et al., (1982) in pigeon pea.

The reduction in germination may be due to genetic and physiological process inhibited by the mutagens resulting in cell maturity. Such increase in lethality values with respect to increasing concentrations/doses was also reported by Hakande (1992) in winged bean and Satpute (1994) in safflower. Sahai and Dalal (1973) reported that germination, survivability and seedling height decreased with increase in dose of gamma rays with two varieties US10 and K11842 of safflower. Rangasamy (1973) reported the effect of gamma rays and EMS on Sesame in two varieties KPR – 2 and TMN – 3.

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