

Effect of mutagenesis on emergence and plant survival percentage in some varieties of *Carthamus tinctorius* L. (safflower)

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Abstract

The present investigation was undertaken to study effect of mutagenesis on emergence and plant survival percentage in PBNS-86 variety of safflower (*Carthamus tinctorius*.L) in M1 generation. Seeds of the variety were treated with different doses of gamma rays i.e. 100Gy, 200Gy and 300Gy and different concentrations of E.M.S and S.A as chemical mutagens with 0.10, 0.20, 0.30 while 0.2, 0.4, and 0.6 of EMS and SA resp. in m1 generation. Results revealed significant as well as harmful effects in different dosages of mutagen. Seed emergence and plant survival rate increases with increasing dose of gamma rays while it decreases in chemical treatments.

KEYWORDS- emergence, plant survival, gamma rays, E.M.S, S.A, germination.

Introduction

Safflower (*Carthamus tinctorius* L.) is one of the oilseed crops and has been traditionally grown for its flowers as a source of dye for colouring food and fabrics. It is grown for edible oil, animal meal, bird feed, medicinal uses, as a potential candidate crop for production of plant made pharmaceuticals, biofuel and specialty type oils (Hamdan *et al.*, 2008). Safflower oil was considered well for health because it contains important compounds i.e. unsaturated fatty acid as well as Vitamin E which is used in daily diet. After seed germination, plant survival is the first growth stage of any plant hence mutation induction and in vitro bio techniques has been used to solve certain problems in breeding of various crops.

To increase these wide cross parameters collective methods of physical and chemical mutagenesis have been employed. In the field of plant breeding induction of mutation has been one of the effective method to produce vigorous germplasm. For agricultural and economic development it is necessary to introduce new varieties which shows high survival percentage. However such varieties have been developed in India (Gawande *et al.*, 2022). So that current study of induction of mutation taken into consideration to produce high surviving germplasm on PBNS-12 and PBNS-86 of safflower with gamma rays, EMS and SA.

Material and method

The field experiment was conducted on experimental field at Gandhari, po. shahagad on safflower during rabi 2019-20 of m1 generation. The germplasm for experiment was made available from agri. research Centre badnapur, Jalna which consist of PBNS-86. The seeds were treated by gamma rays 100Gy, 200Gy, and 300Gy resp. at GIS Aurangabad. For chemical mutagenic treatment the uniform pure 200 dry seeds of var. PBNS-86 were presoaked in distilled water for 3 hrs then given chemical treatment

by using 0.10,0.20 and 0.30 of EMS while 0.02,0.04 and 0.06 of SA in shaker at 200 rpm in 25+₂ temperature for 12 hrs. Irradiated but dry seeds and water soaked seeds sown as control is tabulated in form.

Mutagens

Physical(gamma)	Chemical(EMS)	Chemical(SA)
100Gy	0.10%	0.02%
200Gy	0.20%	0.04%
300Gy	0.30%	0.06%

Raising m1 generation-

To grow m1 generation given treated seeds were sown in rabbi 2019 in field by RBD method and control with three replication each with provision of recommended fertilizers.

These m1 plants grows with spacing and and laid them self-pollinated to produce m2 generation.

Observation of m1 generation of field-

1) Emergence (%) -

This observation was done periodically after 10, 12 and 15th days of sowing and recorded the percentage Souza and Valio (2001).

Emergence % was calculated by formula-

$$\text{Emergence (\%)} = \frac{\text{Total no. of seeds emerged}}{\text{Total no. of seed sown}} \times 100$$

2) **Plant survival-** it is no of no plants survived even after 30th day of sowing were counted and calculated percentage by using formula Souza and Valio (2001).

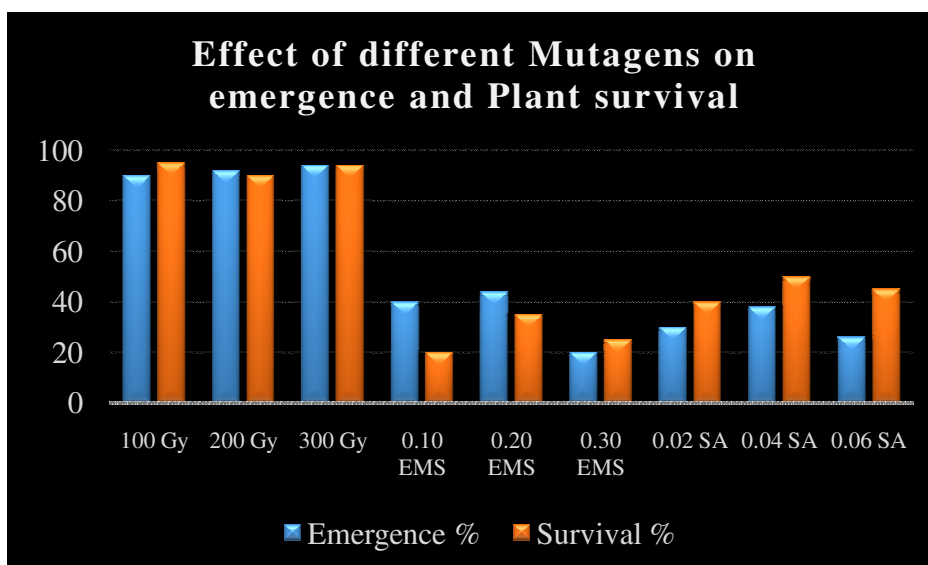
$$\text{Survival (\%)} = \frac{\text{No. of seedlings survived}}{\text{No. of seedlings emerged}} \times 100$$

Results

Table 1.1 Effect of different Mutagens on emergence and Plant survival.

Sr. No	Treatment	Emergence %	Survival %
1	100 Gy	90	95
2	200 Gy	92	90

3	300 Gy	94	94
4	0.10 EMS	40	20
5	0.20 EMS	44	35
6	0.30 EMS	20	25
7	0.02 SA	30	40
8	0.04 SA	38	50
9	0.06 SA	26	45



The effect of different dosage of EMS, SA and gamma rays on seed emergence in PBNS-86 studied during m1 generation and obtained results are presented in table 1. Given table shows advantageous results on emergence for all mutagens. Seed emergence percent reduced in EMS as compared to control. The highest emergence percent (94%) is observed in 300Gy followed by in 100 Gy (90%). The maximum decline of emergence was shown by 0.30% EMS followed by 0.06% SA. The lowest emergence was observed in 0.30% EMS (30%) followed by SA (26%). Declined percent of emergence considered as radio sensitivity and destruction of genetic and physiological damage. In the current study emergence percent decreases as increases mutagenic dosages both in physical and chemical mutagen. Such results are revealed by Sharifi- sirchiet. al. (2012) in African sesame.

Plant survival percentage-

Plant survival is observed after a month from date of sowing. It shows that no. of plants survived in m1 generation of each treatments line in var. PBNS-86 was recorded and calculated percentage and maintained in tabulated form. It seems to be declined graph of percent survival in both mutagens comparing to control. The maximum plant survival is recorded from gamma rays 100Gy, 200Gy and 300Gy resp. followed by EMS 0.10% and the lowest survival was observed in SA 0.06 and EMS 0.30 % resp. in chemical mutagens plant survival percentage seems to be decreased as increasing concentration. Similar types of results have been reported by Goyal et. al. (2019) in Moong bean.

Discussion

From the present research work it is concluded that seed emergence and plant survival has been decreased as increasing concentration of chemical mutagens while in physical mutagen both seed emergence and plant survival percentage increases with increasing dosages in var.PBNS-86.2 quite similar results were recorded by Mhetre and Kshirsagar (2022) In African sesame. Singh *et al.*, in 2012 reported that Seed germination of *Carthamus* was decreased with increase in gamma radiation along with 0.6% EMS. Their research finding showed similarity with present investigation. In conclusion, NaN₃ is a strong mutagen, and affected seed germination, it should be used further on other species, and by creating mutation its traits also produce resistance against biotic and abiotic stress. Quite similar finding were recorded by Khan and Al-Qurainy in 2009 from Saudi Arabia for *Eruca sativa* (L.).

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