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Effect of Mutagens on Frequency of Chlorophyll Mutants in M_2 Generation of Sunflower (*Helianthus Annus* L.)

Vijayata Jamdhade[1], Navnath Kashid[2]

[1]Department of Botany, Baburaoji Adaskar Mahavidylay, Kaij, Beed (M.S)431123, India.
Email: *ivijayata[at]gmail.com*

[2]Department of Botany, Baburaoji Adaskar Mahavidylay, Kaij, Beed (M.S)431123, India.

Abstract: ***Present investigation studied mutagenic effect in sunflower (Helianthus annus L.) cultivars Bhanu and SS 56. Mutagenic frequency was calculated as percentage of mutated progenies to total population, the total chlorophyll mutagenic frequency observed in all physical and chemical conc/doses, like EMS, SA, and Gamma ray. The chlorophyll mutation observed and categorised into Xantha, Chlorina, Viridis and Albina respectively during M2 generation.***

Keywords: Sunflower, chlorophyll mutants, EMS, SA and gamma rays

1. Introduction

Sunflower (*Helianthus annus* L.), belong to family Asteraceae. *Helianthus* genus contains 65 different species (Andrew *et. al* 2013). It is an annual plant which possesses a large inflorescence (flowering head) and its name is derived from the flower's shape and image, which is often used to depict the sun. The plant has a rough, hairy stem, broael, coarsely, toothed, rough leaves and circular heads of flowers (Khaleghizadeh, 2011).

Sunflower is the second most important edible oil seed crop in the world after soybean. Its seeds are use as food and its dried stalk as fuel it is already being used as ornamental plant and was used in ancient ceremonies Sunflower is used in industry for making Paints and cosmetics.

Basically, sunflower is temperate oil seed crop but it is adopted to tropical and subtropical climate the crop required a cool climate during germination seedlings growth and warm sunny days during flooring to maturity are most favourable minimum temperature for germination is 8 -10 o C but it can germinate even up to 40 ^oC the crop is photo insensitive as it flowers at wide range of photo periods.

The present study was undertaken in order to effect of different mutagens like Gamma Rays, EMS, SA on frequency of chlorophyll mutant in M_2 generation of two cultivars of sunflowers.

2. Material and method

The physical mutagen Gamma Rays and chemical mutagen EMS and SA were employed as mutagens during present studies. seeds were irradiated with Gamma Rays from Government Institute of Science, Cave's Road Aurangabad (M.S).

The seeds of sunflower Bhanu and SS-56 cultivars were collected from Dry Farming Research Station, Solapur 413002(MS) India. The seeds treated with different doses of gamma rays viz. 10, 20, 30 kR and EMS (Ethyl methane sulphonate). viz 0.05%, 0.10%, 0.15% and SA (sodium Azide) viz. 0.01%, 0.02, and 0.03% along with control. The experimental seeds were pre-soaked in distilled water for six hours a room temperature, followed by six hours immersed in mutagenic solutions. These seeds were thoroughly washed under running water for four hours. A set of 300 seeds from each treatment were sown in randomized blocked design (RBD) three replication along with control for rising in generations during rabi season 2016. The seeds were sown at the distance 15cm in line and 30cm between the rows.

Estimation of mutation frequency: The frequency of chlorophyll Mutation was estimated using the formulae suggested by (Gaul 1958)

$$\text{Chlorophyll Mutation frequency} = \frac{\text{Number of mutations}}{\text{Total number of plant scored}} \times 100$$

3. Result and Discussion

In the sunflower variety, the frequency was low at lower concentration and high at higher concentrations of all mutagenic treatments. All the concentration of EMS, SA and doses of Gamma Rays produced the four types of chlorophyll mutation i.e. *chlorina, Xantha, viridis and Albina.*

The frequency of chlorophyll Mutants is an increasing rate with increasing concentration/dose. The frequency of chlorophyll mutant value range 2.67% to 4.72% in gamma ray treatments, 3.23% to 4.58% in EMS and 1.50% to 3.31% in SA treatments of variety Bhanu, while variety SS-56 the frequency of chlorophyll mutant value range was 2.66% to 5.2% after gamma rays 1.92% to 4.76% in EMS treatment

and 1.62% to 3.17% in SA treatments respectively. In case of Bhanu the concentration of EMS range of chlorophyll mutant 4.58% to 5.54% was reduce after increase the doses.

Table 1: The effect of mutagens on frequency of chlorophyll mutants in M_2 generations [*Helianthus annus L.]*
Variety: Bhanu

Mutagen	Concentration/ Dose	Total number of plants screened	Total number of chlorophyll mutants	Frequency of of chlorophyll mutants
Control	Control	266	00	0.00
Gamma rays	10 kR	262	07	2.67
	20 kR	254	12	4.72
	30 kR	217	10	4.60
EMS (%)	0.05	262	12	4.58
	0.10	247	08	3.23
	0.15	240	11	4.54
SA (%)	0.01	199	03	1.50
	0.02	191	04	2.09
	0.03	181	06	3.31

Table 2: The effect of mutagens on frequency of chlorophyll mutants in M_2 generations [*Helianthus annus* L.]
Variety: SS-56

Mutagen	Concentration/ Dose	Total number of plants screened	Total number of chlorophyll mutants	Frequency of of chlorophyll mutants
Control	Control	275	00	0.00
Gamma rays	10 kR	263	07	2.66
	20 kR	251	09	3.58
	30 kR	250	13	5.2
EMS (%)	0.05	260	05	1.92
	0.10	241	08	3.31
	0.15	210	10	4.76
SA (%)	0.01	208	04	1.98
	0.02	189	06	3.17
	0.03	185	03	1.62

The highest frequency of mutant in (4.72%) 20 kR treatment of gamma Rays in variety Bhanu while in the variety SS-56 (5.2%) recorded highest in 30 kR gamma ray treatment.

The lowest frequency of chlorophyll mutant observed (1.50%) of SA (0.01%) treatment in Bhanu variety, while in the variety of SS-56 (1.62%) recorded lowest in 0.03% of SA treatment.

In the present investigation four types of chlorophyll mutations viz. *chlorina, Xantha, Viridis and Albina were* observed in M_2 generation. This is similar with the findings of Mehraj ud-din *et al.,* (1999) in *Vigna radiata*, Sharma *et al.,* (2006) in urdbean, and sagade (2008) in urdbean, Tambe *et al.,* (2010) in soybean Giri *et al.,* (2010) in pigeon pea, solanki and sharma, (2001) in *lentil*, and Ahire (2008) in soybean.

The chlorophyll mutations have been utilise not only as measuring for assessing effectiveness and efficiency of nitrogenous but also as indicators to predict the size of vital factor mutations. it is considered as a dependable index for evaluating genetic effect of mutagenic treatments (Gustafsson 1951).

4. Conclusion

Chlorophyll mutations serve as key indicators assessing the genetic impact and mutagenic treatments. the frequency of mutation observed in sunflower population among the treatments the highest frequency of chlorophyll mutant in (4.72%) 20 KR treatment of gamma ray in variety Bhanu while in the variety ss-56 (5.2%) recorded highest in 30 KR gamma ray treatments. The lowest frequency of chlorophyll mutant observed (1.50%) of SA (0.01%) in Bhanu variety, while in the variety of SS-56 (1.62%) recorded lowest in 0.03% of SA treatment.

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