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INDUCED CHLOROPHYLL MUTATION IN GROUNDNUT *(ARACHIS HYPOGAEA* L.)

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Abstract:
An investigation entitled 'Induced Chlorophyll Mutation in Groundnut (Arachis hypogaea L.)' was conducted during the kharip (rainy season) 2009 in the experimental field. The germplasm of locally adopted cultivar JL-24 (Phule Pragati) was procured from M.P.K.V.Rahuri, Dist- Ahmednagar (MS), India. Attempts were made to induce genetic variability in yield contributing traits in groundnut (Arachis hypogaea L.) employing gamma radiation to obtain the spectrum and frequency of chlorophyll mutations in M_2 generation The seeds of cultivar were presoaked in distilled water for 8 hrs and then treated with four different concentrations of EMS (0.05, 0.10, 0.15, 0.20%) for 04 hrs The uniform and healthy 200 dry seeds were irradiated with five different doses of Gamma rays (100, 150, 200, 250, 300Gy) at Department of Biophysics, Government Institute of Science, Aurangabad (MS), India. Both treated as well as untreated seeds were sown in the experimental field, M_2 progeny was raised from the M_1 seeds and was screened for different chlorophyll mutations. A variation in frequency of different chlorophyll mutations was observed in different doses. Three different types of chlorophyll mutants, namely, xantha, albino and chlorina, were observed. Out of these mutants, xantha was most frequent while alnina and chlorina were least frequent. The highest frequency of chlorophyll mutations (11.66) was reported in the 100,150 and 250 Gy. There was a dose dependent spectrum and frequency of chlorophyll mutations.

Key words: Gamma rays, mutation, Groundnut

Introduction

A large number of desirable varieties have been developed through mutation breeding in field and horticulture crops. But the application and success of mutation breeding in improvement of grain legume crops is relatively limited except perhaps soybean and groundnut. Chlorophyll mutations offer one of the most reliable indices for the assessment of genetic effects of mutagenic treatments. Genotypic differences in response to induction of chlorophyll mutations can be observed as frequency of induced chlorophyll mutations in M_2 generation. Gamma Rays induce high frequencies of chlorophyll and morphological mutations with negligible frequency of chromosomal aberrations (Swami Nathan 1957). So also Von Wettstein (1980) in barley and Haque and Godward (1986) in Lectuceae reported involvement of considerable number of genes at different stages of plastid development as revealed from the plastid ultra structure of leaves. Hence, the probability of occurrence of such category of mutation is obvious in all mutagen treatments. Chlorophyll mutations are one among the few dependable parameters for evaluation of genetic effects of various mutagens and are widely used as genetic markers in basic and applied research. The present study reports the induction of different chlorophyll mutants in M_2 generation in groundnut (peanut) variety JL-24.

Materials and Methods

The cultivar JL-24(Phule-Pragati) of Groundnut was procured from M.P.K.V.Rahuri, District-A.Nagar and employed as experimental material during the present study. Seeds of this variety were irradiated with 100, 150, 200,250 and 300 Gy doses of gamma radiation at 60Co gamma cell, Government Institute of Science, Aurangabad and 200 seeds were presoaked in the distilled water for 14 hours at room temperature and Irradiated seeds along with control (parental variety), were grown in randomized block design and maintaining a spacing of 25×50 cm. to study the M1 generation during kharif (rainy season) 2009-2010.

The M_2 population was screened for frequency and spectrum of chlorophyll mutations. Lethal chlorophyll mutations were scored within 10 to 25 days of sowing whereas viable chlorophyll mutations were scored throughout the life period of plants. The spectrum of chlorophyll mutations was studied and the mutants were classified as per the scheme of Gustafson (1940) with modifications.

- Albino-white, lethal, no chlorophyll or carotenoids are formed.
- Xantha yellow to yellowish white, lethal, carotenoids present but chlorophyll absent.
- Chlorina – uniform green colour with white on tips, viable.

- Viridis – uniform light yellow green colour of leaves, viable.
- Striata – longitudinal strips of different colours,

Results and Discussion

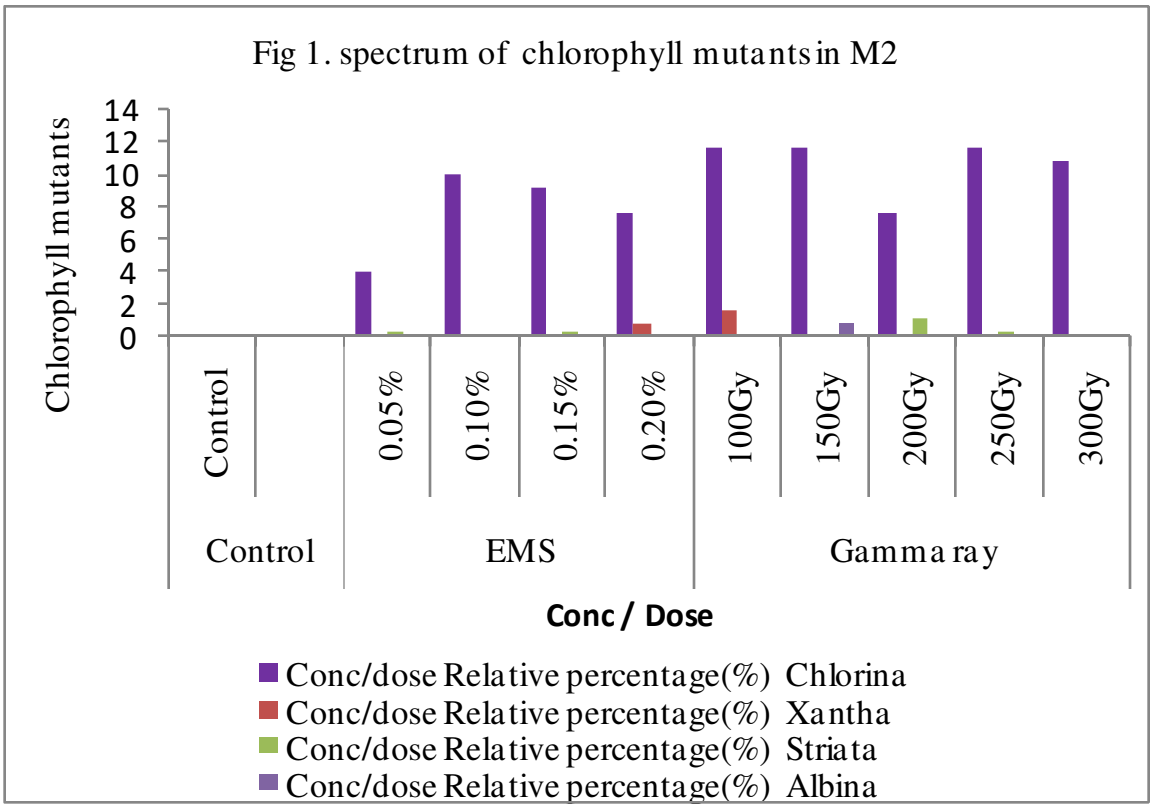
Chlorophyll mutations provide one of the most dependable indices for the evaluation of genetic effects of mutagenic treatments and have been reported in various pulse crops by several workers including Gautam *et al.* (1992). The data was recorded on the frequency of chlorophyll mutations per 500 M_2 plants Chlorophyll mutations were found in almost all the mutagenic treatments. In the present investigation total 4 types of chlorophyll mutations such as chlorina, xantha, striata and albino were recorded in groundnut variety JL 24. The frequency and relative spectrum of chlorophyll mutants were represented in the table (Table 1) and fig. Results revealed that only Chlorina chlorophyll mutant was recorded in all the treatments of both the mutagens.

The frequency of chlorophyll mutant (4.16%) was higher in EMS (0.15 %) and (3.33%) in 100,250 and 300 Gy doses of gamma rays. The presence and absence of some chlorophyll mutants in some mutagenic treatments indicating differences in the availability of mutagenic loci to the mutagen. The frequency of chlorophyll mutants was higher in gamma rays than EMS. Increase in the frequencies of chlorophyll mutations with increase in the concentration / dose reported by the results obtained in this work confirming that gamma rays was found to be more effective for inducing chlorophyll mutations in comparison to E.M.S. Spectrum of chlorophyll mutations in segregating M_2 generation (Table 1) indicates presence of broad chlorophyll mutant spectrum comprising 3 types (maximum) was induced by 0.15% EMS followed by 100,200,250 and 250 Gy doses each, which induced 3 types of chlorophyll mutants. Chlorina mutant recorded highest relative % (11.66) in 100,150 &250 Gy doses. Higher relative % of striata mutants (1.05) was found with 200 Gy, xantha (1.66) in case of 100 Gy) dose while albino mutants were found in 150 Gy (0.83) The viable chlorophyll mutations, i.e., chlorina were produced at all doses/concentrations of mutagen whereas lethal mutants, namely, xantha was observed in higher conc. (20%) of EMS and 100 Gy of gamma. while albina was observed in 150 Gy dose of gamma.

The doses of gamma rays enhanced the frequency of chlorophyll mutations, which is supported by previous results found in various crops, such as mungbean Gautam and M ittal, 1998 in black gram, Tambe, A.B.,and Apparao, B.J. 2009 in Soybean. Four different types of chlorophyll mutants produced in the present study are in agreement with the findings of several workers in the past. Ignacimuthu and Babu, 1988 reported albino, viridis, chlorina, xantha mutants in three species of *Vigna*. Out of 4 mutants induced in the present study, chlorina and striata mutants were most frequent while albina type was the least frequent. There was a dose dependent increase in the spectrum and frequency of chlorophyll mutations in M_2 which is similar to the present study. Manju *et al* (1983) observed that chlorophyll mutation frequency in M_2 seedlings showed dose dependence in horse gram.

Table: 1. Effect of different doses of gamma rays on frequency and spectrum of chlorophyll mutations in M_2 generation of groundnut.

	Conc./dose	Frequency of chlorophyll mutations (%)	Relative percentage (%)			
			Chlorina	Xantha	Striata	Albina
Control	Control	0	0	0	0	0
EMS	0.05%	0.83	4	0	0.29	0
	0.10%	2.5	10	0	0	0
	0.15%	**4.16**	9.16	0	0.39	0
	0.20%	0	7.5	0.83	0	0
Gamma ray	100Gy	**3.33**	11.66	1.66	0	0
	150Gy	2.5	11.66	0	0	0.83
	200Gy	2.5	7.5	0	1.05	0
	250Gy	**3.33**	11.66	0	0.35	0
	300Gy	**3.33**	10.83	0	0	0



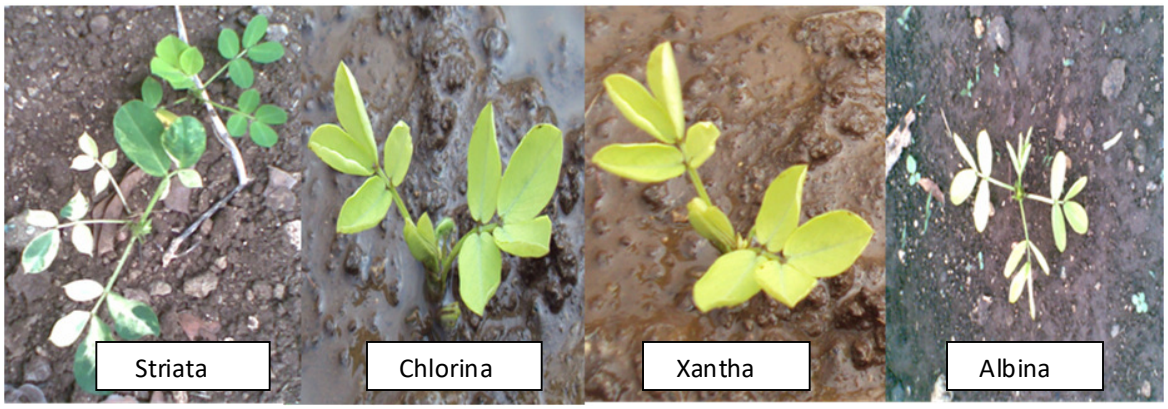


Figure 2. Spectrum of chlorophyll mutations in groundnut.

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