IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 10, Issue 1, October 2019
Impact Factor: 4.819

Chlorophyll Mutation Induced in Mungbean by Chemical Mutagens

Arvind Kumar
Department of Botany
S.M.P Govt. Girls P. G. College, Meerut
arvindkm031@gmail.com

Abstract: *Chlorophyll mutants were isolated in three mungbean varieties namely, Plant Moong-1, PS-10 and T-44 by ethylmethane sulphonate (EMS), methylmethane sulphonate (MMS) and sodium Miniscent, EMS produced the higher frequency and spectrum of chlorophyll mutants in comparison to anide (SA), Chlorophyll mutants spectrum includes albina, xantha, chlorina, maculata, viridis, and MUS and SA The order of mutagens based upon effectiveness was MMS, SA and EMS, EMS was found to be more efficient as compared to MMS and SA*

Keywords: Chlorophyll mutations, chemical mutagens, mungbean.

I. INTRODUCTION

Mutation breeding is simplest and easiest method for crop improvement. Various methods have been made to determine the most effective and efficient mutagens and treatments for the induc-tion of beneficial mutations in various crop plants.

The chlorophyll mutation frequencey is useful in assessing the potency of a mutagen. Hence, scoring of chlorophyll mutations has proved to be much dependable index for evaluating the genetic effects of the mutagenic treatments.

In this paper, the chlorophyll mutations induced by chemical mutagens in mungbean is re-ported.

II. MATERIALS AND METHODS

Three hundred uniform and healthy seeds of the three mungbean (Vigna radiata (L.) Wilczek) varieties namely, Plant Moong-1, PS-10 and T-44 were presoaked in distilled water for 9 hours were treated with chemical mutagens viz., ethylmethane sulphonate (EMS), methylmethane sulphonate (MMS) and sodium azide (SA) at 27±1°C for 6 hours. The concentration used for MMS and SA was 0.02 per cent whereas it was 0.2 per cent for EMS. All solutions of the chemical mutagens were prepared in phosphate buffer of pH-7. To facilitate uniform absorption, large quantities of solution of mutagens, approximately three times the volume of the seeds (Konzak et al., 1965), were used. Immediately after treatment the seeds were thoroughly washed in running water and sown directly in the field along with untreated controls to raise M, generation. Three replications of 100 seeds each were sown for every treatment in each variety. Seeds of M, plants and control in all the three varieties were harvested separately and sown in plant progeny rows to raise M.. The distance between seeds in a row and between the rows was kept 30x60 cms respectively in both the generations. Chlorophyll mutations were scored in M, when seedlings were 8-15 days old. They were identified and classified according to Gustafsson (1940). Formula suggested by Konzak et al., (1965) were used to evaluate mutagenic effectiveness and efficiency of the mutagens used.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 10, Issue 1, October 2019
Impact Factor: 4.819

III. RESULTS

Frequency and spectrum of chlorophyll mutations: The spectrum of different M, chlorophyll mutants included, albina, xantha, chlorina, meculata, viridis and viriscent. A brief description of differ-ent chlorophyll mutants is given below:

Albina - Complete white leaves. It is a lethal mutation.

Xantha- Leaves were yellow in colour. Seedlings survived for 8-12 days only.

Chlorina -Leaves were light green in colour. Most of the seedlings died within 15 days.

Meculata - Seedlings showed yellow or whitish dots on leaves. Plants were late in flowering and maturity.

Viridis - Light green colour of leaves. The plants were slow growing and had low seed yield.

Viriscent- Leaves with white or yellow patches. Plants were fertile and set seeds.

Although response to chemical mutagens in different varieties differed in relation to chloro-phyll mutation frequency, Pant Moong-1 appeared to produce more chlorophyll mutants than the other two varieties (Table -1). Mutants like chlorina and xantha were the most frequent and viriscent and albina were least frequent. In all the three varieties, the frequency of chlorophyll mutants induced were in the following order: chlorina> xantha >viridis > meculata > viriscent > albina.

A perusal of the Table-1 revealed that EMS induced the higher frequency of chlorophyll muta-tions and was followed by MMS and SA in all the three varieties of mungbean.

Mutagenic effectiveness and efficiency: Data on effectiveness and efficiency for mutagen treated populations of the varieties Pant Moong-1, PS-10 and T-44 are presented in Table -2. The mutagenic effectiveness was recorded highest (448.66) with 0.02% MMS in the var. Pant Moong-1. The highest effectiveness of EMS was 58.64 in the var. T-44 whereas the highest effectiveness of SA was 312.50. in the var. PS-10. MMS treatment was found to be most effective in all the three varieties as com-pared to EMS and SA. The order of mutagens based upon effectiveness was: MMS> SA> EMS.

The mutagenic efficiency varied depending upon the criteria selected for its estimation. In the present study, the mutagenic efficiency worked out on the basis of seedling injury (Mp/l), pollen sterility (Mp/S) and inhibition in seed germination (Mp/R). The mutagenic efficiency was the highest in EMS treated populations in all the three varieties of mungbean. In general, the efficiency of mutagens in a descending order was: EMS > MMS > SA (Table-2). The efficiency calculated on the basis of inhibition in seed germination (Mp/R) was generally higher as compared to pollen sterility and seed-ling injury in all the three varieties of mungbean.

IV. DISCUSSION

The occurrence of chlorophyll mutations after mutagenic treatment has been reported by Venkateshwarlu et al. (1978) in spigeonpea, Dixit and Dubey (1986) in lentil and Singh et al. (1999) inundbean. In the presnet study, chlorina mutants occurred at maximum frequency followed by xantha and viridis. Singh et al. (1999) reported the higher frequency of xantha mutants followed by chlorina and albina in urdbean. The present investigation revealed that EMS induced highest frequency of chlorophyll mutants in all the three varieties. EMS is supposed to be specific to certain chromosomal regions (Goud. 1967) containing genes for chlorophyll development and has been reported to induce of chlorophyll mutations chlorophyll mutations differed in three varieties. Varietal differences have also been reported in Cicer (Nerkar and Mote, 1978), Lens (Sharma and Sharma, 1981) and Cajanus (Rao and Reddy, 1984). Goud et al. (1970) reported that the genetic architecture of the organism is a potent factor in deter mining its response to mutagens

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 10, Issue 1, October 2019
Impact Factor: 4.819

Treatment	No. of M_1 plant progenies	No. of plant progenies segregating in M_2	%age of mutated plant progenies	No. of M_2 plants	Chlorophyll mutant type						Total	Frequency (%)
					Albina	Xantha	Chlorina	Meculata	Viridis	Viriscent		
					Var. Pant Moong-1							
Control	25	–	–	–	–	–	–	–	–	–	–	–
0.2% EMS	24	15	62.50	279	5	16	17	8	9	5	60	21.50
0.02% MMS	26	14	53.84	263	4	12	16	6	6	4	48	18.25
0.02% SA	25	8	32.00	319	3	7	12	4	5	3	34	10.65
					Var. PS-10							
Control	25	–	–	–	–	–	–	–	–	–	–	–
0.2% EMS	24	14	58.33	290	4	15	18	4	7	5	53	18.27
0.02% MMS	27	13	48.15	328	5	13	21	5	4	4	52	15.85
0.02% SA	24	9	37.50	334	3	7	14	4	3	3	34	10.17
					Var. T-44							
Control	25	–	–	–	–	–	–	–	–	–	–	–
0.2% EMS	27	19	70.37	336	6	16	22	6	10	6	66	19.64
0.02% MMS	26	12	46.15	317	4	11	20	6	4	5	50	15.77
0.02% SA	26	9	34.61	344	3	7	7	3	3	4	27	7.84

Table 2. Effectiveness and efficiency of different mutagens in M_2 generation of mungbean.

Treatment	Seedling injury (I) %	Pollen sterility (S) %	Inhibition in seed germination (R) %	Mutagenic effectiveness Mp/t.c.	Mutagenic efficiency		
					Mp/I	Mp/S	Mp/R
				Var. Pant Moong-1			
0.2% EMS	26.94	23.86	15.19	52.08	2.32	2.62	4.11
0.02% MMS	23.80	23.69	15.28	448.66	2.26	2.27	3.52
0.02% SA	37.99	20.55	20.00	266.66	0.84	1.55	1.60
				Var. PS-10			
0.2% EMS	33.49	21.57	21.26	48.60	1.74	2.70	2.74
0.02% MMS	34.16	20.11	19.85	401.25	1.41	2.39	2.42
0.02% SA	46.13	17.75	17.50	312.50	0.81	2.11	2.14
				Var. T-44			
0.2% EMS	31.30	21.59	21.05	58.64	2.25	3.26	3.34
0.02% MMS	29.61	20.26	17.02	384.58	1.82	2.65	3.16
0.02% SA	40.67	17.15	16.64	288.41	0.85	2.01	2.07

The results indicate that the efficiency calculated on the basis of inhibition in seed germination was higher as compared with that based on pollen sterility and seedlings injury. This trend was obtained in all the three varieties of mungbean. These results are in contrary to the earlier findings of Grover and Virk (1984) in mungbean.

REFERENCES

1. Dixit, P. and Dubey, D.K. (1986). Chloromutations and seedling morphology mutations induced by separate and simultaneous application of gamma rays and NMU in lentil, LENS Newslett. 13 (1): 5-8
2. Goud, J.V. (1967). Induced polygenic mutations in hexaploid wheats. Rad. Bot. 7: 321-331.
3. Goud, J.V., Nayar, K.M.D. and Rao, M.G. (1970), Mutagenesis in sorghum. Ind. J. Genet. 30: 81-89
4. Grover, I.S. and Virk, G.S. (1984). Induced chlorophyll mutants in mungbean (Vigna radiata (L.) Wilczek). Acta Botanica. Indica 12: 138-147. 11:1-40.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 10, Issue 1, October 2019
Impact Factor: 4.819

5. Gustafsson, A. (1940). The mutation system of chiorophyll apparatus. Lunds Univ. Arsskr, M.F. Adv: 2Bd. 36 Nr. (Suppl.): 49-70.
6. Konzak, C.F., Nilan, R.A., Wagner, J. and Foster, R.J. (1965). Efficient chemical mutagenesis. Rad. Bot. 5 faba. Chromosome (Berl.) 15: 156-187.
7. Natrajan, A.T. and Upadhya, M.D. (1964). Localized chromosome breakage induced by EMS and HA in Vicia
8. Nerkar, Y.S. and Mote, S.E. (1978). Induced mutations in bengalgram (Cicer arietinum).I. Viable mutations. J.
9. Rao, D.M. and Reddy, T. P. (1984). Induction of mutations in pigeonpea (Cajanus cajan L.). Mutations Breed. Newslett. 24: 8.
10. Sharma, S.K. and Sharma, B. (1981). Effect of mutagens on character association in lentil. Indian J. Agric Sci 51 (9): 619-622.
11. Singh, V.P., Singh, M. and Pal, J.P (1999). Mutagenic effects of gamma rays and EMS on frequency and spectrum of chlorophyll and macromutations in urdbean (Vigna mungo (L.) Hepper). Indian J. Genet. 59 (2): 203-210.
12. Venkateswarlu, S., Singh, R.M., Singh, R.B. and Singh, B.B. (1978). Radiosensitivity and frequency of chloro-phyll mutations in pigeonpea. Indian. Jss. Genet. 38: 90-94