

## FREQUENCY AND SPECTRUM OF MUTATIONS INDUCED BY CHEMICAL MUTAGENS IN *LATHYRUS SATIVUS* L. VAR. P-25.

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(Accepted May 1993)

Frequency and spectrum of mutations, isolated in  $M_2$  generation from seeds of Khesari (*Lathyrus sativus* L.) cultivar P25 treated with varying concentrations of DES and EMS have been reported, Mutation frequency in terms of percentage of families segregating as well as in terms of mutations per thousand  $M_2$  plants increased with an increase in the concentration of mutagen, DES inducing higher mutation frequencies than EMS. Frequency of vital mutations was much higher than those of the chloromutations or the sterile mutations. Some promising mutants such as giants, tall, early maturing, tri and tetraflorates, long podded and bold seeded have been reported.

**Key Words:** Chemical mutagen, mutation, *Lathyrus sativus*.

Induced mutagenesis has assumed an important role in plant breeding by increasing variability for yield and its component characters. It has been clearly shown in a number of plant species that the effect induced, varies with the varying mutagens and with variations in doses. Thus selecting a mutagen and its optimum dose for a genotype in any plant species is important for the mutation breeding work. In the present study seeds of cultivar P25 (*Lathyrus sativus* L.) were subjected to varying concentrations of two chemical mutagens viz. diethyl sulphate (DES) and ethyl methane sulphonate (EMS). The present paper reports the frequency and spectra of mutations induced in  $M_2$  generation.

### MATERIAL AND METHODS

Genetically pure seeds of cultivar P25 of khesari were subjected to treatment with three different concentrations each of the two chemical mutagens EMS and DES for a period of six hours. Concentrations of DES applied were 0.1%, 0.05% and 0.025% while those of EMS were 0.025%, 0.0125% and 0.005%. Usual procedures of presoaking prior to treatment and post treatment washing etc. were adopted. The  $M_1$  population were raised in the crop season 1988-89 and harvested plant wise. The  $M_2$  population were raised in plant to family manner during the crop season 1989-90. These populations were screened regularly for mutations from the seedling stage up to maturity. Frequency of mutations under different treatments was estimated in terms of percentage of families segregating for mutants as also in terms of mutants per thousand  $M_2$  plants. The spectrum of mu-

Table 1: Frequency of mutations induced in khesari variety P25 by DES and EMS

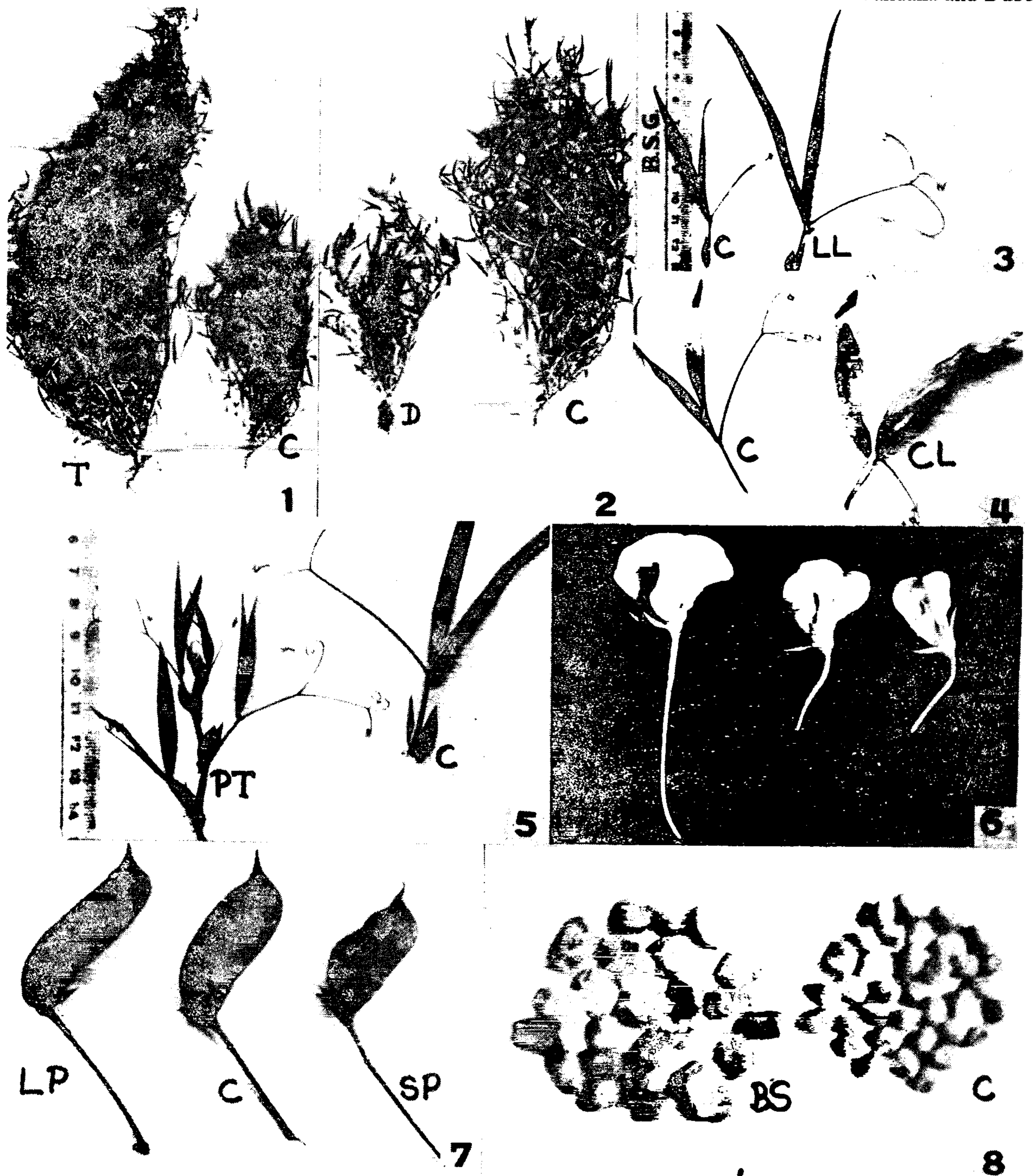
Treatment	Total families sown	Total families segregated	Percent age of families segregated	Total plants observed	Total mutants observed	Mutants/ 1000 $M_2$ plants
Control	132	-	-	8844	-	-
DES 0.1%	39	17	43.58	1300	46	35.38
DES 0.05%	32	10	31.25	2000	24	12.00
DES 0.025%	25	6	24.00	2101	20	9.52
EMS 0.025%	62	21	33.87	4033	38	9.37
EMS 0.0125%	52	13	25.00	4081	24	5.88
EMS 0.005%	38	1	2.63	1303	13	9.98

tations was classified into three categories i.e. chloromutations, sterile/nonviable mutations and viable mutations.

### RESULT AND DISCUSSION

Frequency of mutations induced by different treatments summarised in table-1, reveals that for both the mutagens the frequencies increased with the increase of the concentrations of mutagens. This holds good both for the percentage of families segregating as well as for the number of mutants per thousand  $M_2$  plant. Mutation frequencies under different DES doses were higher than those under the EMS doses.

Chloromutations of the categories *Albina*, *Viridis*, *Xantha*, *Alboviridis*, *Viridoalba*, *Alboxantha* and *Straita* were recovered during the present study (Table 2), of these, xantha was the most frequent type and was induced in all the treatments. Albina was induced by the highest dose of EMS alone, while viridis and alboxantha were recovered only in the highest dose treatment of DES. Viridoalba and straita were induced



Figures 1-8 Showing mutated characteristics in *Lathyrus sativus* L.

Fig. 1. T = Tall mutant; C = Control plant. 2. D = Dwarf mutant; C = Control plant. 3. C = Control leaf; LL = Large leaf. 4. C = Control leaf; CL = Curled leaf. 5. PT = Pentafid tendril; C = Control tendril. 6. LF = Large flower; C = Control; SF = Small flower. 7. LP = Large pod; C = Control pod; SP = Short pod. 8. BS = Bold seeds; C = Control seeds.

by the highest dose treatments of both the mutagens while alboviridis was induced only by the middle dose of the two mutagens. DES and EMS appear to be

equally effective in inducing chloromutations in this genotype of khesari.

Table 2 : Spectrum of chlorophyll mutations induced in khesari variety P25 by DES and EMS.

Treatment	Albina Vidi- dis	Xan- tha	Albo- viri- dis	Viri- doal- ba	Albo- xan- tha	Strai- ta	Total
Control	-	-	-	-	-	-	-
DES 0.1%	-	1	2	-	1	1	6
DES 0.05%	-	-	1	1	-	-	2
DES 0.025%	-	-	1	-	-	-	1
EMS 0.025%	1	-	2	-	1	1	5
EMS 0.0125%	-	-	1	1	-	-	2
EMS 0.005%	-	-	1	-	-	-	1
<b>Total</b>	<b>1</b>	<b>1</b>	<b>8</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>17</b>

Table 3 : Spectrum of sterile mutants induced in khesari variety P 25 by DES and EMS.

Treatment	Flower- less	Cleisto- gamous	Seed- less	Under developed seeded	Total
Control	-	-	-	-	-
DES 0.1%	1	-	1	2	4
DES 0.05%	1	-	-	1	2
DES 0.025%	1	-	-	1	2
EMS 0.025%	1	1	1	1	4
EMS 0.0125%	1	-	-	1	2
EMS 0.005%	-	-	-	1	1
<b>Total</b>	<b>5</b>	<b>1</b>	<b>2</b>	<b>7</b>	<b>15</b>

Sterile mutants of four categories were induced in the present study (Table 3). These included flowerless, where the plants dried up without flowering; cleistogamous, where flower buds failed to blossom; seedless, where fruits contained no seeds and undeveloped seed type where small, shrivelled, nonviable seeds were produced. Of the four types, under developed seed type and flowerless were more frequent and were induced by almost all the treatments, where as cleistogamous was induced only by highest dose of EMS and seedless was induced by highest doses of both the mutagens.

A wide variety of viable mutants were obtained from the M<sub>2</sub> segregating populations of different treatments. A perusal of the table-4 summarising the spectrum of viable mutations reveals that a number of plant characteristics such as colour of cotyledary leaves; plant height (Fig. 1 and 2); pattern of branching; size, shape and colour of leaves (Fig. 3 and 4); colour and texture of plant surface; tendrils size and five forked tendrils in place of trifid (Fig. 5); size, colour and arrangement of flowers (Fig. 6); maturity period; size and texture of pods (Fig. 7) and size and shape of seeds (Fig. 8) were altered through mutations. Among these, mutations effecting floral characteristics were more frequent than the other categories.

Spectra of vital mutations are of the most important consideration for isolating desirable mutant types. Some of the vital mutants induced in the present study such as tall, giants, highly branched, tri and tetraflorates, early flowering, long poded and large seeded mutants hold promise for their possible use in breeding better varieties for commercial cultivation. Besides these desirable mutations, a number of

mutants of academic interest showing variation in cotyledary leaf, stunted, dwarf characteristics, variations in plant habit, plant texture, flower colour etc. were also induced. Further cytogenetical analysis of these mutants may help in better understanding of the genetics of these traits.

The frequency of vital mutations in the present study was found to be much higher than that of chlorophyll mutations or the sterile mutations. Gamma irradiations have been found to induce a higher frequency of chloromutations than that of vital mutations in a number of crops (Tyagi and Das, 1975; Singh *et al.*, 1977; Dixit and Dubey, 1983). However, Dixit and Dubey (1983) in lentil observed that NMU induced a higher frequency of vital mutations than the chloromutations. We have also noted a much higher frequency of vital mutations in comparison to the chloromutants in *Vicia faba* L. treated with EMS and DES. Thus chemical mutagens appear to be less effective in inducing chloromutations than the physical mutagens.

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