Biosciences, Biotechnology Research Asia Vol. **3**(2), 363-366 (2005)

DES INDUCED VARIATIONS FOR ECONOMIC TRAITS IN BROAD BEAN (*Vicia faba* L.)

Afaq Ahmad Khan, M.Y.K. Ansari, Tariq Ahmad Bhat and Danish Shahab

Mutation Breeding and Cytogenetics Laboratory, Department of Botany,
Aligarh Muslim University, Aligarh - 202 002 (India)

(Received: June 10, 2005; Accepted: August 25, 2005)

ABSTRACT

Seeds of broad bean (*Vicia faba* L.) var. major were treated with 0.25%, 0.50%, 0.75%, concentrations of diethyl sulphate (DES) to induce variability in seven economic traits viz. plant height, days to flowering, days to maturity, pods/plant, seeds/pod, seeds/plant and 100-seeds weight. The direction of shift in mean values for plant height indicated that negative micromutations out-weighed the positive ones. While as for days to flowering, days to maturity, pods/plant seeds/pod, seeds/plant and 100 seeds weight shift of mean was recorded both in positive and negative direction. Coefficient of variation was recorded to be higher in mutagen treated populations.

Key words: DES, *Vicia faba*, Economic traits, Coefficient of variations.

INTRODUCTION

Induced mutagenesis serves as an important tool for creating genetic variability in crop plants and significant achievements in crop improvement have been made through mutation approach. It also serves as a supplement to conventional breeding programmes to improve one or two specific characters in a well-adapted variety. Since the induction of mutations has been accepted as a useful tool in plant breeding programme, a systematic study of induced mutagenesis creating variability for economic traits appears to be essential in broad bean, a self pollinated pulse crop.

MATERIAL AND METHODS

Uniform and healthy seeds of broad bean (*Vicia faba* L.) var. major were presoaked in distilled water for 8 hours prior to mutagen treatment. Three concentration of DES (0.25%, 0.50%, 0.75%,) were prepared in phosphate buffer of PH-7. One set of seeds was kept untreated to act as control. After completion of treatment period for 24 hours, seeds were thoroughly washed in running tap water to reduce the residual effects of the mutagen sticking to the seed coat. Three replications of 100-seeds each were sown for every treatment in the field in complete randomized block design (CRBD) to raise M_1 generation. The M_1 plants were harvested separately and the seeds sown in the next season in plant progeny rows to raise M_2 generation. The plant to plant and row to row distance was kept as 30 and 60 cm, respectively. Data collected for various economic traits was analysed statistically to find out mean, shift in mean and coefficient of variations (CV).

RESULTS AND DISCUSSION

Data on the effects of various treatments of DES on mean values, shift in mean and coefficient of variation for different economic traits in M_1 and M_2 generations are presented in Tables 1 and 2. The mean values for plant height showed dose dependent reduction and both increase and decrease in other traits (Table 1,2). The shift in mean values was recorded both in negative and positive

Table 1: Estimates of mean values, shift in ($\overline{X}$), S.D. and Coefficient of variation (CV) for various economic traits in M_1 generation of *Vicia faba* L.

Treatment	Mean ±S.E.	Shift in	S.D.	CV (%)
		Plant height (cm)		
Control	38.00±0.57	-	2.16	5.68
0.25% DES	24.00±0.60	-14.00	4.90	20.42
0.50% DES	21.16±0.72	-16.84	5.72	27.03
0.75% DES	22.00±0.80	-16.00	4.30	19.55
		Days to flowering (cm)		
Control	93.50±0.82	-	0.52	1.60
0.25% DES	91.80±0.91	-1.70	0.91	1.80
0.50% DES	92.80±0.42	+0.70	0.91	2.99
0.75% DES	92.33±0.60	+0.60	0.73	3.10
		Days to maturity		
Control	160.50±0.72	-	0.52	1.32
0.25% DES	158.80±0.60	-1.70	0.91	2.57
0.50% DES	155.50±0.52	+5.00	0.54	3.60
0.75% DES	162.70±0.77	+2.20	0.82	3.80
		No. of pods/plant		
Control	15.86±0.52	-	0.33	2.06
0.25% DES	13.18±0.72	-5.68	0.56	3.60
0.50% DES	18.96±0.35	+3.10	0.46	3.80
0.75% DES	16.00±0.38	+0.14	0.62	4.09
		No. of seeds/pod		
Control	3.4±0.20	-	0.51	10.30
0.25% DES	3.6±0.36	-0.20	0.52	14.34
0.50% DES	4.9±0.52	+1.50	0.73	15.05
0.75% DES	2.3±0.30	+1.10	0.48	21.00
		No. of seeds/plant		
Control	41.22±0.60	1.59	1.59	3.87
0.25% DES	36.00±0.70	-5.22	2.86	4.00
0.50% DES	44.00±0.80	+2.78	2.78	4.25
0.75% DES	46.00±0.32	+4.78	1.28	5.72
		100-seeds weight (gm)		
Control	24.49±0.20	0.52	0.52	2.13
0.25% DES	26.70±0.38	+2.21	0.81	3.58
0.50% DES	27.88±0.22	+3.39	0.84	3.86
0.75% DES	20.96±0.32	-3.53	1.64	8.14

Table -2: Estimates of mean values, shift in ($\overline{X}$), S.D. and Coefficient of variation (CV) for various economic traits in M_2 generation of *Vicia faba* L.

Treatment	Mean ±S.E.	Shift in	S.D.	CV (%)
		Plant height (cm)		
Control	38.66±0.33	-	2.49	6.44
0.25% DES	31.66±0.26	-7.00	2.70	7.33
0.50% DES	28.16±0.38	-10.50	2.80	8.49
0.75% DES	29.83±0.30	-8.83	2.99	9.83
		Days to flowering (cm)		
Control	93.80±0.26	-	1.42	1.44
0.25% DES	93.40±0.38	-0.40	2.52	2.55
0.50% DES	90.20±0.76	+3.60	2.31	3.45
0.75% DES	95.10±0.73	+1.30	2.56	3.77
		Days to maturity		
Control	160.70±0.76	-	1.48	1.30
0.25% DES	159.20±0.91	-1.50	2.91	2.57
0.50% DES	157.40±0.80	+3.30	3.51	3.80
0.75% DES	161.10±1.10	+0.40	4.10	4.25
		No. of pods/plant		
Control	15.18±0.20	-	0.24	1.55
0.25% DES	11.85±0.22	-3.33	0.13	1.77
0.50% DES	20.60±0.32	+5.42	0.38	3.27
0.75% DES	18.22±0.11	+3.04	0.40	4.33
		No. of seeds/pod		
Control	3.50±0.22	-	1.52	8.04
0.25% DES	2.9±0.56	-0.6	3.56	19.57
0.50% DES	5.1±0.73	+1.6	4.73	14.46
0.75% DES	3.80±0.42	+0.3	3.88	11.09
		No. of seeds/plant		
Control	39.60±0.42	-	1.80	2.06
0.25% DES	28.89±0.33	-10.71	1.00	2.30
0.50% DES	42.42±1.70	+2.82	1.70	3.41
0.75% DES	41.33±0.83	+1.73	1.90	4.72
		100-seeds weight (gm)		
Control	26.19±0.44	-	1.54	2.06
0.25% DES	31.69±0.54	+5.50	2.66	2.19
0.50% DES	21.79±0.69	+4.40	2.80	3.41
0.75% DES	21.28±0.21	-4.91	3.10	4.72

direction. The shift in mean values in negative direction indicates that the negative micromutations has out weighted the positive ones. The mean values were recorded in positive direction in some of the concentrations of the mutagen for days to flowering, days to maturity, pods/plant, seeds/pod, seeds/plant and 100-seed weight while as for plant height, the shift in mean values were recorded in negative direction in all the concentrations of the mutagen. (Table 1,2). The mutagen treatments were effective for changing coefficient of variation for treated population. No significant change in mean values was observed in M_1 generation, whereas mean values were significantly altered in M_2 generation. The decrease in mean values of various quantitative traits is in agreement with the hypothesis that, due to mutagenic treatment, mean is shifted to a direction opposite to selection (Bhatia and Swaminathan, 1962), whereas the increase in mean values could be due to the occurrence of polygenic mutations with cumulative effects (Singh *et al.,* 2000a). The shift in mean values in the positive direction indicates that more positive mutations have occurred for these traits, whereas, a decline in the treatment mean is a pointer of more frequent induction of negative micromutations than the positive ones. The change in the mean values after mutagenic treatments has been reported earlier by Anis *et al* (1999), Kumar and Dubey (1998b) in sunflower.

In the present study, coefficient of variability increased over the control for almost all the characters in both M_1 and M_2 generations, various economic traits responded differently to the mutagenic treatments. A linear relationship was observed between the mutagen concentrations and the variability induced for various economic traits. These results are not in agreement with the earlier report of Singh *et al.* (2000b) who observed no linear relationship between the mutagen doses and the induced variability in urdbean. The maximum variability was recorded for seeds/pod, plant height seeds/plant and 100-seeds weight. According to Singh *et al.* (2000a) induction of greater variability in polygenic traits might be due to increased mutations and recombinations. The induction of variability by DES indicates that the mutagen can be effectively used to induce favourable changes in *Vicia faba* L. for further improvement of its genotype.

ACKNOWLEDGEMENT

The authors are thankful to Chairman, Department of Botany, Aligarh Muslim University, Aligarh for providing necessary facilities for completion of this work.

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