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Mutagen induced polygenic variability in sesame (*Sesamum indicum* L.)

A.SHEEBA, S.M.IBRAHIM, P.YOGAMEENAKSHI AND S.BABU
Dept. of Plant Breeding and Genetics, Agricultural College and Research Institute, Madurai, Tamil Nadu

Abstract: Two varieties of sesame *viz.* SVPR 1 and CO 1 were treated with two mutagens *viz.* gamma rays and EMS. In M_2 generation, a wide range of polygenic variability in the form of micromutations was generated. M_2 generation shifted the overall mean values in the positive direction in lower doses upto 50 krad of gamma rays and 1.2% of EMS for the characters 1000 seed weight, oil content and single plant yield. Treated M_2 populations showed a much greater range of variability for all the characters than controls. Induced genetic variability was more in CO 1 than SVPR 1. The enhanced genetic variability observed for seed yield and its component characters in the M_2 generation of the present study indicated the scope for effective selection.

Key words : Sesame, Induced mutations, Polygenic variability, Genotypic co-efficient of variation.

Introduction

Induced mutagenesis can be efficiently employed as an alternative or supplement source to increase the variability. The variability in quantitative characters increases considerably by treating the biological materials with different mutagenic agents. The genetic variability offered by the mutagenic agents is of extreme importance in plant breeding. Improvements in quantitative characters have been achieved through accumulation of genes affecting their expression in a positive or negative direction and thus, increasing the variability. An estimation of the extent of variability induced in M_2 generation will be of great value to provide useful information for carrying out further selection. Among different methods available to detect the induced variability in the mutated population, mean and components of variance serve as a suitable statistical parameters (Scossiroli, 1977). The present investigation was attempted during 2001-02 in Agricultural College and Research Institute, Madurai to assess the impact of different mutagenic treatments on mean and components of variance in different quantitative characters.

Materials and Methods

Two sesame varieties *viz.* SVPR 1 and CO 1 were treated with gamma rays (30 to 70 krad) and EMS (0.8 to 1.6%). The treated seeds along with their respective controls were sown immediately in the field to raise the M1 generation with two replications in a randomized block design durign Aug-Oct, 2001 at AC & RI, Madurai. Each M_1 plant was harvested individually and raised as M_2 progeny in separate rows during Jan-Mar, 2002. The progeny of each M_1 plant constituted one M_2 family. The spacing between rows and plants were 30 and 15 cm, respectively. The treated as well as control populations were carefully screened for polygenic variability/micromutations. Data on eight quantitative characters *viz.* plant height, number of branches per plant, number of capsules per plant, capsule length, number of seeds per capsule, 1000 seed weight, oil content and single plant yield from five normal looking competitve plants from each M_2 family were recorded and the mean and variance interms of GCV were calculated. Genotypic coefficient of variation (GCV) was computed by using the formula given by Burton (1952).

Results and Discussion

The effect of mutation can be adjudged simply from the mean values as it gives a direct measure about the induction of mutagens. In SVPR 1, a positive shift upto 50 krad of gamma rays and 1.2 per cent of EMS as the dose/concentration increased and a negative

Table 1. Mean and GCV (%) value for quantitative traits in M_2 generation

Treat-ment	Plant height				No. of branches plant^{-1}				No. of capsules plant^{-1}				Capsule length			
	SVPR 1		CO 1		SVPR 1		CO 1		SVPR 1		CO 1		SVPR 1		CO 1	
	Mean	GCV	Mean	GCV	Mean	GCV	Mean	GCV	Mean	GCV	Mean	GCV	Mean	GCV	Mean	GCV
0	100.7	1.63	111.8	2.38	6.92	4.00	6.56	2.62	89.77	1.68	117.1	3.93	2.67	5.00	2.59	1.36
Gamma																
30	74.39	1.00	100.8	3.13	5.13	1.40	5.38	1.35	93.09	1.43	92.21	1.50	2.39	5.46	2.52	11.13
40	73.45	5.06	98.86	2.01	4.74	2.11	5.35	4.20	88.40	3.51	97.05	2.49	2.47	3.23	2.52	3.22
50	91.02	1.08	115.3	7.50	7.01	0.46	5.90	3.22	109.4	1.86	116.4	2.14	2.68	1.04	2.81	3.24
60	75.86	1.04	84.85	3.11	4.63	1.53	5.35	2.93	77.26	1.94	92.66	6.49	2.64	5.42	2.43	2.21
70	70.51	1.69	77.78	1.27	4.31	2.65	5.21	0.61	77.17	1.94	77.57	1.43	2.60	6.91	2.60	5.24
EMS																
0.8	78.70	2.39	92.23	4.87	7.36	2.04	6.19	2.87	105.0	0.51	106.9	2.32	2.54	4.20	2.48	4.14
1.0	81.40	2.40	89.00	3.35	5.82	1.98	6.06	2.41	106.9	3.54	107.8	4.20	2.64	5.78	2.40	6.84
1.2	86.66	1.67	106.3	3.58	6.40	2.78	7.06	1.83	117.1	2.71	116.8	2.25	2.64	1.20	3.09	3.82
1.4	72.46	2.19	70.94	2.67	4.89	3.13	6.26	0.75	78.07	0.91	89.70	2.10	2.44	1.50	2.24	4.36
1.6	64.52	1.46	75.54	1.81	4.87	2.69	5.82	1.47	75.61	0.84	76.92	2.76	2.33	4.30	2.38	5.95

shift afterwards was observed for t characters 1000 seed weight, oil conte and single plant yield. M_2 generati shifted the overall mean values in t negative direction for plant height SVPR 1. In CO 1, negative shift w observed in all the treatments for pla height in EMS, for number of branch per plant in gamma rays and for numb of capsules per plant in both the mutage The mean values were maximum f the characters plant height and numb of capsules per plant in CO 1 and f oil content and single plant yield SVPR 1. No significant deviation w noticed between SVPR 1 and CO 1 f other characters. Borojevic (1971) stat that the positive shift in mean valu might be due to the effect of natu selection and elimination of chromoso aberrants. Similarly the negative sh may be due to more frequent occurre of detrimental mutants than the favoura ones as observed by Bhatia and Swaminath (1962).

In SVPR 1, the maximum GC was observed at 40 krad for plant heig number of capsules per plant and c content, at 70 krad for number of branch per plant, capsule length and numb of seeds per capsule and at 30 kr for 1000 seed weight and single pla yield for gamma rays. In the case EMS, 1.0 per cent registered the maximu GCV for plant height, number of capsul per plant and capsule length, where the high GCV for number of branch per plant, number of seeds per capsu and single plant yield was recorded l 1.4 per cent. In CO 1, the maximu GCV was exhibited by 40 krad for numb of branches per plant and oil conter by 60 krad for number of capsules p plant and number of seeds per capsu and by 30 krad for capsule length ar 1000 seed weight for gamma rays. EMS, 0.8 per cent for plant height ar number of branches per plant and 1 per cent for capsule length, number seeds per capsule and single plant yie

were found to have maximum GCV. While comparing both the varieties, induced genetic variability was more in CO 1 than SVPR 1. In CO 1, increased genetic variability was observed for almost all the characters.

In the present study, capsule length recorded comparatively higher GCV followed by number of seeds per capsule in both the varieties, 1000 seed weight in CO 1 and single plant yield in SVPR 1. Such pronounced variability for yield and yield attributes was also recorded in sesame by Prabhakar (1985) and Govindarasu and Ramamoorthi (2000). The enhanced genetic variability that observed for seed yield and its component characters in the M_2 generation of the present study indicated the scope for effective selection.

M_2 progenies which showed higher co-efficient of variation (CV%) than the control for any of the characters were considered to be the progenies carrying induced mutations. Although a large number of progenies were identified as mutated (with higher CV) for the characters studied, all of them were not expected to be of equal selection value. The promising M_2 progenies should have higher GCV as well as higher mean for various characters (Solanki and Sharma, 2001).

The gamma rays, 30 krad in SVPR 1 for the characters 1000 seed weight and single plant yield, 40 krad in SVPR 1 and CO 1 for oil content and 50 krad in CO 1 for plant height registered high GCV along with high mean values. In the case of EMS, 1.0 per cent in CO 1 for number of capsules per plant and 1.2 per cent in SVPR 1 for single plant yield exhibited high GCV and high mean values. This combination of high GCV values and relatively high mean values for these characters suggest that a large part of the induced variability has been in the positive direction. The above treatments, therefore, deserve special attention for carrying forward to further generation.

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