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INDUCED GENETIC VARIATION IN *BRASSICA JUNCEA*

I. VARIABILITY IN PLANT HEIGHT, NUMBER OF FRUIT BEARING BRANCHES, YIELD AND OIL CONTENT

M. Saleem Shaheen*, Abdul Shakoor and A. Rehman Chowdhry****

Seed of *Brassica juncea* variety Poorbi Raya was irradiated with 75 kR, 90 kR and 100 kR exposures of gamma rays from 60C° source. The magnitude of genetic variation and heritability estimates in broad sonse were worked out for various plant characters in M_2 generation. The coefficient of variation and heritability estimates for plant height and number of fruit bearing branches were high in 100 kR treatment as compared to the lower doses. The heritability estimates for yield per plant ranged from 55.30 to 58.35 and for oil content the heritability estimates were rather high ranging from 88.38 to 90.63. Selection for plant height, number of fruit bearing branches, yield per plant and oil content could be effectively made in M_2 generation after irradiation treatment.

INTRODUCTION

Oleiferous Brassicae constitute an important source of edible oils in Pakistan, occupying about 23 per cent of the entire area under oil bearing crops. The yield per acre of brassica is very low in Pakistan as compared to developed countries of the world. The commercial varieties grown by the farmers have poor response to fertilizer and other inputs. Considerable losses in yield may occur due to lodging and shattering in field. There is need to reconstitute a plant type capable of giving better yield under improved cultural practices. Induced mutation breeding procedures have proved to be quite useful, particularly in cases where natural genetic variation is scanty. Induced mutation procedures have already been successfully exploited for the improvement of different field crops for various economic characters (Gardner 1969, Gregory 1965).

Sanghavan and Yadava (1974) observed a significant change in mean values of plant height and yield per plant in M_1—M_3 generations of *B. juncea* after irradiation treatment with 60—120 kR gamma rays. Gupta (1965) obtained short statured mutants and high heritability values for number of branches in M_3 generation of *B. juncea*. Nayar (1968) reported 1 per cent more oil in yellow seeded mutant Rai 5 obtained from *B. juncea* L. Rai 5.

MATERIALS AND METHODS

Selfed seed of variety Poorbi Raya was treated with 75 kR, 90 kR,

*Maize and Millets Research Institute, Yusafwala, Sahiwal.
**University of Agriculture, Faisalabad.

100 kR exposures of gamma rays from 60C° source located at Nuclear Institute for Agriculture and Biology Faisalabad, one day prior to sowing. Before treatment, seeds were kept in desiccator containing calcium oxide for about a week to equiliberate moisture content, which was brought to 12.5 per cent at the time of irradiation treatment. M_1 generation alongwith parent variety was planted in an isolated place to guard against possible contamination from stray pollen. More than 500 M_1 plants were selected in each treatment and threshed individually to raise M_2 generation.

M_2 progenies of Poorbi Raya alongwith parent variety were planted in complete randomized block design with three replications. A distance of 45 cm was kept between adjacent rows where as plants were spaced 25 cm apart after germination. Data on various morphological characters were taken at the time of maturity for parents and M_2 progenies. Heritability estimates in broad sense were worked out according to the formula described by Shakoor *et al.* 1978.

RESULTS AND DISCUSSION

The irradiation treatment on Poorbi Raya with 75 kR, 90 kR and 100 kR exposures of gamma rays generated enormous genetic variability for plant height, number of fruit bearing branches, yield per plant and oil content. The mean values, coefficient of variation and heritability estimates obtained in M_2 generation are given in Table 1.

The mean values for plant height resulting from various irradiation treatments were lower than the control. The coefficient of variation was high (12.26) in 100 kR treatment as compared to the control (6.55). The heritability estimate for plant height was highest in 100 kR treatment as compared to 75 kR and 90 kR treatments. The high heritability estimates showed that selection for short stature after irradiation treatment may effectively be made in M_2 generation. Short statured mutant in *B. juncea* have been reported (Gupta 1965) and significant change in mean values for plant height was reported by Sanghavan and Yadava (1974) in M_1—M_3 generation after irradiation treatment.

In Brassica high number of fruit bearing branches is an important character for obtaining higher yield. The mean number of fruit bearing branches in all the M_2 populations were higher than the control. The coefficient of variation (40.22) and heritability estimate (60.19) were highest in 100 kR treatment, showing that selection for high number of fruit bearing branches would be more effective in populations resulting from treatments with higher doses of gamma radiation. Gupta (1965) also reported high heritability values for number of fruit bearing branches in M_3 generation of *Brassica juncea*. The values for mean yield per plant were higher invariably

Table 1. *Mean Values, Coefficients of Variation and Heritability Estimates for Plant Height, Number of Fruit Bearing Branches, Yield per Plant and Oil Content in M_2 Generation of Poorbi Raya Resulting from Irradiation Treatment With Gamma rays.*

Treatment	Plant Height			Fruit Bearing Branches			Yield/Plant			Oil Content		
	Mean Plant height (cm)	Coefficient of variation	Heritability estimates	Mean number of fruit bearing branches.	Coefficient of variation	Heritability estimates	Mean yield per plant (gm)	Coefficient of variation	Heritability estimates	Mean oil cont % age	Coefficient of variation	Heritability estimates
75 kR	210.56 ± 15.79	7.50	10.72	46.91 ± 15.22	32.44	22.83	29.88 ± 14.38	48.15	58.35	35.39 ± 0.94	2.66	89.81
90 kR	212.28 ± 18.66	8.79	36.07	60.59 ± 20.48	33.80	57.38	33.13 ± 14.29	43.13	57.83	37.72 ± 0.88	2.33	88.38
100 kR	199.31 ± 24.45	12.26	62.76	52.69 ± 21.19	40.22	60.19	29.33 ± 13.88	47.32	55.30	37.36 ± 0.98	2.62	90.63
Control (Poorbi Raya)	277.87 ± 14.92	6.55	—	40.55 ± 13.37	32.97	—	22.74 ± 9.28	40.81	—	38.22 ± 0.30	0.81	—

in all the treatments as compared to control, but the differences of coefficient of variation among various treatments and control were very small. However, the heritability estimates were quite high in all the treatments. Yield per plant is a complex character therefore, due care would be needed while making selection in M_2 generation. High yielding mutants of brassica have been reported by various other workers Sanghavan and Yadava (1974) and Kumar (1972).

Oil content is an other important breeding objective in Brassica. In the present investigations the mean values for oil percentage were slightly lower in the treated population as compared to the control. However, the heritability estimates were very high in all the treated populations. Mutations occurring within a narrow range both in positive and negative directions might have influenced the magnitude of coefficient of variation. Heritability estimates indicated that selection for higher oil content would be possible. Nayar (1968), also reported a mutant line which gave 1 per cent more oil than its parent line.

The genetic variability for plant height is limited in *Brassica juncea* and induced mutation offers an effective approach in creating genetic variability for plant height, plant type and other characters of economic importance. Short statured plants with high number of fruit bearing branches and better yield potential resulting from irradiation treatment of Poorbi Raya, were observed in M_2 generation. Such a plant type is expected to respond better to high rate of fertilization and amenable to improved cultural practices for obtaining high yield in Brassica.

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