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Extent of Induced Variation in M_2 Progenies of Coriander

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Abstract: A study was conducted during rabi season of 1996-97 to evaluate extent of induced variation for various quantitative characters in M_2 progenies of coriander variety UD-436. These M_2 progenies were originally obtained by treating the seeds with 15, 20, 25 kR doses of gamma irradiation with or without sodium azide (1 mM) and hydroxylamine (1%) and following selfing of M_1 progeny. The inter-progeny variance was highly significant, whereas the intra-progeny variance was non-significant for all the traits studied. Progenies differing significantly from the control on positive and negative directions were more frequent for all the traits except grain yield per plant and 100-grain weight. Based on mean and coefficient of variation, two progenies, namely 43 and 56, may be advanced to M_3 generation to obtain even better segregants.

Key words: Coriander, induced variation, mutagens, quantitative traits.

Coriander (*Coriandrum sativum* L.) is one of the important seed spice crops of India (Purthi, 1976). Besides large domestic consumption in various forms, it has a bright export potential (Rao *et al.*, 1994). It was estimated that genetic base is very narrow to achieve any substantial improvement even if the systematic breeding programs are taken up. Whatsoever variability is present is not usable on account of vary small floral structure, leading to difficulty in hybridization.

Hence, mutation breeding is generally advocated to genetically improve the crop. An attempt was made to use physical (gamma rays) and chemical (azide and hydroxylamine) mutagens in a released coriander variety UD-436, with the objectives to estimate the extent of induced variation in M_2 progenies for yield and yield attributes and then select superior mutants for high yielding potential.

Material and Methods

The experimental material consisted of 192 M_2 progenies of coriander variety UD-436. Each M_2 progeny was corresponded to a single M_1 plant, which was selfed to obtain M_2 progenies. Among 192 progenies, 11 were obtained from 15 kR gamma rays, 13 from 20 kR, 4 from 25 kR, 16 from azide + 0 kR, 20 from hydroxylamine + 0 kR, 82 from Az + 15 kR and 3 from hydroxylamine + 25 kR treatments. Each of the M_2 progenies were sown in a plot of one row of 3 m length, each spaced 30 cm apart while plant to plant distance was maintained at 10 cm. Since there were no replications, therefore, the check variety

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UD-436 (untreated) was repeated after every 24 rows.

Observations were recorded in respect of eight quantitative characters, viz., plant height, primary branches per plant, umbels per plant, grains per umbel, grain yield per plant on 5 randomly selected plants in each M_2 progeny. The data were subjected to analysis of variance. The estimation of magnitude of variability, such as variance and coefficient of variation was done on progeny and population basis, using the standard statistical procedures outlined by Snedecor and Cochran (1967).

Results and Discussion

The results of analysis of variance revealed that inter-progeny mean square was highly significant for all the traits, suggesting induction of variation in respect of all the characters analyzed. This finding also indicates that different loci-/genes are mutated in different M_2 progenies and shows the efficiency of the mutagenic treatments used initially. The intra-progeny variance was, however, non-significant for all the traits. Significant intra-progeny variance has been reported in coriander for umbels per plant (Singh *et al.*, 1992).

Lack of significant variation within progenies may be partly attributed to increase in homozygosity, arising due to induced mutation. As a matter of fact, the basic genotypic constitution of a cross pollinated crop, such as coriander, is expected to be heterozygous at most loci. An event of forward mutation may turn a heterozygous locus into homozygous in M_1 itself, and hence, variation that results from segregation in M_2 would reduce.

However, when the progenies exhibiting significantly high or low mean values than the control mean were compared, it could

Table 1. Distribution of progenies showing significant increase or decrease in the mean performance for various characters studied in respect of different mutagenic treatments

Mutagenic treamtnes received	Yield per plant (g)		Plant height (cm)		Primary branches per plant		Umber per plant		Grains per umbel	
	a	b	a	b	a	b	a	b	a	b
15 kR	9	1	10	1	9	–	10	1	8	2
20 kR	6	4	5	8	6	6	9	3	3	9
AZ + 0 kR	3	1	4	–	4	–	3	–	3	1
AZ + 15 kR	29	36	50	19	48	19	45	23	41	25
AZ + 20 kR	2	–	1	1	–	–	2	–	1	–
AZ + 25 kR	3	–	3	–	3	–	3	–	3	–
HA + 0 kR	–	19	–	17	–	17	–	19	6	11
HA + 15 kR	11	17	11	12	14	10	20	5	8	16
HA + 20 kR	–	3	2	1	3	–	3	1	–	–
HA + 25 kR	1	1	3	–	1	1	1	1	1	1

Table 2. Magnitude of different quantitative characters of M_2 progenies with high yield and high or low coefficient of variation

M_2 progenies	Matagenic treatment received	Yield plant^{-1} (g)		Primary branches/ plant		Umbels/ plant		Grains/ Umbel	
		Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.
43	20 kR	8.580	84.38	7.2	11.62	22.4	44.57	44.6	15.98
44	20 kR	5.720	49.20	6.8	16.10	27.6	27.66	39.0	29.23
46	20 kR	6.880	42.59	7.6	11.76	35.0	21.44	25.8	33.27
56	20 kR	7.290	36.37	7.8	7.20	31.2	19.41	36.4	21.11
59	20 kR	5.420	28.44	7.2	11.62	18.6	18.46	24.4	19.56
81	Az + 20 kR	5.010	54.51	5.4	16.56	19.2	47.36	23.6	22.14
104	Az (1 mM)	6.686	41.88	5.6	9.78	10.0	15.81	19.4	20.81
113	15 kR	6.288	32.79	7.0	10.10	23.0	50.00	33.8	30.34
135	Az = 15 kR	4.476	30.74	7.4	3.02	28.6	30.54	44.4	11.44
165	Az + 15 kR	6.070	51.00	7.2	18.10	22.6	85.71	42.6	23.33
Control	Untreated	2.368	34.26	5.2	13.64	11.8	24.23	24.93	26.25

be seen that numerically, the variants showing positive shift in the mean, out-numbered those showing negative shift for all the characters, except yield per plant for which progenies more frequently showed negative shift it their mean. However, it is unlikely to expect more mutations with positive shift in their mean values in respect of a character as mutations generally have deleterious effects. Both azide and hydroxylamine seemed to reduce the mutagenic effect of 15 kR γ rays with respect to all the characters analyzed (Table 1). The dose of 15 kR is also LD 50, which was determined earlier on the basis of generation and survival of M_1 plant.

A comparison of the progeny means for different traits with control mean revealed that 97 progenies superseded the respective control mean values for plant height (Table 1). The number of such progenies was 98 for primary branches per plant, 101 for umbels per plant, 76 for umbellets per umbel, 84 for grains per umbel, 105 for seed setting per umbel, 68 for grain yield per plant and 62 for 100-grain weight. The per cent increase recorded by the best progenies for each character was as high as 262% for grain yield per plant, followed by 218% for seed setting per umbel, 197% for umbels per plant, 88% for grains per umbel, 53% for plant height, 50% for primary branches per plant and 20% for 100-grain weight over control.

Based on significantly higher mean and coefficient of variation a number of desirable progenies were identified in M_2 (Table 2). Two progenies, namely 43 and 56, were identified with high mean and high coefficient

of variation, which permit further improvement in M_3 through selection.

The results of this study demonstrate the potential of gamma ray treatment in inducing variability for various polygenic traits, particularly for yield.

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