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Gene effects of yield and its components in Indian mustard (*Brassica juncea* Czern & Coss.)

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Ten diverse parent of Indian mustard were crossed in 10 x 10 diallel design excluding reciprocals Analysis. of the data on seed yield and its ten component characters suggested that dominant genes were more frequent than recessive ones for all the characters studied except days to flower in both the generations. Symmetrical proportions of positive and negative genes were observed for days to flower, plant height and seed yield per plant, while asymmetrical proportions of positive and negative genes were observed for the remaining characters. More than one major gene groups were involved in the inheritance of most of the characters. Predominance of non-additive gene action was observed for seed yield and its components characters. The exploitation of non-additive gene action through heterosis breeding or population improvement by intermating the improved genotypes in successive generations is suggested for improvement of seed yield and its component characters.

Key words : Indian mustard, Diallel analysis, Gene action.

INTRODUCTION

Rapeseed - mustard groups of crops plays a very important rote in the oilseeds economy of our country. India is the second largest rapeseed mustard growing country in the world and ranks third next to Canada and China in production, its productivity is much lower (941kg/ha) than the worlds average (1511kg/ha) which received great attention of breeders for its genetic improvement as it has exhibited greater production potential under varying environment as it has exhibited greater production potential under varying environment. To enhance the present yield level and overcome yield stagnation it is essential to reshuffle the genes through hybridization in suitable parents. For this, it is necessary to identify gene action involved in the expression of varies yield contributing characters. In the present investigation, efforts have been made to understand the nature and estimate the genetic component of seed yield and its contribute in Indian mustard.

MATERIALS AND METHODS

The experimental material comprising the diverse genotypes of Indian mustard, viz, RK 9807, RK 9808, RK 9803, RK 8605, NDR-8501, Mathura Rai, Rohini, Basanti, Vardan and Varuna. These parents maintained as purelines by selfing for several generations were crossed in half diallel fashion. The experiment comprising 100 treatments (10 parents, 45 F_1s and 45 F_2s) were evaluated in a Randomized Block Design with three replications during *Rabi* 2002-03 at Oilseeds Research Farm Kalyanpur, Kanpur of C.S. Azad University of Agriculture and Technology, Kanpur. Each parent and F_1s were grown in single row and each F_2s in two rows of five metre length spaced at 45 x 15 cm apart. All recommended agronomic practices were adopted for raising a good crop. Ten plants each from parents and F_1s and 20 plants from F_2s were randomly selected for recording the observations on eleven characters (Table 1). The data were subjected to genetic analysis of following Hayman (1954 a, b) and Jinks (1954).

RESULTS AND DISCUSSION

The estimated components (Table 1) revealed that the highly significant additive (D) and dominance (H) gene actions were noticeable for all the characters studied except for seed yield per plant for which only dominance component was significant in both the generations. This indicated that both additive and non-additive gene action were important in controlling days to flowering, days to maturity, plant height, primary & secondary branches, length of main raceme, number of siliquae on main raceme, seeds per siliqua, 1000-seed weight and oil-content. The present findings was supported by the reports of Jain *et al*. (1988), Kumar *et al*. (1994), Pahuja *et al.* (1996), Kant and Gulati (2001) and Sridhar and Raut

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Table 1 : Estimates of genetic parameters and related statistics for 11 characters in a 10 parent diallel mating design in *Brassica juncea*.

Characters	Generation	$\hat{D}$	$\hat{H}_1$	$\hat{H}_2$	$\hat{F}$	$\hat{h}^2$	$\hat{E}$	$(\hat{H}_1\hat{D})^{0.5}$	$(\hat{H}_1/4\hat{H}_1)$	$\frac{(4\hat{D}\hat{H}_1)^{0.5}+\hat{F}}{(4\hat{D}\hat{H}_1)^{0.5}-\hat{F}}$	$\hat{h}^2/\hat{H}_2$
Days to flower	F_1	26.05**	58.15**	54.58**	-17.85**	7.89**	0.17	1.49	0.25	0.63	0.14
	±	1.27	12.85	11.78	8.58	2.98	0.37	-	-	-	-
	F_2	26.03**	165.25**	161.90**	-17.72**	8.85**	0.18	2.52	0.24	0.76	0.05
	±	1.82	45.61	43.57	7.25	3.12	0.52	-	-	-	-
Plant Height	F_1	160.42**	170.45**	163.76**	89.24**	18.15**	0.57	1.06	0.24	1.47	0.11
	±	4.10	51.12	47.45	29.67	5.20	0.22	-	-	-	-
	F_2	160.32**	357.30**	328.79**	187.98**	16.87**	0.56	1.49	0.23	2.29	0.05
	±	5.75	118.27	88.12	28.17	4.95	0.23	-	-	-	-
Primary branches	F_1	8.45**	10.21**	7.58**	6.12**	8.34**	0.18	1.09	0.16	1.98	1.10
	±	0.56	1.60	1.27	0.76	0.69	0.15	-	-	-	-
	F_2	8.35**	20.79**	12.45**	10.05**	13.95**	0.17	1.58	0.15	2.23	1.12
	±	0.47	1.52	1.25	0.87	0.65	0.16	-	-	-	-
Secondary branches	F_1	31.35**	73.12**	62.19**	15.35**	175.47**	0.19	1.53	0.21	1.38	2.82
	±	6.23	12.15	19.95	9.77	26.25	1.57	-	-	-	-
	F_2	31.15**	104.22**	92.25**	30.12**	197.98**	0.18	1.83	0.22	1.73	2.15
	±	5.78	47.62	40.95	17.08	27.52	1.62	-	-	-	-
Main shoot length	F_1	85.54**	167.45**	147.36**	59.12**	111.25**	2.66	1.40	0.22	1.65	0.75
	±	10.445	22.15	29.12	22.75	12.67	6.15	-	-	-	-
	F_2	85.16**	266.43**	213.15**	58.75**	147.08**	2.72	1.77	0.20	1.98	0.58
	±	9.37	31.88	39.06	21.95	22.45	6.48	-	-	-	-
Siliquae on main shoot	F_1	13.68**	69.22**	11.49**	3.14**	6.67**	1.87	2.25	0.21	1.11	0.58

Contd.....

Table 1 Contd.....

Characters	Generation	Parameters									
		$\hat{D}$	$\hat{H}_1$	$\hat{H}_2$	$\hat{F}$	$\hat{h}^2$	$\hat{E}$	$(\hat{H}_1\hat{D})^{0.5}$	$(\hat{H}_1/4\hat{H}_1)$	$\frac{(4\hat{D}\hat{H}_1)^{0.5}+\hat{F}}{(4\hat{D}\hat{H}_1)^{0.5}-\hat{F}}$	$\hat{h}^2/\hat{H}_2$
	±	7.38	17.47	5.12	0.27	2.37	2.39	-	-	-	-
Siliquae on main shoot	F_2	13.37**	110.89**	88.71**	13.00**	46.12**	1.47	2.88	0.20	1.41	0.52
	±	6.36	27.28	15.18	4.28	14.28	4.32	-	-	-	-
	F_1	2.71**	9.93**	8.73**	1.76**	1.92**	1.95	1.91	0.22	1.41	6.22
	±	0.78	3.14	1.39	0.40	0.06	2.37	-	-	-	-
Seeds per siliqua	F_2	2.61**	17.54**	14.03**	6.15**	1.52**	1.45	2.59	0.20	2.67	0.11
	±	0.82	6.20	7.16	1.46	0.05	4.46	-	-	-	-
	F_1	36.60**	39.62**	31.32**	-28.46**	5.64**	0.46	1.04	0.20	2.19	0.18
	±	4.44	10.86	8.72	10.46	1.60	1.13	-	-	-	-
Days to maturity	F_2	36.58**	248.96**	214.15**	-101.56**	34.26**	0.48	2.61	0.22	3.39	0.16
	±	9.65	88.94	78.48	46.25	14.46	1.22	-	-	-	-
	F_1	0.22**	0.55**	0.38**	0.21**	0.38**	0.09	1.58	0.17	1.86	1.01
	±	0.05	0.12	0.10	0.08	0.07	0.10	-	-	-	-
Test weight	F_2	0.21**	1.62**	1.04**	0.43**	0.94**	0.08	2.78	0.16	2.16	0.90
	±	0.04	0.25	0.22	0.10	0.05	0.11	-	-	-	-
	F_1	3.25**	46.45**	44.59**	1.85**	58.54**	0.09	3.78	0.24	1.16	1.31
	±	3.00	14.97	16.02	7.05	4.05	1.00	-	-	-	-
Seed yield per plant	F_2	3.24**	89.30**	82.16**	14.33**	106.82**	0.08	5.25	0.23	2.46	1.30
	±	4.17	39.31	34.15	20.15	15.82	1.32	-	-	-	-
	F_1	11.52**	21.00**	15.00**	15.00**	13.10**	0.05	1.35	0.18	2.86	0.87
	±	1.66	3.80	3.30	3.90	2.22	0.56	-	-	-	-
Oil content	F_2	11.48**	83.05**	59.20**	29.30**	44.03**	0.05	2.69	0.18	2.86	0.74
	±	1.55	14.10	12.25	7.25	12.06	0.54	-	-	-	-

** $P > 0.001$

(2003) for different characters.

The magnitude of dominance components (H_1 and H_2) as compared to additive component (D) were found greater for all the characters in both the generations thus indicating predominance of non-additive type of gene action for these characters. These findings are in conformity with reports from Patel *et al*. (1996), Sharma and Singh (1994) and Singh and Sachan (2003) for different levels. Significant and positive values of (F) were noticeable for all the characters, suggested that dominant genes were more frequent than the recessive ones except days to flower in both the generations.

The values of $(H_1/D)^{0.5}$ indicated over dominance for most of the characters in both the generations. Symmetrical proportion of positive and negative genes $(H_2/4H_1)$ was observed for days to flower, plant height and seed yield per plant, while asymmetrical proportion of positive and negative genes was observed for the remaining character studied. The ratio $[(4D\ H_1)^{0.5} + F/(4D\ H)^{0.5} - F]$ which reflected the relative values of dominant and recessive genes were more than an unity of all the characters indicating that dominant genes were more pronounced except days to flower in both the generations.

The group of dominant $H_2/4H_1$ alleles are about two times more frequent than recessive ones for number of secondary branches per plant in F_1 and F_2. It suggested appreciable changes in F_2. It suggested realizing sizable genetic gain for these characters. More than one major gene grouped were involved in the inheritance of number of primary branches per plant, seed yield per plant and 1000 seed-weight (F_1) and other at least one major gene group was involved.

A comparative evaluation for nature and magnitude of genetic parameters has been presented in Table 1. The predominance of non-additive gene action for seed yield and it comports could be explored through heterosis breeding (Patel *et al*., 1993) or through population improvement by intermitting the improved genotypes (Jensen 1970).

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