TRIPLE TEST CROSS ANALYSIS FOR SEED AND OIL YIELD AND ITS COMPONENTS IN INDIAN MUSTARD /BRASSICA JUNCEA L. CZERN AND COSS./

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The choice of most efficient breeding procedure depends on knowledge of the gene action controlling the economic characters. Most genetic models used to estimate the components of continuous variation assume absence of nonallelic interactions whereas, the fact is often contrary. The triple test cross method proposed by Kearsey and Jinks /1986/ and subsequently extended by Jinks et al. /1969/ and Jinks and Perkins /1970/ not only detects and partitions epistasis within a population but also in its absence estimates precisely the additive and dominance components of variation. The present study was undertaken to estimate additive, dominance and epistatic components in two crosses of Indian mustard in two environments.

Materials and methods

Three homozygous and genetically diverse varieties of Indian mustard /*Brassica juncea* L. Czern and Coss./ namely, Varuna, TM-9 and RW 75-80-1 were selected to develop the material. Two crosses Varuna X TM-9 and Varuna X RW 75-80-1 were made and using parents, F_1 and F_2 populations experimental material was developed following the method suggested by Kearsey and Jinks /1968/. Twenty plants randomly chosen from each of the two F_2 populations were used as male parents for crossing with their respective female testers /P_1, P_2 and F_1/ designated as L_1, L_2 and L_3 respectively.

The experimental material consisting of 60 families from each original cross were grown in Compact Family Block Design with three replications under rainfed and

irrigated conditions during winter season 1985-86.Within each replication, each family was represented by a row of 30 plants at a distance of 15 cm maintained by thinning. Each row was spaced 45 cm apart. Under irrigated condition, fertilizers 120 kg N, 40 kg P_2O_5 and 40 kg K_2O per hectare and two irrigations were given while under rainfed the fertilizer was applied 60 kg N, 20 kg P_2O_5 and 20 kg K_2O. Plant Protection measures were adopted to raise a good crop. Five competitive plants from each family in each replication were selected for recording observations on 6 characters, namely plant height /cm/, number of primary branches, 1000-seed weight /g/, seed yield per plant /g/, oil content /%/ and oil yield /g/. The triple test cross analysis was done as suggested by Jinks and Perkins /1970/.

Results and discussion

Detection of epistasis: Significant epistasis was recorded for plant height, number of primary branches, 1000-seed weight, seed yield per plant, oil content and oil yield /Table 1/. Further partitioning of the epistasis item also revealed that both "i" type epistasis and "j+l" type epistasis were highly significant for all the characters in both crosses. The relative magnitude of "i" type epistasis was higher than "j+l" type of epistasis for plant height in Varuna X TM-9 and its reverse in Varuna X RW 75-80-1. For primary branches magnitude of "i" type epistasis was higher in both the crosses in rainfed and "j+l" type of epistasis in irrigated condition. The "j+l" type epistasis played major role in the inheritance of 1000-seed weight and seed yield in both crosses under both conditions. However, "i" type of epistasis was more important for oil content. For oil yield in cross Varuna X TM-9 "i" type epistasis was found important and vice versa in Varuna x RW 75-80-1 in rainfed and irrigated condition.

Additive and dominance components: The estimates of genetic components of variance are presented in Table 2.Additive /D/ and dominance /H/ components were significant in both the crosses under rainfed and irrigated conditions for

all the characters studied. In the cross Varuna x TM-9 /rainfed/ the magnitude of additive component was more than that of dominance for primary branches and oil yield. However, dominance component was more important for plant height, 1000-seed weight, seed yield and oil content. In cross Varuna x TM-9 /irrigated/ additive component played major role in the inheritance of all the characters except seed and oil yield. The Varuna x RW 75-80-1 exhibited greater additive component for primary branches under rainfed and plant height under irrigated condition. Dominance component played predominant role in the expression of other characters. However, owing to epistasis, the estimates of components were baised for most of the characters. Similar were the results of Chaunan and Singh /1979/, Govil et al. /1981/, Kumar and Yadava /1985/ and Labana et al. /1983/. In Varuna x TM-9 mean degree of dominance showed complete dominance for plant height and over dominance for seed yield in both the situations. For 1000-seed weight and oil content partial to over dominance and for primary branches and oil yield partial to complete dominance was observed. In the cross Varuna x RW 75-80-1 mean degree of dominance showed partial dominance for primary branches, complete dominance for plant height, 1000-seed weight and over dominance for oil content, seed and oil yield in rainfed condition. Whereas partial dominance for plant height and oil content and over dominance for remaining characters was observed under irrigated condition. The directional element "F" was positive and significant for plant height, 1000-seed weight and yield per plant in Varuna x TM-9, whereas it was negative and significant for oil content.

In cross Varuna x RW 75-80-1 directional element "F" was positive and significant for plant height, oil content and oil yield in both rainfed and irrigated conditions.

Heritability estimates in narrow seans were high for all characters in both the crosses under both conditions except yield per plant in Varuna x RW 75-80-1 /irrigated/.

The results of the present investigation suggest that a breeding method which could exploid fixable gene effects /additive, additive x additive/ and at the same time maintain considerable heterozygosity for exploiting dominance gene effect would be most appropriate for improvement of seed and oil yield in Indian mustard.

References

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Table 1 : Analysis of variance for the test of epistasis of Triple Test Cross families for different characters in two crosses of Indian mustard in rainfed and irrigated conditions.

Item	d.f.	Plant height		No. of primary branches		Thousand seed weight		Yield per plant		Oil content		Oil yield	
		R	I	R	I	R	I	R	I	R	I	R	I
Varuna X TM-9													
Epistasis	20	158.13**	345.50**	16.80**	36.13**	17.72**	23.59**	64.61**	60.95**	64.82**	21.54**	10.60**	9.83**
Overall Epistasis i type	1	244.71**	579.52**	60.84**	11.37**	8.11**	13.20**	30.85**	22.64**	29.60**	12.06**	47.54**	14.80**
Epistasis j and i type	19	153.58**	333.18**	14.84**	37.45**	14.38**	17.86**	51.70**	52.24**	7.72**	18.61**	8.64**	7.81**
Within family error	720	13.48	25.99	2.07	3.53	1.64	3.02	4.72	1.92	2.07	2.06	2.24	3.82
Varuna X RW-75-80-1													
Epistasis	20	938.27**	213.20**	69.61**	56.31**	13.31**	55.11**	44.43**	40.67**	59.79**	18.90**	9.12**	9.46**
Overall Epistasis i type	1	176.06**	217.62**	96.10**	23.68**	15.48**	11.93**	36.13**	20.68**	15.79**	18.28**	7.89**	15.63**
Epistasis j and i type	19	894.94**	232.97**	68.21**	46.80**	25.86**	57.38**	44.47**	31.92**	9.10**	9.46**	19.56**	29.13**
Within family error	720	62.57	56.63	7.98	5.58	2.52	1.57	1.32	5.57	2.49	1.85	2.03	1.16

** Significant at 1% level

R = Rainfed, I = Irrigated

Table 2: Estimates of genetic components, degree of dominance and heritability in two crosses of Indian mustard.

Cross / Component	Plant height		No. of primary branches		Thousand seed weight		Yield per plant		Oil content		Oil yield	
	R	I	R	I	R	I	R	I	R	I	R	I
Varuna X TM-9												
D	130.25**	194.72**	62.27**	85.99**	174.54**	234.90**	468.00**	680.39**	807.65**	709.28*	82.28**	109.58**
H	146.56**	192.30**	39.28**	78.15**	284.75*	45.10*	1658.39**	2051.07**	977.95**	365.72**	50.28**	177.44
E	15.48	25.99	2.07	3.53	1.4	3.92	4.72	1.92	2.07	2.06	2.24	3.82
F	20.48**	18.39**	-0.58	-1.53	6.58**	7.58**	5.58**	7.19**	-4.58**	-2.18**	7.58**	-0.57
$(H/D)^{0.5}$	1.05	0.99	0.79	1.03	1.28	0.44	1.88	1.74	1.10	0.72	0.73	1.03
h^2n	0.62	0.63	0.74	0.32	0.55	0.91	0.36	0.39	0.62	0.79	0.72	0.64
Varuna X RW-75-80-1												
D	189.23**	720.02**	27.58**	47.45**	322.84**	172.10**	558.07**	241.16**	1092.18**	816.71**	99.12**	53.35**
H	223.52**	385.92**	24.51**	90.27**	370.68**	262.67**	1938.52**	1827.75**	1447.73**	178.71**	139.12*	66.37**
E	6.25	6.63	1.98	5.58	2.52	1.57	1.32	5.52	2.49	18.56	2.03	1.16
F	16.58**	12.32**	-0.32	-5.88**	4.90**	4.00**	0.32	0.78	3.92*	5.59**	7.86**	6.58**
$(H/D)^{0.5}$	1.09	0.77	0.88	1.38	1.07	1.25	1.86	2.75	1.20	0.38	1.19	1.12
h^2n	0.62	0.78	0.67	0.49	0.83	0.56	0.37	0.21	0.59	0.88	0.59	0.61

** Significant at 1% level

* Significant at 5% level

R = Rainfed, I = Irrigated