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**Shiva Mohan**  
(Section of Oilseeds)  
Department of Genetics & Plant  
Breeding, Chandra Shekhar Azad  
University of Agriculture &  
Technology, Kanpur, U.P., India

**RK Yadav**  
(Section of Oilseeds)  
Department of Genetics & Plant  
Breeding, Chandra Shekhar Azad  
University of Agriculture &  
Technology, Kanpur, U.P., India

**Amit Tomar**  
(Section of Oilseeds)  
Department of Genetics & Plant  
Breeding, Chandra Shekhar Azad  
University of Agriculture &  
Technology, Kanpur, U.P., India

**Mahak Singh**  
(Section of Oilseeds)  
Department of Genetics & Plant  
Breeding, Chandra Shekhar Azad  
University of Agriculture &  
Technology, Kanpur, U.P., India

**Correspondence**  
**Shiva Mohan**  
(Section of Oilseeds)  
Department of Genetics & Plant  
Breeding, Chandra Shekhar Azad  
University of Agriculture &  
Technology, Kanpur, U.P., India

## Studies on heterosis over economic parents for quantitative traits in Indian mustard (*Brassica juncea* L. Czern & Coss)

Shiva Mohan, RK Yadav, Amit Tomar and Mahak Singh

### Abstract

Analysis of variance revealed that the genotypes were genetically-differ to each for all the characters. Out of 21 Crosses the cross combinations namely; Varuna x Pusa Jagannath, Varuna x Pusa Bahar, RK-9101 x Rohini, Pusa Jagannath x Kanti and Pusa Bahar x Kanti showed positive and significant heterosis over economic parents for more number of siliquae per plant.

**Keywords:** *Brassica*, heterosis, Indian mustard and sca.

### 1. Introduction

India plays a major role in global oil seeds and vegetable oil economy contributing about 16% of world's oil seed crop area, 7% world's oil seed production and 6.7% vegetable oil production. Oil seed crop being the second most important determinant of agricultural economy next after early sharing about 15% of the country's gross cropped area and accounting for nearly 3% of the gross national product and 10% of the value of all agricultural products and 1 millions farmers involved in oil seed cultivation and processing, respectively.

### 2. Material & Methods

The present investigation was carried out at Oil Seed Research Farm, Kalyanpur of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, during rabi season 2013-15. The experiment was conducted in Randomized Block Design (RBD) with three replications. 7 parents/strains (Varuna, RK-9101, Pusa jagannath, RH-9801, Pusa bahar, Rohini & Kanti) were crossed in diallel mating design (excluding reciprocal crosses). 28 genotypes (21 F<sub>1</sub> + 7 parents) were evaluated for seven characters viz., Days to 50% flowering, number of primary branches per plant, number of secondary branches per plant, days to maturity, plant height (cm), number of siliquae per plant, Length of main raceme (cm). The parents and F<sub>1</sub>s were growing in single row of five meter length spaced 45 cm apart. The distance of 15 cm between the plants in a row maintained by thinning. All the recommended agronomic practices were followed for raising the good crop. The components of variance in diallel cross were computed by the use of formula suggested by Hayman (1954a)<sup>[7]</sup>.

### 3. Results & Discussion

The results of analysis of variance are given in table-1. Analysis of variance revealed that the genotypes were genetically-differ to each for all the characters. The estimates of heterosis over standard or economic variety (Varuna) for seven characters were calculated and presented in Table-2. Out of 21 crosses the best five cross combinations viz., Varun x Pusa Jagannath, Varuna x Rohini, RK-9101 x Pusa Jagannath, Pusa Jagannath x RH-819 and Pusa Jagannath x Kanti showed negative and significant heterosis for days to 50% flowering. Top five crosses namely, Varuna x Pusa Jagannath, Varuna x Kanti, Pusa Jagannath x Kanti, RH-819 x Kanti and Pusa Bahar x Kanti were showed significant and desirable heterosis for days to maturity, the superior four cross combinations viz., Varuna x Rohini, RK-9101 x Rohini, Pusa Jagannath x Pusa Bahar and Pusa Bahar x Rohini were showed significant and negative heterosis for plant height, the best five crosses namely, Varuna x RK-9101, Varuna x Pusa Bahar, RK-9101 x Kanti, RH-819 x Kanti and Pusa Bahar x Kanti were showed negative and significant heterosis for length of main raceme, the crosses Varuna x Pusa Jagannath, Varuna x Pusa Bahar, RK-9101 x Rohini, Pusa Jagannath x Kanti and Pusa Bahar x Kanti were showed significant heterosis for number of siliquae per plant and none of the cross combinations were showed significant and desirable heterosis over economic parent.

Similar findings were also observed by Kakroo *et al.* (2000) [8], Katiyar *et al.* (2000) [10], Kant *et al.* (2001) [9], Ghosh *et al.* (2002) [4], Parmar *et al.* (2004) [13], Goswami *et al.* (2005) [5], Monalisa *et al.* (2005) [12], Prajapati *et al.* (2009) [14], Singh *et al.* (2009b) [15], Gupta *et al.* (2010) [6], Chauhan *et al.* (2011) [1], Dond *et al.* (2012), Frasad *et al.* (2012), Lal *et al.* (2013) [11], Dholu *et al.* (2014) [2].

**Table 1:** ANOVA of parents, F<sub>1</sub>'s and parents vs. F<sub>1</sub>'s for seven characters in a 7 x 7 parental diallel cross analysis in Indian mustard: mean sum of squares

Source of variation	d.f.	Days to 50% flowering	Number of primary branches per plant	Number of secondary branches per plant	Days to maturity	Plant height (cm)	Length of main raceme (cm)	Number of siliquae per plant
Replicates	2.00	1.58	3.05*	17.19**	3.96	100.14	55.87***	174.73***
Treatments	27.00	3.86***	3.32***	5.93**	112.38***	354.26***	467.84***	152.46***
Parents	6.00	4.33**	7.86***	5.21*	111.19***	754.74***	720.60***	312.41***
Hybrids	20.00	2.01	0.95	4.45*	104.32***	215.18***	410.88***	102.92***
Parent Vs. F <sub>1</sub> 's	1.00	38.11***	23.53***	39.68***	280.78***	733.05**	90.48***	183.43***
Error	54.00	1.19	0.91	2.26	1.84	64.61	3.61	12.80
Total	83.00	2.07	1.75	3.82	37.85	159.69	155.88	62.13

\*,\*\*Significant at 5% and 1% level of significance, respectively.

**Table 2:** Estimate of heterosis over economic parent for seven characters in 21 F<sub>1</sub>'s derived from a 7 x 7 diallel cross analysis in Indian mustard EP= Varuna

Hybrid combinations	Days to flowering		Number of primary branches/plant		Number of secondary branches/Plant		Days to maturity	
	EH	SCA	EH	SCA	EH	SCA	EH	SCA
Varuna X Rk-9101	-3.14*	-0.13	-6.25	-0.18	1.39	0.78	-4.87**	-0.72
Varuna X Pusa Jagannath	-4.48**	-0.69	3.12	0.45	4.17	0.85	-6.15**	-0.61
Varuna X Rh-819	-4.48**	-1.65**	-3.13	-0.03	1.39	-0.22	-6.41**	-2.20**
Varuna X Pusa Bahar	-1.79	0.57	-6.25	0.08	4.17	0.30	-5.13**	-2.20**
Varuna X Rohini	-3.59**	-1.09	0.00	-0.03	4.17	1.07	-6.41**	-1.98*
Varuna X Kanti	-3.59**	0.28	-12.50	0.27	-8.33	-0.41	-15.64**	-4.02***
Rk-9101 X Pusa Jagannath	-5.83**	-1.17	-3.13	-0.10	2.78	1.15	-4.87**	-0.54
Rk-9101 X Rh-819	-3.14*	-0.13	0.00	0.42	5.56	1.41	-4.36**	-1.13
Rk-9101 X Pusa Bahar	-3.14*	0.09	3.12	1.19*	-2.78	-0.74	-2.82**	-0.80
Rk-9101 X Rohini	-3.14*	-0.24	3.12	0.42	-5.56	-0.63	-3.08**	0.76
Rk-9101 X Kanti	-4.48**	0.13	-12.50	0.38	-9.72	-0.11	-12.56**	-1.61*
Pusa Jagannath X Rh-819	-4.48**	-0.69	3.12	0.38	1.39	-0.19	-5.38**	-0.69
Pusa Jagannath X Pusa Bahar	-4.48**	-0.46	-3.13	0.16	5.56	0.67	-3.08**	0.65
Pusa Jagannath X Rohini	-3.14*	0.20	3.12	0.05	1.39	0.44	-4.62**	0.54
Pusa Jagannath X Kanti	-5.83**	-0.43	-6.25	0.68	-4.17	0.63	-14.62**	-2.50**
Rh-819 X Pusa Bahar	-3.59**	-0.76	-9.38	-0.32	8.33	0.93	-2.31**	0.39
Rh-819 X Rohini	-1.79	0.24	-3.13	-0.44	4.17	0.70	-3.08**	1.28
Rh-819 X Kanti	-4.48**	-0.39	-6.25	0.86	-5.56	-0.11	-13.08**	-1.76*
Pusa Bahar X Rohini	-3.14*	-0.54	3.12	0.68	4.17	0.56	-2.82**	-0.06
Pusa Bahar X Kanti	-4.93**	-0.50	-6.25	1.31*	-1.39	0.74	-11.54**	-1.43
Rohini X Kanti	-4.93**	-0.83	-9.38	0.19	-5.56	0.52	-14.62**	-3.54***
SE(EP) ±	0.89		0.78		1.23		1.11	
SE (S <sub>ij</sub> ) ±		1.61		1.41		2.22		2.00
SE (S <sub>ij</sub> - S <sub>ik</sub> ) ±		2.39		2.09		3.30		2.97

**Table 2:** Continue.....

Hybrid combinations	Plant height (cm)		Length of main raceme (cm)		Number of siliquae/plant	
	EP	SCA	EP	SCA	EP	SCA
Varuna X Rk-9101	-3.95	-2.15	-14.86**	-2.08*	-1.85*	6.18**
Varuna X Pusa Jagannath	-3.05	7.39	-9.42**	-4.05***	-3.17**	-0.45
Varuna X Rh-819	-7.88*	-1.69	0.00	7.81***	-2.64**	-1.19
Varuna X Pusa Bahar	-3.90	9.54*	-24.28**	-1.08	-2.03*	1.69**
Varuna X Rohini	-11.08**	3.37	-15.58**	4.29***	-3.26**	2.06
Varuna X Kanti	-11.81**	0.02	-21.74**	6.77***	-5.55**	0.40**
Rk-9101 X Pusa Jagannath	-5.15	-3.69	-7.61**	-1.97	-1.15	1.06
Rk-9101 X Rh-819	-3.15	0.56	-10.51**	-1.45	-0.79	-0.34
Rk-9101 X Pusa Bahar	-5.47	-0.51	-17.39**	5.66***	-1.06	-0.79
Rk-9101 X Rohini	-10.01**	-1.51	-17.75**	2.69*	-1.67*	1.92
Rk-9101 X Kanti	-3.09	10.10*	-28.99**	0.51	-3.88**	0.58
Pusa Jagannath X Rh-819	-8.32*	-1.77	-5.43**	-3.75**	0.44	2.69
Pusa Jagannath X Pusa Bahar	-10.74**	-3.04	-14.86**	1.03	-0.09	1.25**
Pusa Jagannath X Rohini	-12.14**	2.09	-11.23**	1.73	-1.94*	-0.71
Pusa Jagannath X Kanti	-5.93	12.31**	-10.14**	10.88***	-3.26**	1.29**
Rh-819 X Pusa Bahar	-9.56**	-0.39	-9.42**	9.21***	0.44	0.51

Rh-819 X Rohini	-12.51**	1.71	-15.58**	0.92	-0.70	1.21
Rh-819 X Kanti	-11.23**	2.29	-30.80**	-4.94***	-2.73**	0.55**
Pusa Bahar X Rohini	-16.23**	-2.09	-49.64**	-16.97***	-1.59	-1.56
Pusa Bahar X Kanti	-13.84**	0.66	-42.03**	-1.82	-2.64**	1.44*
Rohini X Kanti	-16.86**	2.62	-38.04**	-0.79	-4.32**	0.14
SE(EP) ±	6.56		1.55		2.92	
SE (s <sub>ij</sub> ) ±		11.85		2.80		5.28
SE (s <sub>ij</sub> - s <sub>ik</sub> ) ±		17.61		4.16		7.84

\*,\*\*Significant at 5% and 1% level of significance, respectively.

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