HETEROSIS BREEDING IN INDIAN MUSTARD [*Brassica juncea* (L.) Czern & Coss]

***VAGHELA, P. O., BHADAURIA, H. S., PATEL, J. B. AND SUTARIYA, D. A.**

MAIN CASTOR-MUSTARD RESEARCH STATION
SARDARKRUSHINAGAR DANTIWADA AGRICULTURAL UNIVERSITY
SARDARKRUSHINAGAR – 385 506, DIST; BANASKANTHA, GUJARAT, INDIA

****E-mail: vaghelaprakash68@gmail.com***

ABSTRACT

Six parents viz., BPR 380-1, RSK 28, RH (OE) 0103, SKM 532, GM 3 and GM 1 were crossed in diallel fashion (excluding reciprocals) in Indian mustard [Brassica juncea (L.) Czern & Coss]. The resultant 15 crosses along with parents and standard check, GM 2 were evaluated following randomized block design replicated thrice during rabi 2009-10 to measure the extent of heterosis for seed yield and its components. The analysis of variance for various characters revealed that the considerable genetic variation existed among the parents and hybrids for all the traits under study. The cross combination, RSK 28 x RH(OE)0103 manifested significant and positive heterosis over mid-parent (90.02 %), better parent (44.76 %) and standard check (32.30 %), which could be exploited for getting transgressive segregants in the subsequent generation for developing high yielding varieties. The other best cross combination with respect to all three types of heterosis for days to 50 per cent flowering was RSK 28 x GM 3 and GM 3 x G 1 for days to maturity and SKM 532 x GM 1 for number of branches per plant. RSK 28 x RH (OE) 0103 was the best cross combination for plant height and siliquae per plant with respect to standard heterosis, whereas RH (OE) 0103 x GM 1, BPR 380-1 x RH(OE) 0103 and SKM 532 x GM 3 were thee best cross combinations main branch length, number of siliquae on main branch and 1000 seed weight, respectively.

KEY WORDS: Heterosis, heterobeltiosis, Indian mustard

INTRODUCTION

The *Brassica* is an important genus of angiosperms consisting of over 3200 species with high diverse morphology. It is used as nutritious vegetables, condiments and producing oil. The average seed yield range from 1000-2000 kg/ha, which is very low. It has also been reported by Dalal and Nandkar (2011) that *Brassica juncea* is low yielding species but can tolerate both drought and salinity to some extent during late sowing. In addition, *Brassica juncea* is resistant to diseases and insects during growing period. The crop duration period of Indian mustard is little higher than other *Brassica* species, but has non-shattering properties and can be grown in boron deficient soil.

In Indian mustard, Yadava *et al*. (1974) reported heterosis of 239 per cent over better parent for seed yield per plant, whereas Banga and Labana (1984) reported 200 per cent heterosis. Verma *et al*. (2000) reported significant degree of heterobeltiosis in several varieties of Indian mustard. A wide range of positive heterosis for seed yield and important yield components was also reported by Rawat (1975) and Ram *et al*. (1976). Keeping this in view, the present study was undertaken to

identify potential parental material for producing high yielding varieties, following half diallel analysis which helps plant breeders to predict the utility of F_1 hybrids and its behavior in subsequent generation.

MATERIALS AND METHODS

The 15 hybrids developed from six diverse parents (BPR 380-1, RSK 28, RH (OE) 0103, SKM 532, GM 3 and GM 1) of Indian muatard, selected from diverse gene pool maintained at Main Castor-Mustard Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, following half diallel mating design. The parents and hybrids along with Standard check, GM 2 were evaluated in randomized block design with three replication at Main Castor-Mustard Research Station, S. D. Agricultural University, Sardarkrushinagar during *rabi* 2009-10. The materials were sown in 4 m long single row plots keeping distance 45 cm apart between rows and between plants within rows being 15 cm. observations were recorded on five random plants within a row for characters *viz.*, days to 50 per cent flowering, days to maturity, plant height, main branch length, number of branches per plant, siliquae per plant, number of siliquae on main branch, seed yield per plant and 1000 seed weight and were analyzed as per the method suggested by Griffing (1956).

RESULTS AND DISCUSSION

The analysis of variance for parents, hybrids and parents vs. hybrids computed for different characters is presented in Table 1. The results revealed highly significant differences due to genotypes for all the characters indicating sufficient genetic variability was present in the materials for all the characters under study. The variance due to genotype was further partitioned into parents, hybrids and parent vs. hybrids for all the traits revealed significant difference due to parents and hybrids for all the characters. However, means squares due to parents vs. hybrids were significant for days to 50 per cent flowering, days to maturity, main branch length, number of branches per plant and 1000 seed weight, which indicated presence of heterosis for these characters.

The best heterotic desired cross combinations and range of heterosis (%) with respect to different characters in Indian mustard was given in Table 2. The cross combination, RSK 28 x RH(OE)0103 manifested significant and positive heterosis over mid-parent (90.02 %), better parent (44.76 %) and standard check (32.30 %), which could be exploited for getting transgressive segregants in the subsequent generation for developing high yielding varieties. As observed in the present study, higher magnitude of heterotic response for seed yield per plant was also reported by Banga and Labana (1984), Hirve and Tiwari (1991), Patel *et al.* (1993), Khulbe *et al.* (1998), Tyagi et al., (2001), Dixit *et al.* (2005), Patel *et al.* (2010) and Narsin *et al.* (2011). The range of heterosis, heterobeltiosis and standard heterosis was observed in the present study for seed yield per plant was -45.85 to 90.02 per cent, -63.33 to 44.76 per cent and -52.92 to 32.30 per cent, respectively (Table 2).

The other best cross combination with respect to all three types of heterosis for days to 50 per cent flowering was RSK 28 x GM 3 and GM 3 x G 1 for days to maturity and SKM 532 x GM 1 for number of branches per plant (Table 2). These crosses could be exploited for improvement of respective characters in Indian mustard. Das *et al.*, (2004) found significant values for heterosis for days to maturity. RSK 28 x RH (OE) 0103 was the best cross combination for plant height and siliquae per plant with respect to standard heterosis, whereas RH (OE) 0103 x GM 1, BPR 380-1 x RH (OE) 0103 and SKM 532 x GM 3 were thee best cross combinations main branch length, number of siliquae on main branch and 1000 seed weight, respectively (Table 2). A wide range of positive heterosis for yield components in Indian mustard was

reported by Rawat (1975), Ram *et al*. (1976), Joshi & Patil (2003) and Patel *et al.* (2010).

CONCLUSION

RSK 28 x RH(OE)0103 manifested significant and positive heterosis over mid-parent (90.02 %), better parent (44.76 %) and standard check (32.30 %), which could be exploited for getting transgressive segregants in the subsequent generation for developing high yielding varieties.

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Table 1: Analysis of variance for parents and hybrids for seed yield and its components characters in Indian mustard

Source of Variation	df	Days to 50 Per Cent Flowering	Days to Maturity	Plant Height (cm)	Main Branch Length (cm)	Number of Siliquae on Main Branch	Total Siliquae Per Plant	Number of Branches Per Plant	Seed Yield Per Plant (gm)	1000 Seed Weight (gm)
Replications	**2**	3.92	13.86*	190.25	1.02	18.30	1232.60	11.49	7.75	0.01
Genotypes	**20**	34.29**	44.04**	891.22**	180.90**	151.92**	13922.70**	276.58**	79.67**	1.06**
Parents	**5**	44.59**	120.63**	1798.59**	204.20**	69.26**	17273.90**	129.45**	153.45**	1.91**
Hybrids	**14**	31.27**	10.62**	606.26**	170.30**	191.43**	13687.70**	317.21**	58.82**	0.79**
P vs. H	**1**	25.60**	128.93**	343.80	212.60**	12.18	511.74	443.35**	2.56	0.70**
Error	**40**	1.50	3.82	124.53	3.69	13.76	897.79	6.03	5.23	0.06

and **, significant at 5 per cent and 1 per cent levels of significance, respectively

Table 2: Summary of best heterotic desired cross combinations and range of heterosis (%) with respect to different characters in Indian mustard

Character	Best Heterotic Crosses and Range of Heterosis		
	Over Mid Parent	**Over Better Parent**	**Over Check (GM 2)**
Days to 50 Per Cent Flowering	RSK 28 x GM 3	RSK 28 x GM 3	RSK 28 x GM 3
	(-7.91 to 13.14)	(-17.42 to 7.59)	(-11.71 to 8.98)
Days to Maturity	GM 3 x GM 1	GM 3 x GM 1	GM 3 x GM 1
	(-2.77 to 11.92)	(-4.58 to 5.07)	(-4.58 to 0.86)
Plant Height (cm)	GM 3 x GM 1	RH(OE)0103 x GM 3	RSK 28 x RH(OE)0103
	(-9.58 to 20.05)	(-19.62 to 14.09)	(-19.81 to 12.41)
Main Branch Length (cm)	RSK 28 x GM 1	SKM 532 x GM 3	RH(OE)0103 x GM 1
	(-32.62 to 15.36)	(-36.61 to 10.72)	-36.61 to 2.68
Number of Siliquae on Main Branch	SKM 532 x GM 1	SKM 532 x GM 1	BPR 380-1 x RH(OE)0103
	(-30.49 to 35.37)	(-39.86 to 28.25)	(-29.82 to 44.74)
Siliquae Per Plant	BPR 380-1 x RH(OE)0103	SKM 532 x GM 3	RSK 28 x RH(OE)0103
	(-38.01 to 49.39)	(-44.02 to 42.61)	(-61.09 to 1.41)
Number of Branches Per Plant	SKM 532 x GM 1	SKM 532 x GM 1	SKM 532 x GM 1
	(-45.11 to 130.85)	(-55.49 to 83.29)	(-43.89 to 83.13)
1000 Seed Weight (gm)	RH(OE)0103 x GM 3	RSK 28 x GM 1	SKM 532 x GM 3
	(-39.8 to 19.02)	(-46.46 to 8.55)	(-46.30 x 32.34)
Seed Yield Per Plant (gm)	RSK 28 x RH(OE)0103	RSK 28 x RH(OE)0103	RSK 28 x RH(OE)0103
	(-45.85 to 90.02)	(-63.33 to 44.76)	(-52.92 to 32.30)

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