Indian J. Genet., **51** (2): 190–193 (1991)

HETEROSIS AND INBREEDING DEPRESSION IN INDIAN MUSTARD

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(Received: March 26, 1990; accepted: April 11, 1990)

ABSTRACT

For seed yield, (heterosis over better parent) was highest in the cross RAU RP 4 x PR 18, followed by RLM 198 x Varuna, RAU RP 4 x Varuna, and TM 7 x Varuna. The crosses RAU RP 4 x Varuna, TM 7 x Varuna, and RLM 198 x Varuna, showing high heterosis for seed yield, also exhibited significant (higher) heterosis for yield contributing characters. In general, it was noticed that the crosses having Varuna as one of the parents had higher heterosis. In most of the crosses, there was no inbreeding depression. Only four crosses, viz. TM 7 x Sita, TM 7 x Varuna, RLM 198 x Varuna, and RLM 198 x Prakash, showing significant positive heterosis, also showed inbreeding over selfing.

Key words: Indian mustard, *Brassica juncea* L., heterosis, inbreeding depression.

The magnitude of heterosis provides a basis for genetic diversity and a guide for the choice of desirable parents for developing superior F_1 hybrids so as to exploit hybrid vigour and/or for building genepools to be employed in breeding programme. Study of heterosis and inbreeding depression has a direct bearing on the breeding methodology to be employed for varietal improvement. The present investigation aims to estimate the extent of heterosis and inbreeding depression in an eight parent nonreciprocal diallel set of Indian mustard (*Brassica juncea* L.)

MATERIALS AND METHODS

Eight elite genotypes were selected for a diallel cross analysis. The parental lines were RAU RP 4, PR 18, RH 761, TM 7, Sita, RLM 198, Varuna, and Prakash. The parents and their 28 F_1 and F_2 were grown in randomized block design with three replications. Each parent and F_1 progeny were represented by a single row- and F_2 by 3-row plots of 3 m length with 30 cm spacing between rows and 15 cm between plants. Observations on days to maturity, secondary branches/plant, siliquas and seed yield/plant, and siliqua length were recorded on 10 random plants in the parents and F_1 generation, and 25 plants in F_2 generation from each plot. The magnitude of heterosis over better parent (BP) and inbreeding depression from F_1 to F_2 were estimated.

RESULTS

The BP heterosis and inbreeding depression for five characters are presented in Table 1. The BP heterosis for seed yield/plant ranged from –89.6% to 160.7% and was significant positive in four crosses: RAU RP 4 x PR 18 (160.7%), RLM 198 x Varuna (104.9%), RAU RP 4 x Varuna (98.3%), and TM 7x Varuna (62.3%). Inbreeding depression was significantly positive in the crosses RLM 198 x Varuna (63.6%) and TM 7 x Varuna (47.2%). Many crosses showed negative heterosis with medium to low inbreeding depression. For number of secondary branches, three crosses, viz. Sita x Prakash (46.3%), Varuna x Prakash (33.7%), and RLM 198 x Prakash (29.1%), showed significant positive BP heterosis coupled with low values for inbreeding depression. Except five, all the remaining crosses showed negative

Table 1. BP heterosis and inbreeding depression in mustard hybrids for seed yield and yield characters

Cross	BP heterosis %	Inbreeding depression	Cross	BP heterosis %	Inbreeding depression
Seed yield:			**Secondary branches:**		
PR 18 x RH 761	–89.6**	11.5	Sita x Prakash	46.3**	–2.1
RAU RP 4 x PR 18	160.7**	14.3	Varuna x Prakash	33.7**	8.8
RLM 198 x Varuna	104.9**	63.6**	RLM 198 x Prakash	29.1*	15.8
RAU RP 4 x Varuna	98.3**	–1.7			
TM 7 x Varuna	62.3**	47.2**	**Siliquas per plant:**		
RAU RP 4 x TM 7	–80.7**	–7.1	Sita x Prakash	57.5**	21.3
PR 18 x TM 7	–66.4**	7.9	RLM 198 x Varuna	52.0**	31.7*
PR 18 x RLM 198	–72.9*	0.1	TM 7 x Sita	45.0*	35.3*
RH 761 x RLM 198	–82.8**	8.2	RLM 198 x Prakash	42.1*	33.0*
RH 761 x Varuna	–77.1**	16.2	Varuna x Prakash	37.7*	16.5
Days to maturity:			**Length of siliquas:**		
RAU RP 4 x P R 18	8.2*	3.3	Sita x Varuna	–13.7**	–19.9
RAU RP 4 x RH 761	17.5**	–4.5	RAU RP 4 x TM 7	13.0**	0.1
RAU RP 4 x RLM 198	13.4**	1.1	RAU RP 4 x RLM 198	14.5**	3.3
RAU RP 4 x Varuna	7.7*	0.2	RAU RP 4 x Varuna	21.5**	–8.3
RAU RP 4 x Prakash	10.3**	–3.1	RAU RP 4 x Prakash	19.7**	3.7
P R 18 x Sita	13.3**	–0.1	P R 18 x RH 761	7.6*	2.2
RH 761 x RLM 198	–10.0**	1.8	P R 18 x TM 7	14.7**	2.8
RH 761 x Prakash	–8.9**	0.5	RH 761 x RLM 198	17.4**	5.1
TM 7 x Sita	8.5**	–1.0	RH 761 x Varuna	35.0**	3.1
Sita x RLM 198	7.5*	0.2	TM 7 x Varuna	7.9*	2.3
Sita x Varuna	14.7**	0.0	Sita x Prakash	14.4**	5.6
RLM 198 x Varuna	8.4*	1.6	RLM 198 x Prakash	11.8*	9.1

heterosis for this trait. For siliquas/plant, significant positive heterosis was observed in five crosses: Sita x Prakash (57.5%), RLM 198 x Varuna (52.0%), TM 7 x Sita (45.0%), RLM 198 x Prakash (42.1%), and Varuna x Prakash (37.7%). Interestingly, four out of these five crosses, involved parents with high mean value for this trait. Three crosses exhibited significant positive and the other two moderate inbreeding depression. Positive BP heterosis for siliqua length was exhibited in 11 crosses with the maximum heterotic value of 35.0% combined with absence of inbreeding depression. The cross Sita x Varuna showed significant negative heterosis. Ten crosses showed positive and two crosses, viz. RH 761 x RLM 198 and RH 761 x Prakash had significant negative heterosis for days to maturity and none of these crosses exhibited inbreeding depression on selfing.

DISCUSSION

In the present investigation, several crosses have shown moderate to high BP heterosis for seed yield and siliquas/plant, siliqua length, and days to maturity, while many of the crosses exhibited negative heterosis for number of secondary branches [1–4]. The crosses showing high estimates of heterosis for seed yield also had significant heterotic effects for some of the yield components. For example, the crosses RLM 198 x Varuna and RAURP 4 x Varuna were having higher BP heterosis for seed yield, also showed highly significant positive heterotic effects for its component like siliquas/plant. In general, the F_2 mean was lower than that of F_1 but in one or two crosses it was comparable or even higher in F_2 due to additive x additive type epistasis, which is in agreement with the earlier findings [5]. The relationship between heterotic response and inbreeding depression indicated that the crosses TM 7 x Varuna and RLM 198 x Varuna for seed yield, RLM 198 x Varuna, TM 7 x Sita, and RLM 198 x Prakash for number of siliqua, showing high BP heterosis in F_1, also showed high inbreeding depression in F_2. This indicates the importance of nonadditive gene action in the Indian mustard.

It is suggested that biparental progenies should be made from such crosses and evaluated subsequently to get segregates superior to better parent/standard variety, which may be handled through pedigree method of breeding. The BP heterosis for yield to the extent of 160% offers a good scope for heterosis breeding in this crop provided it becomes economical and practical.

REFERENCES

1. D. Singh and T. R. Mehta. 1954. Studies in breeding of brown *sarson*. I. Comparison of F_1s and their parents. Indian J. Genet., **14**: 74–77.

2. T. P. Yadav, H. Singh, V. P. Gupta and R. H. Rana. 1974. Heterosis and combining ability in raya for yield and its components. Indian J. Genet., 34: 684–695.

3. D. S. Rawat. 1975. Genetical Studies on Yield, Oil Content and Characters Related to Yield in *Brassica juncea*. Ph. D. Thesis. IARI, New Delhi.

4. Rajendra Prasad and Basudeo Singh. 1985. Heterosis for some quantitative characters in Indian rape seed. Indian J. agric. Sci., 55(11): 671–673.

5. S. K. Choudhary and S. K. Sharma. 1982. Note on the inheritance of some quantitative characters in a cross of Indian mustard. Indian J. agric. Sci., 52 (1): 23–25.