Indian J. Genet., **60**(4): 557-559 (2000)

Short Communication

HETEROSIS AND COMBINING ABILITY IN INDIAN MUSTARD (*BRASSICA JUNCEA* L. CZERN. & COSS.)

R. K. KATIYAR, R. CHAMOLA AND V. L. CHOPRA

National Research Centre on Plant Biotechnology, Indian Agricultural Research Institute, New Delhi 110 012

(Received: August 1999; accepted: August, 2000)

Indian mustard (*B. juncea*) is an important edible oil yielding crop in the Indian subcontinent. So far, the agronomic improvement was sought by developing pure lines through pedigree method of breeding. Recently, the availability of stable cytoplasmic male sterile (CMS) lines[1] and their restorer counterparts[2] has stimulated the interest of plant breeders to explore the possibility of producing productive commercial hybrids. This paper reports the results on heterosis and combining ability of 96 intervarietal crosses obtained by line × tester mating of newly bred lines and germplasm lines of *B. juncea* for seed yield and some important yield components.

Six lines and 16 testers of *B. juncea* were crossed in line × tester mating design. Ninety six resultant crosses (F1) were field evaluated alongwith their parents and best national cultivar (Varuna) in randomized block design with 3 replications, for seed yield, branches, pods on branches and seeds per pod. The crop was sown in rows, 40 cm apart and plant to plant distance within row was kept 8-10 cm by thinning plot size was 3 × 0.4 M. Two irrigations and fertilizer @ 80 kg 'N', 60 kg 'P', 40 kg 'K' and 25 kg 'S' per hectare were applied.

Data on number of primary branches per plant (PB), number of pods on 3 PB and number of seeds on 5 siliquae were recorded on 3 competitive plants per plot on crosses, parents and the national check (Varuna) in all replications at physiological maturity of crop. At complete maturity, the seed yield per plot was recorded. Means over plants and replications were worked out and combining ability [3] and heterosis over better parent and Varuna was worked out.

Of the 96 crosses, 64 (65.3%) and 38 (39.6%) were heterotic for seed yield over better parent and Varuna respectively. Seventeen crosses showed significant heterosis over both better parents and Varuna (Table 1). A large proportion of significant heterotic combinations which gave high heterosis (upto 97.7%) suggested the possibility

Table 1. Crosses showing significant heterosis for seed yield and heterosis for key characters contributing towards yield

Cross combination	Seed yield		PB/plant		Pods/PB		Seeds/silq.	
	Het. Over BP	Het. Over NV	Het. Over BP	Het. Over NV	Het. Over BP	Het. Over NV	Het. Over BP	Het. Over NV
BIO-322-93 × GM-1	33.5	52.4	4.5	15.0	18.0	44.5	3.0	11.2
BIO-322-93 × BIO-YSR	31.5	66.3	-	33.3	19.8	46.7	-	12.8
BIO-322-93 × BIO-53-93	-	43.5	21.2	33.3	3.6	26.8	-	18.4
BIO-322-93 × BIO-466-95	-	39.8	3.0	13.3	16.8	43.0	0.7	11.2
BIO-322-93 × BIO-467-95	43.1	63.3	-	20.0	29.4	60.3	-	3.2
BIO-322-93 × BIO-341-92	40.5	60.4	18.2	30.0	4.5	27.9	-	-
BIO-322-93 × CSR-1240	33.5	52.4	31.5	60.0	6.6	30.5	10.3	20.0
BIO-322-93 × CSR-1246	-	40.4	21.3	51.7	-	14.3	-	13.6
BIO-322-93 × CSR-258	-	32.5	16.7	40.0	-	31.3	-	13.6
BIO-322-93 × JMG-414	-	44.4	-	6.7	-	14.7	-	13.6
BIO-322-93 × JMG-401	42.6	62.7	16.2	43.3	10.2	34.9	-	-
BIO-772 × BIO-53-93	38.5	-	23.6	46.7	16.5	22.1	-	20.8
BIO-772 × RLM-198	64.7	-	-	38.3	8.3	24.3	-	-
PJK × CSR-499	76.3	44.0	-	11.7	4.9	18.4	-	16.4
PJK × JMG-417	64.3	-	15.6	23.3	7.4	6.3	8.3	15.2
PJK × RLM-198	97.7	39.8	-	43.3	29.5	48.5	-	0.8
BIO-200-94 × RLM-198	67.7	-	-	48.3	11.2	27.6	4.4	13.6

BP = Better parent; NV = National variety (cv. Varuna); PB = No. of primary branches per plant

of production of successful commercial hybrids in this crop by judicious choice of parents. Earlier studies [4-6] also indicated the potential of heterosis breeding for improving the productivity in this crop. Results indicated that gain in seed yield was mainly due to increased pods and to some extent by combination of increased branches and seeds per pod. BIO-322-93, BIO-YSR, JMG-401, BIO-53-93 and BIO-467-95, were good general combiners, while BIO-322-93 × BIO-341-92, PJK × CSR-499, PJK × RLM-198, PJK × JMG-417, BIO-772 × BIO-53-93 and BIO-344-93 × JMG-414 were good specific combiners for seed yield (Table 2).

Table 2. Cross combinations showing significant specific combining ability effects (sca) and their per se performance for seed yield and its components

Crosses	SCA	Mean values of characters			
		Yield Kg/plot	PB/plant	Pods/PB	Seeds/silq
BIO-722 × BIO-53-93	0.106*	0.647	6.8	33.2	15.1
BIO-200-94 × BIO-467-95	0.104*	0.615	5.2	35.2	14.8
BIO-322-93 × BIO-341-92	0.157**	0.805	7.8	34.8	12.4
PJK × CSR-499	0.218**	0.723	6.7	32.2	14.6
BIO-344-93 × JMG 414	0.114*	0.532	6.4	26.9	15.0
PJK × JMG-417	0.113*	0.613	7.4	28.9	14.4
PJK × RLM-198	0.154*	0.702	8.6	40.4	12.6

SE (Sij) ± 0.051; PB = Number of primary branches per plant

Parent Pusa Jai Kisan (PJK) produced three crosses with significant positive sca effect for seed yield (Table 2). Presence of non- additive genetic control and its reflection in significant positive heterosis in crosses with CSR-499, JMG-417 and RLM-198 proved its worthiness for heterosis breeding for enhancing productivity. Among lines BIO-322-93 showed significant gca effects. This suggested its potentiality in crosses with BIO-YSR, BIO-53-93, BIO-467-95 and JMG-401 to seek yield improvement by pedigree method of breeding.

REFERENCES

1. S. Prakash and V. L. Chopra. 1990. Male sterility caused by cytoplasm of *Brassica oxyrrhina* in *B. campestris* and *B. juncea*. Theor. Appl. Genet., **79**: 285-287.
2. P. B. Kirti, A. Baldev, K. Gaikwad, S. R. Bhat, Dinesh Kumar, S. Prakash and V. L. Chopra. 1997. Introgression of gene restoring fertility of CMS (*Trachystoma*) *Brassica juncea* and genetics of restoration. Plant Breeding., **116**: 259-262.
3. O. Kempthorne. 1957. An Introduction to Genetic Statistics, John Willey & Sons, New York.
4. T. P. Yadav, H. Singh, V. P. Gupta and R. K. Rana. 1973. Heterosis and combining ability in *raya* for yield and its components. Indian J. Genet., **34A**: 684-695.
5. A. K. Pradhan, A. Mukhopadhyay and D. Pental. 1993. Heterosis breeding in Indian mustard (*Brassica juncea* L. Czern & Coss) : Analysis of component characters contributing to heterosis for yield. Euphytica., **69**: 219-229.
6. P. K. Agrawal and S. S. Badwal. 1998. Possible utilization of commercial heterosis in Indian mustard, *Brassica juncea* (L.) Coss & Czern. Indian J. Genet., **58**: 513-516.