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Heterosis for Some Quantitative Characters in *Brassica juncea* L.

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Abstract: Five cross of *Brassica juncea* viz., SMP 13-78 x Zem-I, SML 31E x Zem-I, DL 8 x Zem-I, SM 83000 x Zem-I, Pr 171-71 x Zem-I were made. These crosses (F_1 's) along with their parents were sown and heterosis was studied for branches per plant, plant height (cm), number of siliques and yield per plant (g) in F_1 generation. It was found that a cross of SMP 13-78 x Zem-I showed maximum heterosis and heterobeltotic for all the characters studied. Therefore, this cross combination can fruitfully be utilized for improving yield and its components in future breeding programmes.

Key words: *Brassica juncea*, heterosis, heterobeltosis, yield components, Pakistan

Introduction

The rapeseed and mustard yield in Pakistan is generally low in comparison with other countries. A key factor in the poor performance is the scarcity of high yielding, locally adapted cultivars. The breeder, ultimately, looks for better ways and means which can guarantee to raise per unit production. Among other means of boosting productivity, the exploitation of heterosis holds a good promise and has increased the production of various crops enormously. It evidently acknowledged in the literature that hybrid vigour manifests itself both for developmental and economical characters in Rapeseed and Mustard. The effect of the phenomenon on yield and various components is obviously well documented by the breeders and reported to affect the seed yield, branches and pods per plant to an appreciable extent (Grant and Beversdorf, 1985; Katiyar *et al.*, 2000; Khan *et al.*, 1993). Heterosis for branches per plant, height of the main stem, siliques and yield per plant had variably been reported by different workers. A little heterotic effect was observed in yield per plant. Additional studies also showed different magnitude of heterosis in siliques per plant and 1000-seeds weight (Weirong *et al.*, 1999). Heterosis was the highest for seed yield per plant followed by pods and branches per plant. (Ali *et al.*, 2000). Different workers in their studies have reported a considerable degree of heterotic effect for height of the main stem, pods, branches and seed yield per plant (Sernyk and Stefansson, 1983; Varshney, 1985; Parsad and Singh, 1985). Heterotic effect in seed yield per plant was observed upto the extent of 96.4% (Cunkou *et al.*, 2000). The studies revealed highly significant increase over the better parents for height, seed yield and number of branches per plant (Singh *et al.*, 1985).

A varying degree of heterosis was estimated for seed

yield, 1000-seeds weight, plant height and yield per pod over mid parent values. It was further confirmed that some of the crosses exhibited heterobeltiosis also (Verma *et al.*, 2000; Khulbe *et al.*, 1998). So, F_1 generation comparing mid and superior parents, heterosis occurred for all the characters to varying degree. However, in the proposed study good types with different genetic background are crossed for such information. The amount of heterosis for different characters was assessed and results of the present study were obtained.

Materials and Methods

The following 5 crosses were made to study the heterotic effect for number of branches, plant height, number of siliques per plant and yield during the year, 2000-2001.

SMP 13-78 x Zem-I
SML 31 E x Zem-I
DL 8 x Zem-I
SM 83000 x Zem-I
Pr 171-71 x Zem-I

The seeds obtained from these crosses were sown as F_1 in the following year, i.e. 2001-2002 at Oilseeds Research Institute, Faisalabad. F_1 crosses along with their parents were sown by dibbling in four replications.

The following data for ten plants in each replication was recorded.

Number of branches per plant.
Plant height (cm)
Number of siliques per plant.
Yield per plant (g).

Heterosis in F_1 for all these characters were calculated in

percentage over the mid parent and heterobeltiosis over the better parent values. The data was subjected to analysis of variance to see whether the differences in the performance of parents and their F_1 's were real or just incidental.

Results and discussion

Number of branches per plant: It is clear from Table 1 that only the cross of DL 8 x Zem-I could show highly significant differences among F_1 's and their parents. During the study number of branches per plant, heterosis was observed in crosses over mid parent, ranging from 3.4% (SM 83000 x Zem-I) to 23.8% (DL 8 x Zem-I). The crosses of SMP 13-78, SML 31E and DL 8 with Zem-I showed heterosis over their better parents ranging from 12.1% (SMP 13-78 x Zem-I) to 18.2% (DL 8 x Zem-I) meanings thereby over dominance type of gene action in all these crosses, while heterosis in SM 83000 x Zem-I had showed additive type of gene action with partial dominance. Ali *et al.* (2000), Varshnay (1985) and Singh *et al.* (1985) have reported reasonable degree of heterosis on number of branches per plant while studying the F_1 generation of *Brassica juncea*.

Plant height (cm): The data of plant height given in Table 1 four out of five crosses showed significant differences among F_1 's and their parents. In this case heterosis was observed in all the crosses over their mid parent values while crosses of SMP 13-78, SML 31E, DL 8 and SM 83000 with Zem-I showed heterotic effect even over better parents which reveals the fact that over dominance type of gene action was present in these crosses while heterosis in Pr 171-71 x Zem-I had showed additive type of gene action with partial dominance. The magnitude of heterosis over mid parents ranged from 6.5% (Pr 171-17 x

Zem-I) to 15.8% (SML 31E x Zem-I) but the degree of increase over better parents range from 4.2% (SM 83000 x Zem-I) to 8.8% (DL 8 x Zem-I). The above findings confirm those of Weirong *et al.* (1999), Ali *et al.* (2000), Verma *et al.* (2000) and Khulbe *et al.* (1998) who already reported heterosis for this character.

Number of siliques per plant: As regards number of siliques per plant only two crosses, i.e., SMP 13-78 x Zem-I and SML 31E x Zem-I showed significant differences among F_1 's and their parents (Table 1). The magnitude of hybrid vigour when compared with mid parent values ranged from 5.3% (SM 83000 x Zem-I) to 81.5% (SMP 13-78 x Zem-I) and 3.6% (DL 8 x Zem-I) to 32.5% (SMP 13-78 x Zem-I) when compared with better parental values. The crosses of SMP 13-78, SML 31E and DL 8 with Zem-I showed heterosis over their better parents which indicated the fact that over dominance type of gene action was present in these crosses while heterosis in SM 83000 x Zem-I has additive type of gene action with partial dominance. Hybrid vigour have also been observed for this character by Weirong *et al.* (1999), Ali *et al.* (2000), Parsad and Singh (1985) and Katiyar *et al.* (2000).

Yield per plant (g): In case of yield per plant SMP 13-78 x Zem-I and SML 31E x Zem-I showed highly significant differences among F_1 's and parents (Table 1). All the crosses showed heterosis when compared with mid parental values with a range of 3.5% (SM 83000 x Zem-I) to 87.2% (SMP 13-78 x Zem-I). Heterobeltiosis values of the crosses depict that over dominance type of gene action was present in these crosses. The range of heterobeltiosis in this case was 1.2% (SM-83000 x Zem-I) to 55.9% (SMP 13-78 x Zem-I). These results are in accordance with Sernyk and Stefansson (1983), Ali *et al.*

Table 1: Heterosis in intra specific crosses of *Brassica Juncea* L.

Crosses	Branches plant ⁻¹		Plant height (cm)		Siliques plant ⁻¹		Yield plant ⁻¹ (g)	
	Heterosis of F_1 over		Heterosis of F_1 over		Heterosis of F_1 over		Heterosis of F_1 over	
	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.	M.P.	B.P.
SMP 13-78 x Zem-I	14.4*	12.1	12.0**	6.97	81.5**	32.5**	87.2**	55.9**
SML 31E x Zem-I	22.6*	15.2	15.8**	7.4	33.7**	31.9**	40.8**	25.7
DL 8 x Zem-I	23.8**	18.2*	13.0*	8.8*	9.5	3.6	10.6	1.7
SM 83000 x Zem-I	3.4	-9.1	12.8**	4.2	5.3	-5.5	3.5	1.2
Pr 171-71 x Zem-I	-6.9	-18.2	6.5	-1.3	-1.4	-18.7	15.3	4.1

* Significant

** Highly significant

(2000), Cunkou *et al.* (2000), Singh *et al.* (1985), Verma *et al.* (2000) and Khulbe *et al.* (2000). Who obtained similar results for heterosis in F₁ hybrids in *B.juncea* and *B. napus*.

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