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Short Communication

Combining ability and heterosis for resistance to leaf blight disease in Indian mustard [*Brassica juncea* (L.) Gen and Coss]

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Leaf blight [C.O. *Alternaria brassicae* (Berk.) Sacc. and/or *Alternaria brassicola* (Schw.) Wilt], the most destructive and wide spread disease of Indian mustard [*Brassica juncea* (L.) Gen and Coss] in India including tarai ecological zone of West Bengal [1], causes 10-70% crop loss [2-3]. The use of resistant cultivar could substantially minimize the loss. As the resistance in the mustard cultivars is threatened due to evolution of new races of the pathogen [4], incorporation of disease resistance through breeding to the agronomically superior cultivar using diverse sources of resistance will be the most effective strategy. The present investigation was, therefore, carried out to understand the pattern of inheritance of leaf blight in Indian mustard.

Indian mustard varieties, namely, Vardhan, NDR-8501, MCN-20, Rohini, RH-30, Varuna, Seeta and Kranti were crossed in half- diallel mating system without reciprocals. Parents and F_1s were grown with inter-row and plant to plant spacing of 45cm and 15cm, respectively at the Bidhan Chandra Krishi Viswavidyalaya Research Farm, Pundibari, Cooch Behar, West Bengal, in a randomized block design with three replications.

Highly susceptible *B. juncea* cultivar, Prakash, was inter- planted as an infector row after every fourth test entry and all round the experimental plot.

Data for leaf blight infection were recorded thirty days after disease appearance as per cent area of leaf infected by scoring all leaves of eight randomly selected plants of each parent and F_1 from each replication based on 0-6 scale (0 = 0%, 1 = 1-5%, 2 = 6-10%, 3 = 11-25%, 4 = 26-50%, 5 = 51-75% and 6 = 76-100%]. Per cent disease index (PDI) was computed by using the following formula.

$$PDI = \frac{\text{Sum of total disease rating}}{\text{No. of plants examined} \times \text{Maximum grade}} \times 100$$

Percentage data were subject to square root transformation and analyzed statistically for combining ability analysis using Griffing Model II, Method-2 [5] and for heterosis using Gardner and Eberhart Analysis-II [6]. The significance of heterosis was tested in each hybrid by $\sqrt{2Me/r}$, where Me = error variance of the general ANOVA table of parents and F_1s, r = no. of replications.

The mean per cent disease index (PDI) of the genotypes ranged from 10.1 in Kranti to 16.9 in RH-30. The results indicated that Kranti has considerable resistance to leaf blight disease followed by Varuna (1.6%), whereas RH-30 exhibited susceptibility. The PDI of hybrids ranged from 10.4 in Vardhan × Kranti to 21.8% in Varuna × Seeta. The PDI of some crosses surpassed the highest degree of susceptibility of parents. A few crosses between resistant and susceptible parents exhibited higher PDI compared to mid-parental value. Majority of crosses exhibited lower PDI value compared to mid-parental value indicating dominance for disease inheritance.

Significant MS values for both general combining ability (*gca*) and specific combining ability (*sca*) indicated the importance of both additive and non-additive gene actions in controlling leaf blight resistance in Indian mustard.

Most of the cross combinations produced significant negative *sca* effects (Table 1). Only the cross combination MCN 20 × Rohini had both the parents with significant negative *gca* effects.

Analysis of variance for heterosis revealed that the differences among combining abilities of parents and differences for heterosis among individual crosses were significant. The variance for heterosis was, therefore, further partitioned into average, parental and specific heterosis. The values of the latter two

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Table 1. Estimates of general combining ability effects (diagonal) and specific combining ability effects (above diagonal) for resistance to leaf blight disease in 8 × 8 half diallel cross of *Brassica juncea*.

Parents	Vardhan	NDR-8501	MCN-20	Rohini	RH-30	Varuna	Seeta	Kranti
Vardhan	0.008	−0.150*	−0.320**	−0.200**	−0.010	0.640**	−0.150*	−0.330**
NDR-8501		0.128**	0.170**	0.290**	−0.420**	−0.170**	0.440**	0.360**
MCN-20			−0.113**	−0.281**	−0.090	−0.240**	−0.530**	0.890**
Rohini				−0.133**	−0.470**	−0.420**	0.290**	−0.090
RH-30					0.078	0.470**	0.080	0.000
Varuna						0.028	0.730**	−0.250**
Seeta							0.118**	−0.140*
Kranti								−0.203**

*,** Significant at 5% and 1% levels, respectively.

Table 2. Specific heterosis of crosses

Parents	Vardhan	NDR-8501	MCN-20	Rohini	RH-30	Varuna	Seeta	Kranti
Vardhan	−0.053	−0.137	−0.156	−0.052	−0.000	0.636**	−0.173	−0.247*
NDR-8501		0.270**	0.221*	0.325**	−0.523**	−0.387**	0.304**	0.330**
MCN-20			−0.211*	−0.094	−0.042	−0.206*	−0.515**	1.011**
Rohini				−0.215*	−0.438**	−0.402**	0.289**	0.015
RH-30					0.133	0.350**	−0.059	−0.033
Varuna						0.097	0.577**	−0.297**
Seeta							0.206*	−0.206*
Kranti								−0.220*

*,** Significant at 5% and 1% levels, respectively.

components were significant indicating significant additive effect of each parent on hybrid concerned and significant differential interaction of parents in specific cross combination. On the basis of the estimates of genetic constants, the varieties Kranti, Varuna and Seeta showed the greatest effect on the variance among the diallel progenies. So far as contribution to heterosis is concerned, the parents Rohini, MCN-20, Vardhan, Kranti and RH-30 are expected to manifest the highest additive effects being better general combiners. Additive effect of each parent on hybrid, revealed that the parents Kranti, Rohini, MCN-20 and Vardhan would behave in the desired direction (Table 2). With regard to specific heterosis, eight crosses had significant and desirable values. Among these three cross combinations *viz.*, MCN-20 × Seeta, Rohini × RH-30 and Varuna × Kranti may be considered as the promising combinations since these crosses had the F_1 mean below the mid- parental value and desirable *gca* and *sca* effects.

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