COMBINING ABILITY ANALYSIS OF YIELD AND ITS COMPONENTS IN INDIAN MUSTARD

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Abstract

Combining ability analysis in a 8x8 diallel cross excluding reciprocals and parents in Indian mustard /*B. juncea* L. Coss/ was done for eight characters, namely plant height, primary branches, secondary branches, main shoot length, siliquae on main shoot, siliqua length, seeds per siliqua and seed yield. General and specific combining ability mean squares were significant for the characters under study.

Preponderance of non-additive gene effects was evident for all the characters except plant height for which additive gene effects were more predominant. The best general combiners were: RLM 198 for seed yield and siliquae on main shoot; RH 30 for plant height; RLM 514 for primary and secondary branches; RLM 29 for siliqua length; Varuna for seeds per siliqua and Pusa bold for main shoot length. On the basis of specific combining ability effects and performance *per se*, two crosses exhibited high SCA effects as well as high mean performance for all the characters except main shoot length. Crosses RLM 82 x Varuna and RLM 198 x RH 30 involving high x average and high x high combining parents respectively were identified as the best crosses for further exploitation through selection.

Introduction

Indian mustard /*Brassica juncea* L. Coss/ is an important Rabi oilseed crop grown in Northern and Eastern India. Recently a wide range of genetic variability has been created through mutations, hybridizations and introductions. Before using these lines in the efficient breeding programme their nicking ability through combining ability analysis must be understood. The present investigation was, therefore, taken up for the evaluation of yield and its components with regard to combining ability of genetically diverse lines.

Material and methods

Eight diverse genotypes, namely RLM 29, RLM 82, RLM 198, RLM 514, Varuna, P26/21, RH 30 and Pusa Bold were crossed in all possible combinations /excluding reciprocals/. Twenty eight F1s were grown in replicated field trial in rows of 3 m length 30 cm apart with a plant to plant distance of 15 cm. Data were recorded on five competitive plants taken from each row at random and averaged for different characters. The analysis of variance was based on Method 4, Model I of Griffing /1956/.

Results and discussion

Analysis of variance showed that differences among F_1 were highly significant for all the traits. Analysis of variance for combining ability showed that both additive and non-additive gene effects were operative in controlling the inheritance of all the traits. The proportion $\sigma^2 g$ to $\sigma^2 s$ is less than unity for all the traits except plant height, indicating predominance of non-additive gene effects whereas additive gene effects are controlling the inheritance of plant height.

The estimates of general combining ability effects /GCA/ are presented in Table 1. Results revealed that the best general combiners were RLM 198 for seed yield and siliquae on the main shoot, RH 30 for plant height, RLM 514 for primary and secondary branches, RLM 29 for siliqua length; Varuna for seeds per siliqua and Pusa bold for main shoot length. It is suggested that these parents for specific character can be used as a donor parent in hybridization programme.

The three top ranking crosses, exhibiting high mean performance and high SCA effects for different characters are given in Table 2. On the basis of specific combining ability effects and performance per se two crosses exhibited high SCA effects as well as high mean performance for all the characters except main shoot length. Crosses exhibiting high mean for various characters were the result of high x high, or high x low general combining parents. The crosses with high SCA effects and high mean performance involving high general combiners are likely to give transgressive segregants. However, in crosses involving high x low combining parents, both additive and non-additive gene effects seem to be operative. The high SCA effects of crosses RLM 29 x P26/21 for seed yield, Varuna x Pusa bold for primary branches, RLM 198 x RH 30 for secondary branches, RLM 514 x P 26/21 for main shoot length and P 26/21 x RH 30 and RLM 29 x RLM 82 for siliquae on the main shoot have arisen from favourable genic interaction due to genetic diversity of the parents involved. Similar results have also been reported by Yadav et al /1979/ and Gupta et al /1984/ in Indian mustard. Crosses RLM 82 x Varuna and RLM 198 x RH 30 involving high x average and high x high combining parents respectively were identified as the best crosses for further exploitation for seed yield.

In this material non-additive gene effects were more pronounced than the additive effects. Therefore, in order to exploit the genetic variance due to both additive and non-additive effects, firstly the modified parental mating technique among the selected early generation segregants from the desirable crosses should be followed. Secondly, the population building programme can be taken up with the best combining parents following Jensens' /1970/ diallel selective mating scheme as modified by Frey /1975/. Dominances and epistatic variance can also be exploited by synthesizing of F_1 hybrids since male sterility sources as suggested by Rawat and Anand /1979/ are becoming available in Indian mustard.

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TABLE 1: ESTIMATES OF GENERAL COMBINING ABILITY EFFECTS OF SEED YIELD AND ITS COMPONENTS

Parents	Plant height	Primary branches	Secondary branches	Main shoot length	Siliquae on main shoot	Siliqua length	Seeds per siliqua	Seed yield
RLM 29	-12.90*	-0.43*	-0.44*	0.87	-2.81*	0.22*	0.38*	-0.95*
RLM 82	5.31*	0.25*	0.22	-1.96*	-0.05	0.02	-0.67*	0.43*
RLM 198	23.29*	0.63*	-0.38*	2.14*	4.49*	-0.01	-0.35	0.50*
RLM 514	10.25*	0.94*	1.26*	-7.59*	0.26	-0.19*	0.09	-0.17
Varuna	-0.92*	-0.18*	-0.41*	0.72	2.18*	-0.09*	1.16*	0.16
P26/21	1.56	-0.27*	-0.57*	-1.24	-0.05	-0.09*	-0.69*	-0.39*
RH 30	-15.14*	-0.48*	-0.46*	3.37*	-1.23*	0.11*	0.12	0.25*
Pusa bold	-9.46*	-0.47*	0.79*	3.69*	-2.80*	0.04	0.19	0.17
$SE(g_i)$	1.15	0.07	0.17	0.63	0.49	0.02	0.19	0.13

* $P \leq 0.05$

TABLE 2: THE TOP THREE CROSSES ON THE BASIS OF THEIR MEAN PERFORMANCE AND SPECIFIC COMBINING ABILITY (SCA) EFFECTS FOR DIFFERENT CHARACTERS

Characters	SCA effects I	SCA effects II	SCA effects III	Mean performance I	Mean performance II	Mean performance III
Seed yield	RLM 29 xP26/21 (LxL)	RLM 82 x Varuna (HxA)	RLM 198 x RH 30 (HxH)	RLM 82 x Varuna	RLM 198 x RH 30	RLM 198x Varuna
Plant height	P26/21xPusa bold (LxH)	Varuna xRH30 (HxH)	RLM29 x P26/21 (HxL)	Varuna x RH30	P26/21xPusa bold	RH30 x Pusa bold
Primary Branches	RLM 198x RH30 (HxL)	RLM511xPusa bold (HxL)	Varunax Pusa bold (LxL)	RLM 198xRH30	RLM 514x Varuna	RLM 511xPusabold
Secondary branches	RLM 198xRH30 (LxL)	VarunaxPusa bold (LxH)	RLM 514xP26/21 (HxL)	VarunaxPusabold	RLM 198xRH30	RLM 514xPusabold
Main shoot length	RLM 514xRH30 (LxH)	RLM514xP26/21 (LxL)	RLM29xP/26/21 (AxL)	RLM 198xPusabold	RLM 82xPusabold	RLM 198 xVaruna
Siliquae on main shoot	p26/21xRH30 (LxL)	RLM29xRLM82 (LxL)	VarunaxP26/21 (HxL)	RLM 198xVaruna	VarunaxP26/21	RLM 198xPusabold
Siliqua length	RLM29xP2 /21 (HxL)	RLM 198xPusa bold (LxA)	RLM 514xRH30 (LxH)	RLM 29xRLM198	RLM 198xPusabold	RLM29 x P26/21
Seeds/ Siliqua	RLM198xVaruna (LxH)	RH30xPusabold (LxA)	RLM29xP26/21 (HxL)	RLM198xVaruna	RH30xPusabold	RLM29 x Varuna

General combining ability of parents: H= High, L= Low, and A= Average