BREEDING FOR PHYSIOLOGICAL ATTRIBUTES IN INDIAN MUSTARD

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ABSTRACT

28 F_1's and 8 parents were studied for seed yield, NAR (net assimilation rate), LAR (leaf area ratio), RGR (relative growth rate) and harvest index. The general and specific combining ability variances were significant for all the traits. The component analysis indicated the presence of both additive and non-additive genetic components with the latter being more important for all the traits. The parents RH-7514 and RCU-101A were superior for seed yield and harvest index; RSS3A and RH-7307-1 for NAR and RGR at flowering and development phase and Domo and Blaze for LAR at vegetative and flowering phase. Assay means had positive association with gca effects, suggesting thereby that assay means could effectively be used for isolating desirable parents.

INTRODUCTION

The importance of physiological factors affecting the seed yield of crop plants have been laid by many workers. Therefore, the understanding of genetic architecture of some important growth parameters in Indian Mustard (Brassica juncea L.) may be a guide in future breeding programmes.

MATERIALS AND METHODS

Eight parents namely RH-7513, RH-7514, RSS-3A, RCU-101A, RH-7307-1, Domo, RH-781 and Blaze were crossed in diallelic fashion (excluding reciprocals). Twenty eight F_1's alongwith parents were grown in a randomized block design with three replications each. Each of the genotype was represented by a single row of 4.5m length and 30cm apart in each replication. Five random and competitive plants were uprooted at 4 different stages viz., vegetative stage, pre-flowering stage, full bloom stage and at maturity stage. The leaf area per plant was measured with the help of leaf area meter. After recording leaf area, the total harvested material which includes leaves, shoot and inflorescence was dried in a hot air oven at a constant temperature of 80°C for a period of 48 hrs. The interval between each stage constituted a phase termed as vegetative phase (Ist phase); flowering phase (IInd phase) and developmental phase (IIIrd phase). The leaf area and total dry matter were utilized to calculate mean net assimilation rate (NAR), mean leaf area ratio (LAR) and mean relative growth rate (RGR) as per formulae reveiwed by Radford (1967). The seed yield and harvest index were recorded at the time of harvest. The data recorded for all the traits was subjected to the analysis of variance for combining ability using model 1 method 2 of Griffing (1956). The genetic components of variance were calculated using technique of Rayman (1954).

RESULTS AND DISCUSSION

The mean sum of squares due to general and specific combining

ability were significant for all the traits (Table-1). These results indicated the pre-ponderance of non-additive genetic variance for all the traits. But a substantial amount of additive genetic variance was also observed for these traits.

The components of genetic variation alongwith derived genetic ratios for the different traits (Table-2) indicated that the estimates of D (additive genetic components) and Hi (dominance components)were significant for all the traits. The dominance component (H_1) was also significant for all the attributes at all the phases. However, the magnitude of dominance component was higher for all the characters indicating thereby the pre-ponderance of non-additive genetic component. This was further confirmed when the estimates of mean degree of dominance $(H_1/D)^{0.05}$ fell in the range of overdominance. The proportion of dominant and recessive genes in parents, given by statistic, $(4\ DH_1)^{0.5} + F/(4DH_1)^{0.5} - F$, ranged 1.27 (NAR at flowering phase) to 1.89 (LAR at development phase) for different characters under study. This indicated that for every recessive allele there were one to two dominant alleles involved in the inheritance of these traits. The low values recorded for h^2/H_2, indicated that it might have been under-estimated and as such no valid interpretation about gene groups exhibiting dominance can be made. The asymetry of genes among parents entering crosses and the presence of genic interaction in the present material, might be among the causes for low estimated value of this ratio. The heritability (n.s) estimates ranged from 11.95 per cent (RGR at vegetative phase) to 35.78 per cent (RGR at development phase).

The estimates of general combining ability effects indicated that parents RH-7514 and RCU-101A were best general combiners for seed yield and harvest index. For NAR and RGR at flowering and development phase, parents RSS-3A and RH-7387-1 possessed highest gca effects. The parnets Domo and Blaze were superior for LAR at vegetative and flowering phase. The significant positive relationship between assay means and gca effects was indicative of the possibility of using away means as an effective tool for isolating desirable genotypes/parents.

Inspite of very scanty information available relating to present study in Indian mustard, it would be most desirable to utilise the available kind of genetic components (both additive and non-additive), to develop a genetic population with broad and diverse genetic base. Intermating of genotypes having high gca effects for various growth attributes and seed yield in the early generations should be most desirable procedure for the simultaneous exploitation both fixable and non-fixable components. The use of hybrid breeding programme is also advocated to exploit the dominance variance provided technique is available for producing large quantities of hybrid seed commercially.

REFERENCES

Donald,C.M. (1968). The breeding of crop ideotypes. Euphytica, 17, 385-403.

Griffing,B. (1956). Concept of general and specific combining ability in relation to diallel crossing system. Aust. J.Biol. Sci., 9, 463-493.

Hayman,B.I. (1954). The theory and analysis of diallel crosses. Genetics, 39, 789-809.

Radford,P.J. (1967). Growth analysis - formulae - their use and abuse. Crop Sci., 7, 171-175.

Table-1 : Analysis of variance for combining ability with respect to seed yield and some growth attributes in Indian Mustard.

Source	d.f.	Seed yield	NAR			LAR			RGR			H-1
			Ist	IInd	IIIrd	Ist	IInd	IIIrd	Ist	IInd	IIIrd	
GCA	7	50.23*	0.098*	0.119*	0.193*	2.98*	375.68*	297.18*	115.26*	310.21*	51.86*	7.89*
SCA	28	70.18*	0.136*	0.178*	0.210*	3.76*	576.10*	497.80*	190.14*	564.92	81.26*	13.16*
Error	70	10.26*	0.012	0.026	0.042	0.26	31.86	19.76	37.58	110.76	72.86	1.06

Table-2 : Estimates of genetic components of variation and their ratios with respect to seed yield and some growth attributes in Indian Mustard.

Components/ Ratios	Seed yield	NAR			LAR			RGR			H-1
		Ist Phase	IInd Phase	IIIrd Phase	Ist Phase	IInd Phase	IIIrd Phase	Ist Phase	IInd Phase	IIIrd Phase	
D	19.10* ±7.89	0.172* ±0.062	0.278* ±0.108	0.196* ±0.960	1.86* ±1.01	198.26* ±75.18	111.36* ±41.57	42.86* ±16.19	115.62* ±69.26	76.76* ±46.26	8.15* ±4.09
H_1	115.62* ±46.18	0.427* ±0.201	0.746* ±0.396	0.506* ±0.193	4.23* ±1.98	576.18* ±261.46	315.68* ±172.26	215.06* ±113.17	315.80* ±161.26	210.63* ±101.62	32.16* 17.16
$(H_1/D)^{0.5}$	2.46	1.57	1.64	1.66	1.50	1.70	1.68	2.24	1.65	1.66	1.98
$\frac{(4DH_1)^{0.5}+F}{(4DH_1)^{0.5}-F}$	1.40	1.32	1.27	1.35	1.42	1.81	1.89	1.70	1.82	1.80	1.80
$H_2/4H_1$	0.23	0.24	0.22	0.23	0.25	0.22	0.24	0.22	0.23	0.21	0.24
h^2/H_2	1.38	0.26	0.13	0.24	0.64	0.32	1.00	0.14	0.10	0.12	0.39
Heritability (n.s)	24.00	30.07	27.17	24.25	30.39	28.07	28.68	11.95	24.96	35.78	23.13

* Significant at P = 0.05