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COMBINING ABILITY IN SOME VARIETIES OF BROWN SARSON

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The concept of choosing parents on the basis of their general combining ability for components of yield and genetic divergence from each other in self as well as cross-pollinated crops has helped in a substantial genetic advance in crops like maize, tobacco and alfalfa (Griffing, 1956; Matzinger, Mann and Cockerham, 1962; Carnaham and Carlson, 1963). A set of nine parents of diverse origin in brown *sarson* were examined for a better understanding of the nature of the gene action for yield components in a set of diallel crosses among them as no information is available on nature of gene action in brown sarson (*Brassica campestris*). The results of such an investigation are reported in this paper for the first time.

Materials and Methods

Nine varieties comprising four self-compatible (Kanpur *tora* 5907, Kanpur *tora* 5905, IARI 117 and Brown *Sarson*-73); four self-incompatible (Kanpur *lotni*-27, Kanpur *lotni*-17, Assam local and PC 54 G) and a partially self-compatible type (Gurgaon brown *sarson*-1) were crossed in diallel fashion without reciprocals during *rabi* 1965. Parents and hybrids were grown in replicated completely randomised block design in pots at the Indian Agricultural Research Institute, New Delhi during *rabi* 1966. The data was recorded on plant height, days to first flower, number of primary branches and fruit bearing secondary branches and type of branching for which a scale of 1-10 was taken. The angle formed by the fourth branch to the main stem from the ground level was taken. A score of 1–2 which makes an angle of 20° or less are known as compact branching while a score of 9-10 (70° or more) gives very open types known as stragglers. The estimates of general and specific combining ability effects and analysis of variance for combining ability was done on the fixed effects mode] (Griffing, 1956).

Results and Discussion

The analysis of combining ability in brown sarson for five economic characters are presented in Table 1. The variation due to g. c. a. was

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significant in all characters, except for number of primary and secondary branches. Except for number of secondary branches, s. c. a. was significant for all the characters. Hence, it appears that secondary branches is under the influence of environment for which the magnitude of error m. s. s. was considerable compared to other characters. Contribution of non-additive gene action was high in respect of all characters except for flowering time which was mostly additive.

The estimates of g. c. a. and s c. a. effects for parents and hybrids for five characters are given in Table 2. On the basis of the magnitude and direction of general combining ability effects, self-compatible types proved better in respect of branching type and primary branches. Whereas self-incompatible types were better than self-compatible types in respect of other three characters. No parent was found to be a good general combiner for number of primary and secondary branches. Kanpur *lotni*-27, A sam local and Kanpur *Lotni*-17 in the descending order were good combiners for plant height. Gurgaon brown *sarson*-1, Brown *sarson*-73 and Kanpur *tora* 5905 were good combiners for branching. Four parents (Kanpur *lotni* 17, Kanpur *lotni* 27, Gurgaon brown *sarson* 1 and Assam local) were showing good g. c. a. effects for early flowering. Thus crosses involving these parents will yield superior progenies for various characters.

Table I

Analysis of combining ability in brown sarson for some characters

Source	D. F.	Mean sum of squares				
		Plant height cm.	Branching type	Primary branches	Secondary branches	Days to first flower
Gca	8	735.12**	1.87**	2.07	2.79	222.72**
Sca	36	3007.93**	2.04**	3.06**	20.39	103.14**
Error	86†	6.34	0.16	1.62	14.77	18.10

** Significant at 1% ; others not significant.

† Reduction in degrees of freedom is due to missing plot values.

Table 2

Estimates of gca and sca effects for parents and crosses in brown sarson

1	2 Plant height cm.	3 Branching type	4 Primary branches	5 Secondary branches	6 Davs to first flower
Parents			Gca effects		
Brown sarson-73 P1	15.99**	0.55**	0.30	0.09	8.09**
Kanpur lotni-27 P2	-13.15**	-0.13	-0.71	0.30	-3.87*
Kanpur lotni-17 P3	-7.43**	-0.09	-0.21	0 60	-5.10**
Gurgaon B. S. I P4	0.61	0.69**	0.29	1.20	-3.44*
Kanpur tora 5907 P5	42.4**	0.23	0.22	-1.65	4.90**
I. A. R. I. 117 P6	3.40**	-0.22	-0.08	-1.70	0.89
Assam Local P7	-7.65**	-0.15	0.29	0.83	-3.12*
Kanpur tora 5905 P8	1.95*	-0.29*	050	0.71	-1.03
PC 54 G P9	2.06*	-0.59**	-0.60	-0.38	2.68
S. E. g i	0.74	0 11	0.37	1.14	1.26
Crosses			Sca effects		
P1 XP2	1.98	-1.12**	0.83	2.61	14.07**
P1 X P3	1.27	0.75*	-1.67	-5.50	5.20
P1 XP4	33.62**	3.85**	3.62**	2.20	9.64*
P1 XP5	34.59**	4.32**	2.68*	2.53	22.27
P1 XP6	11.73**	-0.03	2.31	-4.17	-6.01
P1 XP7	-16.31**	-0.80*	-1.38	-0.92	-8.47*
P1 xPs	13.48**	-0.97**	1.59	4.20	-7.06
P1 × P9	-12.24**	-0,37	0.01	-2.70	4.21
P2 × P3	9.11**	0.24	-1 35	-4.42	-2 21

1	2	3	4	5	6
P2 × P4	8.75**	−1.46**	-0.66	-4.82	9.34*
P2 × P5	0,63	0.01	1.20	-0.94	2.26
P2 X P6	-4.14	0.96*	−0.79	2.41	-9.72*
P2 × P7	-0.77	0.39	-1.16	1.37	-5.48
P2 × P8	-5.23*	0.22	0.41	-0.82	-4.77
P2 × P9	22.20**	0.02	2.23	7.78	7.00
P3 × P4	-2.86	0.12	-1.86	5.38	-2.44
P3 × P5	−29.88**	-0.12	-1.60	-4.95	-7.51
P3 X P6	4.05	0.33	-0.99	-5.70	-0.29
P3 X P7	5,02*	-0.74*	4.34**	7.56	-9.24*
P3 X P8	0.11	0.10	-1.89	-4.82	0.45
P3 X P9	19.19**	−1.10**	1.73	0.48	14.93
P4 X P5	−20.74**	0.18	-1.11	2.65	−16.96**
P4 × P6	-4.30	0,33	1.00	2.00	2.06
P4 × P7	6.36**	-0.24	-1.67	-5.54	4.39
P4 X P8	16.85**	−1.60**	0.90	3.08	1.00
P4 X P9	7.53**	−1.00**	1.48	-4.12	-1.43
P5 X P6	2.47	−1.40**	0.56	-0.12	-3 32
P5 x P7	17.03**	−0.98**	−0.31	-1.97	3.02
P5 × P8	-3.07	−1.84**	-0.04	-3.35	12.13**
P5 × P9	16.91**	-0.84*	1.08	-1.95	12.28**
P6 x P7	−7.53**	0.58	-0.50	588	-1.26
P6 × P8	−19.64**	-0.68	1.97	-1.80	24.64**
P6 × P9	−29.36**	−1.58**	-0.11	-2.40	1.92
P7 × P8	-3.57	0.24	-1.60	-4.54	-4.02
P7 × P9	−15.99**	0.34	-1.98	-3.94	−8.55*
Pg X P9	5.50*	0.98**	-0.71	-1.12	-0.14
S. E. s i j	2.30	0.36	1.16	3.51	3.89

*Significant at 5%; **Significant at 1%; others not significant.

Th s. c. a. effects were in general agreement with the g. c. a. effects of parents and it is seen that parents with good g. c. a. effects produced hybrids also with good s. c. a. effects. Crosses involving parents (Brown *sarson*-73, Gurgaon brown *sarson* 1, Kanpur *tora* 5907 and IARI 117) were showing more heterotic hybrids and prove worthy of commercial exploitation of heterosis for all characters. The data also have indicated that it is possible to select erect branching habit in self-incompatible types and open-branching habit in self-compatible types which are useful in different conditions as mixed cropping or pure stand. Thus the study has revealed that heterosis breeding is fruitful in respect of plant height, branching type, and number of primary branches whereas simple phenotypic selection is more rewarding in advanced generations of crosses involving above parents.

Summary

A study on diallel analysis of nine varieties of brown sarson indicated non-additive gene action for plant height, branching type, primary branches for which heterosis breeding is more fruitful. On the other hand, days to first flower showed additive gene action and simple phenotypic selection is sufficient to gain genetic advance.

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