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RESEARCH ARTICLE

Combining ability analysis in chickpea (*Cicer arietinum* L.)

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SUMMARY

In this study, three females were crossed with five male parents and fifteen hybrids were developed. These fifteen hybrids along with their parental lines and check *viz.*, BDNG 797 were grown during *Rabi* season of 2014. The parental line BDNGK 798 exhibited high GCA effect for plant height and 100 seed weight, Vijay for number of primary and secondary branches per plant, Digvijay for number of pods per plant and seed yield per plant. The cross BDNGK 798 x SAKI 9516 recorded high significant and desirable SCA effect for number of pods per plant and seed yield per plant and the cross BDNGK 9-3 x ICC 14871 for seed yield per plant.

Key Words : Combining ability, Chickpea

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Chickpea is one of the important food legumes in the World. Chickpea is the only cultivated species under the genus '*Cicer*', and has 2n = 2x = 16 chromosomes with relatively small genome size of 738.09 Mbp (Varshney *et al.*, 2013). *Macrospora (Kabuli)* and *Microspora* (Desi) are the two distinct types of chickpea with the production share of 25 per cent and 75 per cent, respectively (Soregaon, 2011). India, a major pulse producing country, accounts roughly 33 per cent of the total world production. Pulses are grown both during *Kharif* and *Rabi* seasons. Through, India is the largest producer of this crop; its productivity is low when compared to that in countries like Italy, Turkey, Iran, Sudan etc. The important genetic factors like, photo and thermo sensitivity, low harvest index, flower drop, poor stability of present cultivar, susceptibility to disease and pest, management factors like predominantly cultivated on receding soil moisture and marginal land, inadequate plant protection, low use of organic and inorganic fertilizer and inadequate availability of quality seeds limits the productivity of chickpea in this country. Among the factors listed above susceptibility to major biotic factors namely *Fusarium wilt*, pod borer and abiotic factors namely drought, heat, salt and cold are the most important stresses which need immediate attention of the plant

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breeder.

A study of combining ability helps in identifying the useful parental lines and the desirable specific cross combination which could be further exploited in development of improved varieties. Such studies are essential in choosing the appropriate breeding and selection methodologies for further improvement of crop. Combining ability analysis is frequently employed to identify the desirable parents and crosses. Therefore, it is urgently required to identify the best combiners and desirable crosses. Line X Tester analysis is an extension of top cross method in which several testers are used (Kempthorne, 1957) which provides information about general and specific combining ability of parents and at the same time it is helpful in identifying best heterotic crosses.

MATERIAL AND METHODS

The experiment was conducted at Agricultural Research Station, Badnapur. In this study, three lines were crossed with five male parents and fifteen hybrids were developed. The total 15 Chickpea hybrids along with 8 parents and one check BDNG 797 in three replications were grown during *Rabi* of 2014-15 at the Agriculture Research Station, Badnapur. One row each of P_1, P_2 and F_1 were grown in Randomized Block Design with three replications. Data were recorded on ten randomly selected plants from each row excluding border plants. Each row consisted of 4m length and row to row and plant to plant distance was 30 cm and 10 cm, respectively. All the agronomic practices were followed to raise a good crop. Data in each experiment of all entries was subjected to analysis of variance (Panse and Sukhatme, 1967) for testing the significance of treatments. Combining ability analysis and the testing of significance of different genotypes was based on the procedure given by Kampthorne (1957).

RESULTS AND DISCUSSION

A study of combining ability helps in identifying the useful parental lines and the desirable specific cross combination which could be further exploited in development of improved varieties. Such studies are essential in choosing the appropriate breeding and selection methodologies for further improvement of crop. Combining ability analysis are frequently employed to identify the desirable parents and crosses. Therefore, it is urgently required to identify the best combiners and

Table 1 : General combining ability effects of parents in chickpea

Sr. No.	Parents	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of primary branches per plant	No. of secondary branches per plant	No. of pods per plant	No. of seed per pod	100 seed wt. (g)	Seed yield Per plant (g)	Protein (%)
Female parents											
1.	BDNGK 798	-0.86	-0.45	12.76**	-0.18	-1.59**	6.08	-0.56*	3.88**	1.51	-0.13
2.	BDNG 9 3	1.24	0.67	-6.31**	-0.45**	-0.45	-5.77	0.09**	-2.57**	-0.88	0.12
3.	VIJAY	-0.37	-0.21	-6.45**	0.63**	2.05**	-0.31	-0.04*	-1.31*	-0.62	0.009
Male parents											
4.	DIGVIJAY	0.40	0.28	1.27	-0.50*	-1.16**	10.42*	0.26**	-0.04	3.75**	0.72*
5.	BCP 49	0.14	0.48	-1.97*	-0.33	-0.67	3.20	-0.03	0.35	1.42	-0.01
6.	GJG-0906	1.56	0.14	-025	-0.05	-0.07	8.97	0.01	1.07	1.75	-0.20
7.	SAKI 9516	0.48	0.91	0.73	0.10	-0.06	-12.44**	-0.12**	3.11**	-2.80**	0.56
8.	ICC 14871	-2.59*	-1.82*	0.21	0.78**	1.84**	-10.35	-0.12**	-4.30**	-4.13**	0.05
	SE ±Gi (line)	0.77	0.60	0.67	0.14	0.29	1.56	0.02	0.52	0.41	0.22
	SE ±Gj (tester)	0.99	0.77	0.87	0.18	0.38	2.02	0.01	0.68	0.52	0.29

* and ** indicate significance of values at P=0.05 and 0.01, respectively.

Table 2: Specific combining ability effects in chickpea

Sr. No.	Crosses	Days to 50 % flowering	Days to maturity	Plant height (cm)	No. of primary branches per plant	No. of secondary branches per plant	No. of pods per plant	Seed per pod	100 seed wt. (g)	Seed yield per plant (g)	Protein (%)
1.	BDNGK 798 × DIGVIJAY	-1.31	0.97	1.41	0.34	0.38	9.24*	0.00	-1.14	1.37	0.731
2.	BDNGK 798 × BCP 49	-3.42	-0.88	-1.74	-0.49	-0.10	5.80	-0.03	0.55	-1.95	-0.50
3.	BDNGK 798 × SAKI 9516	0.86	-0.92	1.63	-0.23	-0.07	16.35**	-0.07	-0.50	2.04*	-0.48
4.	BDNGK 798 x GJG 0906	0.14	-2.15	-0.71	0.27	-0.01	-13.75**	0.05	1.86	-0.06	-0.41
5.	BDNGK 798 x ICC 14871	3.72*	2.98*	-0.59	0.11	-0.19	-17.64**	0.05	-0.76	-1.40	0.66
6.	BDNG 9-3 x DIGVIJAY	-0.21	-2.44	-1.74	-0.12	-0.55	17.44**	-0.05	-1.99	1.44	0.01
7.	BDNG 9-3 X BCP 49	-0.26	-0.21	0.63	0.30	-0.24	-13.33**	0.08	2.23	-1.22	1.04
8.	BDNG 9-3 x SAKI 9516	-1.34	0.45	-0.25	0.69*	1.15	-14.77**	0.16**	-2.55*	-2.55**	-0.03
9.	BDNG 9-3 X GJG-0906	-0.76	0.21	1.78	-0.56	0.41	3.44	-0.09*	0.24	6.73**	0.26
10.	BDNG 9-3 X ICC 14871	2.58	1.99	-0.42	-0.31	-0.76	7.22*	-0.09	2.06	2.33*	-1.28*
11.	VIJAY × DIGVIJAY	1.52	1.47	0.32	-0.21	0.17	-26.68**	0.05	3.14*	-2.82**	-0.742
12.	VIJAY ×BCP 49	3.68*	1.10	1.10	0.18	0.34	7.53*	-0.04	-2.78*	3.17**	-0.542
13.	VIJAY × SAKI 9516	0.47	0.47	-1.38	-0.45	-1.08	-1.57	-0.09	3.05*	0.51	0.513
14.	VIJAY x GJG 0906	0.61	1.93	-1.07	0.28	-0.39	10.31**	0.04	-2.11	0.06	0.14
15.	VIJAY x ICC 14871	-6.30*	-4.98**	1.01	0.19	0.96	10.42**	0.04	-1.30	-0.93	0.62
	SEij	1.72	1.34	1.52	0.32	0.66	3.50	0.04	1.17	0.91	0.51

* and ** indicate significance of values at P=0.05 and 0.01, respectively.

desirable crosses. Line x Tester analysis is an extension of top cross method in which several testers are used (Kempthorne, 1957) which provides information about general and specific combining ability of parents and at the same time it is helpful in identifying best heterotic crosses. The parental lines BDNGK 798 exhibited high GCA effect for plant height and 100 seed weight, Vijay for number of primary and secondary branches per plant, Digvijay for number of pods per plant and seed yield per plant. The cross BDNGK 798 x SAKI 9516 recorded high significant and desirable SCA effect for number of pods per plant and seed yield per plant and the cross BDNGK 9-3 x ICC 14871 for seed yield per plant.

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