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Combining ability analysis for grain yield and components traits in aromatic rice (*Oryza Sativa* L.) under transplanting condition

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Abstract
Combining ability analysis was carried out for grain yield and its component traits in line x tester mating design from a systematic set of crosses. The analysis of variance of combining ability revealed significant differences among parents, crosses and interaction (line x tester) for all the traits. General combining ability effects indicated that, IET 12016 was found best general combiner for grain yield per plant, panicles per m^2 and number of spikelet's per panicle. Among the tester, Pusa Sugandha-4 was found best general combiner for most of the traits studied. The crosses IET 19695 / Pusa Sugandha 4, IET12016 / Pusa Sugandha 4 and IET 19695 / Pusa Sugandha 4 were the best specific combiner for grain yield and panicles per m^2. The superior crosses were found to involve at least one parent with high gca and other parent having high, average and low gca effects.

Keywords: Combining ability, GCA and SCA effects, line x tester analysis, aromatic rice, yield and yield attributing traits

Introduction
Rice (*Oryza sativa* L.) is the most important and stable food in Asian countries. About 20 % of the total calorie supply worldwide comes from rice and especially in Asia; more than 2 billion people derive 60-70 % of their daily energy requirement. India is one of the countries that took full advantage of the plant type based high-yielding varieties of rice. According to FAO, the productivity level of rice in India is very low (3.21t/ha) as compared to the average productivity of the China (6.35t/ha) and world (4.15 t/ha). The Agricultural statistics of 2009 reveals the rice productivity of various states –Punjab (4.022t/ha), Andhra Pradesh (3.247 t/ha), Haryana (2.726 t/ha), whereas Uttar Pradesh showed 2.17 t/ha. The reliable yield potential of this crop based on various observations is reported to be much more than what has been achieved so far. The increase in productivity through breeding efforts has not been adequate because of traditional selection methods following hybridization. Therefore, the present study was undertaken to generate information on combining ability for grain yield and yield attributing traits.

Materials and Methods
The materials consisted of six lines, three testers and their eighteen F_1 cross combinations were grown in randomized block design with three replications at Agricultural Research Station, Kota during *kharif* 2009- 2010 under transplanted condition. Twenty five days old seedlings were transplanted in the field. Each entry raised in single rows of 5 m. length spaced 20 cm. apart with 10 cm. inter plant distance. The standard agronomic packages of practices were followed to raise healthy crop. The observations were recorded on six quantitative traits *viz;* grain yield per plant (gm), plant height (cm.), number of panicles per m2, number of spikelet's per panicle from ten equally competitive plants were randomly selected from each plot, whereas days to 50 per cent flowering and days to maturity were recorded on whole plot basis. The mean values of each genotype were sufficient to combining ability analysis by line x tester method of Kempthorne (1957) [1].

Results and Discussion
The analysis of variance of combining ability revealed significant differences among genotypes, crosses and line x testers (Table-1). Significance of mean squares of lines and testers indicated prevalence of additive variance. However, mean squares due to line x tester interactions were also significant for all the traits, indicated the presence of adequate genetic variability in their crosses and presence of uniformity among the experimental material.

Similar results were reported by Kumar *et al.* (2006) [2], Raj *et al.* (2006) [7], Kumar *et al.* (2010) [3] and Singh *et al.* (2005) [5] in rice.

Table-2, presented general combining ability effects of all the lines and testers. The IET 12016 appeared as best general combiner for grain yield per plant and number of panicles per m^2, whereas IET 13846 also good combiner for number of panicles per m^2. The line IET 16320 was found best combiner for late flowering, tallness and less number of panicles per m^2. The results suggested exploitation of these lines in combination breeding. Among the testers, Pusa Sugandha 4 was found best general combiner for earliness and maximum number of spikelets per panicle.

Specific combining ability effect estimates revealed a very wide range of variation for all the characters (Table-3). Cross combination IET 19695 / Pusa Sugandha 5 had high magnitude of SCA effects for grain yield. For dwarfness cross IET 16310 / Pusa Sugandha 5 and Basmati 370 / Improved Pusa Basmati-1 had desirable SCA effects. The cross combination viz.; IET 19695 / Pusa Sugandha 5, IET 16310 / Pusa Sugandha 4, IET 12016 / Pusa Sugandha 4 and IET 13846 / Improved Pusa Basmati-1 showed significantly desirable SCA effect for number of panicle per m^2 and cross IET 16310 / Pusa Sugandha-5, IET 13846 / Pusa Sugandha-4, IET 16320 / Improved Pusa Basmati-1 showed desirable SCA effect for spikelet's per panicle, Whereas, cross IET 16320 / Pusa Sugandha-5 and IET 16320 / Improved Pusa Basmati-1 showed significant SCA effect for panicles per m^2 and spikelet's per panicle. These crosses seem to be most potential ones and deserve due consideration in future breeding programme. Similar results reported by Kumar *et al.* (2010) [3], Manuel and Paranisamy (1984) [4], Roy and Senapati (2012) [6] in rice. The high *per se* performance in these crosses could be attributed to interaction between positive alleles for good combiner and complementary alleles for poor combiners. The superiority of low x low GCA effects in most of the crosses for majority of the traits may be due to concentration of interaction between favorable alleles contributed by the parents. It is suggested to use the derived line and testers that possess desirable attributes of high yield potential in hybridization programme.

Table 1: Analysis of variance of line x tester for grain yield and its contributing traits.

Source of variation	Degree of freedom	Grain yield per plant (gm)	Plant height (cm.)	Panicles Per m^2	Spikelet's per Panicle	Days to 50% flowering	Days to maturity
Replication	2	12.316**	97.14**	488.01	1020.60**	7.45	6.90**
Treatment	26	10.940**	96.08**	1847.73**	920.97**	35.63**	6.75**
Parents	8	9.941**	42.45	882.00**	495.92**	28.89*	6.67**
Parents V/S Crosses	1	0.041	144.50**	713.58	2632.15**	0.61	7.56**
Crosses	17	12.052**	118.47**	2368.91**	1020.34**	40.86**	6.75**
Line	5	12.333**	118.37**	1576.20**	1517.44**	30.26*	10.01**
Tester	2	1.246	31.18	127.62	861.90**	80.16**	12.57**
Line x tester	10	14.072**	135.98**	3213.51**	803.48**	38.30**	3.95**
Error	52		41.67	215.10	96.48	11.82	2.54

Table 2: Estimates of general combining ability (GCA) effects of parents for grain yield and its contributing traits

Parents	Grain yield per plant (gm)	Plant height (cm.)	Panicles per m^2	Spikelet's per Panicle	Days to 50% flowering	Days to maturity
Lines						
IET – 19695	0.696	-2.981	-2.703	9.129*	1.777	-0.759
IET – 16310	-1.540**	-3.759	1.296	6.463	-1.555	-0.537
IET – 12016	1.485	1.240	11.074**	3.796	-1.555	-0.981
IET – 13846	-0.873	2.907	17.851**	-25.981**	-0.555	0.685
IET – 16320	-0.591	5.129**	-18.592**	5.129	2.777**	-0.203
Basmati -370	0.822	-2.537	-8.925**	1.463	-0.888	1.796**
SE (lines)	0.472	2.151	4.888	3.274	1.146	0.531
Testers						
Pusa Sugandha-4	-0.084	1.519	-1.593	7.463**	-2.278	-0.70
Pusa Sugandha-5	0.295	-0.704	-1.481	-6.204	0.389	0.074*
Improved Pusa Basmati-1	-0.211	-0.815	3.074	-1.259	1.889	0.796
SE (Tester)	0.333	1.521	3.456	2.315	0.813	0375

Table 3: Estimates of specific combining ability (SCA) effects of hybrids for grain yield and its contributing traits.

Hybrids	Grain yield per plant (gm)	Plant height (cm.)	Panicles per m^2	Spikelet's per Panicle	Days to 50% flowering	Days to maturity
Lines						
IET 19695 x Pusa Sugandha-4	0.817	2.593	-0.519	11.315*	-3.056	-0.241
IET 19695 x Pusa Sugandha-5	2.634**	-0.519	22.370*	-8.685	3.611	-0.519
IET 19695 x Improved Pusa Basmati-1	-3.451	-2.074	-21.852	-2.630	-0.556	-0.759
IET – 16310 x Pusa Sugandha-4	-0.107	2.037	19.148*	-4.685	3.944	-0.130
IET – 16310 x Pusa Sugandha-5	-1.406	-8.741**	-13.630	12.981**	1.611	0.926
IET– 16310 x Improved Pusa Basmati 1	1.513	6.704	-5.519	-8.296	-5.556	-0.796
IET 12016 x Pusa Sugandha-4	1.068	-5.630	40.370**	6.981	-0.722	-0.352
IET 12016 x Pusa Sugandha-5	-2.918	4.593	-14.741	-9.685	-0.722	1.037
IET 12016 x Improved Pusa Basmati-1	1.851	1.037	-25.630	2.704	1.444	-0.685
IET 13846 x Pusa Sugandha-4	-2.260	-6.963	-1.407	24.759**	-0.056	-1.352

IET 13846 x Pusa Sugandha-5	0.857	1.593	-27.519	-11.574	-2.722	0.037
IET 13846 x Improved Pusa Basmati-1	1.403	5.370	28.926**	-13.185	2.778	1.315
IET 16320 x Pusa Sugandha-4	-0.256	1.148	-57.630	-21.685	-3.389	0.204
IET 16320 x Pusa Sugandha-5	0.865	-0.963	34.593**	11.315*	0.278	-0.407
IET 16320 x Improved Pusa Basmati-1	-0.609	-0.185	23.037**	10.370*	3.111	0.204
Basmati -370 x Pusa Sugandha-4	0.738	6.815	0.037	-16.685	3.278	1.870
Basmati -370 x Pusa Sugandha-5	-0.032	4.037	-1.074	5.648	-2.056	-1.074
Basmati-370xImproved Pusa Basmati-1	-0.706	-10.852**	1.037	11.037*	-1.222	-0.796
S.E. (Crosses)	0.818	3.727	8.467	5.671	1.985	0.920

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References

1. Kempthorne O. An introduction to genetic statistics. Joha Wiley and Sensing. New York, 1957.
2. Kumar A, Singh NK, Sharma VK. Combining ability analysis for identifying elite parents for heterosis hybrids. *Oryza*. 2006; 44(2):82-86.
3. Kumar M, Kumar K, Verma GP, Verma OP. Combining ability analysis for yield and components traits under saline alkali soil in rice. *Oryza.* 2010; 47(3):193-200.
4. Manuel WW, Paranisamy Line x tester analysis of combining ability in rice. *Oryza*. 1984; 26:27-32.
5. Singh RV, Maurya DM, Dwivedi IL, Verma OP. Combining ability studies on yield and its components using CMS lines in rice (*Oryza sativa* L.). Oryza. 2005; 42(2):306-309.
6. Roy SK, Senapati BK. Combining ability analysis for grain yield and quality characters in rice. Indian J Agril. Sci. 2012; 82(2):293-303.
7. Raj Y, Panday MP, Dwivedi DK, Shukla SK. Genetic evaluation of WA based CMS and restorer lines for yield and agronomic characters in rice. *Oryza*. 2006; 43(3):241-243.