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Combining ability studies for yield and its components in desi cotton (*Gossypium arboreum* L.)

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Abstract
Combining ability studies was conducted in 24 cross combinations by using 6 lines and 4 testers in cotton. The analysis of variance for combining ability revealed significant differences among the genotypes. Combining ability analysis helps in the evaluation of inbreds in terms of their genetic value and in the selection of suitable parents for hybridization. It also helps in the identification of superior cross combinations. The study revealed that lines and tester showed wide variation for most of the characters indicating their diversity. The estimates of specific combining ability effects revealed that of 24 crosses were having significantly desirable sca effects. The best sca effects and the highest per se performance was noted in the crosses PA741 X JLA 505, PA 710 X AKA 7, PA 760 X CINA 363 and PA 740 X RAC 024. The parental combination in aforesaid cross combinations is either high x high gca, high x low gca, low x high gca. Therefore, it appeared that for getting good cross combination at least one of the parents should have good gca effect.

Keywords: Combining ability, *Gossypium arboreum*, gca, sca, seed cotton yield

Introduction
Cotton is crop of prosperity having a profound influence on men and matter is an industrial commodity of worldwide importance. It occupies the place of pride in Indian agriculture and economy by earning valuable foreign exchange. It provides employment opportunities to nearly 215 million people. Therefore, it plays pivotal role by producing lint, oil and protein. India has the largest area under cotton with an average productivity of 374 kg/ha, which is very low as compared to world productivity (504 kg/ha).Cotton hybrids played significant role to attain self-sufficiently in production in India. Presently, cultivation of varieties and hybrids of tetraploid cotton has become more risky and non-remunerative, creating socioeconomic problems among the cotton cultivars forcing them in to money lenders trap. The increased cost of cultivation in these cotton hybrids is due to high seed cost, more plant protection and high dose of fertilizer. On the contrary, diploids involve low seed cost, minimum or no cost of plant protection and plant nutrition. Looking to this, one will be really be optimistic for cultivation of *desi* cotton provided they yield on par with tetraploid cotton varieties and hybrids and must possesses equivalent fibre quality.

Allard (1960) pointed out that, the common approach for selection of parents for hybrid development on the basis of per se performance is not a good indication of their combining ability. The choice of parents in hybrid breeding particularly of rainfed areas has to be based on the complex genetic information and a knowledge of combining ability becomes more important for which various biomaterial tools have been developed for Identifying desirable parents. Among these L x T analysis (Kempthore, 1957) [8] is useful technique suitable for identification of cross combination and parents to be used in crossing programme for hybrid breeding.

Materials and Methods
The experimental material comprised 6 lines (PA 710, PA 741, PA 734, PA 760, PA 740 and PAIG 326) as females and 4 testers (AKA 7, JLA 505, RAC 024 and CINA 363) as males were tested along with their parents including 2 checks (PKVDH 1 and Swadeshi 651) in 'Line X Tester' fashion during *Kharif* 2013. The parents and their twenty four hybrids were grown in randomized block design with three replications at Cotton Research Farm, Mahboob Baugh farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Each genotype was sown in two rows of 15 hills at 60 X 30 cm spacing. Data on five randomly selected plants in each genotype were collected for days to 50% flowering, days to maturity, plant height (cm), number of sympodia per plant, number of bolls per plant, number of seeds per boll, boll weight(cm), harvest index (%), 2.5% span length, fibre fineness and seed cotton yield per

plant. Combining ability analysis was based on the procedure developed by Kempthorne (1957) [8] related to design II of Comstock and Robinson (1952) [3].

Results and Discussion

The analysis of variance for combining ability revealed significant differences among the genotype for the characters studied indicating presence of genetic diversity among the genotypes for morphological traits which is important, pre-requisite in any breeding programme. The lines differed significantly for most all the characters while the testers showed significant differences for numbers of seeds per boll. The source of variation, Lines x Testers showed significant differences for all the characters except numbers of sympodia per plant.

Since prescence of desirable gca effect is related to additive and additive x additive interaction which represents preponderance of friable genetic variance. The parents with superior gca effects, should be exploited extensively in breeding programme. The parental lines showing gca effects are presented in Table 1. The parents PA 760, JLA 505 and PA 710 recorded negative gca effect for days to maturity indicating that these parents are best combiners for early maturity. In case of plant height significant positive gca effect were recorded by the parents PA 741, JLA 505 and CINA 651. While JLA 505 exhibited significant positive gca effect for number of bolls per plant. The study of general combining ability revealed that the parent PA 710 exhibited significant gca effect for seed cotton yield. Utilization of such parents having considerable amount of fixable component for the trait in question, in a breeding programme may be fruitful. The parents PA 740 and PA 734 were significantly positive indicating that these parents were best combines of staple length of fibre (mm). The parent PA 760 exhibited positive significant gca effect for boll weight indicating best combiner for the trait.

The estimates of sca effects are presented in Table 2. The best sca effects and the highest per se performance for seed cotton yield /plant was noted in the crosses PA 741 X JLA 505, PA 710 X AKA 7, PA 760 X CINA 363 and PA 760 X RAC 024.The crosses either involved poor x good, poor x poor or good x poor gca combination. The good x good gca combination could be due to additive and additive and additive type of gene action which is fixable in nature which had significant sca effects for seed cotton yield, number of bolls per plant and number of sympodia per plant. Moreover, PAIG 326 X CINA 363 for days to 50% flowering, boll weight 2.5% span length and short fibre index. Whereas cross PAIG 326 X RAC 024 for ginning outturn and lint index. Similarly the cross PA 741 X AKA 7 for fibre strength and seed index recorded highest sca effects. Out of 24 crosses, the cross combination PA 741 X JLA 505 was found to be best for specific combining ability.

These results are in accordance with the reports of Anandhan (2010) [2], Deshmukh, *et al.*, (2010) [4], Karademir and Gencer (2010) [7], Dewdar (2011) [5], Dhamayanthi (2011) [6], Nadagundi *et al.* (2011) [12], (2012) Mendez-Natera *et al.*, (2012) [11], Kumar *et al.* (2014) [10] and Khan *et al.* (2015) [9].

Table 1: General combining ability effects (gca) for various characters

Genotypes	Days to 50% flowering	No. of sympodia / plant	No. of bolls/ plant	No. of seeds / boll	Boll weight (g)	Plant height (cm)	Seed cotton yield/ plant (g)	Days to maturity	Harvest index	2.5% Span length (mm)	Fibre fineness (μg/inch)
Lines											
PA 710	-0.639	-0.078	0.767	2.503**	0.008	-7.047**	4.740**	-0.292	-0.996	-0.204	0.058
PA 741	1.278**	1.189	1.142	-1.581**	-0.094*	4.269*	-3.210	2.215**	-0.160	-0.104	0.308**
PA 734	-0.056	0.526	0.292	-0.535	-0.016	3.886	-1.768	0.292	-2.611*	0.046	0.283**
PA 760	-0.806	-0.261	-1.017	0.361	0.102*	2.969	-1.676	-1.708**	1.396	0.396	-0.192
PA 740	0.194	-0.883	-0.425	-1.341*	0.039	-1.947	2.107	-0.625	1.969	1.221**	-0.492
PAIG 326	0.028	-0.494	-0.758	0.592	-0.038	-2.131	-0.193	0.208	0.402	-1.354**	0.033
SE (Gi)	0.364	0.675	0.613	0.499	0.045	2.071	1.646	0.557	1.166	0.419	0.099
SE (Gi-Gj))	0.514	0.955	0.866	0.706	0.064	2.930	2.328	0.788	1.649	0.593	0.140
Testers											
AKA 7	-0.194	-1.651**	-0.386	0.157	0.067	-17.30**	-0.204	-0.181	2.320*	-0.288	-0.033
JLA 505	-0.361	1.073	1.658**	-0.458	-0.024	7.725**	0.824	-0.569	-1.304	-0.354	-0.017
RAC 024	0.472	0.192	-0.208	0.696	-0.031	0.247	-1.393	0.153	1.059	0.363	0.033
CINA 651	0.083	0.386	-1.064	-0.395	-0.012	9.336**	0..774	0.597	-2.076*	0.279	0.017
SE (Gi)	0.297	0.551	0.500	0.407	0.037	1.691	1.344	0.455	0.952	0.342	0.08
SE (Gi-Gj))	0.420	0.780	0.707	0.576	0.052	2.392	1.901	0.643	1.346	0.484	0.114

Table 2: Specific combining ability (sca) effects for various characters

Genotypes	Days to 50% flowering	No. of sympodia / plant	No. of bolls/ plant	No. of seeds / boll	Boll weight (g)	Plant height (cm)	Days to maturity	Seed cotton yield/ plant (g)	Harvest index	2.5 (%) Span length (mm)	Fibre fineness (μg/inch)
PA 710 X AKA 7	-1.472*	-0.633	1.978	-0.944	0.058	5.518	-2.319*	7.471*	0.011	0.338	0.108
PA 710 X JL 505	-1.639*	-0.556	-3.40**	-0.413	0.189*	6.858	-1.264	-6.757	1.754	1.604	0.392
PA 710 X RAC 024	0.861	0.725	-1.50	0.567	-0.024	-2.531	2.681*	-2.607	-0.825	0.787	-0.258
PA 710 X CINA 363	2.250**	0.464	2.922*	0.791	-0.223*	-9.486*	0.903	1.893	-0.940	-2.729**	-0.242
PA 741 X AKA 7	1.278	-3.166*	-0.597	1.656	0.046	-8.292	1.931	-5.579	0.208	1.337	0.058
PA 741 X JL 505	0.111	3.244*	8.158**	0.803	0.031	-2.325	-0.014	15.32**	-0.351	-0.296	0.342
PA 741 X RAC 024	-1.056	-1.675	-4.642**	0.317	-0.035	7.419	-2.736*	-8.724*	0.883	-1.513	-0.108
PA 741 X CINA 363	-0.333	1.597	-2.919	-2.776	-0.041	3.197	0.819	-1.024	-0.739	0.471	-0.292
PA 734 X AKA 7	0.611	1.763	0.853	-0.257	-0.113	8.825*	-0.903	4.713	-1.601	-1.413	0.283
PA 734 X JL 505	0.111	-2.010	0.542	1.424	0.059	2.458	0.153	-5.415	-0.531	0.554	0.067
PA 734 X RAC 024	0.611	1.587	2.342	0.071	0.246**	-2.664	1.097	4.168	2.217	1.338	0.117
PA 734 X CINA 363	-1.333	-1.340	-3.736**	-1.238	-0.193*	-8.619*	-0.347	-3.465	-0.085	-0.479	-0.467*
PA 760 X AKA 7	-0.972	0.351	-2.706*	0.781	-0.053	-4.325	1.764	-4.713	-2.032	-1.963*	-0.142
PA 760 X JL 505	-0.139	-0.639	-2.417	-0.338	-0.098	7.908	-1.514	-0.207	5.495*	-0.296	0.042
PA 760 X RAC 024	0.361	-0.358	2.550*	0.292	0.029	-11.28**	-0.569	-2.057	-2.471	2.588**	-0.008

PA 760 X CINA 363	0.750	0.647	2.572*	-0.734	0.123	7.697	0.319	6.976*	-0.993	-0.329	0.108
PA 740 X AKA 7	-0.306	-0.718	-0.631	-1.384	0.059	-0.342	0.014	-6.829*	2.909	0.012	-0.042
PA 740 X JL 505	1.194	0.869	-1.408	-0.193	-0.063	-15.84**	1.069	-3.324	-3.397	-0.121	-0.758**
PA 740 X RAC 024	-1.306	-0.020	0.925	-0.990	-0.089	11.83**	-1.653	12.49**	-0.393	-1.237	0.092
PA 740 X CINA 363	0.417	-0.131	1.114	2.568*	0.092	4.347	0.569	-2.34	0.882	1.346	0.708**
PAIG 326 X AKA 7	0.861	2.403	1.103	0.159	0.003	-1.025	-0.486	4.938	0.506	1.688	-0.267
PAIG 326 X JL 505	0.361	-0.907	-1.475	-1.283	-0.118	0.942	1.569	0.376	-2.971	-1.446	0.083
PAIG 326 X RAC 024	0.528	-0.259	0.325	-0.256	-0.128	0.942	1.181	-3.274	0.590	-1.963*	0.167
PAIG 326 X CINA 363	-1.750*	-1.237	0.047	1.389	0.243*	2.864	-2.264*	-2.040	1.875	1.721*	0.183
SE±	0.727	1.351	1.225	0.998	0.091	4.143	1.115	3.293	2.332	0.839	0.198

*, ** significant at 5% and 1% levels, respectively

References

1. Allard RW. Principal of plant breeding. John Wiley and Sons Inc. New York, 1956, 84-85.
2. Ananadan A. Environmental impact on the combining ability of fibre traits and seed cotton yield in cotton. J Crop Improv. 2010; 24(4):310-323.
3. Comstock RE, Robinson HF. Estimation of average dominance of genes. In “Heterosis” Ed. G.W. Gowen. IowaState College Press, Ames, Iowa. 1952, 494-516.
4. Deshmukh SB, Misal MB, Bhongale SA. Combining ability studies for qualitative traits in cotton. Annals of plant physio. 2010; 24(1):58-61.
5. Dewdar MDH. Nature of combining abilities and genetic interpretation for some quantitative traits in Egyptian cotton. Bulletin of Faculty of Agriculture, Cairo University. 2011; 62(4):418-424.
6. Dhamayanthi KPM. Study of ineterspecific hybrids (*Gossypium hirsutum x Gossypium barbadense*) for heterosis and combining ability. World Cotton Research Conference-5., Mumbai, India, 2011, 51-55.
7. Karamdir E, Gencer O. Combining ability and heterosis for yield and fibre quality parameters in cotton (*Gossypium hirsutum* L.) obtained by half diallel mating design. Notulae Botanicae, Horti Agrobotanici, Cluj-Napoca. 2010; 38(1):222-227.
8. Kempthorne O. An introduction to genetic statistics, New York, John Willey and Sons Inc. London, Chapman and Hall Ltd, 1957.
9. Khan SA, Khan NU, Gul R, Bibi Z, Baloch, Combining ability studies for yield and fibre traits in upland cotton. The Journal of Animal and plant sciences. 2015; 25(3):698-707.
10. Kumar KS, Ashok Kumar K, Ravi Kesavan R. Genetic effects for combining ability studies for yield and fibre quality traits in diallel crosses of upland cotton (*Gossypium hirsutum* L.) Academic Journal. 2014; 13(1):119-126.
11. Mendez-Natera JR, Rondon A, Hernandez J, Merazo-Pinto JF. Genetics studies in upland cotton (*Gossypium hirsutum* L.) II. General and specific combining ability. J Agri. Sci. and Tech. 2012; 14(3):617-327.
12. Nidagundi JM, Deshpande SK, Patil BR, Manr RS. Combining ability and heterosis for yield and fibre quality traits in American cotton (*Gossypium hirsutum* L.). Crop improve. 2011; 38(2):179-185.