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Short Communication

Studies on combining ability for yield and its components in pigeonpea

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The selection of suitable parents in any breeding programme is important to effect improvements in quantitative characters like yield and its components. The estimation of combining ability and their effects provides guidelines to select such best combiners for hybridization programme. Also, the nature and magnitude of gene action involved in controlling such traits can be identified and quantified. Therefore, the present investigation aimed to analyze combining ability for grain yield and its component characters in pigeonpea.

The experimental material comprised 3 cytoplasmic male sterile (CMS) lines having A_4 cytoplasm (*C. cajanifolius*) procured from ICRISAT, Patencheru, 20 restorers (collected from different places like ICRISAT, Patencheru; ARS, Badanpur; PDKV, Akola and MPKV, Rahuri), 60 cross combinations (hybrids) and 2 checks. All the parents and crosses were grown in a randomized complete block design (RCBD) with two replications having an inter- and intra-row spacing of 75 cm and 30 cm, respectively. Recommended agronomic practices were followed for raising the crop. Observations were recorded on five randomly selected competitive plants for ten characters *viz*., days to flowering (no.), days to maturity (no.), plant height (cm), primary

Table 1. General combining ability effects for lines and testers for different traits

Parents	Days to 50% flowering (no.)	Days to maturity (no.)	Plant height (cm)	Primary branches/ plant (no.)	Secondary branches/ plant (no.)	Pods/ plant (no.)	Seed/ pod (no.)	100-seed weight (g)	% fertility	Grain yield/plant (g)
Lines										
ICPA 2043	-3.233**	-2.750**	6.978**	1.190**	0.813**	-17.629**	-0.004	0.117*	1.316	-5.780**
ICPA 2047	4.842**	1.700**	-2.330*	-0.274*	0.488*	-11.739**	-0.034	0.136**	-0.934	-4.374**
ICPA 2092	-1.608**	1.050**	-4.647**	-0.916**	-1.302**	29.368**	0.038	-0.252**	-0.382	10.154**
SEm (Lines)	0.2132	0.2431	1.0968	0.0876	0.1700	1.3566	0.0440	0.0350	0.5780	0.4811
CD (P = 0.05)	1.5488	1.7658	7.9672	0.6360	1.2351	9.8547	0.1239	0.2539	4.1986	3.4945
CD (P = 0.01)	2.0550	2.3429	10.571	0.8438	1.6388	13.075	0.1643	0.3369	5.5708	4.6366
Testers										
BSMR198	2.883**	-1.967*	2.606	0.227	-0.385	34.04**	0.014	-0.110	-7.243**	11.497**
BSMR846	2.550**	-1.300	-0.449	-0.733*	-2.435**	-48.99**	-0.019	0.223	2.390	-17.623**
BSMR164	5.883**	0.700	-4.117	-0.906**	-4.118**	-18.07**	-0.003	0.623**	0.723	-4.138*
BSMR20096	-0.450	0.367	-8.560*	-0.330	-4.218**	94.24**	0.248**	0.073	0.257	42.940**
ICPR3525	0.717	1.533	7.381	1.954**	-2.785**	-24.68**	-0.203**	-0.944**	3.023	-15.788**
BSMR175	0.217	0.867	-4.674	0.114	-2.835**	-21.17**	0.198**	0.861**	-2.893	-1.717
BSMR2	3.050**	2.033*	-11.44**	-0.963**	-6.552**	-7.703	0.131*	0.185	-1.410	-0.222
ICPL12749	1.550*	-0.467	2.551	1.820**	0.568	2.418	0.214**	0.806**	-1.527	6.955**
BSMR203	1.550*	-0.133	1.993	-0.273	1.265*	-19.51**	0.047	-0.077	0.807	-7.857**
BWR154	4.050**	-0.300	-1.340	0.889**	3.332**	-7.253	-0.136*	-0.377**	-1.877	-7.802**
BSMR571	-0.283	0.867	-5.172	-0.940**	-0.902	-17.09**	-0.169**	-0.260*	-1.310	-9.662**
ICPR 13991	-4.617**	-0.300	-16.17**	-0.453	1.432*	-47.63**	-0.019	0.123	-5.893**	-18.903**
ICPR 10934	-0.117	-0.300	-4.674	-0.163	0.232	148.15**	0.014	-0.210	3.590	53.228**
ICPR 3475	-3.283**	1.533	-1.395	0.704*	2.715**	21.325**	0.181**	-0.105	5.907**	10.481**
BSMR 736	-6.617**	0.867	-2.504	-0.716*	0.632	20.302**	-0.002	-0.344**	2.023	5.501
TV 1	-0.283	-0.633	2.161	0.225	4.498**	-11.19*	-0.036	0.451**	2.573	-2.209
AKT 8811	-1.950*	-1.800*	6.216	0.817*	6.615**	-34.65**	-0.202**	-0.877**	0.457	-18.302**
PHULE-T-00-1-25-1	-3.783**	-2.133*	11.71**	-0.940**	0.998	-33.99**	-0.169**	-0.439**	3.307	-17.338**
PHULE-T-04-31	-2.783***	-0.800	6.663	-1.351**	2.048**	-44.40**	-0.019	-0.194	-1.127	-18.094**
AKT 9913	1.717*	1.367	19.21**	1.059**	1.032	15.887**	-0.069	0.590**	-1.777	9.053**
SEm (Testers)	0.5505	0.6276	2.8319	0.2261	0.4390	3.5028	0.0170	0.093	1.4924	1.2421
CD (P = 0.05)	0.5998	0.6839	3.0857	0.2463	0.4784	3.8167	0.0480	0.0983	1.6261	1.3534
CD (P = 0.01)	0.7959	0.9074	4.0942	0.3268	0.6347	5.0641	0.0636	0.1305	2.1576	1.7957

*,**: Significant at P = 0.05 and 0.01, respectively

Table 2. Five best specific combiners for grain yield/plant and their performance for other traits

Crosses with maximum *sca* effects	Mean grain yield/ plant (g)	*sca* effects	*gca* effects of parents		Significant response in related characters for *sca* effects
			P1	P2	
ICPA 2092 × BSMR 164	107.1	40.42	10.15	-4.13	Days to 50% flowering, days to maturity, plant height, pods/ plant, 100-seed weight, % fertility
ICPA 2047 × ICPR 3475	64.6	31.31	-4.37	10.48	Days to 50% flowering, primary branches/plant, pods/plant
ICPA 2047 × ICPR 13991	62.3	25.22	-4.37	-18.90	Days to 50% flowering, days to maturity, plant height, secondary branches/plant, pods/plant, 100-seed weight.
ICPA 2043 × BSMR 2	74.1	19.73	-5.78	-0.22	Days to 50% flowering
ICPA 2043 × AKT 8811	55.4	19.13	-5.78	-18.30	Days to 50% flowering, plant height, primary branches/plant, pods/ plant

branches/plant (no.), secondary branches/plant (no.), pods/ plant (no.), seeds/pod (no.), 100-seed weight (g), % fertility and grain/plant (g). The analysis of combining ability was done according to Griffing (1956).

Analysis of variance revealed that the *sca* variance (σ^2*sca)* was higher than *gca* (σ^2*gca*) for all characters. The ratio of *gca* to *sca* variances was less than unity for all the characters indicating preponderance of non-additive gene action (dominance and epistasis). The per cent contribution of lines in hybrid was higher than that of testers for two characters namely, days to 50% flowering and days to maturity.

Percentage contribution of testers to total variance was higher for grain yield/plant, number of pods/plant, number of secondary branches/plant and 100-seed weight. Similarly, the contribution of lines × testers to the total variance was higher for characters like restoration followed by number of seed/ pod, plant height and 100-seed weight. Similar results were also reported earlier (Dalvi *et al.* 2009). Among parents, 'BSMR 736' and 'ICPA 2043' exhibited significant negative *gca* for days to 50% flowering and days to maturity, while 'AKT 9913' and 'ICPR 3525' were the best general combiners for plant height and number of primary branches/plant, respectively. 'AKT 8811' was the best combiner for number of secondary branches/plant, while 'BSMR 20096' was the best general combiner for number of seeds/pod. High *gca* estimates of 'ICPR 3475' and 'ICPR 10934' indicated that these parents were good combiners for % fertility, pods/plant and grain yield/ plant. In general, good general combiners for grain yield had good or average combining ability for one or more characters. These results were in agreement with the results of Ghodke *et al.* (1993) and Jayamala and Rathnaswamy (2000).

The estimates of *sca* revealed that 19 cross-combinations showed significant positive effects on grain yield/plant. The results of *sca* effects in best five cross combinations along with their per se performance as well as *gca* effects of parents and their significant response to other characters have been presented in Table 2. Out of five crosses showing high mean and significant positive *sca* effects for grain yield, two crosses 'ICPA2092' × 'BSMR 164' and 'ICPA 2047' × 'ICPR 3475' belonged to high × low and low × high, respectively and the remaining three 'ICPA 2047' × 'ICPR 13991', 'ICPA2043' × 'BSMR 2' and 'ICPA2043' × 'AKT 8811' belonged to low × low *gca* classes. These results were also in conformity with those of Baskaram and Muthian (2007). The present study indicated that the crosses showing high *per se* performance and *sca* effects for grain yield and other related traits could be commercially exploited for development of high yielding hybrids.

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