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DIALLEL ANALYSIS IN PIGEONPEA

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ABSTRACT

A 6 x 6 diallel combining ability analysis in pigeonpea showed the predominant role of nonadditive gene action for seed yield per plant. Number of pods and seeds/plant had equal importance of both additive and nonadditive genes. Genotypes No. 148 and T 21 exhibited significant and positive gca effects for seed yield, pods and seeds/plant. Two crosses, ICPL 86007 x No. 148 and ICPL 86012 x No. 148, had positive and significant sca effect for seed yield, and pods and seeds/plant.

Key words: Combining ability, pigeonpea, diallel.

The discovery of male sterility in pigeonpea [1] (*Cajanus cajan* (L.) Millsp.) has made the commercial production of hybrid seed practical and has made it necessary for pigeonpea breeders to isolate inbred lines that will contribute favourable genes, or combinations of genes, for yield and other agronomic traits to the hybrid. Diallel analysis provides useful information about combining ability of the parents and their usefulness in breeding programme. This paper deals with the combining ability of yield and yield components in a 6 x 6 diallel set of pigeonpea.

MATERIALS AND METHODS

Six diverse genotypes of pigeonpea were crossed in all possible combinations (nonreciprocal). The 15 F_1s and their 6 parents were planted in randomized complete block design with three replications. Observations were recorded on 10 plants of each treatment in each replication for five characters. The combining ability analysis was done according to the method of Griffing [2].

RESULTS AND DISCUSSION

Highly significant variation was recorded among all the progenies of pigeonpea for all the observed characters. Specific combining ability (sca) variance was also significant for all the traits except for seeds/pod and 100-seed weight, indicating that both additive and

Table 1. Analysis of variance (M.S.S.) in 6 x 6 diallel set of pigeonpea

Source	d.f.	Pods per plant	Seeds per plant	Seeds per pod	100-seed weight	Yield per plant
Replication	2	1228.2	17208	0.12	0.32	2.34
Treatment	20	7399.7**	71204**	0.62**	4.63**	75.44**
Error	40	820.3	10124	0.26	0.47	22.22
Gca	5	7856.3**	67072**	0.44**	5.41**	402.87**
Sca	15	670.0**	9288**	0.13**	0.25*	80.46**
Error	40	273.4	3374	0.09	0.16	23.71
$\hat{\sigma}^2$gca/ $\hat{\sigma}^2$sca		2.4	1	1.09	6.94	0.84

*, **Significant at 5% and 1% levels, respectively.

nonadditive gene actions were involved in the inheritance of these traits. However, consistently lower sca than gca variance suggested predominance of additive gene action in the expression of these traits, as was also reported earlier [3–5]. This was also confirmed by the $\hat{\sigma}^2$gca/ $\hat{\sigma}^2$sca ratio (>1) and has also been reported by Venkateswarlu and Singh [6]. For seed yield/plant, this ratio was less than unity, indicating predominance of nonadditive gene action in the inheritance of this trait. Similar results were also obtained by Dahiya and Brar [7], Sidhu et al. [8] and Patel [9], although both additive and nonadditive components of variation had also been found important in the inheritance [10].

The gca estimates were calculated to evaluate the combining ability of each breeding line in a series of crosses (Table 2). Varieties No. 148 and T 21 showed excellent gca for seed

Table 2. Estimates of gca effects of five characters of six parents in pigeonpea

Parent	Pods/plant	Seeds/plant	Seeds/pod	100-seed weight	Seed yield/ plant
ICPL 87	–13.2*	–21.2	0.30**	–0.47**	–2.64
ICPL 86007	–16.6**	–44.8*	–0.23*	–0.08	–3.39*
ICPL 86012	–13.6*	–39.6*	0.03	0.76**	–1.41
ICPL 85030	–34.8**	–115.8**	0.01	0.92**	–9.03**
No. 148	38.3**	110.1**	–0.30**	0.16	10.91**
T 21	39.9**	111.2**	0.20*	–1.30**	5.55**
SE ($\hat{g}$i)	5.3	18.7	0.10	0.13	1.57
SE ($\hat{g}$i – $\hat{g}$j)	8.3	29.0	0.15	0.20	2.43

*, **Significant at 5% and 1% levels, respectively.

yield/plant and its major contributing traits, viz., pods and seeds/plant. No. 148 had positive nonsignificant gca for 100-seed weight, indicating the possibility of improvement in seed yield without reducing seed size in the medium and early maturing genotypes. T 21 and ICPL 87 had negative general combining ability for 100-seed weight but positive for seeds/pod. ICPL 85030 and ICPL 86012 were the best general combiners for 100-seed weight.

An examination for the predominance of hybrids, as estimated by the sca effects (Table 3) in different crosses, indicated that it would be possible to isolate crosses possessing most of the attributes in desirable combinations. Crosses with high sca effects for seed yield, pods/plant, and seeds/plant involved combination of parents with low x high gca effects, i.e., ICPL 86007 x No. 148, followed by ICPL 86012 x No. 148. ICPL 86007 x T 21 (poor x poor gca) and ICPL 86012 x ICPL 85030 (best x best gca) were found to be the best specific combiners for seed size. No. 148 was the best specific combiner for yield and most of the yield contributing characters.

Table 3. Estimation of sca in F_1 of pigeonpea

Cross	Pods per plant	Seeds per plant	Seeds per pod	100-seed weight	Yield per plant
ICPL 87 x ICPL 86007	–12.9	–31.3	0.54*	–0.49	–3.48
ICPL 87 x ICPL 86012	–24.0*	77.4	–0.15	–0.80**	5.27
ICPL 87 x ICPL 85030	9.0	–1.6	–0.65**	–0.11	1.08
ICPL 87 x No. 148	–0.6	2.8	–0.07	0.45	1.28
ICPL 87 x T 21	7.2	30.1	–0.17	–0.06	1.37
ICPL 86007 x ICPL 86012	–19.6	–84.0*	–0.52*	0.34	–8.25*
ICPL 86007 x ICPL 85030	–4.2	–8.1	0.13	–0.51	–1.43
ICPL 86007 x No. 148	56.2**	219.8**	0.13	–0.15	19.43**
ICPL 86007 x T 21	18.3	18.8	–0.41	0.91**	5.59
ICPL 86012 x ICPL 85030	–10.3	–38.4	–0.22	0.77*	–4.24
ICPL 86012 x No. 148	31.9**	95.3*	–0.04	0.17	11.52**
ICPL 86012 x T21	–10.7	–13.6	0.21	0.17	0.95
ICPL 85030 x No. 148	2.4	6.4	–0.10	0.14	1.94
ICPL85030 x T 21	7.2	43.8	0.08	–0.62*	4.83
No. 148 x T 21	15.7	89.1*	0.44*	–0.33	4.09
SE ($\hat{S}ij$)	12.1	42.5	0.22	0.29	3.56
SE ($\hat{S}ij$–$\hat{S}ik$)	21.9	76.8	0.39	0.53	6.44
SE ($\hat{S}ij$–$\hat{S}kj$)	20.2	71.1	0.36	0.48	5.96

*, **Significant at 5% and 1% levels, respectively.

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