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GENETIC ANALYSIS OF YIELD AND YIELD COMPONENTS IN PIGEONPEA(*CAJANUS CAJAN* |I MILL SP>

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Abstract : Generation mean analysis carried out in pigeonpea to estimate gene effects revealed that, yield and yield components are under all the three types of gene action. viz.. additive, dominance and epistasis. Hence reciprocal recurrent selection seems to be the best suited method of breeding for improvement of this crop.

Key words : Gene action, additive, dominance, epistasis, pigeonpea.

INTRODUCTION

Pigeonpea is the second most important puise crop in India. Even though it constitutes one of the major portions of pulses consumed by Keralites, Kerala has the lowest area and average yield of pigeonpea among the Indian states. Being a hardy and drought resistant crop, it can he grown in a wide range of soil types. In order to formulate efficient breeding programmes for improvement of yield, it is essential to characterise the nature and mode of gene action that determine the yield and its components. This information, however, is scanty in pigeonpea and research on this aspect has received attention only in recent past. A knowledge on the inheritance of various economic characters will help in chousing the appropriate method of breeding for effecting further improvement towards increasing the yield potential of this crop. The present study was undertaken to determine the nature of gene action of some important characters in pigeonpea.

MATERIALS AND METHODS

Five diverse cultivars of pigeonpea namely UPAS 120, PLA 550, PLA 600, PLA 345-1 and IC 15708 representing various clusters in a previous D^2 analysis, were crossed in all possible combinations excluding reciprocals. The F,s were allowed to self to generate F, and at the same time they were back crossed to both the parents to get ʳˀ and B_2 generations. The seeds of six generations viz, P_1, P_2, F_1, F_2, B_1 and B_2 were grown in a randomised block design replicated thrice at the farm attached to the College of Horticulture, Vellanikkara, Trichur. Each entry was grown on ridges of 3 m long and 1 m apart with a plant spacing of 60 cm. Observations were recorded from all the plants in respect of eleven quantitative characters viz; height of plant at harvest, number of primary branches, number *of* secondary branches, days to first flowering, days to maturity, number of clusters per plant, number of pods per plant, length of pod hearing branches, number of seeds per pod, hundred seed weight and seed yield.

The scaling tests A, B and C for additivity suggested by Mather (1949) based on the assumption that epistasis is absent were employed. The inadequacy of an additive dominance model in most of the crosses for the characters demanded the extension of analysis for the estimation of parameters of epistatic components. Using the six generation means, estimates of mean ("m) as well as additive (*d), dominance (^h), additive x additive ('i), additive x dominance (*j) and dominance x dominance (^l) effects were found out according to Hayman (1958).

Table 1, Estimates of gene effects in different crosses by six parameter model for eleven characters

Cross	(^m)	(^d)	(^h)	(^i)	(^j)	(^l)	Type of epistasis
Plant height							
1 x 2	178.10**	-4.60	-36.03	-40.53	4.03	27.13	-
1 x 3	167.96**	-2.80	-60.71**	-58.51**	15.87*	130.38**	D
1 x 4	175.67**	3.60	14.57	14.93	22.77**	-41.67	-
1 x 5	160.27**	21.27**	117.31**	96.11**	15.20**	-197.58**	D
2 x 3	178.44**	-33.07**	-26,11	-30.01*	-23.03**	78.21**	D
2 x 4	165.79**	-10.13	-35,62	-24.75	0.40	90.75	D
2 x 5	170.13**	-1.40	16.90	-13.20	-15.77*	32.60	-
3 x 4	168.37**	-17.00**	51.58**	65.82**	-16.50*	-62.35*	D
3 x 5	194.08**	-12.20**	-47.47**	-63.67**	36.60**	50,07	D
4 x 5	172.12**	6,80	17.94	-2.62	-18.03	13.49	-
Number of primary branches							
1 x 3	17.05**	-0.07	-1.61	-2,47	7.00**	16.07*	D
1 x 4	18.17**	0.87	-3.50	0.80	9.10**	-0.60	-
1 x 5	18.88**	4.87*	10.45	5.15	5.03**	-25.22**	D
2 x 3	17.85**	-6.07**	0,83	3.93	-1.90	3.74	-
2 x 4	17.97**	-4.20**	-12.95**	-7.48	1.13	26.01**	D
2 x 5	18.67**	-3.87**	-0.26	-5.33	-6.60**	7.73	-
3 x 4	17.47**	-2.60*	11.35**	20.18**	-1.43	-17.32**	D
3 x 5	13.52**	-0.67	29.55**	28.32**	-7.57**	-29.98**	D
4 x 5	14.40	1.06	16.05**	17.32**	-7.00**	-11.85**	D
Days to maturity							
1 x 2	126.63**	-1,07	-2.97	-8.93*	0.10	2.07	-
1 x 3	126.87**	-4.13**	-6.62	-5.89	1.93	1.22	-
1 x 4	129.79**	-5.67**	-7.65	-11.85**	0.93	13.45	-
1 x 5	131.33**	0.73	-26.87**	-22.53**	7.07**	10.53	D
2 x 3	127.38**	2.20	-0.95	2.88	7.10**	-19.88**	C
2 x 4	124.27**	-0.80	...1314**	15.71**	4.70**	-28.44**	D
2 x 5	124.38**	-1.07	3,52	6.22	4.10**	11.22*	D
3 x 4	125.63**	1.73	7.99*	9.99**	2.27	-1.72	D
3 x 5	129.94**	5.47**	-2.12	• 2.68	5.70**	10.62	-
4 x 5	129.44**	7.27**	0.91	2.9!	7.00**	-1.71	-
Number of pods per plant							
1 x 2	270.02**	-201.93**	145.53	54.20	-145.50	52.80	-
1 x 3	317.05**	-65.07	-202.31	-315.94	32.77	813,74*	D
i x 4	225.56**	167.80**	359.14**	311.47**	228.93**	-370.41**	D
1 x 5	254.82**	67,00	867.03**	686.73**	83.83	-1133.33**	D
2 x 3	221.12**	-281.80**	339.79**	181.23	-240.50**	519.11*	C
2 x 4	236.42**	-144.26**	80.30	71.64	-138.40*	208.90	-
2 x 5	289.49**	-113.07*	35.61	-89.42	-152.77**	395.89*	C
3 x 4	304.09**	-61.87	30.54	227.10	-100.63	-604,64	-
3 x 5	274.23**	-96.06**	215,22	224.02*	-177.07**	-272.42	D

Table I (continued)

4 x 5	236.39**	162.27**	42.39	77.39	204.20**	-34.05	-
Hundred seed weight							
1 x2	7.61**	-0.60**	-1.33*	-1 32**	• 0.36	4.00**	D
1 x 3	7.14**	-0.83**	-2.71**	-2.86*	-1.33**	4.37**	D
1 x 4	8.10**	0.43	1.10	0.53	0.04	-3.07*	D
1 x S	7.12**	-0.29	0.69	1.26	-0.19	• 0.89	-
2 x 3	7.13**	0.12	5.79**	4.35**	-0.61*	-4,47	D
2 x 4	8.08**	-1.73**	3.41**	2.35**	-2.37**	-4.70**	D
2 x 5	7.95**	1.75**	-3.76**	-2.37**	1.62**	4.4 1 **	D
3 x 4	7,57"	-0.22	1.92**	1.17*	-0.13	-3.79**	D
3 x 5	8.01**	0.21	-2.21**	-2.86**	0.79**	4.28**	D
4 x S	7.27**	-0.84**	4.47**	4.45**	-0.35	-7.72**	D
Seed yield							
1 x 2	48.74**	39.16*	84.02**	51.64	-31.25**	-34.45	D
1 x4	40.99**	53.17**	125.00**	116.55** '	57.42**	-195.37**	D
1 x 5	45.69**	12.99	157.50**	135.22**	16.68	-225,64	D
2 x 3	40.80**	-33.65**	86.11**	46.06*	-35.27**	48.90**	C
2 x 4	44.91**	-28.48*	46,47	46.23	-32.09*	-55.47	-
2 x 5	47.37**	-8.58	37,77	6.35	-12.72	74.18	C
3 x 4	52.22**	-7.3S	41.22	70.27*	-9.35	-197.90**	D
3 x 5	40.23**	-36.01**	85.02**	88.08**	-38.58**	-135.86**	D
4 x S	39.16**	-30.59**	9.55	15.05	-31.16**	5,65	-

i. UPAS 120; 2. PLA 55ft 3. PLA 600; 4. PLA 345-1; 5. IC 15708; C = complementary; D • duplicate
** Significant at 1 per tent level; * Significant at 5 per cent level.

RESULTS AND DISCUSSION

The estimates of gene effects and their interactions of important characters are presented in Table I. The dominance (^h) gene effects made a significant contribution to the inheritance of plant height, number of primary branches, days to first flowering, hundred seed weight and seed yield per plant. Both additive and dominance effects were almost equally important for all the remaining six characters.

The scaling tests indicated the absence of epistasis for number of primary branches in the cross UPAS 120 x PLA 350, number of secondary branches in UPAS 120 x IC 15708, number of clusters per plant in PLA 600 x PLA 345-1, number of seeds per pod in PLA 550 x PLA 345-1 and PLA 600 x PLA 345-1 and seed yield in UPAS 120 x PLA 600. Fur these characters the 3-parameter was used to estimate (^m), (^d) and (^h) (Table 2). The epistatie components were estimated for all the other characters in different crosses.

Both additive and dominance gene effects were having role in the expression of most of the characters, but the magnitude of dominance effect was slightly higher than that of additive effect. Among the epistatie components dominance x dominance I i effects were higher for plant height, number of pods per plant hundred seed weight and seed yield, whereas both additive x additive and dominance x dominance effects were equally important for number of primary branches and days to maturity (Table 1).

The additive x additive and dominance x dominance effects were having more influence

Cross and character	Gene effects		
	(m)	(d)	(h)
UPAS 120 x PLA 550			
Number of primary branches	19.23**	-2.90**	-7.63
UPAS 120 x PLA 600			
Seed yield per plant	79.87*	-6.27	-79.50
UPAS 120 x IC 15708			
Number of secondary branches	17.00	1.53	43.80
PLA 550 x PLA 345-1			
Number of seeds per pod	-2.74**	-.015	1,24
PLA 550 x IC 15708			
Number of seeds per pod	2.60**	-0.18**	1.67**
PLA 600 x PLA 345-1			
Number of clusters per plant	139.64	20.60	149.25

** Significant at 1 per cent level ; ** Significant at 5 per cent level

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