INTERACTION AND LINKAGE OF YIELD COMPONENTS IN PEA

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There are few reports indicating that non-allelic interactions and linkage might play an important role in the inheritance of pea seed yield and its components (3,4,5). This question was investigated in two of our crosses. In cross A, between Ujmajori Arany x Grune Perle, we studied the following populations: P1, P2, F1, F2, F3, B_{1s}, B_{2s}. In cross B, between Wav.01 x Triton, the populations were: P1, P2, F1, F2, F3, B1, B2. Information on the nature of the genetic effects and the partitioning of the variation were obtained by weighted least square analysis (1,2). In cross B the number of statistics was insufficient for the test of linkage.

Table 1 gives the estimates of the parameters of the digenic interaction model for seed yield components in the two crosses. The simple additive-dominance model is adequate only for seeds/5 pods in Cross B; hence in all other cases some form of epistasis is present. The highly significant Chi-square for 100 seed weight in Cross A indicates the operation of higher order interaction, but the number of families does not allow fitting the required model. In other cases the 6 parameter model fits well, indicating digenic epistasis, either duplicate or complementary.

The standard test for linkage based on second degree statistics was performed for Cross A (Table 2). There is good evidence of linkage in the characters pods/plant and seeds/5 pods. In the case of 100 seed weight, the failure of detecting linkage could be due to the strong epistasis. This complex case would require a more sophisticated joint analysis or non-allelic interaction and linkage.

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Table 1. Estimates of genetic parameters in two different crosses.

	Statistic	Cross A	Cross B
Pods per plant	m	14.96 ± 2.08***	5.12 ± 0.68***
	(d)	2.81 ± 0.59***	0.30 ± 0.21
	(h)	25.91 ± 8.59**	7.96 ± 2.26***
	(i)	2.98 ± 2.08	1.44 ± 0.70*
	(j)	-3.76 ± 3.64	-4.53 ± 1.30***
	(l)	-13.11 ± 6.88*	-5.89 ± 1.74***
		Chi sq. $_{(1)}$ = 2.98	Chi sq. $_{(1)}$ = 0.05
		0.1<P<0.05	0.9<P<0.8
Type of interaction:		Duplicate	D
Seeds per 5 pods	m	34.40 ± 1.04***	27.79 ± 0.31***
	(d)	-4.16 ± 0.32***	-0.35 ± 0.34
	(h)	-14.75 ± 4.23***	-0.16 ± 0.61
	(i)	-3.09 ± 1.05**	-
	(j)	1.51 ± 1.89	-
	(l)	11.47 ± 3.30***	-
		Chi sq. $_{(1)}$ = 0.67	Chi sq. $_{(4)}$ = 6.42
		0.5<P<0.3	0.2<P<0.1
Type of interaction:		D	-
100 seed weight	m	15.32 ± 0.69***	19.39 ± 0.71***
	(d)	2.09 ± 0.25***	-5.17 ± 0.24***
	(h)	34.83 ± 2.82***	0.25 ± 2.18
	(i)	10.79 ± 0.69***	0.93 ± 0.71
	(j)	-3.95 ± 1.46**	1.32 ± 1.15
	(l)	-24.30 ± 2.22**	2.26 ± 1.62
		Chi sq. $_{(1)}$ = 44.59	Chi sq. $_{(1)}$ = 3.70
		P>0.001	0.1<P<0.05
Type of interaction:		-	Complementary

Table 2. Test of linkage in Cross A (based on V_{1F2}, V_{1F3}, V_{2F3}, V_{1B1S^+}, V_{1B2S}, V_{2B1S}, V_{2B2S}, E_1 AND E_2).

	Pods/plant	Seeds/5 pods	100 seed weight
Inclusive Chi square $_{(4)}$	18.76***	13.89**	6.02
Exclusive Chi square $_{(1)}$	0.04	6.02*	3.29
Linkage Chi square $_{(3)}$	18.72***	7.87*	2.73