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Summary and Conclusion

Results of the Exp. A could be summarized as follows:

The combined analysis of variance between two years indicates significant differences among the seventeen genotypes for all studied characters. Moreover, significant or highly significant differences among years for all the studied traits were existed except for the node of the first flower, number of flowers, number of branches/plant, number of undeveloped seeds/pod, pod filling rate, shelling %, 100-seed weight, number of pods/plant and yield. The genotypes x year interaction was highly significant for all characters except for the node of the first flower, number of flowers, number of ovules/pod and TSS, indicating that some genotypes differed in their characters from year to year.

The pertinent variance components for the traits show that δ^2g were large in magnitude compared to δ^2e , reflecting the genetic differences among genotypes, for all characters except for seed set which refer to the large sampling error involved in this trait.

Estimates of phenotypic and genotypic coefficients of variability were in magnitude with slight discrepancy between them for the most characters referring to highly genotypic variances as calculated from the combined analysis of variance. It is worth noting that some genotypes performed constantly in some studied traits for both years, i.e. Little Marvel, Alaska, Pigeon Cojouny Indicus and Master cvs in seed set. On the other hand, some genotypes fluctuated from one year to another, i.e. seed set of Master cv. Was 88.2 in the first and 95.5 in the second year.

Results of the Exp. B could be summarized as follows:

F_1 means of both crosses for most traits were significantly differed from its parents and from mean values of the family sets derived from triple test cross L_{1i} , L_{2i} and L_{3i} . Biometrical analysis were done to test epistasis ($L_{1i} + L_{2i} - 2L_{3i}$) which was partitioned into two items (i, j+1), detecting additive genetic variations ($L_{1i} + L_{2i}$), detecting dominance genetic variations ($L_{1i} - L_{2i}$), estimation of F value and genetic correlations. Results revealed highly significant overall epistasis and its two components in the two crosses, while it showed insignificant (i) type in number of flowers TTC1 and pod filling rate (TTC2). Therefore, epistasis gene effects plays an important role in the inheritance of most the studied traits. However, the additive x additive (i) type epistasis was more important than (j+1) type in all studied characters except number of flowers, maturity date and TSS (TTC₁) as well as stem length and shellout percentage (TTC₂), pod length, seeds number, pod filling and seed set in both crosses. Both additive and dominance genetic components were involved in the genetic control of yield and yield components traits. D component was predominant in the inheritance of all studied traits in both crosses, while H was the important one in cross 2 for seed set trait. The ratio $(H/D)^{1/2}$ was less than unity in all characters, indicating the presence of partial dominance in both crosses, except seed-set% in cross 2 was higher than unity indicating the presence of over-dominance. This result coupled with the importance of (i) type of epistasis suggest that the additive components was the predominant type in the inheritance of the studied traits in both crosses and consequently the possibility of improving the traits by phenotypic selection.

The directional element (F) and correlation coefficient of sums and differences indicated that the dominant increasing alleles were more

frequent than the dominant reducers and of ambidirectional case and/or unidirectional dominance in both crosses in the inheritance of the most traits of pea.

There was epistatic correlation between yield/plant and each of stem length, pod length, seeds/pod, setting %, 100-seed weight, pods/plant (both crosses) and shell-out (TTC_2).

A similar conclusion was obtained for additive and dominance correlation suggesting these traits as effective selection criteria for improving yield of pea.

Conclusion

Dwarf Gray Sugar cv. had high values of most vegetative traits and number of pods/plant, Master cv. produced the highest number of seeds/pod, number of ovules, pod filling %, seed set percentage and shellout %; Filanon 60 and Early Perfection cvs produced the heaviest yield and the highest value of TSS.

The over all means for the produced families of both TTC_1 and TTC_2 (Tables 72 and 73) exceeded those for the parents of both crosses (Master, Early Perfection and Dwarf Gray Sugar) in flowers number, stem length, branches number, pod length, TSS, 100-seeds weight, number of pods/plant and green pod yield.

Of the 60 families, 17 (TTC_1) and 10 (TTC_2) surpassed significant or highly significant the overall and/or F_1 means in total yield, whereas only 4 families (5, 10, 12 and 18) in TTC_1 and 6 families (2, 5, 7, 10, 17 and 19) in TTC_2 exceeded all other families in the same cross in green pod yield and most of its components.

Of the four and six highest families of TTC_1 and TTC_2 , respectively; family 5 (TTC_1) and each of 2, 5 and 15 (TTC_2) were earliest one.

We believe that these should be evaluated under different agroclimatic zones and could be useful as a source to improve yielding ability for well adapted pea cultivars.

Table (72): Mean performance of progeny families (Master x Early perfection TTC₁) for the studied characters in pea.

No	Population	Flowering date	Nodes	No. of flowers	Maturity Date	Stem length	No. of branches	Pod length	Seeds/pod	Filling%	Seed set %	Shellout %	TSS	100-seeds	Pods/plant	Yield/plant
1	P1 x Alaska	40.33	9.00	1.00	64.33	95.00	3.03	8.20	6.93	84.70	88.50	39.87	17.00	44.73	40.60	221.17
2	F1 x Alaska	44.67	9.67	1.50	68.67	147.37	2.63	8.20	6.37	77.60	85.13	46.43	17.00	49.33	85.63	440.20
3	P2 x Alaska	55.00	11.33	2.00	78.67	162.27	4.47	7.53	6.70	89.00	88.93	45.50	16.63	31.97	144.67	417.83
4	P1 x Cash	41.33	9.00	1.00	64.00	76.67	2.10	9.57	7.70	76.53	83.63	45.20	17.20	51.13	33.50	227.17
5	F1 x Cash	42.33	8.33	1.33	63.33	91.03	6.33	9.13	7.63	83.27	86.73	48.47	17.53	54.40	186.47	694.63
6	P2 x Cash	63.00	12.00	2.00	87.00	90.57	2.00	8.33	7.00	83.97	82.37	54.70	17.07	49.63	51.20	223.37
7	P1 x No. 40	58.00	12.00	1.80	76.67	166.63	6.27	9.00	7.43	82.63	87.83	38.60	16.33	27.93	181.57	545.60
8	F1 x No. 40	62.33	13.00	1.93	92.33	167.27	5.50	7.63	6.20	81.33	84.67	47.77	18.20	29.27	196.27	402.40
9	P2 x No. 40	64.33	14.67	2.00	91.67	187.83	3.87	6.83	5.77	84.47	81.13	43.47	15.93	28.63	138.20	332.67
10	P1 x Club	58.33	12.33	2.00	79.67	85.77	8.57	9.90	8.77	88.53	92.50	53.70	15.83	35.40	168.30	573.93
11	F1 x Club	67.33	12.67	2.00	82.33	76.27	5.33	8.83	6.80	77.00	81.13	50.07	18.17	31.50	116.47	299.60
12	P2 x Club	62.67	13.67	2.00	83.67	88.83	7.87	8.63	8.10	93.83	95.30	53.67	18.07	35.47	181.93	629.73
13	P1 x Pigeon C.I.	56.33	11.67	1.90	79.33	160.63	8.20	7.97	6.30	79.13	80.33	50.77	15.90	39.60	161.20	497.47
14	F1 x Pigeon C.I.	59.33	12.67	1.97	81.33	149.90	5.00	6.87	5.53	80.47	81.97	48.97	15.33	33.43	107.13	221.77
15	P2 x Pigeon C.I.	64.33	13.67	2.00	86.67	186.13	4.40	7.00	5.43	77.63	74.77	43.17	17.10	29.33	141.10	287.00
16	P1 x Dwarf G.S.	54.00	11.67	2.00	77.67	156.73	5.07	8.23	6.77	82.13	81.80	66.43	14.00	43.23	153.77	402.60
17	F1 x Dwarf G.S.	63.33	14.00	1.93	87.00	126.20	6.50	7.33	6.53	89.03	86.10	51.80	13.67	39.07	146.50	454.23
18	P2 x Dwarf G.S.	66.00	15.00	2.00	91.33	126.53	6.50	8.10	7.10	87.70	89.83	42.87	14.10	30.63	186.00	557.17
19	P1 x Protor	48.33	8.67	1.00	73.00	68.93	3.30	10.80	7.90	73.17	86.00	41.93	17.13	51.23	36.87	261.23
20	F1 x Protor	59.67	11.67	1.73	78.33	86.50	4.40	10.00	7.60	76.03	90.63	47.13	17.47	62.67	102.67	524.60
21	P2 x Protor	61.33	12.33	1.83	86.00	87.97	3.13	9.50	6.20	65.30	81.70	48.23	16.27	49.30	63.40	320.83
22	P1 x Falanin 60	63.00	13.67	2.00	89.67	103.30	4.00	10.73	7.10	66.07	80.27	42.20	18.23	51.27	78.90	496.80
23	F1 x Falanin 60	66.67	13.00	1.97	89.33	97.27	6.37	9.60	6.83	71.20	85.43	45.23	15.23	46.33	97.73	532.10
24	P2 x Falanin 60	61.67	14.00	2.00	97.33	122.53	4.80	9.00	5.40	59.93	67.47	34.50	15.90	39.30	107.57	450.37
25	P1 x Lincoln	63.67	13.67	2.00	86.33	86.83	5.67	11.40	8.10	71.00	89.00	45.17	15.70	45.60	96.70	591.63
26	F1 x Lincoln	67.33	13.33	1.90	87.67	92.07	5.50	11.07	8.50	77.23	93.13	46.00	15.50	45.07	99.17	537.00
27	P2 x Lincoln	65.33	14.33	1.93	90.67	93.67	4.10	10.13	7.07	69.73	84.47	44.37	16.77	49.67	74.20	432.17
28	P1 x Progress 9	60.33	12.33	1.87	79.33	108.27	4.93	9.50	6.60	69.47	80.47	43.40	17.20	41.60	106.33	461.83
29	F1 x Progress 9	65.33	13.67	1.87	90.33	97.13	4.00	10.93	6.50	59.43	74.93	44.10	16.93	56.23	82.67	465.90
30	P2 x Progress 9	64.67	12.67	1.87	85.67	93.30	3.37	9.63	7.07	73.37	83.17	38.87	15.90	38.30	47.10	222.13
Over all means		59.01	12.32	1.81	82.31	115.98	4.91	8.99	3.93	77.70	84.31	46.42	16.44	42.04	113.79	424.17
LSD 0.05		1.24	0.62	0.051	1.35	2.91	0.28	0.16	0.46	5.12	4.93	0.28	0.32	0.72	3.17	19.91

Table (73): Mean performance of progeny families (Master x Dwarf Gray Sugar TTC₂) for the studied characters in pea.

No	Population	Flowering date	Nodes	No. of flowers	Maturity Date	Stem length	No. of branches	Pod length	Seeds/pod	Filling%	Seed set %	Shellout %	TSS	100-seeds	Pods/plant	Yield/plant
1	P1 x Alaska	40.33	9.00	1.00	64.33	95.00	3.03	8.20	6.93	84.70	88.50	39.87	17.00	44.73	40.60	221.17
2	F1 x Alaska	43.33	9.67	1.33	66.67	152.60	4.53	7.50	6.53	87.13	86.43	49.83	16.27	43.33	121.00	498.57
3	P2 x Alaska	53.33	11.67	1.93	69.67	162.03	5.20	6.57	5.43	82.73	69.73	45.67	14.03	28.40	104.07	225.87
4	P1 x Cash	41.33	9.00	1.00	64.00	76.67	2.10	9.73	7.70	76.53	83.63	45.20	17.20	51.13	33.50	227.17
5	F1 x Cash	46.67	11.67	1.53	66.67	146.07	4.67	9.03	7.43	82.27	85.43	50.30	12.80	47.00	148.83	622.13
6	P2 x Cash	56.00	13.33	1.90	72.67	164.60	4.00	7.40	7.07	95.70	82.73	51.73	16.10	38.17	98.63	325.47
7	P1 x No. 40	55.00	12.00	1.80	76.67	166.63	6.27	9.00	7.43	82.63	87.83	38.60	16.33	27.93	181.57	545.60
8	F1 x No. 40	69.00	13.67	1.43	87.67	132.83	4.50	6.40	4.83	69.33	69.03	43.93	17.80	30.50	105.40	237.00
9	P2 x No. 40	72.33	16.33	1.93	91.67	158.43	5.37	7.67	7.23	94.33	87.87	45.13	13.00	27.07	143.37	364.97
10	P1 x Club	58.33	12.33	2.00	79.67	85.77	8.57	9.90	8.77	88.53	92.50	53.70	15.83	35.40	168.30	573.93
11	F1 x Club	45.33	10.00	1.97	67.00	170.07	5.50	7.13	6.93	97.17	81.37	44.97	14.93	37.93	173.90	611.40
12	P2 x Club	66.33	15.00	2.00	90.33	173.80	8.43	7.40	5.97	80.27	72.60	49.63	16.77	23.63	207.40	334.40
13	P1 x Pigeon C.I.	56.33	11.67	1.90	79.33	160.63	8.20	7.97	6.30	79.13	80.33	50.77	15.90	39.60	161.30	497.47
14	F1 x Pigeon C.I.	47.00	10.67	1.70	65.00	110.07	4.53	7.37	6.37	86.43	85.47	48.33	14.67	46.20	166.03	634.00
15	P2 x Pigeon C.I.	63.67	13.33	1.90	85.67	162.90	5.00	6.37	5.67	84.53	79.77	51.13	13.67	29.67	141.27	420.20
16	P1 x Protor	48.33	8.67	1.00	73.00	68.93	3.30	10.80	7.90	73.17	86.00	41.93	17.13	51.23	36.87	261.23
17	F1 x Protor.	49.33	9.67	1.20	71.33	102.20	4.50	9.33	7.47	80.00	89.07	44.97	14.00	52.73	97.20	509.47
18	P2 x Protor	60.33	11.67	1.77	84.33	140.63	3.93	8.33	5.60	67.17	68.43	48.07	15.93	52.50	119.50	498.33
19	P1 x Early P.	57.00	12.00	2.00	77.67	101.13	6.60	8.83	7.27	82.33	86.47	50.40	16.07	39.90	131.50	519.43
20	F1 x Early P.	70.00	15.33	1.97	88.67	87.40	6.00	7.67	6.67	86.97	81.77	43.93	14.73	30.23	160.07	352.07
21	P2 x Early P.	61.67	13.67	2.00	85.33	173.13	5.33	7.27	6.23	85.80	86.13	53.37	13.37	45.47	113.47	385.67
22	P1 x Falanin 60	63.00	13.67	2.00	89.67	103.30	4.00	10.73	7.10	66.07	80.27	42.20	18.23	51.27	78.90	496.80
23	F1 x Falanin 60	63.67	13.00	1.97	90.33	150.57	4.00	9.23	6.00	65.70	74.93	45.07	14.50	40.97	138.27	414.17
24	P2 x Falanin 60	70.00	14.00	2.00	94.67	173.27	5.80	7.53	5.33	70.90	63.97	36.03	13.50	28.30	106.90	295.03
25	P1 x Lincoln	63.67	13.67	2.00	86.33	86.83	5.67	11.40	8.10	71.00	89.00	45.17	15.70	45.60	96.70	591.63
26	F1 x Lincoln	66.67	13.67	1.77	91.00	153.60	3.60	10.77	8.33	77.43	93.97	39.27	12.83	39.50	131.80	543.50
27	P2 x Lincoln	68.33	14.67	2.00	93.00	143.17	4.20	8.80	7.07	80.20	82.13	42.63	12.20	30.70	105.80	338.93
28	P1 x Progress 9	60.33	12.33	1.87	79.33	108.27	4.93	9.50	6.60	69.47	80.47	43.40	17.20	41.60	106.33	461.83
29	F1 x Progress 9	68.00	14.00	1.77	88.33	102.50	6.00	10.30	6.80	65.93	79.50	46.67	13.50	43.30	152.20	460.27
30	P2 x Progress 9	63.00	14.00	2.00	79.00	160.27	6.03	7.50	6.43	85.77	88.67	50.60	13.50	37.53	115.87	338.70
	Over all means	58.26	12.44	1.75	79.85	132.44	5.13	8.52	6.78	79.98	82.13	46.08	15.16	39.38	122.89	426.88
	LSD _{0.05}	1.25	0.53	0.051	1.17	3.51	0.28	0.28	0.48	5.76	4.81	0.77	0.46	0.68	3.22	36.42