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GENETIC IMPROVEMENT OF BEAN (*Phaseouls vulgaris* L.) UNDER HIGH TEMPERATURE CONDITION

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ABSTRACT

This study was conducted at Barrage Horticulture El-Kanater, Kaluobia Agricultural , Research Station. During the period 2002-2004 to study the inheritance of some bean varieties. Four bean cultivars *viz.*, Bronco, Poulesta, Tema and Deoul were used in this study. Production of different generation, i. e, Parents, F_1, F_1r, and F_2 population were estimated. The population were evaluated for plant height, number of days to flowering, green pods yield/plant, number of pods/plant, pod weight and pod length.

Generally, all degrees of dominance (no, partial, complete and overdominance) were estimated. Average degree of heterosis for all characters, minimum number of genes, and broad sence heretability (BSH) were estimated.
The different types of dominance were observed in many populations, such as overdominance for the better parents were observed in some traits, i. e, plant height, pod weight, pod yield and number of pod/plant. On the contrary overdominance towards the low parents was observed in number of days to flowering. Partial dominance for the better parents were showed in pod weight and number of pod/plant. On the other hand partial dominance towards the low parent observed in characters such as plant height, number of days to flowering, pod weight, and green pod yield/plant. Complete dominance were showed in pod weight and number of pod/plant. No dominance were obtained in plant height, number of pod/plant and green yield/plant. Positive heterosis were showed in most characters as plant height, number of days to flowering, pod weight, number of pod/plant and green pod yield/plant. Also negative heterosis was in some characters for some crosses. Minimum number of genes were estimated for all characters it is ranged from one pair to three pairs. BSH were estimated in all characters it is ranged from 40.70 to 93.40.

INTRODUCTION

Bean (*Phaseouls vulgaris* L.) is an important vegetable crop in Egypt, as well as, many other countries.

In developing countries, there is an important role for breeding programs to improve the quality of agricultural production, firstly to provide sheaps sources of nutrients such as protein, minerals and vitamins and secondly to raise the income of small farmers. Therefore, improvement of bean yield is always in demand. The improvement of both quantitative and qualitative traits of bean depends on the present of genetic variability that permits effective selection

Studying the genetics of bean to be inheretance Bliss (1971) found partial dominance for high parent to plant height. This results agree with Ranall and Mari (1993), while overdominance towards high parent was observed by Coyne 1968 but Hamed (1999) showed complete dominance in cross Giza 6 x Serbo and partial dominance were found in the other crosses. Bliss (1971) found to be controlled by one pair of genes, and agree with

Detengon 1985, Ram and Prasad (1985), and Ranall and Mari 1993. Broad sence heritability (BSH) was estimated by Brothers and Kelly (1993), Mebrahtu and Elmi (1993). Dickson (1976) and Al-Mukhtar and Coyne (1981), showed overdominance for number of days to flowering. Negative heterosis for early parent ranged from – 60.90 % to – 1.20 obtained by Hamed (1999). Minimum number of gene is controlling by Al-Mukhtar and Coyne (1981) found one pair of gene. BSH were estimated by Escribanon *et al* (1994) , Singh and Urre (1994). Positive heterosis was observed by Hamad (1976). Minimum number of genes controlling pod weight were estimated from 1-3 pairs of genes by Hamed (1999). BSH were estimated by Mebrahtu and Elmi (1993), it was 67.00 %. Hamed (1999) found no significant between F_1, F_1r in all crosses for green pods yield/plant. Hamad (1976) showed complete dominance, but Hamed (1999) showed overdominance for all crosses except Bronco x Giza 6 which complete dominance. Heterosis was positive obtained by Hamad (1976), Singh *et al* (1978), Dhillon and Chahal (1981). BSH were estimated by Escribanon *et al* (1994) it was 24.0 %. Hamad (1976) found overdominance, for number of pods/plant, and agree with Singh *et al* (1978), Dhillon and Chahal 1981. Hamad 1976 and Dhillon and Chahal (1981) showed positive heterosis for this character. BSH estimated by Escribanon *et al* (1994). Singh *et al* (1978) and Dhillon and Chahal (1981) obtained complete dominance for pod weight. BSH were estimated by Mebrahtu and Elmi (1993). Dickson (1976) showed absence dominance for the pod length character. Hamed (1999) showed complete dominance, partial dominance were obtained towards the high parent. Positive heterosis was found in the cross Giza 6 x Serbo it was 2.60 %. while negative heterosis were ranged from – 17.29 to – 5.40 % by Hamed (1999). Minimum number of gene was observed one pairs by Ram and Prasad 1985. BSH were estimated by Singh *et al* (1994) it was 29.0 %, Mebrahtu and Elmi (199)3 and Escribanon *et al* (1994) it was 87.20 % and 69.0%, respectively.

MATERIALS AND METHODS

This study was conducted during the period from 2002 to 2004. Evaluation of genetic population were carried out at Barrage Horticulture Research Station (BHRS), Kalubia, while production of these populations were carried out at Vegetable Research Department (VRD) in El Dokki.

Production of Genetic Populations

Seeds of the four cvs Bronco, Poulesta, Tema and Deoul were sown in 25 cm pots in the greenhouse (2 seeds/pot) and also in the open field on September 25, 2002 and First March, 2003, September, 15 to produce F_1, F_1r and F_2 seeds and evaluated in July 10. Six crosses and their reciprocal were made as follows :

Straight crosses	Reciprocal crosses
Bronco × Poulesta	Poulesta × Bronco
Bronco × Tema	Tema × Bronco
Bronco × Deoul	Deoul × Bronco

Poulesta × Tema	Tema × Poulesta
Poulesta × Deoul	Deoul × Poulesta
Tema × Deoul	Deoul × Tema

Some seeds of the straight F_1 crosses were sown . Flowers of F_1 plants were left for selfing to produce F_2 seeds.

Evaluation of Genetic Populations

Seeds of parental, F_1, F_1r, and F_2 populations for each of the six crosses were sown on July 10, 2004, in a randomized complete block design with four replicates. Each replicate consisted of one row of every non-segregating population *viz.* parents, F_1, and F_1r and three rows of each F_2. Each row was 4.5 m long and 0.6 m wide. Individual seeds were sown at a distance of 30 cm apart. Data were recorded on individual plants of the different populations in each cross.

Vegetative and Flowering Characters

Plant height

Number of days to flowering

Yield and its Components

Green pods yield/plant

Number of pods/plant

Pod weight

it was weight as the mean of five pods/plant .

pod length

it was measured as the mean of five pods/plant.

Genetic Parameters Estimated

Maternal effect

It was estimated by measuring the significance of difference between F_1 means and their reciprocals by using the t test.

Potence ratio

The relative potency of gene set (P) was used to determine the direction of dominance according to the formula given by smith (1952).

Heterosis

Heterosis was calculated on the highest parent basis using the following wright formula by (Sinha and Khanna, 1975).

Minimum number of genes

The minimum number of genes controlling the character in each cross was calculated using Wright formula (Burton, 1951).

Broad sense heritability (BSH)

BSH was calculated using the formula given by (Allard, 1960)

RESULTS

Plant height

Data obtained on plant height of parental, F_1, F_1r, and F_2 populations of the different crosses are presented in (Table 1).

Table 1. Distribution, mean, and variance of plant height of parental, F_1, F_1r, and F_2 populations of pea crosses.

Population	Frequency of plant height in class [a]										Total No. of plants	Mean ($\bar{X} \pm S_{\bar{x}}$)	b	Variance (S^2)
	33	36	39	42	45	48	51	54	57	60				
Bronco × Tema														
Bronco (P_1)		3	3	7	2	1					16	41.50 ± 0.80	*	11.91
Tema (P_2)			3	5	8	7	6	3			32	46.59 ± 0.77	*	19.15
F_1			2	-	1	6	7	6	4		26	50.70 ± 0.94	NS	22.99
F_1r		2	1	5	5	4	2				19	44.21 ± 0.98		18.42
F_2	4	8	16	23	21	14	9	6	5		106	44.29 ± 0.57		34.38
Bronco × Deoul														
Bronco (P_1)		3	3	7	2	1					16	41.50 ± 0.81	*	11.91
Deoul (P_2)					2	6	4	7	5		24	51.88 ± 0.80	*	15.24
F_1			6	8	4	4	1				23	43.17 ± 0.75	NS	12.88
F_1r	2	14	8	5	1						30	37.30 ± 1.12		37.55
F_2	2	6	11	18	22	8	8	12	4	2	93	45.65 ± 0.65		39.69
Poulesta× Tema														
Poluiesta (P_1)	2	2	5	9	3						21	40.29± 0.76	*	12.22
Tema (P_2)			3	5	8	7	6	3			32	46.59± 0.77		19.15
F_1		6	2	8	4	4	6				30	43.60± 0.97	NS	28.39
F_1r		6	9	8	2						25	39.72± 0.56		7.71
F_2	4	8	4	16	16	20	18		6		92	45.52± 0.62		34.93
Pouleesta × Deoul														
Poluiesta (P_1)	2	2	5	9	3						21	40.29± 0.76	*	12.22
Deoul (P_2)					2	6	4	7	5		24	51.88± 0.80		15.24
F_1		6	8	2	4						20	39.60± 0.74	NS	10.99
F_1r		9	12	3							24	38.25± 0.41		4.11
F_2											110	45.05± 0.56		34.51
Tema × Deoul														
Tema (P_1)			3	5	8	7	6	3			32	46.59± 0.77	*	19.15
Deoul (P_2)					2	6	4	7	5		24	51.88± 0.80		15.24
F_1							8	16	11		35	54.26± 0.38	NS	4.96
F_1r					6	6	14				26	48.92± 0.49		6.31
F_2		6	12	11	18	22	8	8	16	8	109	47.82± 0.62		42.21

[a] Each class represents a range of 3 cm and class values indicated represent class centers.

[b] Pairs of means were either significantly (*) or not significantly (NS) different from each other according to t- test.

Parents were distinctively different in plant height in all crosses. In each cross, $F_1$and F_2 means were intermediate between its two parents with a tendency towards the highest parent except in the cross Bronco × Tema where F_1 means was higher than the highest parent. Non significant differences were observed between F_1's and their reciprocals for plant height in all crosses indicating absence of maternal effect.

Quantitative genetic parameters obtained for plant height are presented in (Table 7). positive value of potence ratio indicated overdominance in the cross Bronco × Tema, partial dominance was obtained in the cross Poulesta × Dooul. These results were in agreement with Bliss 1971. Complete dominance of the low parent were found in the crosses Bronco × Deoul and Poulesta × Deoul. These results were in agreement with Hamed 1999.

Table 7. Quantitative genetic parameters obtained for characters in beans crosses.

Characters	Crosses	Parameters			
		Potence ratio (P)	Heterosis (H)	Number of genes (N)	Broad sence heritability (BSH) %
Plant height	Bronco x Poulesta	2.61	8.82	1.26	49.48
	Bronco x Deoul	-0.68	-16.79	1.01	66.57
	Poluesta x Tema	0.05	-6.42	0.76	46.90
	Poluesta x Deoul	- 0.53	-23.67	1.23	63.20
	Tema x Dioul	0.47	4.59	0.81	73.80
Number of days to flowering	Bronco x Poulesta	-4.80	3.45	0.09	93.40
	Bronco x Tema	-1.93	-4.5	0.88	71.14
	Bronco x Deoul	-0.54	2.45	0.37	59.00
	Poulesta x Tema	-1.91	-6.25	1.30	41.84
	Poulesta x Deoul	-0.82	2.47	0.14	79.05
Pod length	Bronco x Poluesta	-0.61	1.96	0.17	73.71
	Broncox Deoul	1.76	9.2	1.28	41.88
	Poulesta x Tema	0.53	-3.75	0.23	57.14
	Poulesta x Deoul	-5.72	-22.79	1.10	76.16
	Tema x Deoul	2.71	12.62	0.95	48.61
Pod weight	Bronco x Poulesta	2.09	10.74	0.28	60.06
	Bronco x Tema	1.83	5.68	1.05	43.58
	Bronco x Deoul	1.3	3.18	0.57	64.57
	Poulesta x Tema	0.08	-14.03	1.60	56.66
	Tema x Deoul	0.52	-7.57	2.26	76.74
Green pod yield / plant	Bronco x tema	4.6	12.16	0.14	74.77
	Bronco x Deoul	2.29	13.88	0.50	57.26
	Poulesta x Tema	0.03	-4.5	0.27	48.35
	Poulesta x Deoul	-0.07	-11.15	1.13	40.70
	Tema x Deoul	0.96	-0.56	2.68	50.81
Number of pod / plant	Bronco x Poulesta	1.19	14.96	0.32	82.64
	Bronco x Tema	1.59	7.72	0.55	83.24
	Bronco x Deoul	1.23	6.65	0.32	82.42
	Poulesta x Deoul	0.06	-22.42	2.27	85.19
	Tema x Deoul	-0.05	-26.00	2.28	87.26

Positive heterosis values were observed in the crosses Bronco × Poulesta and Tema × Deoul.8.82 %, 4.59 %, respectively. Negative heterosis value were obtained in other crosses it is ranged from –6.42% - to -23.67.
Plant height was found to be controlled by one pair of genes in the crosses Poulesta × Tema, and Tema × Deoul. Two pairs of genes in the crosses Bronco × Poulesta, Bronco × Deoul and Poulesta × Deoul. These results were in agreement with Bliss (1971), Detengon (1985), Rama and Prasad 1985 and Ranal and Mari 1993.

Estimates of BSH for plant height were moderate to high being 46.90 % to 73.80 % in all crosses (Table 7). These results were partially agree with estimates Brothers and Kelly (1993), Mebrahtu and Elmi (1993).

Number of days to flowering

Data obtained on number of days to flowering of parental, F_1, F_1r, and F_2 populations of the different crosses are presented in (Table 2)

Parents were distinctively different in this trait in all crosses. F_1 means in all crosses were earlier than the early parent, except in the crosses Bronco × Poulesta and Bronco × Deoul which intermediated between their parents. Also F_2 means were intermediate between their parents in all crosses with a tendency towards the lowest parent, except in the crosses Bronco × Tema and Bronco × Deoul, where F_2 means which were higher than the highest parent.

No significant differences were observed between F_1's and their reciprocals for number of days to flowering in all crosses except in the cross Bronco × Tema.

Quantitative genetic parameters obtained for number of days to flowering are presented in (Table 7). Different types of dominance were observed for number of days to flowering. Early flowering parent was overdominance in the cross Poulesta × Tema and partially dominant in the crosses Bronco × Tema , Bronco × Deoul and Poulesta × Deoul. On the contrary, early flowering parent was completely dominant in the cross Bronco × Poulesta. These results are in agreement to some extent with that obtained by Dickson (1976), Al-Mukhtar and Coyne (1981) and hamed (1999).

Negative heterosis values of - 4.50 % and – 6.25 % were found in the crosses Bronco × Tema and Poulesta × Tema, respectively, as shown in Table 7. These results were in accordance with that of Hamed (1999). Meanwhile, other crosses, exhibited positive heterosis values which were ranging from 2.45 % to 3.45.

Minimum number of genes controlling number of days to flowering character was one pair in all crosses except in the cross Poulesta × Tema with two pairs of genes. These results are agreement with Al-Mukhtar and Coyne (1981) and Hamed (1999).

Estimates of BSH for number of days to flowering ranged from 41.84 % to 93.40 %. These results are in agreement with that obtained by Escribanon *et al* (1994), Singh and Uree (1994) and Hamed (1999).

Table 2. Distribution, mean, and variance of number of days to flowering of parental, F_1, F_1r, and F_2 populations of pea crosses.

Population	Frequency of number of days to flowering in class [a]							Total No. of plants	Mean ($\bar{X} \pm S_{\bar{x}}$) b	Variance (S^2)
	30	33	36	39	42	45	48			
Bronco× Poulesta										
Bronco (P_1)		1	8	9				18	37.33 ± 0.45	3.41
Poluesta (P_2)		5	11	5				21	36.00 ± 0.46	4.50
F_1	6	9	5	2				22	33.41 ± 0.60 NS	7.97
F_1r	2	4	11	1				18	34.83 ± 0.55	5.44
F_2	8	21	24	18	16	5		96	35.38 ± 0.86	71.23
Bronco ×Tema										
Bronco (P_1)		1	8	9				18	18 ± 37.33 **	3.41
Tema (P_2)		2	4	5	8	9		28	28 ± 40.93	14.81
F_1		4	11	2				17	17 ± 36.35	8.99
F_1r			6	14	8			28	28 ± 39.21	4.62
F_2		4	12	22	11	24	12	85	58 ± 41.65	18.95
Bronco × Deoul										
Bronco (P_1)		1	8	9				3.41	37.33 ± 0.45	3.41
Deoul (P_2)			4	4	12	6		8.86	41.31 ± 0.58 *	8.86
F_1			8	14	2			3.33	38.25 ± 0.37	3.33
F_1r			18	1	6			2.25	37.56 ± 0.52 NS	6.84
F_2		2	4	11	35	42	8	9.41	42.94 ± 0.30	9.41
Poulesta × Tema										
Poluesta (P_1)		5	11	5				21	36.00 ± 0.46 *	4.50
Tima (P_2)		1	8	9				18	40.93 ± 0.73	14.81
F_1	2	16	4	2				24	33.75 ± 0.45 NS	4.89
F_1r	6	6	14					26	33.92 ± 0.39	6.31
F_2	12	28	34	22	5	2		103	35.59 ± 0.34	11.83
Poulesta × Deoul										
Poluesta (P_1)		5	11	5				21	37.90 ± 0.46 **	4.50
Deoul (P_2)		4	4	12	6			26	37.90 ± 0.58	8.86
F_1	2	6	11	11	2			32	36.47 ± 0.54 NS	9.35
F_1r		2	16	14	6			38	41.31 ± 1.09	44.96
F_2	4	4	42	16	8	11	4	90	36.00 ± 0.62	34.27

[a] Each class represents a range of 3 days and class values indicated represent class centers.

[b] Pairs of means were either significantly (*) or not significantly (NS) different from each other according to t- test.

Green pods yield/plant

Data obtained on green pods yield/plant of parental, F_1, F_1r, and F_2 populations of the different crosses are presented in (Table 3)

Parents were significantly differed in all crosses. F_1 and F_2 means intermediate between its two parents with a slight tendency towards the highest parent, except F_1 means in the crosses Bronco × Tema and Bronco× Deoul were greater than the highest parent. Meanwhile F_2 mean was greater than the highest parent in the cross, Bronco × Tema.

Significant differences were existed between F_1's and their reciprocals in all crosses except the cross Bronco × Deoul.

Quantitative genetic parameters obtained for green pods yield/plant are presented in (Table 7). positive (P) value in the crosses Bronco × Tema and Bronco × Poulesta indicated overdominance of high green pods yield/plant. These results coincided with that obtained by Hamed (1999). Complete dominance of the highest green pods yield/plant was found in the crosses Poulesta × Tema, and Tema × Deoul, which partial dominance was observed in the cross Poulesta × Deoul.

Negative heterosis were found in all crosses except in the crosses Bronco × Tema and Bronco × Deoul meanwhile positive heterosis ranged from 12.16 % to 13.88 %. These results are in agreement with previous results obtained on this trait by Hamad (1976), Singh *et al* (1978), Dhillon and Chahal (1981).

Minimum number of genes controlling green pods yield/plant character was ranged from one pairs to three pairs.

Broad sense heritability estimated for green pods yield/plant were ranged from 40.70 % to 74.77 %. These results agree with that obtained by Escribano *et al* (1994).

Number of pods/plant

Data obtained on number of pods/plant of parental, F_1, F_1r, and F_2 populations of the different crosses are presented in (Table 4).

Parents were significantly in number of pods/plant in all crosses. F_1 and F_2 means higher than their better parents.

Significant differences were observed between F_1's and their reciprocals for number of pods/plant indicating maternal effect in all crosses except in the cross Bronco × Poulesta and Bronco × Deoul.

Quantitative genetic parameters obtained for number of pods/plant are presented in (Table 7). Positive P values indicated complete dominance of the highest number of pods/plant were obtained in crosses Bronco × Poulesta, Bronco × Tema and Bronco × Deoul. while as partial dominance was observed for high and low parent in crosses Poulesta × Deoul and Tema× Deoul.

Data obtained on heterosis in the number of pods/plant Table (4) indicated that crosses Bronco × Poulesta, Bronco × Tema and Bronco Deoul exhibited positive heterosis over the best parent and heterosis values were 6.65 %, 7.72, 14.96 % respectively. These results are in agreement with that obtained by Dhillon and chahal (1981). On the other hand, negative heteroses were observed in crosses Poulesta × Deoul and Tema × Deoul for the same characters.

Table 3. Distribution, mean, and variance of Green pods yield/plant of parental, F_1, F_1r, and F_2 populations of pea crosses.

Population	Frequency of Green pods yield/plant in class [a]												Total No. of plants	Mean ($\bar{X} \pm S_{\bar{x}}$) b	Variance (S^2)
	18	27	36	45	54	63	72	81	90	99	108	117			
Bronco × Tema															
Bronco (P_1)													21	60.43 ± 1.98	82.16
Tema (P_2)				2	6	7	4	2					25	66.60 ± 1.72 *	74.25
F_1					5	8	9	3					20	74.70 ± 1.86 *	69.06
F_1r						5	5	9	1				22	67.09 ± 2.)82 *	175.33
F_2				4		8	2	8					66	76.36 ± 2.12	297.19
			3	12	5	9	14	18	3		1	1			
Bronco × Deoul															
Bronco (P_1)					2	6	7	4	2				21	60.43 ± 1.98 *	82.16
Deoul (P_2)			3	12	5	2							22	47.46 ± 1.59 *	55.40
F_1					3	7	4		2	1			17	68.82 ± 3.18 NS	171.53
F_1r					4	8		5					17	66.18 ± 3.24 *	110.78
F_2	1	2	5		8	19	12	4					51	60.18 ± 2.06	215.43
Poulesta × Tema															
Poluesta (P_1)				2	8	6	5						21	60.50 ± 1.90 *	75.60
Tema (P_2)					5	8	9	3					25	66.60 ± 1.72 *	74.25
F_1					4	8	2		1				15	63.60 ± 2.40 *	86.40
F_1r					6	3	5						14	62.36 ± 2.21 *	68.09
F_2		2	1		12	26	6		2	1			50	61.74 ± 1.74	152.12
Poulesta × Deoul															
Poluiesta (P_1)			2	8	6	5							21	60.00 ± 1.90 *	75.60
Deoul (P_2)		3	12	5	2								22	47.46 ± 1.59 *	55.40
F_1			3	8	2								13	53.31 ± 1.60 *	33.23
F_1r			7	5		3							15	53.40 ± 2.71 *	109.54
F_2	2	3	3	18	22	3	1	1					52	49.33± 1.30	87.32
Tema × Deoul															
Tema (P_1)					5	8	9	3					25	66.60 ± 1.90 *	74.25
Deoul (P_2)			3	5	9	2							22	47.46 ± 1.59 *	55.40
F_1					4	5	3		2				14	66.21 ± 3.22 *	144.64
F_1r				4	9		2						15	54.00 ± 2.15 *	69.43
F_2	1		2	9	15	8	9	3					47	57.45 ± 1.91	170.99

[a] Each class represents a range of 9 (g) and class values indicated represent class centers.

[b] Pairs of means were either significantly (*) or not significantly (NS) different from each other according to t- test.

Table 4. Distribution, mean, and variance of Number of pods/plant of parental, F_1, F_1r, and F_2 populations of pea crosses.

Population	Frequency of number of pods/plant in class (a)												Total No. of plants	Mean ($\bar{X} \pm S\bar{x}$) b	Variance (S2)
	5	8	11	14	17	20	23	26	29	32	35	38			
Bronco × Poulesta															
Bronco (P_1)				4	14	6							24	17.25 ± 0.40	3.85
Poluista (P_2)					1	6	18	1					26	22.19 ± 0.36	3.28
F_1						4	12	2					18	22.67 ± 0.42	3.06
F_1r						8	6	2					16	21.88 ± 0.54	4.65
F_2			2		12	28	12	8	4		2		68	21.41 ± 0.54	19.47
Bronco × Tema															
Bronco (P_1)				4	14	6							25	17.25 ± 0.39	3.85
Tema (P_2)						3	12	5					20	23.30 ± 0.43	3.70
F_1					2	2	5	4	6				20	25.10 ± 1.03	20.94
F_1r			2	5	4	6		1					18	17.00 ± 0.91	14.82
F_2		1	6	2	5	18	22	9		4	3	2	72	22.17 ± 0.74	39.86
Bronco × Deoul															
Bronco (P_1)				4	14	6							24	17.25 ± 0.40	3.85
Deoul (P_2)		1	16	6									23	11.65 ± 0.33	2.42
F_1				5	4	6	2						17	17.88 ± 0.81	9.86
F_1r			2	8	1		2						13	15.15 ± 1.05	14.31
F_2		1		11	9	14	16	5		4			60	20.35 ± 0.65	25.66
Poluesta × Deoul															
Poluiesta (P_1)					1	6	18	1					26	22.19 ± 0.36	3.28
Deoul (P_2)		1	16	6									23	11.65 ± 0.31	2.42
F_1				3	7	4							14	17.21 ± 5.93	4.80
F_1r		3	5	2		1							11	11.55 ± 1.05	12.27
F_2	2	5	4	8	12	22	6						56	16.75 ± 0.62	22.75
Tema ×Deoul															
Tema (P_1)				4	6	3	12	5					20	23.30 ± 0.43	
Deoul (P_2)		1	16	6									23	11.65 ± 0.33	
F_1				5	7	6							18	17.17 ± 0.57	
F_1r				4	6	1	3						14	17.64 ± 0.90	
F_2	4	7	5	14	22	16	6	3		1			78	16.27 ± 0.61	

(a) Each class represents a range of 3 pods and class values indicated represent class centers.

(b) Pairs of means were either significantly (*) or not significantly (NS) different from each other according to t- test.

Minimum number of genes controlling number of pods/plant character was estimated as one pair in all crosses.

BSH estimated for number of pods/plant ranged from 82.42 % to 87.26 % (Table 4). These results are partially agree with high BSH estimates obtained by Escribanon *et al* (1994).

Pod weight

Data obtained on pod weight of parental, F_1, F_1r, and F_2 populations of the different are presented in (Table 5). Non significant differences were existed between F_1's and their reciprocals in all crosses indicating the presence of maternal effect

Parents were significantly different in pod weight in all crosses. The F_1 means of the crosses Bronco × Poulesta and Bronco × Tema were higher than their better parents. The F_2 means were intermediate between its two parents with a slight tendency towards the highest parent, except in the cross Bronco × Deoul greater than the highest parent.

Non significant differences were existed between F_1's and their reciprocals in all crosses indicating the presence of maternal effect

Quantitative genetic parameters obtained for pod weight are presented in (Table 7). Positive P values indicated overdominance where the highest pod weight were obtained in crosses Bronco × Poulesta and Bronco × Tema. These results confirmed pervious results obtained by Hamad 1976, Singh *et al* 1978 and Dhillon and Chahal 1981, complete dominance was observed in the cross Bronco × Deoul. While partial dominance was observed in the crosses Poulesta × Tema and Tema× Deoul.

Data obtained on heterosis of pod weight (Table 5) indicated positive heterosis over the best parent value ranged from 3.14 %, 10.74 % in the crosses Bronco × Poulesta, Bronco × Tema and Bronco × Deoul. Negative heterosis was observed in crosses Poulesta × Tema and Tema × Deoul, -14.03 %, - 7.57 %, respectively.

Minimum number of genes controlling pod weight character was estimated from 1 – 3 pairs of genes for this trait.

BSH estimated for pod weight ranged from 43.58 % to 76.74 % (Table 5). These results are partially agree with high BSH estimates obtained by Mebrahtu and Elmi (1993).

pod length

Data obtained on pod length of parental, F_1, F_1r, and F_2 populations of the different crosses are presented in Table (6). Parents were significantly different in all crosses. The F_1 and F_2 means were intermediated between its two parents with a slight tendency towards the highest parent in all crosses. The F_1 means in the crosses Bronco × Deoul and Tema × Deoul were greater than the highest parent.

Non significant differences between F_1's and their reciprocals in the crosses Bronco × Poulesta, Bronco × Tema and Poulesta × Tema indicating the absences of maternal effect.

Table 5. Distribution, mean, and variance of pod weight of parental, F_1, F_1r, and F_2 populations of pea crosses.

Population	Frequency of pod weight in class [a]										Total No. of plants	Mean ($X \pm S_x$)	b	Variance (S^2)
	5	6.5	8	9.5	11	12.5	14	15.5	17	18.5				
Bronco × Poulesta														
Bronco (P_1)					6	9	8	6			29	13.22 ± 0.29	*	2.51
Poluesta (P_2)			2	8	8	6					24	10.63 ± 0.28	*	1.92
F_1				1		4	8	8	5		26	14.64 ± 0.35	NS	3.15
F_1r						5	4	6	7		22	15.02 ± 0.38	NS	3.08
F_2		4	12	8	8	28	8	6			74	11.37 ± 0.29		6.21
Bronco × Tema														
Bronco (P_1)					6	9	8	6			29	13.22 ± .29	*	2.51
Tema (P_2)							9	10	6		25	15.32 ± 0.23	*	1.37
F_1							4	8	9	3	24	16.19 ± 0.29	NS	1.95
F_1r								6	8	4	18	16.83 ± 0.26	NS	1.22
F_2				2	8	12	24	15		2	63	13.69 ± 0.23		3.35
Bronco × Deoul														
Bronco (P_1)					6	9	8	6			29	13.22 ± 0.29	*	2.51
Deoul (P_2)				8	14						22	12.17 ± 0.16	*	3.81
F_1					2	5	10	4			21	12.25 ± 0.25	NS	1.01
F_1r					2	9	7				18	12.92 ± 0.16	NS	.055
F_2			2	6	22	16	8	9			63	13.64 ± 0.29		1.78
Poulesta × Tema														
Poluiesta (P_1)			2	8	8	6					24	10.63 ± 0.26	*	1.92
Deoul (P_2)							9	10	6		25	15.32 ± 0.23	*	1.37
F_1				2		6	8	2			18	13.17 ± 0.39	NS	2.71
F_1r					3	9	2				14	12.39 ± 0.25	NS	0.85
F_2		1	1		9	22	14		2	1	54	13.02 ± 0.29		4.43
Tema × Deoul														
Tema (P_1)							9	10	6		25	15.32 ± 0.23	*	1.37
Deoul (P_2)				8	14						22	10.46 ± 0.16	*	0.55
F_1						6	9		4		19	14.16 ± 0.38	NS	2.72
F_1r						8	6	3			17	13.56 ± 0.28	NS	1.34
F_2				8	22		14	6		2	52	12.39 ± 0.33		5.46

[a] Each class represents a range of 1.5 (g) and class values indicated represent class centers.

[b] Pairs of means were either significantly (*) or not significantly (NS) different from each other according to t- test.

Table 6. Distribution, mean, and variance of pods length of parental, F_1, F_1r, and F_2 populations of pea crosses.

Population	Frequency of pod length in class [a]												Total No. of plants	Mean ($\bar{X} \pm S_{\bar{X}}$)	b	Variance (S^2)
	6.4	7.3	8.2	9.1	10	10.9	11.8	12.7	13.6	14.5	15.4	16.3				
Bronco × Poulesta																
Bronco (P_1)				2	6	15	2						25	9.70 ± 0.13	*	0.45
Poluista (P_2)		4		10	12	1	2						29	8.70 ± 0.17	*	0.82
F_1				4	6	6	2						18	9.40 ± 0 12	NS	0.76
F_1r		2		8	8	2							20	8.65 ± 0.05		0.05
F_2	1	16		22	32	14	12	5	1				104	9.01 ± 0.16		2.51
Bronco × Deoul																
Bronco (P_1)				2	6	15	2						25	9.71 ± .09	*	0.45
Deoul (P_2)						2	6	8	2	7	2		27	12.20 ± 0.26	*	1.77
F_1								6	6	12	5		29	13.20 ± 0.17	NS	0.84
F_1r							2	12	13				28	12.22 ± 0.12		0.39
F_2				5	5	3	16	8	16	3			56	11.24 ± 0.21		3.16
Poulesta × Tema																
Poluesta (P_1)		4		10	12	1	2						29	8.70 ± 0.17	*	0.82
Tema (P_2)				4	6	4	4	8	2				28	10.39 ± 0.28	*	2.13
F_1				4		12	8						24	10.00 ± 0.19	NS	0.85
F_1r		2		8	12	4							26	8.82 ± 0.15		0.57
F_2	2	4		8	22	8	21	6		5			76	9.94 ± 0.19		2.66
Poulesta × Deoul																
Poluiesta (P_1)		4		10	12	1	2						29	8.70 ± 0.1	*	0.82
Deoul (P_2)						2	6	8	2	7	2		27	12.20 ± 0.26	*	1.77
F_1				6	8	7	4						25	9.42 ± 0.19	*	0.87
F_1r						6	6	12	2				26	11.25 ± 0.17	*	0.72
F_2	2		8	8	14	22	6	18	4		1	2	85	10.97 ± 0.21		
Tema × Deoul																
Tema (P_1)			4	6	4	4	8	2					27	12.20 ± 0.26	*	1.77
Deoul (P_2)					2	6	8	2	7	2			28	10.39 ± 0.28	*	2.13
F_1							4		6	9			20	13.74 ± 0.25	*	1.22
F_1r							6	6	10	4			26	13.12 ± 0.18	*	0.86
F_2		2	6	8	12	22	8	32	14	2	1	1	108	11.56 ± 0.17		3.23

[a] Each class represents a range of 0.9 mm and class values indicated represent class centers.
[b] Pairs of means were either significantly (*) or not significantly (NS) different from each other according to t- test.

Quantitative genetic parameters obtained for green pods yield/plant are presented in Table (7). Positive P value were observed in the crosses Bronco × Deoul and Tema × Deoul indicated overdominance of high pod length, complete dominance was observed in the cross Poulesta × Tema, partially dominance for low parent were obtained in the crosses Bronco × Poulesta and Poulesta × Deoul. These results coincided with Hamed (1999). Positive heterosis for pod length were found in the crosses Bronco× Poulesta, Bronco × Deoul and Tema × Deoul. 1.90 %, 9.20 % and 12.62 %, respectively. On the other hand negative heterosis were observed in the crosses Poulesta × Tema and Poulesta × Deoul

Minimum number of genes controlling pod length character was 1– 2 pairs of genes. These results agree with that obtained by Ram and Prasad (1985).

BSH estimated for pod length ranged from 41.88 % to 76.16 % (Table 6). These results are partially agree with Singh *et al* 1994, Mebrahtu and Elmi (1993), Escribanon *et al* (1994).

Conclusion

1 – Eight of isolated F_2 plants of the cross Bronco x Tema were selected for high green yield and temperature stress tolerance.

2– four isolated F_2 plants performed the best for qualitative and quantitative traits as well as the earliness under the high temperature of the study region.

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التحسين الوراثى فى الفاصوليا تحت درجات الحرارة العالية.

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اجريت هذه الدراسة بمحطة بحوث البساتين بالقناطر الخيرية بمحافظة القليوبية خلال الفترة من ٢٠٠٢ – ٢٠٠٤ لدراسة وراثة طول النبات ، عدد الأيام حتى التزهير ، المحصول الكلي ، وزن القرون ، عدد القرون على النبات ، طول القرن. زرعت عشائر كل من الجيل الأول والجيل العكسي والجيل الثاني لكل هجين في قطاعات كاملة العشوائية وقيمت عام ٢٠٠٤ حيث وجدت الطرز المختلفة من انواع السيادة . وجدت السيادة الفائقة للأب الاكبر في بعض الصفات مثل طول النبات – وزن القرن – المحصول الأخضر – عدد القرون/نبات لبعض الهجن بينما وجدت السيادة الفائقة للأب الأقل في بعض الهجن الاخرى لصفة عدد الأيام حتى التزهير والسيادة الجزئية للأب الأكبر وجدت لصفة وزن القرن – عدد القرون /نبات بينما كانت جزئية للأب الأقل لصفة طول النبات – عدد الأيام حتى التزهير – وزن القرون والمحصول الأخضر. والسيادة التامة وجدت في وزن القرن – المحصول الاخضر وعدد القرون/نبات. عدم السيادة وجدت في بعض الهجن لصفات طول النبات – عدد القرون/نبات – وزن المحصول الأخضر. التفوق الموجب وجد في معظم الصفات مثل طول للنبات – عدد الايام حتى التزهير – وزن القرون – عدد القرون/نبات. بينما وجد التفوق السلبي لبعض الهجن لصفات أخري. قدرت عدد الجينات التى تتحكم في الصفات فتراوحت بين واحد الى ثلاث جينات . وقدرت درجة التوريث على النطاق العريض فتراوحت بين ٤٠,٧٠ % - ٩٣,٤٠ % .