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GENETIC ANALYSIS OF EARLINESS AND GRAIN YIELD TRAITS IN TWO WHEAT CROSSES

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ABSTRACT

The six parameter model was used to determine the intra - and inter-allelic gene interactions controlling the inheritance of earliness and yield traits in two crosses of wheat (cross I : Saunval X Line 126; cross II : Gemmeiza 9 X Sids 4). Analysis of variance indicated that significant differences existed among generations i.e P_1, P_2, F_1, F_2, BC_1 and BC_2 for all studied traits in both crosses. Significant and positive additive (a) effects were exhibited in days to heading, days to maturity, spikes/plant and grain yield/plant in both crosses. This assures the enhancing effect of additive variance in the inheritance of these traits. Dominance (d) effects were significant and positive for grain filling period and 1000 - kernel weight in both crosses, days to heading, days to maturity, spikes/plant and grain yield/plant in cross I. Additive was larger in magnitude than dominance effect for days to heading in both crosses, days to maturity, spikes/plant and grain yield/plant in cross II. Digenetic epistatic gene effects were generally important in the inheritance of studied traits. Additive X additive (aa) gene effects were generally higher in magnitude than ad and dd gene effects. Significant and positive aa effects were exhibited for grain filling period in both crosses, days to heading, days to maturity and grain yield/plant in cross I. Additive X dominance type of epistasis exhibited significant and positive effects in only two cases, namely days to heading in cross I and grain filling duration in cross II. Significant and positive dominance X dominance epistatic effects were shown for days to maturity, spikes/plant and grain yield/plant in cross II. Significant and highly significant desirable percentages of heterosis relative to mid- parent were exhibited for days to heading, grain filing period, spikes / plant and grain yield / plant in both crosses. Only grain yield / plant of cross No. 1 showed highly significant desirable heterosis relative to the better parent of 43.24 %. Very high broad- sense heritability percentages (> 90 %) were obtained in all studied characters for both crosses. Narrow- sense heritability percentage was the lowest (21.22 %) for days to heading, medium (39.12 %) for grain filling period and the highest (88.02 %) for days to heading; all in cross I. Percentage of expected genetic advance from selection was the highest (55.44 %) for number of spikes/plant in cross II, and the lowest (2.40 %) for days to heading in cross I.

Key words: ***Wheat, Triticum aestivum, Earliness, Six parameter model, Epistasis, Heterosis, Heritability.***

INTRODUCTION

Wheat is the most important cereal crop in Egypt and world wide. Increasing grain yield and improving earliness of wheat in Egypt are considered important national goals to face the growing needs of the population; therefore, it has become necessary to develop early- maturing and high-yielding wheat genotypes.

The possibility of double cropping wheat and cotton in Egypt has heightened interest in early-maturing high-yielding wheats (Menshawy 2007). Early harvest of the wheat crop is critical to allow cotton crop sufficient time to develop and to produce an adequate yield.

A better understanding of the type of gene action and inheritance of earliness and yield traits would help wheat breeders to formulate the most advantageous breeding procedures for improving such traits. Additive gene action is evidently accounted for a large amount of the variation for days to heading (Bhatt 1972 Avey *et al* 1982 and Menshawy 2000 and 2005), days to maturity (Menshawy 2000, 2005 and 2007) and grain filling duration (Beiquan and Kronstad 1994 and Menshawy 2004), but dominance also was important (Crumpacker and Allard 1962, Avey *et al* 1982 and Menshawy 2005) for earliness traits, while epistasis was reported in few studies (Amaya *et al* 1972 and Ketata *et al* 1976) for earliness traits.

The present work was undertaken to study the role of different intra- and inter-allelic gene interactions, controlling the inheritance of earliness and yield traits in two bread wheat crosses.

MATERIALS AND METHODS

The present investigation was carried out at the experimental field of Giza Research Station, Agricultural Research Center (ARC), during three successive seasons from 2003/2004 to 2005/2006. Four bread wheat genotypes namely, Gemmeiza 9, Sids 4, Line # 126 and Sunval representing a wide range of variability in earliness traits were used as parents of two crosses in this study (Table 1). In the first season (2003/2004) two crosses (Sunval X Line 126 cross I and Gemmeiza 9 X Sids 4 cross II) were made to obtain their F_1 seeds. In the second season (2004/2005), the hybrid seeds were sown and F_1 plants of each cross were backcrossed to their respective parents to produce the two backcrosses (BC_1's and BC_2's). At the same time, the F_1 plants were selfed to produce F_2 seeds. In the third season (2005/2006), the obtained seeds of these populations, i.e. P_1's, P_2's, F_1's, F_2's, BC_1's and BC_2's for the two crosses (12 entries) were evaluated in the field using a randomized complete blocks design with three replications. Rows were 4 m long, 20 cm width and the space from plant to plant was 10 cm. Each plot consisted of two rows for each P_1, P_2, F_1, BC_1 and BC_2 and five rows for each F_2.

Table 1. Name, pedigree and origin of the four parental bread wheat genotypes used in this study.

Genotype	Pedigree	Origin	Maturity
Line 126	BCH"S"//HORK"S"/4/7C/PATO(B)/3/LR/INIA/BB/5/CNO/Gll//BB/INIA/3/NAPO//TOB66/SPROW"S"	Egypt	Early
Sids 4	Maya"S"Mon"S"/CMH74.A592/3/sakha8*	Egypt	Early
Gemmeiza 9	ALD'S'/HUAC'S'//CMH74A.630/SX	Egypt	Late
Sunval	COOK*2/VPM-1//3COOK(1345)	Australia	Very late

All agricultural practices were followed according to the recommendations. Data were recorded on 20 individual guarded plants in each P_1, P_2 and F_1, 40 plants in each BC_1 and BC_2 and 100 plants in each F_2 for number of days to 50% heading, number of days to 50% physiological maturity, grain filling period (days), number of spikes/plant, number of kernels/spike, 1000 kernel weight/(g) and grain yield/plant (g).

Heterosis (%) was calculated as the percentage increase of F_1 over the mid- and better parent values. Genetic analysis of generation means and estimates of mean effect $(\overline{m})$, additive (a), dominance (d), additive X additive (aa), additive X dominance (ad) and dominance X dominance (dd) effects were computed using the six-parameter model proposed by Gamble (1962). Heritability in both broad and narrow sense was calculated according to Mather (1949).

RESULTS AND DISCUSSION

Generation means and variances

Analysis of variance (not presented) indicated highly significant differences among the six generations for all studied traits of the two wheat crosses. Means $(\overline{X})$ and variances (S^2) of the six generations (P_1, P_2, F_1, F_2, BC_1 and BC_2) of the two studied wheat crosses for earliness and yield traits are presented in Table (2). Significant differences existed between the two parents (P_1 and P_2) of each cross for all studied traits. Such differences were more pronounced between parents for the three earliness traits and spikes/plant in both crosses and kernels/spike, 1000 kernel weight and grain yield/plant in cross II. Significant differences between means of parents of each hybrid is a prerequisite for the validity of six-parameter model to determine the magnitude of different gene effects for studied characters.

Means of both studied crosses for F_1, F_2, BC_1 and BC_2 generations for earliness and yield traits are logic as expected from the plant breeding

Table 2. Means ($\overline{X}$) and variances (S^2) of P_1, P_2, F_1, F_2, BC_1 and BC_2 populations of the two wheat crosses for earliness and yield traits.

Cross	Generation	Days to heading		Days to maturity		Grain filling period (days)	
		$\overline{x}$	S^2	$\overline{x}$	S^2	$\overline{x}$	S^2
Cross I.	P_1	128	1.88	170	1.67	42	1.00
Sunval	P_2	76	0.79	146	1.99	70	1.47
X	F_1	85	1.64	154	0.34	69	1.93
Line # 126	F_2	88	23.5	150	28.4	62	22.0
	BC_1	110	22.0	160	20.0	50	20.0
	BC_2	80	20.0	153	18.0	73	0.71
Cross II.	P_1	108	0.92	155	1.1	47	1.70
Gemmeiza 9	P_2	77	1.68	142	2.6	65	2.16
X	F_1	83	1.20	147	1.5	64	1.93
Sids 4	F_2	92	45.0	147	33.0	55	37.8
	BC_1	100	35.0	150	25.0	50	26.7
	BC_2	85	15.3	144	18.0	59	20.0
LSD 0.05		9		14		6	

Table 2. Cont.

Cross	Generation	Spikes/plant		Kernels/spike		1000-kernel weight(g)		Grain yield/plant(g	
		$\overline{x}$	S^2	$\overline{x}$	S^2	$\overline{x}$	S^2	$\overline{x}$	S^2
Cross I:	P_1	36	2.64	98	2.80	47	0.15	37	2.40
Sunval	P_2	16	1.63	95	0.21	50	0.40	30	2.11
X	F_1	31	1.18	75	0.01	48	0.92	53	1.98
Line #126	F_2	30	29.7	80	27.0	49	22.0	47	24.0
	BC_1	32	20.0	83	18.0	48	14.0	52	18.0
	BC_2	29	18.0	80	19.0	52	16.0	52	16.0
Cross II.	P_1	18	1.40	71	1.80	42	0.15	53	1.20
Gemmeiza	P_2	3.2	3.48	93	1.63	54	0.15	22	1.36
9	F_1	16	4.40	82	1.42	44	0.23	48	1.88
X	F_2	18	60.0	56	22.0	42	12.0	44	42.0
Sids 4	BC_1	18	57.0	76	15.0	40	10.0	46	22.0
	BC_2	11	25.0	87	11.0	50	4.00	33	26.0
LSD 0.05		9		8		15		12	

point of view. Results of Table (2) showed the existence of mid-parent heterosis for days to heading and days to maturity and heterobeltiosis (better-parent heterosis) for grain filling period in both crosses and grain yield/plant in cross I.

The high means of BC_1 for days to heading and days to maturity are due to lateness of the first parent (P_1), while the low means of BC_2 are due to the earliness of the second parent (P_2) in both studied crosses. Likewise, for spikes/plant in both crosses and grain yield/plant in cross II, the higher means of BC_1 are due to high means of P_1 and the lower means of BC_2 are due to the lower means of P_2.

The highest magnitude of variance (S^2) was reported by the F_2 generation for all studied earliness and yield traits in both crosses (Table 2) followed by that of backcross generations (BC'_1s and BC'_2s), while the lowest S^2 magnitude was exhibited by P_1, P_2 and F_1 populations, which is also logic from the breeding point of view, due to the homogeneity of such populations.

Gene effects

Estimates of gene effects calculated from the six-parameter model of the generation mean analysis are presented in Table (3). Significant mean effects ($\overline{m}$) were exhibited in all studied traits for both crosses.

The occurrence of significant and positive additive (a) effects was in 9 out of 14 cases, namely days to heading, days to maturity, spikes/plant and grain yield/plant in both crosses and kernels/spike in cross II. This assures the enhancing effect of additive variance in the inheritance of these traits.

These results indicated that the potentiality of improving the performance of these traits using pedigree selection program may be affective as reported by Abul-Naas *et al* (1993).

The estimates of dominance (d) effects were significant and positive in 9 out of 14 cases, namely grain filling period and 1000-kernel weight in both crosses, days to heading, days to maturity, spikes/plant and grain yield/plant in cross I and kernels/spike in cross II.

Additive was larger in magnitude than dominance effect in 6 cases, namely days to heading in both crosses, days to maturity, spikes / plant and grain yield/plant in cross II and kernels/spike in cross I. On the contrary, dominance was larger than additive variance in 7 cases, namely grain filling period and 1000-kernal weight in both crosses, days to maturity and grain yield/plant in cross I and kernels/spike in cross II. Similar conclusions were reported by Bhatt (1972), Avey *et al* (1982) and Menshawy (2005) for days to heading. However, Beiquan and Kronstad (1994) and Menshawy (2004) reported that additive was more important than dominance effect for grain filling period. Differences in conclusions between this study and others and between cross I and cross II with regard to the relative

Table 3. Mean estimates of the six gene effects for studied traits in two wheat crosses.

Trait	Cross	Gene action parameter					
		m	a	d	aa	ad	dd
Days to heading	I	88**	30**	15**	28**	4.30**	-33**
	II	92**	15**	-7.5	2.0*	-0.50	-21**
Days to maturity	I	150**	7**	10.65**	26**	-4.0**	-27**
	II	147**	6**	-7.50**	0.00	-0.5	3.0*
Grain filling period	I	49**	-23**	35.50**	22**	-9.0**	-19**
	II	48**	-2*	20**	12**	7.0*	-4.0*
Spikes /plant	I	30**	3.0*	3.0*	3.1*	1.5	-12.0**
	II	18**	7.0*	-8.6*	-14.2**	-0.4	9.20**
Kernels /spike	I	80**	3.0*	-15**	6.0*	1.5	11.0**
	II	56**	-11.0**	102**	102**	0.00	-10.0**
1000 kernel weight	I	49**	-4.0*	3.5*	4.0*	-2.50	-11.0**
	II	42**	-9.0**	6.7*	10.6**	-3.30*	-7.89*
Grain yield /plant	I	47**	5.0*	29.5**	10.0**	1.50	-35.0**
	II	44**	13.0**	-7.95**	-18.0**	-2.95*	31.9**

* & ** indicate significance at 0.05 and 0.01 levels of probability, respectively.
m¯= mean effect , a= additive effect and d= dominance effect.

importance of either additive or dominance effects may be due to the differences of the genetic background of materials used in these studies.

Significant digenetic epistatic gene effects (Table 3) were exhibited in most studied cases for all the three types of epistasis (aa, ad, and dd). This indicates that epistatic gene effects were generally important in the inheritance of studied traits. Additive X additive (aa) gene effects were generally higher in magnitude than ad and dd gene effects. Significant and positive aa effects were exhibited in 7 cases, i.e grain filling period in both crosses days to heading, days to maturity and grain yield/plant in cross I and kernels/spike and 1000-kernel weight in cross II. This result suggests an enhancing effect of additive X additive type of epistasis for inheritance of these traits. This component (aa) plus the additive (a) one are amenable types of gene action for more efficient selection.

The additive X dominance type of epistasis exhibited significant and positive effects in only two cases, namely days to heading in cross I and grain filling duration in cross II (Table 3).

Significant and positive dominance X dominance epistatic gene effects were shown in 4 cases, namely days to maturity, spikes/plant and grain yield/plant in cross II and kernels/spike in cross I.

Heterosis, heritability and genetic advance

Favorable (desirable) heterosis percentages in the present study were considered those with negative sign for days to heading and days to maturity and those of positive one for grain filling period and all studied yield traits.

Significant and highly significant desirable percentages of heterosis relative to mid- parent were exhibited for days to heading, grain filling period, spikes/plant and grain yield/plant in both crosses (Table 4). Only grain yield/plant of cross No. 1 showed highly significant desirable heterosis relative to the better parent (heterobeltosis) of 43.24 %. Mid- parent heterosis of grain yield/plant was 58.2 % for cross I and 28.0 % for cross II.

Significant favorable heterosis was also reported by many investigators (El- Borhamy 2000 Salgotra *et al* 2002 and Al- Naggar *et al* 2007 for days to heading and to maturity, Essa *et al* 1994 and El- Maghraby 1998 for spikes / plant and Walia *et al* 1993, El- Sherbeny *et al* 2000 Awaad 2002 and Al-Naggar *et al* 2007 for grain yield and its components).

Very high broad- sense heritability percentages (> 90 %) were obtained in all studied characters for both crosses (Table 4), indicating that genetic variance was accounted for most of the phenotypic variance. However, narrow- sense heritability percentage was the lowest (21.22 %) for days to heading, medium (39.12 %) for grain filling period and the highest (88.02 %) for days to heading; all in cross I (Table 4). The difference in magnitude between broad- and narrow- sense heritability is attributed to the non- additive genetic effects, i.e dominance, additive X dominance and dominance X dominance effects since narrow- sense heritability is based on additive effects which include additive and additive X additive heritability variance. Such differences were very high for days to heading and grain filling period in the first cross, suggesting that non-additive components accounted for the largest part of genetic variance for these cases. Heterosis breeding is a recommended procedure to utilize such non - additive components. On the contrary, in the second cross, days to

Table 4. The heterobeltosis %, heritability % and genetic advance from selection (in absolute units and percentage) for studied traits in two wheat crosses

Trait	Cross	Heterosis %		Heritability %		Genetic advance	
		BP	MP	Broad	Narrow	absolute	%
Days to heading	I	11.82*	-16.7*	93.87	21.22	2.11	2.40
	II	7.79	-10.3*	97.18	88.02	12.16	13.20
Days to maturity	I	5.80	-2.5	96.47	66.09	7.25	4.83
	II	3.52	-1.0	94.77	69.69	8.24	8.24
Grain filling period	I	-1.40	10.7*	93.34	39.12	4.07	8.32
	II	-1.50	14.3*	94.90	76.45	9.69	20.19
Spikes /plant	I	-13.89*	19.2*	93.89	72.22	8.11	27.04
	II	-11.11*	52.4**	94.80	62.54	9.97	55.44
kernels /spike	I	-23.47**	-22.3*	92.27	62.96	6.74	8.42
	II	-11.83*	0.0	92.64	81.81	7.90	14.12
1000 kernel weight	I	-4.00	1.0	97.77	63.63	6.14	12.54
	II	18.33*	8.3	98.53	83.33	5.94	13.92
Grain yield/plant	I	43.24**	58.2**	90.98	58.33	5.88	12.52
	II	-9.43	28.0**	96.47	85.71	11.44	26.00

* & ** indicate significance at 0.05 and 0.01 levels of probability levels, respectively.

heading, kernels/spike, 1000- kernel weight and grain yield/plant traits, which showed heritability in narrow-sense of above 80 %, indicating that selection in the segregating generations could be considered the method of choice.

Percentage of expected genetic advance from selection (Tale 4) was the highest (55.44 %) for number of spikes / plant in cross II, followed by (27.04 %) for spikes/plant in cross I and (26.00 %) for grain yield in cross II and the lowest (2.40 %) for days to heading in cross I. High percentage of expected genetic advance would help breeder in improving the trait of interest via a few cycles of selection. This conclusion was supported by many investigators (Shehab E- Din 1997, Abd El- Aty and Katta 2002, Menshawy 2005 and Al- Naggar *et al* 2007). This is applicable for number of spikes/plant in both crosses, grain filling period and grain yield/plant in the second cross.

REFERENCES

Abd El-Aty, M.S. M. and Y.S. Katta (2002). Genetic analysis and heterosis of grain yield and related traits in bread wheat. J. Agric. Res. Tanta Univ., 28 (2): 287-300.

Abul-Naas, A. A., M. A. Mahrous, A. A. El- Hosary (1993). Genetical studies on grain yield and some of its components in barley (Hordeum vulgare L) Egypt J. Agron. 18 (1 -2) 33-46.

Al-Naggar, A.M.M. M.A.Moustafa, M.M.Atta and M.T.Shehab- Eldeen (2007). Gene action of earliness and grain filling in bread wheat under two irrigation regimes. Egypt. J. Plant Breed. 11 (3):279 – 297.

Amaya, A.A. R.H Busch, and K.L. Lebsock, (1972). Estimates of genetic effects of heading date, plant height, and grain yield in *durum* wheat. Crop Sci., 12:478-481.

Awaad, H.A. (2002). Genetic analysis, response to selection and prediction of new recombinant lines in bread wheat (*Triticum aestivum* L.) Zagazig J. Agric. Res. 29: 1343-1366.

Avey, D.P. H.W. Ohm, F.L. Patterson and W.E. Nyquist, (1982). Advanced generation analysis of days to heading in three winter wheat crosses. Crop Sci., 22:912-915.

Beiquan, M. and W.E. Kronstad, (1994). Duration and rate of grain filling in selected winter wheat populations. I. Inheritance. Crop Sci. 34:833-837.

Bhatt, G.M. (1972). Inheritance of heading date, plant height and kernel weight in two spring wheat crosses. Crop Sci. 12:95-98.

Crumpacker, D.W., and R. W. Allard, (1962). A diallel cross analysis of heading date in wheat. Hilgardia 32:275-318.

El-Borhamy, H.S. (2000). Genetic Studies on Some Quantitative Characters in Bread Wheat (*Triticum aestivum* L.). Ph. D. Thesis, Fac. Agric. Moshtohor, Zagazig Univ. (Benha Branch), Egypt.

El-Maghraby, M.A.M. (1998). Genetic Evaluation of Yield and Its Components in Wheat (*Triticum aestivum* L.) Under Different Environments. Thesis M. Sc. in Department of Genetics, Fac. Agric. Alex. Univ, Egypt.

El-Sherbeny, G.A.R. M.H.Motawea, M.S. Hamada, and P.S. Baenziger, (2000). Nature of gene action controlling yield and its components in three crosses involving Egyptian and exotic bread wheat germplasm. Assiut J. Agric. Sci., 31: 203-214.

Eissa, M.M., A.R Al-Kaddoussi and S.M. Salama, (1994). General and specific combining ability and its interactions with sowing dates for yield and its components in wheat. Zagazig J. Agric. Res., 21: 345-354.

Gamble, E. E. (1962). Gene effects in corn (Zea mays L.). Separation and relative importance of gene effects for yield. Canadian of Plant Sci., 42: 339 – 348.

Ketata, H., E.L Smith,. L.H Edwards,. and R.W. McNew (1976). Detection of epistatic, additive, and dominance variation in winter wheat. Crop Sci. 16:1-5.

Mather, K. and J.L. Jinks (19 49). Biometrical Genetics. Chapman and Hall Ltd., London.

Menshawy, A.M.M. (2000). Genetical Studies on Spring Wheat. Ph. D. Thesis, Zagazig Univ. Egypt.

Menshawy, A.M.M. (2004). Genetical analysis of grain yield and related traits in bread wheat. Egypt. J. Agric. Res. 82 (1): 203-214.

Menshawy, A.M.M. (2005). Genetic analysis for earliness components in some wheat genotypes of different photothermal response. Egypt. J. Plant Breed. 9(1):31-47.

Menshawy, A.M.M. (2007). Evaluation of some early bread wheat genotypes under different sowing dates:1. Earliness characters. Egypt. J. Plant Breed. 11(1):25-40.

Salgotra, R.K., K.S Thakur, G.S. Sethi, and J.K. Sharma, (2002). Hetersois in winter x spring wheat crosses. Indian J. Genet., 62: 104-106.

Shehab El-Din, T.M. (1997). Three methods for studying the genetic behavior of heading date and plant height in several wheat crosses. J. Agric. Sci. Mansoura University 22:1297-1306.

Walia, D.P., Dawa, T. P. Plaha, and H.K. Chaudhary, (1993). Gene action and heterosis in bread wheat. Crop Improvement Society of India. 84-85.

التحليل الوراثى لصفات التبكير و صفات محصول الحبوب فى هجينين من القمح

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٣- قسم بحوث القمح ، معهد بحوث المحاصيل الحقلية ، مركز البحوث الزراعية ، الجيزة

استخدم نموذج المعلمات السته لتقدير التفاعلات بين اليلات الجين الواحد وبين اليلات الجينات المختلفه التى تتحكم فى وراثه صفات التبكير ومحصول الحبوب فى هجينين من قمح الخبز هما : الهجين الاول : سـنفال X سلالة رقم ١٢٦ و الهجين الثانى : جميزة ٩ Xسدس ٤. اشار تحليل الاختلاف الى وجود فروق معنويـه بـين الاجيال السته (الاب الاول ، الاب الثانى ، الجيل الهجينى الاول ، الجيل الهجينى الثانى ،الجيل الرجعى لـلاب الاول ،الجيل الرجعى للاب الثانى) لكل الصفات المدروسه فى كلا الهجينين. ظهرت تاثيرات معنويه و موجبـه للتبـاين المضيف فى صفات عدد الايام حتى طرد السنابل ، عدد الايام حتى النضج ،عدد سنابل النبات ومحـصول حبـوب النبات فى كلا الهجينين ، ويؤكد ذلك التاثير التعظيمى للتباين المضيف فى وراثه هذه الـصفات . كانـت تـاثيرات السياده معنويه وموجبه لفتره امتلاء الحبوب ووزن الـ ١٠٠٠ حبه فى كلا الهجينين وعدد الايـام حتـى الطـرد وعدد الايام حتى النضج وعدد سنابل النبات ومحصول حبوب النبات فـى الهجـين الاول . كـان مقـدار التبـاين

المضيف اكبر من تباين السياده بالنسبه لعدد الايام حتى الطرد فى كلا الهجينين ، عدد الايام حتى النضج ،عدد سنابل النبات ومحصول حبوب النبات فى الهجين الثانى ، كانت تاثيرات التفاعل بين اليلات الجينات المختلفه هامه بصفه عامه فى وراثه الصفات تحت الدراسه ، كانت تاثيرات التفاعل من نوع التباين المضيف اعلى بصفه عامة من التفاعلات التفوقيه من نوع (التباين المضيف X تباين السيادة) ، و(تباين السيادة X تباين السيادة) ، ظهرت تاثيرات معنويه وموجبه لتفاعل التفوق من النوع (المضيف X المضيف) فى صفه فتره امتلاءالحبوب فى كلا الهجينين وعدد الايام حتى الطرد وحتى النضج ومحصول حبوب النبات فى الهجين الاول ،وظهرت تاثيرات معنويه وموجبه للتفاعل من النوع (المضيف / السياده) فى حالتين فقط هما عدد الايام حتى الطرد فى الهجين الاول وفتره امتلاء الحبوب فى الهجين الثانى ، كما ظهرت تاثيرات معنويه وموجبه للتفاعل من نوع (السيادة X السيادة) فى صفات عدد الايام حتى النضج وعدد سنابل النبات ومحصول حبوب النبات فى الهجين الثانى . اشارت النتائج الى وجود قيم معنويه وعاليه المعنويه مرغوبه لقوه الهجين بالنسبه لمتوسط الابوين فى صفات عدد الايام حتى الطرد ، فتره امتلاء الحبوب ، وعدد سنابل النبات ومحصول حبوب النبات فى كلا الهجينين بينما ظهرت قوه هجين عاليه المعنويه مرغوبه بالنسبه للاب الاحسن فى حاله واحد فقط وهى محصول حبوب النبات فى الهجين الاول وقدرها ٤٣,٢٤% ، تم الحصول على نسب عاليه جدا لكفاءه التوريث العامه (تزيد عن ٩٠%) فى كل الصفات المدروسه لكلا الهجينين ، كانت قيم كفاءه التوريث الخاصه اقل مايمكن(٢١,٢٢%) لعدد الايام حتى الطرد ومتوسطه (٣٩,١٢%) لفتره امتلاء الحبوب ، واعلى ما يمكن (٨٨,٠٢%) لعدد الايام حتى الطرد فى الهجين الاول ،كان التقدم الوراثى المتوقع بالانتخاب اعلى ما يمكن (٥٥,٤٤%) لعدد سنابل النبات فى الهجين الثانى واقل ما يمكن (٢٠,٤٠%) لعدد الايام حتى الطرد فى الهجين الاول .

المجلة المصرية لتربية النبات ١٣ : ٣٧١-٣٨١ (٢٠٠٩)