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GENETIC ANALYSIS OF YIELD AND SOME YIELD ATTRIBUTES IN SOME EGYPTIAN WHEAT CULTIVARS

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ABSTRACT: Non-allelic interaction scaling tests (A, B, and C) coupled with joint scaling test χ^2 and six parameters model were applied to test the adeqacy of genetic model and estimate the nature of gene effects for; heading date (days), plant height (cm.), number of grains/spike, number of spikes/plant, grain weight / spike (g) and grain yield / plant (g) using the six generation (P_1, P_2, F_1, B_1, B_2 and F_2) of four wheat crosses; 1. Gemmeiza x Sids1, 2. Sakha 69 x Sakha 92, 3. Sids 7 x Giza 160 and 4. Giza. 164 x Sakha 8. Arandomized complete block design with three replications was used. The obtained results indicated the importance of additive genetic variance (D) in the genetic control of heading date (3rd cross) and grain weight/spike (all crosses) the value of $(H/D)^{0.5}$ less than one. While the dominance genetic variance (H) was found to be the prevailent type controlling for the remaining crosses in the studied characters and the value of $(H/D)^{1/2}$ was more than one fore these characters.

Heritability in narrow sense was high for heading date (3rd cross) and grain weight/spike (3rd and 4th crosses); while ranged from 0.11 (4th cross) to 0.32 (2nd cross) for grain yield/plant. The non-allellic interaction tests (A, B, and C) coupled with joint scaling test (χ^2) revealed that simple genetic model was adequate for explaining the inheritance of heading date (all crosses), plant height (2nd and 4th crosses) number of grains / spike (2nd and 4th crosses) and number of spikes/plant (all crosses), whereas, epistasis played a great role of controlling grain weight/spike and grain yield/plant (all crosses) and for the remaining characters and crosses. Additive (d) and additive x additive (i) interactions were significant for plant height and number of grains / spike for 1st and 3rd crosses and grain weigh t/ spike for 2nd and 3rd crosses. However, dominance (h) and the digenic interaction type dominance x dominance (L) controlling number of

grains/spike (1st and 3rd crosses), and grain weight/spike (2nd and 3rd crosses).

The additive (d) were significant and more importent for grain yield/plant for all crosses except 2nd cross; while additive x dominance were significant for all crosses except 1st cross. In general understanding the type of gene action controlling mechanism of the yield and yield attributes coupled with the reproduction system are considered the main limiting factors for choosing the appropriate breeding method. These information are of great interest for plant breeder to release high yielding wheat cultivars as well as early mature ones.

INTRODUCTION

The success in breeding programme depends on the amount of variability present for different characters in a population and its efficient management and utilization. Assessment the type of gene action for yield and yield attributes may help breeder to choose the method to improve grain yield indirectly. Several studies were employed to ascertaion mode of gene action in wheat. In this respect. Mitkees and Dawla (1983) for number of grains / spike and grain yield / spike, Chatrath and *et al.*, (1986). They showed that the simple additive dominance genetic model was adequate to explain the genetic variation for grain yield and the χ^2 values were non significant, Joshi (1986) and Mahdy (1988) found that dominance gene effects were important than the other effects for yield and yield attributes.

The inheritance and genetic model for grain weight/spike were investigated by Al Kaddoussi and Eissa (1989). They indicated that digenic model was appropriate to ascertain the genetic control for grain yield. Non allelic interaction tests (A, B, and C) and six parameters genetic model to test for epistasis were studied by Eissa and Al Kaddoussi (1989) in durum wheat. The simple genetic model was found to be adequate for explaning the genetic variation for number of spikes / plant number of grains / spike and spike grain weight by Hassan (1993). Shafey *et al* (1993) using six populations, indicated that the additive gene action was the predominant type controlling plant height, heading date, number of grains /spike grain yield / plant. Very limited studies were carried out to study the genetic control of yield and yield attributes characters in wheat Al Kaddoussi (1996), Awaad (1996); Sharma *et al* (1996); Shehab El-Din (1997), Salama (2000 a and b) and Salama and Samia (2002).

MATERIALS AND METHODS

1- Describtion of the parental genotypes and experimental procedures:

The present study was carried out at Tag El-Ezz Research Station, Dakhlia Governorate during three winter successive growing seasons i.e.; 1999/2000, 2000/2001 and 2001/2002. In 1999/ 2000 season the parental wheat genotypes of local origin were grown and four crosses were made by hand; Gemmeiza 1 x Sids 1, Sakha 69 x Sakha 92, Sids 7 x Giza 160 and Giza 164 x Sakha 8. The pedigree of the parental wheat genotypes are shown in Table (1). In the second season, 2000 / 2001 seeds of four F_1's were sown to produce F_1 plants and crossed between P_1, P_2 and F_1 to obtain backcross 1 (B_1) (F_1 x P_1), backcross 2 (B_2) (F_1 x P_2) and P_1 x P_2 (F_1 seeds) and the F_1 plants were selfed to produce F_2 seeds. In the third season 2001/2002, the obtained seeds of the six populations (P_1, P_2, F_1, F_2, B_1 and B_2) of the four crosses were sown on 20[th] November 2001 and evaluated using a randomized complete block design with three replications. Rows was 2m. Length. Spacings between rows was 20 cm. While it was 10 cm between plants. Plot area was $6m^2$ (2m x 3m). The experimental plot consists of two rows for each parent, F_1, and backcrosses and five rows for F_2 generation. The recommended agricultural practices of wheat production were applied.

2- Recorded data :

The studied characters were; heading date (days), plant height (cm) number of grains/ spike, number of spikes/plant, grain weight/spike (g.) and grain yield / plant (g.). Date were recorded on 10 competitive individual plants for each of the parental genotypes as well as F_1's, 20 in B_1 and B_2 and 50 in F_2, were labeled in each replicate.

3- Biometrical analysis:

The "t" statistical test was applied to test the differences between parental genotypes for the studied characters before considering the biometrical analysis.

a- Testing for the genetic model:

The scaling test A, B, and C were applied according to Mather and Jinks (1982), formulae to test the presence of non-allelic interactions were as follows:

$A = 2\bar{B}_1 - \bar{P}_1 - \bar{F}_1$,

$B = 2\bar{B}_2 - \bar{P}_1 - \bar{F}_1$ and

$C = 4\bar{F}_2 - 2\bar{F}_1 - \bar{P}_1 - \bar{P}_2$

Joint scaling test proposed by Cavalli (1952) as indicated χ^2 was applied to test the adequacy of the genetic model controlling the studied characters. Due to the unknown biased effect of nonallelic interaction, the simple genetic model (m), (d) and (h) was applied when epistasis was absent, whereas, in the presence of non-allelic interaction the analysis was proceeded to estimate the interaction types involved using the six – parameters genetic model of Jinks and Jones (1958) as follows:

m = Mean of $\bar{F}_2$

d= Additive gene effects = $\bar{B}_1 - \bar{B}_2$

h= Dominance gene effect $= \bar{F}_1 - 4\bar{F}_2 - (½)\bar{P}_1 - (½)\bar{P}_2 + 2\bar{B}_1 + 2\bar{B}_2$,

i = Additive x Additive = $2\bar{B}_1 + 2\bar{B}_2 - 4\bar{F}_2$,

j= Additive x Dominance = $\bar{B}_1 - ½\bar{P}_1 - \bar{B}_2 + ½\bar{P}_2$ and

l=Dominance x Dominance $= \bar{P}_1 + \bar{P}_1 + 2\bar{F}_1 + 4\bar{F}_2 - 4B_1 - 4B_2$.

The significancy of genetic components were tested using "t" test as follows,

$$\pm t = \frac{\text{effect}}{\sqrt{\text{variance of effect}}}$$

The genetic components of variance for each character in the studied crosses were partitioned into additive (D), dominance (H) genetic variance and environmental variance (E) using Mather (1949) and Mather and Jinks (1971) formula as follows:

$E_w = ¼(V\bar{P}_1 + V\bar{P}_2 + 2V\bar{F}_1)$,

$D = 4V\bar{F}_2 - 2(V\bar{B}_1 + V\bar{B}_2)$,

$H = (V\bar{B}_1 + V\bar{B}_2 - V\bar{F}_2 - Ew)$ and

$F = (V\bar{B}_2 - V\bar{B}_1)$

$(H/D)^{0.5}$ = Average degree of dominance

$F/(DxH)^{0.5}$ provides Little evidence that the dominance at different loci are particulary consistent in sign or magnitude.

Heritability in narrow sense (Tn) and Heritability in broad sense (Tb)were estimated.

RESULTS AND DISCUSSION

1- Mean performance:

Before considering the biometrical analysis for the studied character the "t" statistical test was applied for testing the parental genotypes involved. The "t" value was significant, suggesting that the employed parental wheat genotypes displayed enough amount of genetic variability. Thus, genetic differences for the genes controlling the studied characters were detected (Tables 2 and 3).

Mean and standard error of the six populations (P_1, P_2, F_1, F_2, B_1, and B_2) of the four wheat crosses for the studied characters are given in Tables (2 and 3). According to the mean of F_1 as compared with its standard error (SE). Results indicated that the F_1 was earlier than the early heading parent for all crosses, except cross 4. Whereas, the F_1 exceeded its high performing parent (HP) for number of grains / spike (all crosses except 2nd cross), grain weight/spike (all crosses) and grain yield/plant (all crosses except 3rd cross). These results provide evidence for the presence of overdominance gene effects and the increasing alleles were more frequent in the genetic constitution of wheat parental genotypes, and that dominant gene were dispersed. The F_1 means were close to the intermediate point for plant height (1st and 4th crosses), number of spikes/plant (3rd and 4th crosses) and grain yield / plant (3rd cross), indicating the predominant of additive gene effects in the inheritance of these characters. Whereas, F_1 mean were less than the smaller parent (low performing parent) for plant height (2nd and 3rd crosses), number of grains / spike (2nd cross) and number of spikes/plant (1st cross), indicating the predominant of decreasing alleles over the increasing ones for these characters in these crosses.

The F_2 mean of the four studied crosses in each character indicated high value from high parent for heading date (4th cross), plant height (1st cross), number of grains spike (all crosses except 2nd cross), grain weight /spike (all crosses) and grain yield / plant (2nd and 4th crosses) indicated appreciable amount of genetic variability for these characters in the corresponding crosses.

2- Component of genetic variance:

The assessment of the genetic variance Table (4), revealed that, the dominance genetic variance

(H) were higher in magnitudes than the corresponding additive (D) ones for, heading date (all crosses except 3rd cross), plant height, number of grains/spike, number of spikes/plant and grain yield/plant (all crosses). This resulted in average degree of dominance $(H/D)^{0.5}$ more than unit. However, additive component (D) was found to be the prevailed type controlling heading date (3rd cross) and grain weight/spike (all crosses). Thus, phenotypic selection would be effective in early segregating generations. The negative value for "F" together with the ratio $F/(HD)^{0.5}$, for heading date (2nd and 3rd crosses), plant height (all crosses), number of grains / spike and number of spikes / plant (1st and 3rd crosses) grain weight/spike (1st and 4th crosses), and grain yield / plant (1st and 2nd crosses), thus the decreasing alleles were more frequent. But, for the remining characters in four crosses the increasing allels exceeded the decreasing ones. Heritability in narrow sense were high for heading date 3rd cross (0.61) and grain weight / spike for 3rd and 4th crosses (0.53 and 0.55 respectively, suggesting the importance of straight forward phenotypic selection method to improve characters in this respect Al Kaddoussi and Eissa (1989), Hassan (1993) and Awaad (1996). But for the remaining characters heritability values ranged from (0.11) for grain yield / plant (4th cross) to 0.46 for grain weight / spike (1st cross). These results are in accordance with the findings of Hassan (1993), Al Kaddoussi (1996), Salama (2000 a, b) and Salama and Samia (2002).

Heritability in broad senes were low for grain yield / plant and ranged from 0.40 to 0.57 is quantitively inherited and the grain yield/plant greatly affected by environmental change.

3- Adequacy of the genetic model:

Data presented in Tables (5 and 6) provide evidence for insignificant (A, B and C) non-allelic interaction tests and joint scaling test (χ^2) for heading date (all crosses), plant height (2nd and 4th crosses), number of grains /spike (2nd cross), indicating that the simple genetic model (additive – dominance model) was adequate to explain the genetic variation controlling the inheritance of these characters in different crosses.

The estimates of types of gene action based on the means of the six generations of these characters using simple genetic model [(m) (d) and (h)] showed that additive (d) gene action was the main component controlling the inheritance of these characters.

These results are in accordance with those of Pawar *et al* (1988) who detected main and first order types at gene interactions of additive x additive for heading date and Hassan (1993) for plant height. Significantly of the non allelic interaction A, B and C and χ^2 for yield and its component was found by Ketata *et al.*, (1976) and Eissa (1994), Al Kaddoussi (1996) and Awaad (1996).

The most important digenic interactions as computed by the six parameter genetic model were; additive x additive [i] for plant height and number of grains/spike (1st and 3rd crosses). Whereas; dominance x dominance [l] were the prevailed type that controlled number of grains/spike (1st and 3rd crosses) and grain weight/spike (2nd and 3rd crosses).

The additive x dominance interaction types were controlling the plant height and number of grains/spike (1st and 3rd crosses), grain weight /spike (1st and 2nd crosses) and grain yield / plant (all crosses except 1st cross). Significanty of the non allelic interaction A, B, and χ^2 for yield and its compared was found by Ketata *et al* (1976) Eissa (1994), Al Kaddoussi (1996) and Awaad (1996).

These information are of great interest for wheat breeder to improve and release wheat genotypes to raise grain yield and early mature ones to overcome the gap between production and consumption in Egypt.

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Table (1): Pedigree of the studied parental and local wheat genotypes.

Serial number	Genotypes	Pedigree
1	Gemmeiza 1	Maya 74/ Dn//1160/ 147/3/Bb Gall /4/ Chat "S"
2	Sids 1	HD 2172/Pavon "S" // 1158 57/Maya 74 "S" SD 46 -45D-25D-15D-05D
3	Sakha 69	Inia/RL 4220 //7C/Yr "S"
4	Sakha 92	Napa 63 / Inia 66 // Wern "S"
5	Sids 7	MAYA "S"/MON "S"//CMH 74A 592/3/SAKHA 8*2
6	Giza 160	Chenab 70// G. 155.
7	Giza 164	Kvz/Buha "S" // Kal / Bb
8	Sakha 8	Indus / Norteno "S"

Table (2): Mean performance ± standard error of six populations ($\bar{P}_1$, $\bar{P}_2$, $\bar{F}_1$, $\bar{F}_2$, $\bar{B}_1$ and $\bar{B}_2$) of four wheat crosses for heading date, plant height and number of grains/spike.

Crosses Characters	1	2	3	4	1	2	3	4	1	2	3	4
population	Heading date (days)				Plant height (cm)				Number of grains/spike			
P_1	83.83± 0.12	85.62± 0.22	79.88± 0.20	88.31± 0.08	92.32± 0.35	88.20± 0.43	82.33± 0.37	94.16± 0.32	52.21± 0.16	51.02± 0.08	65.70± 0.23	54.66± 0.21
P_2	94.60± 0.10	93.88± 0.20	89.99± 0.12	98.32± 0.15	104.00± 0.28	99.70± 0.36	88.13± 0.22	106.8± 0.44	64.60± 0.14	58.86± 0.09	55.31± 0.18	48.06± 0.23
F_1	82.32± 0.25	81.99± 0.26	75.32± 0.20	102.30± 0.20	100.41± 0.47	85.12± 0.54	79.12± 0.48	95.12± 0.50	72.41± 0.25	50.0± 0.21	79.20± 0.28	56.30± 0.30
F_2	83.66± 0.21	84.40± 0.22	77.48± 0.28	101.40± 0.25	106.21± 0.25	86.40± 0.37	80.76± 0.26	100.40± 0.36	69.30± 0.18	52.32± 0.15	72.11± 0.18	55.0± 0.20
B_{c1}	84.71± 0.39	83.20± 0.47	78.90± 0.55	93.94± 0.76	93.63± 0.51	86.46± 0.38	81.12± 0.61	93.21± 0.86	51.60± 0.38	50.61± 0.28	68.30± 0.39	55.11± 0.42
B_{c2}	90.30± 0.45	88.40± 0.39	83.70± 0.42	99.60± 0.93	105.5± 0.48	87.30± 0.81	89.93± 0.56	101.22± 0.75	62.20± 0.32	55.41± 0.30	59.11± 0.34	51.60± 0.45
"t" test	**	**	**	**	**	**	**	**	**	**	**	**

Table (3): Mean performance ± standard error of six populations ($\overline{P}_1$, $\overline{P}_2$, $\overline{F}_1$, $\overline{F}_2$, $\overline{B}_1$ and $\overline{B}_2$) of four wheat crosses for number of spikes/plant, grain weight/spike and grain yield/plant.

Crosses Characters	1	2	3	4	1	2	3	4	1	2	3	4
Population	Number of spikes/plant				Grain weight / spike (g.)				Grain Yield / plant (g.)			
P_1	5.40 ± 0.08	5.70 ± 0.05	2.20 ± 0.13	5.10 ± 0.03	2.40 ± 0.05	2.62 ± 0.06	4.20 ± 0.06	2.04 ± 0.03	12.83 ± 0.16	11.89 ± 0.15	8.11 ± 0.12	10.41 ± 0.17
P_2	7.30 ± 0.07	6.60 ± 0.05	6.30 ± 0.08	6.40 ± 0.04	2.98 ± 0.05	2.73 ± 0.03	2.85 ± 0.03	2.52 ± 0.03	16.82 ± 0.12	14.81 ± 0.14	12.39 ± 0.14	13.82 ± 0.18
F_1	5.20 ± 0.16	5.10 ± 0.09	2.80 ± 0.12	5.40 ± 0.06	3.22 ± 0.06	3.11 ± 0.05	4.82 ± 0.07	2.91 ± 0.04	17.73 ± 0.28	16.22 ± 0.17	10.92 ± 0.15	16.51 ± 0.18
F_2	5.30 ± 0.08	5.40 ± 0.06	2.90 ± 0.08	5.90 ± 0.05	3.10 ± 0.02	3.42 ± 0.02	4.87 ± 0.03	3.08 ± 0.02	14.49 ± 0.07	15.98 ± 0.07	11.82± 0.06	15.60 ± 0.07
B_{c1}	5.00 ± 0.17	5.60 ± 0.13	2.60 ± 0.19	5.60 ± 0.11	2.62 ± 0.05	2.32 ± 0.04	4.42 ± 0.05	2.77 ± 0.04	12.42 ± 0.16	15.92 ± 0.16	11.36 ± 0.14	15.22 ± 0.15
B_{c2}	6.30 ± 0.16	6.30 ± 0.14	5.20 ± 0.17	6.26 ± 0.12	3.50 ± 0.04	3.16 ± 0.05	3.20 ± 0.03	3.28 ± 0.03	16.61 ± 0.15	15.99 ± 0.15	13.52 ± 0.15	16.79 ± 0.19
"t" test	**	**	**	**	**	**	**	**	**	**	**	**

Table (4): Components of genetic variance, derived parameters and heritability in broad and narrow sense for studied characters.

		Parameters							
Characters	Cross	D	H	E	F	$(H/D)^{0.5}$	$F/(DH)^{0.5}$	$T_{(n)}$	$T_{(b)}$
Heading date (days)	1	8.34	17.92	1.79	1.17	1.46	0.10	0.46	0.83
	2	10.08	15.28	2.36	-1.62	1.23	-0.13	0.45	0.80
	3	16.94	14.80	1.72	-2.63	0.93	-0.17	0.61	0.80
	4	13.40	48.24	1.56	3.28	1.90	0.06	0.33	0.92
Plant height (cm)	1	9.58	14.52	3.89	-0.58	1.23	-0.04	0.33	0.68
	2	12.00	31.92	4.69	-0.96	2.66	-0.05	0.32	0.75
	3	6.26	24.80	3.86	-0.99	1.99	-0.08	0.24	0.71
	4	7.98	38.88	4.39	-2.23	2.21	-0.13	0.22	0.77
Number of grains/spike	1	7.16	13.52	1.98	-2.24	1.37	-0.22	0.40	0.78
	2	5.90	11.56	1.48	0.34	1.39	0.04	0.40	0.80
	3	6.48	13.04	2.42	-0.94	1.42	-0.10	0.36	0.73
	4	4.78	19.84	2.62	0.51	2.04	0.05	0.24	0.74
Number of spikes/plant	1	2.14	7.28	0.86	-0.01	1.84	0.002	0.28	0.77
	2	0.98	6.96	0.70	0.25	2.78	0.10	0.16	0.69
	3	1.18	9.08	1.13	-0.35	2.77	0.11	0.15	0.70
	4	0.84	6.12	0.50	0.26	2.77	0.11	0.17	0.79
Grain weight/ spike (g)	1	3.32	1.36	1.61	-0.01	0.64	0.005	0.46	0.55
	2	2.98	2.20	1.36	0.01	0.85	0.004	0.44	0.60
	3	5.04	2.16	1.69	0.01	0.65	0.003	0.53	0.64
	4	3.50	1.49	1.08	-0.01	0.64	0.004	0.55	0.66
Grain yield / plant (g.)	1	4.46	8.0	6.3	-0.40	1.35	-0.07	0.21	0.40
	2	7.12	11.20	4.72	-0.60	1.25	-0.07	0.32	0.57
	3	1.52	16.60	4.26	0.62	3.30	0.12	0.08	0.53
	4	2.24	15.08	5.34	0.92	2.59	0.15	0.11	0.48

Table (5): Testing for non-allelic interactions (A, B and C), χ^2 and six parameters genetic model for heading date, plant height and number of grains / spike of four wheat crosses.

Parame-ters	Cross No.	Non-allelic interaction test			Joint scal-ing test	Six-parameter genetic model					
		A	B	C	X^2	m	[d]	[h]	[i]	[j]	[L]
Heading date (days)	1	3.27	3.68	-9.43	N.S.	83.66**	-5.59**	8.49	-	-	-
		±1.93	±2.15	±4.58		±0.21	±0.84	±7.03	-	-	-
	2	-1.21	0.93	-5.88	N.S	84.40**	-5.20**	-2.16	-	-	-
		±1.36	±1.24	±4.98		±0.22	±0.86	±7.47	-	-	-
	3	2.44	2.09	-10.59	N.S	77.78**	-4.80**	6.08	-	-	-
		±2.52	±2.00	±5.68		±0.28	±0.97	±8.75	-	-	-
	4	-2.73	-1.42	14.37	N.S	101.40**	-5.66**	-9.53	-	-	-
		±3.32	±4.07	±7.53		+0.41	±1.69	±13.69	-	-	-
Plant height (cm2)	1	-5.47	6.59*	27.70**	**	106.21**	11.87**	-24.33**	-26.58**	-6.03**	25.46
		±2.86	±2.67	±6.51		±0.25	±0.99	±8.59	±7.96	±1.15	±22.35
	2	1.28	0.58	-12.54	N.S.	86.40	-5.40**	5.57	-	-	-
		±4.21	±3.93	±8.87		±0.37	1.37	12.94	-	-	-
	3	0.79	12.61**	-5.9	**	80.70	-8.81**	13.19	19.30*	11.71**	-32.70
		±3.29	±2.94	±6.67		±0.26	±1.17	±9.47	±8.84	±1.32	±25.39
	4	-286	0.52	10.40	N.S	100.46	-8.01**	-18.10	-	-	-
		±4.26	±0.94	+8.52		±0.36	±1.61	±12.89	-	-	-
Number Of Grains /spike	1	-21.41**	-12.61**	15.59**	**	69.30**	-10.6**	-35.60**	-49.6**	-4.40**	83.61**
		±1.03	±1.67	±4.18		±0.18	±0.70	±6.11	±5.68	±0.77	±15.38
	2	0.18	2.02	0.54	N.S.	52.32**	-4.81**	-2.17	-	-	-
		±1.14	+1.15	+3.41		±0.15	±0.58	±4.97	-	-	-
	3	-0.3**	-16.299**	9.03*	**	72.11**	9.19**	-14.92*	-33.62**	3.99*	58.21**
		±2.07	±1.82	±4.41		±0.18	±0.73	±6.18	±5.80	±0.83	±16.09
	4	-0.74	-1.16	4.68	N.S	55.00**	3.51**	-1.64	-	-	-
		±2.19	±2.33	±4.84		±0.20	±0.87	±7.09	-	-	-

Table (6): Testing for non-allelic interactions (A, B and C), χ^2 and six parameters genetic model formula number of spikes / plant, grain weight / spike and grain yield / plant of four wheat crosses.

Parameters Character	Cross No.	Non-allelic interaction test A	B	C	Joint scaling test X^2	Six-parameter genetic model m	|d|	|h|	|i|	|j|	|L|
	1	-0.60	0.10	-1.90	N.S.	5.30*	1.30**	0.25	-	-	-
Number		+0.81	+0.86	±1.83		±0.08	±0.33	±2.73	-	-	-
Of spikes	2	0.40	0.90	-0.90	N.S	5.40**	0.70**	1.15	-	-	-
/ plant		0.66	0.70	1.42		0.06	0.27	2.15	-	-	-
	3	0.30	1.30	-2.5	N.S	2.90**	2.60**	2.55	-	-	-
		±1.01	±0.88	±1.97		±0.08	±0.36	±2.89	-	-	-
	4	0.70	0.60	1.30	N.S	5.90**	0.60**	0.35	-	-	-
		±0.53	±0.58	±1.11		±0.05	±0.23	±1.78	-	-	-
	1	-0.38	0.80*	0.58	**	3.10**	-0.88**	0.37	-0.16	-0.59**	-0.26
		±0.37	± 0.27	±0.66		+0.14	+0.09	±0.76	±0.68	±0.19	0.31
Grain	2	-1.09**	0.36	2.11**	**	3.42**	-0.78**	-2.40**	-2.84**	-0.67**	3.57**
Weight/		±0.22	±0.32	±0.60		±0.14	0.09	0.75	0.68	0.17	0.61
Spike	3	-0.18	-1.27**	2.79**	**	4.89**	1.22**	-2.95**	-4.24**	-0.13	5.69**
(g.)		±0.33	±0.34	±0.85		±0.17	±0.11	±1.01	±0.92	±0.20	±1.63
	4	0.55**	1.13**	1.94**	**	3.08**	-0.51**	0.41	-0.22	-0.03	-1.5
		±0.23	±0.23	0.54		±0.15	±0.07	±0.65	±0.60	±0.13	±1.44
	1	-5.72**	-1.33	7.15**	**	14.49**	-4.19**	3.00	0.10	-0.20	6.95
		±1.08	1.04	2.52		±0.26	±0.31	±2.71	±1.91	±0.59	±7.64
Grain	2	3.73**	0.95	4.78*	**	15.98**	-0.07	2.77	-0.,10	2.85**	-4.58
Yield /		±0.96	±0.91	2.09		±0.26	±0.31	±2.60	±1.91	±0.64	±7.05
Plant (g.)	3	3.57**	3.73**	4.94**	**	11.82**	-2.22**	3.03	2.36	2.06**	-0.66
		±0.83	±0.89	±1.82		±0.24	±0.29	±2.34	±1,67	±0.55	±6.46
	4	3.52**	3.25**	5.15**	**	15.60	-1.57**	6.01*	1.62	1.84**	-9.39
		±0.95	±1.12	±2.19		±0.26	±0.94	±2.75	1.91	±0.69	±7.63

التحليل الوراثي للمحصول وبعض مساهمته في بعض أصناف القمح المصرى

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إستخدم إختبار التفاعلات الغير أليليه $[\chi^2(C, B, A)]$ والنموذج الثلاثى والسداسى الوراثـــى لدراســة النظام الوراثى المتحكم وكذلك دراسة الإختلافات الوراثية وطبيعة تأثير الفعل الجينى فى وراثة صفات ميعـــاد طرد السنابل (اليوم) وإرتفاع النبات (السم) وعدد حبوب السنبلة وعدد السنابل ووزن حبوب الســنبلة (الجـرام) ومحصول النبات بالجرام وذلك بإستخدام العشائر الستة (الآباء والجيل الأول والهجن الرجعيـــة لكــلا الأبويــن والجيل الثانى) فى أربعة هجن من القمح المصرى المحلى وهى:

(١) جميزة ١ × سدس ١ (٢) سخا ٦٩ × سخا ٩٢

(٣) سدس ٧ × جيزة ١٦٠ (٤) جيزة ١٦٤ × سخا ٨

ويمكن تلخيص النتائج المتحصل عليها على الوجه التالى:-

١- أوضحت النتائج أهمية التباين الراجع للفعل الجينى المضيف فى وراثة ميعاد طرد السنابل (الهجين الثـالث) ووزن حبوب السنبلة (جميع الهجن).

٢- كان للتباين الراجع للفعل الجينى السيادى الأثر الأكبر فى وراثة جميع الصفـــات المتبقيـــة فـــى الـــهجن المدروسة وتطابق ذلك مع النسبة $(H/D)^{0.5}$ حيث كانت أكبر من الوحدة.

٣- كانت كفاءة التوريث بالمعنى الضيق مرتفعة وأكثر من ٥٠% لميعاد طرد السنابل (الهجين الثـالث) ووزن حبوب السنبلة (الهجينين الثالث والرابع) بينما تراوحت لمحصول الحبوب للنبات بين ٠,١١ للهجين الرابـــع إلى ٠,٣٢ للهجين الثانى.

٤- وجد أن النموذج الوراثى البسيط كان ملائما لدراسة السلوك الوراثى لصفات ميعاد طرد السنابل (الجميـــع الهجن) وإرتفاع النبات (الهجينين الثانى والرابع) وعدد السنابل للنبات (لجميع الهجن) بينما كان النمـــوذج غير ملائما لدراسة السلوك الوراثى لباقى الصفات فى الهجن المدروسة.

٥- كان الفعل الجينى المضيف والتفاعل غير الأليلى (المضيف × المضيف) معنويا لصفات إرتفـــاع النبـــات وعدد حبوب السنبلة (الهجينين الأول والثالث) ووزن حبوب المنبلة (الهجينين الثانى والثالث)، بينما كـــان الفعل السيادى والتفاعل الغير أليلى (السيادى × السيادى) معنويا وله الأثر الأكبر فى وراثة عـــدد حبـــوب السنبلة (الهجينين الأول والثالث) ووزن حبوب السنبلة (الهجينين الثانى والثالث).

٦- كان الفعل الجينى المضيف معنويا لجميع الهجين فى محصول الحبوب للنبات بينما كان التفـــاعل الغـــير أليلى معنويا لجميع الهجن فى نفس الصفة ما عدا الهجين الأول.

٧- وعلى وجه العموم يعتبر معرفة النظام الوراثى المتحكم فى المحصول ومساهمته من أهم الأسس لتحديـــد طريقة التربية المستخدمة، وهذه المعلومات مهمة بالنسبة لإستنباط أصناف عالية المحصـــول مـــن القمـــح ومبكرة النضج أيضا.