Minufiya J. Agric. Res. Vol. 32 No.4: 1055 - 1069 (2007)

TRIPLE TEST-CROSS ANALYSIS OF SOME QUANTITATIVE CHARACTERS IN BREAD WHEAT (*Triticum aestivum* L.)

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(Received: May , 29 , 2007)

ABSTRACT: ***Nineteen common wheat varieties were used to establish the experimental materials for the multiple mating desing used in this concern i.e., triple test cross analysis.***

Testers mean square estimates were detected to be significant for heading date, plant height, number of spikelets per main culm ear and number of spikelets per ear. Lines vs testers mean square estimates were found to be highly significant for all traits studied except heading date. The two testers Sakha 69 and Vee "S" (P_1 vs P_2) were detected to be different from each other in plant height, number of spikelets per main culm ear, number of grains per spikelet and nearly 1000-grain weight.

Genotypes, hybrids and parents mean square estimates were found to be highly significant for all traits under investigation. Hybrids vs parents mean squares were highly significant for all traits studied except main culm ear length, number of grains per main culm ear and main culm ear yield.

Significant epistasis was detected for all characters studied. Further partitioning of the epistasis revealed that mean square estimates due to additive × additive (I) epistatic types were found to be significant for mostly characters studied. Additive × dominance (J) and dominance × dominance (L) epistatic types were found to be significant for mostly all traits studied.

The additive genetic variance (D) was found to be much larger in magnitudes than the dominance variance (H) for all traits studied and that resulted in $(H / D)^{1/2}$ to be less than one.

The correlation coefficients between sums (L1i + L2i) and differences (L1i – L2i) were found to be negative for number of productive tillers, plant height, ear yield and 1000-grain weight. However, the remaining traits showed positive correlation and both directions were insignificant hence the dominance was ambid.

Key words: ***Triple test cross, Additive, Dominance, Epistasis.***

INTRODUCTION

Identification of the genetic variance components and the type of gene action determining the inheritance of the agronomic traits has attracted the attention of most geneticists and plant breeders because of their implication in choosing the most efficient selection and procedures to be used for the improvement of these characters.

Most of the designs used in estimating the genetic components of variation assume the absence of epistasis. However, epistatic interactions have frequently been reported by many scientists in wheat (Singh and Singh 1976; Ketata *et al* 1976; Singh1981; Comber 2001 and others). Under such situation most of the information on the genetic analysis is biased due to the presence of epistasis. Among all the designs available for estimation of gene action, triple-test cross is considered the most efficient model as it provides not only a precise test for epistasis, but also unbiased estimates of additive and dominance components if epistasis is absent (Singh and Yunus 1986). In self-pollinated species like wheat, epistasis is perhaps more important to breeders than dominance, because the later is necessarily ephemeral in such species. Epistasis can also be partitioned into three components i.e., additive × additive, additive × dominance and dominance × dominance (Hayman and Mather 1955).

The objectives of the present study are to establish: (1) the role of non-allelic interaction (epistasis) in the inheritance of grain yield and its components using triple test cross suggested by Kearsey and Jinks (1968) and modified by Ketata *et al* (1976) and (2) the detection and estimation of additive (D) and dominance (H) components of genetic variation according to Kearsey and Jinks (1968), Jinks *et al* (1969) and Jinks and Perkins (1970).

MATERIALS AND METHODS

This experiment was also carried out at the Experimental Farm, Faculty of Agriculture Minufiya University at Shebin El-Kom during the three successive seasons 2001 / 2002, 2002 / 2003 and 2003 / 2004. The two wheat varieties Sakha 69 and Vees were crossed to produce their F_1 to be used as three testers. Seventeen wheat varieties, namely Sham 4, Gimmeiza 5, Gimmeiza 7, Gimmeiza 9, Giza 157, Giza 164, Giza 167, Giza 168, Sakha 61, Sakha 93, Sakha 202, Sakha 206, Sids 1, Sids 4, Sids 6, Sids 8 and Sids 9 each was crossed to the three testers Sakha 69 (P_1), Vees (P_2) and their F_1 (Sakha 69 × Vees) to generate 51 crosses i.e. 17 L1i, 17 L2i and 17 L3i progeny families of a triple test cross design in 2002 / 2003 winter growing season (Ketata et al 1976). The fifty one families (crosses), their seventeen parents and the three testers were grown in a randomized complete block design with three replicates in 2003 / 2004 winter growing season. Each progeny family was grown in a 3 meters long row with row to row distance of 30 cm. and plant to plant distance of 10 cm. All the normal agronomic practices were followed as usual in the ordinary wheat fields in the area of the study. Ten competative plants from each row were scored for the subsequent quantitative traits i.e. (heading date(days),plant height (cm), number of productive tillers per plant, main culm ear length(cm), number of spikelets per main culm ear, number of grains per main culm ear, main culm ear yield, number of spikelets per ear, Number of grains per ear, Number of grains per spikelet, ear yield (g), 1000-grain weight (g) and grain yield per plant(g)).

Biometrical analysis

Test of epistasis and detection and estimation of additive (D) and dominance (H) components of genetic variations were carried out according to Kearsey and Jinks (1968), Jinks *et al* (1969) and Jinks and Perkins (1970).

The triple test cross families were firstly subjected to the convential two way analysis of variance for (L1i, L2i and L3i) and (L2i and L3i) sets of families for each character studied. The variance of the comparison (L1i + L2i – 2 L3i) was used to test the presence of epistasis, where L1i, L2i and L3i are the means of the family in respect of the tester concerned. The variance of sums (L1i + L2i) and differences (L1i – L2i) were used to detect the presence of additive (D) and dominance (H) components of genetical variation respectively.

RESULTS AND DISCUSSION

Most of the designs, used in the estimating the genetic components of variation, assume the absence of epistasis. However, epistatic interactions have frequently been reported by many scientists in wheat. Under such a situation most of the information on the genetic analysis is biased due to the presence of epistasis. Triple test cross however, provides not only a precise test for epistasis but also unbiased estimates of additive (D) and dominance (H) components if epistasis is absent. In self-pollinated species epistasis is perhaps more important to breeders than dominance, because the later is necessarily ephemeral in such species. The early attempts to partition the genetic variance were done by Fisher (1918), where he classified the genetic variance into three components, additive, dominance and epistasis. This classification was further developed by Hayman and Mather (1955), where they showed that epistasis can also be partitioned into three components, additive × additive (I), additive × dominance (J) and dominance × dominance (L).

The mean performances of the triple test cross fifty one families for the thirteen traits studied are presented in Table (1). The mean squares of the analysis of variance for all traits studied are presented in Table (2). Genotypes, hybrids and parents mean square estimates were found to be highly significant for all traits under investigation, indicating the presence of

Table 1: Mean performances of the triple test cross families for all traits studied.

A-Hybrids		Heading date,days	Number of productive tillers	Plant height,cm	Main culm ear length,cm	Number of spikelets per main culm ear	Number of grains per main culm ear	Main culm ear yield,g	Number of spikelets per ear	Number of grains per ear	Number of grains per spikelet	Ear yield,g	1000-grain weight,g	Grain yield per plant,g
Sham 4	× P_1	87.70	9.90	116.06	12.29	23.26	69.43	3.26	19.23	47.89	2.48	2.18	45.43	21.68
	× F_1	86.66	9.16	109.70	12.48	22.76	70.26	2.99	19.41	53.57	2.74	2.15	40.87	19.85
	× P_2	88.40	9.50	101.56	12.69	22.46	74.16	2.90	19.04	52.05	2.72	1.92	36.90	18.15
Gimmeiza 5	× P_1	84.26	10.63	118.63	13.65	24.33	79.60	3.28	20.32	55.99	2.74	2.25	39.80	23.49
	× F_1	83.43	9.10	114.56	13.48	24.00	78.10	3.20	20.70	58.21	2.82	2.38	40.42	21.20
	× P_2	84.60	10.90	104.93	13.55	23.53	84.10	3.06	19.92	59.45	2.97	2.10	35.11	22.65
Gimmeiza 7	× P_1	87.83	8.33	122.10	14.03	24.70	79.16	4.64	20.85	53.48	2.55	3.03	57.16	25.49
	× F_1	89.63	6.80	120.13	13.91	24.60	72.30	4.01	20.61	50.13	2.44	2.79	54.65	19.26
	× P_2	90.00	7.56	108.26	14.15	24.03	80.50	3.96	20.60	58.64	2.85	2.84	48.71	21.62
Gimmeiza 9	× P_1	90.43	9.73	121.36	13.37	24.46	59.80	3.16	20.19	44.75	2.20	2.28	51.36	22.50
	× F_1	85.33	8.70	117.20	13.44	24.46	71.56	3.37	20.63	54.40	2.65	2.44	45.28	21.23
	× P_2	91.83	9.13	113.46	13.19	23.56	75.60	3.45	20.32	56.03	2.58	2.39	43.25	21.78
Giza 157	× P_1	93.10	9.73	118.03	12.44	22.66	62.20	2.79	18.71	42.94	2.27	1.92	45.13	18.79
	× F_1	90.60	8.53	115.36	12.57	23.36	67.06	2.76	19.27	45.33	2.34	1.85	41.08	15.73
	× P_2	90.50	9.53	111.06	13.02	23.56	72.63	3.08	19.79	50.83	2.55	2.20	43.49	21.47
Giza 164	× P_1	94.13	10.43	124.60	14.10	24.63	80.10	4.14	20.38	51.70	2.52	2.62	51.57	27.59
	× F_1	93.06	8.93	119.53	13.64	24.10	75.46	3.37	20.30	54.48	2.66	2.46	45.06	22.08
	× P_2	91.93	10.90	113.53	13.89	23.86	79.80	3.48	20.52	59.28	2.93	2.50	42.43	27.50

Table 1: Cont.

A-Hybrids		Heading date,days	Number of productive tillers	Plant height,cm	Main culm ear length,cm	Number of spikelets per main culm ear	Number of grains per main culm ear	Main culm ear yield,g	Number of spikelets per ear	Number of grains per ear	Number of grains per spikelet	Ear yield,g	1000-grain weight,g	Grain yield per plant,g
Giza 167	× P_1	91.90	9.46	121.70	14.01	24.03	72.46	3.62	19.84	49.83	2.47	2.39	48.11	22.93
	× F_1	88.46	9.23	117.50	14.13	23.56	79.03	3.33	20.18	55.67	2.73	2.30	41.47	22.20
	× P_2	91.10	8.50	117.33	13.74	23.56	76.53	3.19	20.17	55.56	2.73	2.39	41.97	20.31
Giza 168	× P_1	89.76	10.13	112.30	14.71	24.36	81.13	3.89	21.34	58.07	2.71	2.59	44.59	26.33
	× F_1	90.50	9.63	108.00	14.05	23.63	79.90	3.51	20.38	54.89	2.69	2.43	44.99	23.89
	× P_2	90.20	10.23	104.13	14.20	23.56	85.36	3.67	20.75	60.19	2.96	2.43	39.65	24.99
Sakha 61	× P_1	87.9	8.80	118.83	13.56	23.16	68.96	3.54	19.43	48.85	2.48	2.40	49.72	21.63
	× F_1	87.20	7.93	112.86	13.28	23.53	68.73	3.13	19.84	49.71	2.50	2.29	45.75	18.94
	× P_2	89.46	9.43	102.53	13.02	22.76	74.33	3.23	19.75	52.15	2.65	2.26	43.35	22.15
Sakha 93	× P_1	79.96	10.36	108.56	13.36	23.63	63.93	3.39	20.38	44.97	2.20	2.34	51.94	24.42
	× F_1	81.76	8.90	102.40	13.13	22.83	79.00	3.52	20.61	59.07	2.84	2.57	44.02	22.59
	× P_2	81.10	10.83	98.10	13.07	22.86	80.13	3.58	20.09	58.19	2.93	2.57	43.74	27.75
Sakha 202	× P_1	91.83	9.46	125.00	14.06	24.06	72.86	3.66	19.93	49.34	2.46	2.36	48.69	22.46
	× F_1	90.53	9.33	117.50	13.92	23.70	75.60	3.50	20.38	54.01	2.59	2.49	46.73	23.40
	× P_2	92.26	8.70	108.26	13.52	23.06	67.66	2.74	19.82	52.96	2.64	2.04	38.66	18.31
Sakha 206	× P_1	91.40	10.56	120.80	13.81	23.40	57.66	3.02	18.87	41.46	2.18	1.96	47.47	20.33
	× F_1	83.73	9.33	117.80	14.01	23.90	73.70	3.12	20.21	50.39	2.47	2.05	40.31	19.25
	× P_2	84.43	10.80	110.63	15.11	24.56	87.76	3.53	20.97	60.03	2.83	2.45	40.59	26.29

Table 1: Cont.

A-Hybrids		Heading date,days	Number of productive tillers	Plant height,g	Main culm ear length,g	Number of spikelets per main culm ear	Number of grains per main culm ear	Main culm ear yield,g	Number of spikelets per ear	Number of grains per ear	Number of grains per spikelet	Ear yield,g	1000-grain weight,g	Grain yield per plant,g
Sids 1	× P_1	90.33	8.96	122.23	14.44	23.86	73.90	3.51	20.77	56.83	2.71	2.58	44.58	23.38
	× F_1	90.86	8.73	121.03	14.03	23.60	77.93	3.40	20.53	55.98	2.70	2.25	40.51	19.79
	× P_2	86.40	8.43	116.46	14.29	23.60	80.33	3.55	20.52	57.70	2.82	2.44	42.66	20.71
Sids 4	× P_1	75.30	10.13	116.33	14.78	23.30	78.13	4.24	20.13	57.26	2.84	3.09	53.77	31.84
	× F_1	75.33	8.03	110.36	13.33	22.00	70.33	3.64	19.37	51.48	2.65	2.70	52.77	21.60
	× P_2	77.06	9.50	105.43	14.42	22.80	79.56	4.21	20.25	61.61	3.02	3.23	51.83	30.86
Sids 6	× P_1	89.23	9.66	120.93	14.59	23.46	69.73	3.74	19.74	49.91	2.50	2.66	53.81	25.98
	× F_1	88.83	8.96	111.66	14.48	23.53	76.33	3.82	19.76	52.39	2.63	2.56	49.02	23.70
	× P_2	89.04	9.30	104.83	14.68	23.03	77.56	3.93	19.86	57.23	2.90	2.86	49.88	26.82
Sids 8	× P_1	82.90	11.03	111.40	15.28	24.80	91.16	4.68	22.03	66.05	2.98	3.32	50.09	36.38
	× F_1	86.56	6.13	106.86	14.29	23.36	77.96	3.76	20.77	59.44	2.89	2.79	47.71	17.16
	× P_2	90.63	8.03	103.70	14.27	23.16	84.16	4.14	21.44	66.38	3.08	3.19	47.88	26.46
Sids 9	× P_1	85.40	10.23	113.20	14.39	24.10	75.70	3.85	20.22	52.97	2.60	2.57	48.69	27.11
	× F_1	82.46	8.76	111.66	14.94	24.30	85.73	3.98	21.35	67.61	3.13	3.08	45.45	26.56
	× P_2	87.46	8.86	100.40	14.63	23.90	88.83	4.25	20.97	67.92	3.12	3.22	47.44	28.62

Table 2: Mean squares of the analysis of variance of (L1i, L2i and L3i) triple test cross hybrids for all traits studied.

Source of variance	d.f.	Heading date	Number of productive tillers	Plant height	Main culm ear length	Number of spikelets per main culm ear	Number of grains per main culm ear	Main culm ear yield	Number of spikelets per ear	Number of grains per ear	Number of grains per spikelet	Ear yield	1000-grain weight	Grain yield per plant
Replications	2	0.43	1.86	51.48	0.433	0.51	247.15	0.36	1.77	45.51	0.03	0.17	12.38	30.29
Genotypes	70	65.52**	6.38**	172.45**	3.82**	1.66**	223.27**	1.06**	2.37**	239.29**	0.34**	0.904**	85.13**	42.58**
Hyprids	50	59.93**	3.14**	141.21**	1.48**	1.17**	147.86**	0.61**	1.31**	105.62**	0.16**	0.383**	71.49**	32.85*
Parents	19	83.47**	13.87**	256.31**	9.85**	2.87**	430.88**	2.37**	5.19**	574.88**	0.79**	2.28**	122.48**	21.55**
Hybrids vs parents	1	3.94**	25.93**	141.54**	0.005	3.41**	49.09	0.11	1.54*	546.76**	0.87**	0.706*	57.48*	271.78**
Lines	16	98.55**	11.18**	247.13**	9.73**	3.18**	485.02**	2.45**	5.204**	629.42**	0.87**	2.37**	118.83**	25.18**
Testers	2	4.44**	4.24	328.52**	0.21	1.32*	45.91	0.19	1.45*	46.08	0.09	0.12	29.41	1.17
Lines vs testers	1	0.409	108.77**	369.62**	44.36**	1.56*	478.12**	7.72**	17.75**	1085.49**	0.99**	7.48**	524.35**	5.98
P_1 vs P_2	1	0.201	0.082	653.12**	0.273	1.92**	64.68	0.006	0.15	1.58	0.17*	0.028	50.11	1.78
Error	140	0.192	1.51	9.43	0.416	0.32	35.502	0.19	0.34	25.87	0.04	0.134	18.92	18.007

*, ** Significant at 0.05 and 0.01 probability levels, respectively.

substantial amount of the genetic variability which could be assessed by means of the triple test cross analysis. Hybrids vs parents mean square estimates, as an average heterosis over all crosses, were found to be highly significant for all traits studied except main culm ear length, number of grains per main culm ear and main culm ear yield. Also, the seventeen wheat varieties (lines) were found to be significantly different from the three testers (P_1, P_2 and their F_1) in all traits studied. Tester mean square estimates were detected to be significant for heading date, plant height, number of spikelets per main culm ear and number of spikelets per ear. Lines Vs testers mean square estimates were found to be highly significant for all traits under investigation except heading date. The two testers Sakha 69 and Vees(P_1 vs P_2) were detected to be different from each other. in plant height, number of spikelets per main culm ear, number of grains per spikelet and nearly 1000-grain weight. The unbiased estimates of additive (D) and dominance (H) gene action and the unambiguous test of epistasis would only be achieved when the testers are different from each other. However, when this condition of difference is not met, the estimates are biased to an unknown extent (Kearsey and Jinks, 1968 and Jinks *et al* 1969).

Test for epistasis

Analysis of variance for testing the presence of epistasis in the inheritance of all traits studied are presented in Table (3). Significant epistasis was detected for all characters studied except plant height, main culm ear yield and 1000-grain weight. Further partitioning of the epistatic effect revealed that mean square estimates due to additive × additive (I) epistatic type were found to be significant for all characters under investigation except number of grains per main culm ear, number of spikelts per ear, number of grains per ear and number of grains per spikelet. Additive × dominance (J) epistatic type and dominance × dominance (L) epistatic type mean square estimates were detected to be significant for all traits studied except plant height, main culm ear yield and 1000-grain weight. The additive × additive epistatic type (I) was found to be much larger in magnitudes than additive × dominance (J) and dominance × dominance epistatic type (L) for eight out of the thirteen characters studied, indicating that fixable components of epistasis were more important than nonfixable one in the inheritance of these traits. In a highly self-fertilized crop like wheat, the fixable component of epistasis could be easily exploited. The presence of epistasis could have important implications in a breeding programme. Standard hybridization and selection procedures could take advantage of epistasis if it is additive × additive type as in all traits studied except number of grains per main culm ear, spikelets number, number of grains per ear and number of grains per spikelet. A greater importance of epistasis was also

Table 3: Analysis of variance for testing the presence of epistasis in a triple test cross for all traits studied.

Source of variance	d.f.	Heading date	Number of productive tillers	Plant height	Main culm ear length	Number of spikelets per main culm ear	Number of grains per main culm ear	Main culm ear yield	Number of spikelets per ear	Number of grains per ear	Number of grains per spikelet	Ear yield	1000-grain weight	Grain yield per plant
Total of epistasis	17	66.325**	22.94**	54.73	2.103**	1.91*	291.58**	0.955	2.67*	228.002**	0.314**	0.599*	81.603	306.69**
I type epistasi	1	285.372**	230.82**	175.84*	7.379**	0.49**	128.32	5.331**	0.355	4.301	0.011	1.047**	245.258*	2209.432**
J + L epistasi	16	52.635**	9.95*	47.16	1.774**	2.003*	301.78**	0.682	2.81*	241.983**	0.333*	0.571*	71.374	187.77**
I type epistasi × block	3	0.459	10.83	106.68	1.092	0.003	124.66	0.01	0.793	23.381	0.091	0.063	27.649	49.87
J + L epistasi × block	48	0.382	4.33	27.55	0.654	1.05	99.74	0.571	1.50	67.603	0.086	0.301	47.738	63.12
Total epistasi × block	51	0.387	4.71	32.21	0.679	0.99	101.21	0.538	1.45	65.002	0.087	0.287	46.556	62.34

*, ** Significant at 0.05 and 0.01 probability levels, respectively.
(I) = additive × additive , (L) = dominance × dominance , (J) = additive × dominance

reported in wheat by Singh and Singh (1976), Singh *et al.* (1988), Singh and Nanda (1989), Eissa (1994a) and Comber (2001).

Detection and estimation of additive and dominance genetic variance components

The analysis of variance for sums (measuring additive genetic variance) and differences (measuring dominance genetic variance) and the estimation of additive (D) and dominance (H) genetic components are presented in Table (4). The mean square estimates due to sums (L1i + L2i) were found to be highly significant for all traits studied. The mean square estimates due to differences (L1i – L2i) were also found to be highly significant for all characters under investigation, except number of productive tillers, number of grains per spikelet and ear yield.

Consequently, it could also be concluded that selection procedures based on the accumulation of additive effects would be successful in improving all traits studied. However, to maximize selection advance, procedures which are known to be effective in shifting gene frequency when both additive and non-additive genetic variances are involved would be preferred. Similar results were previously obtained by Singh and Singh (1976), Nanda *et al* (1982), Singh *et al* (1989), Eissa (1994b) and Comber (2001).

The additive genetic variances (D) were found to be much larger in magnitudes than the dominance variance (H) for all traits studied and that resulted in $(H/D)^{1/2}$ to be less than one confirming the role of partial dominance in the inheritance of all traits under investigation.

The direction of dominance and types of genes exhibiting dominance were detected by calculating the correlation coefficients between sums (L1i + L2i) and differences (L1i – L2i) (Table 4). If (r) is negative and significant, then increasing type of genes are dominant and vice-versa. The correlation coefficients between sums and differences were found to be negative for number of productive tillers, plant height, ear yield and 1000-grain weight, however, the remaining traits showed positive correlation coefficients of sums and differences and both directions were insignificant, hence the dominance was ambidirectional.

The results obtained here would indicate that epistasis is an integral component of the genetic architecture of all traits studied and hence detection, estimation and consideration of this component is important for the formulation of breeding programme to improve wheat population for such economic traits. If epistasis is ignored no presice conclusion can be drawn about the relative importance of additive, dominance and epistasis where the estimation of additive and dominance genetic components would

Table 4: Mean squares from analysis of variance for sums and differences and estimates of additive (D), dominance (H) and degree of dominance in triple test cross for all traits studied.

Source of variance	d.f.	Heading date	Number of productive tillers	Plant height	Main culm ear length	Number of spikelets per main culm ear	Number of grains per main culm ear	Main culm ear yield	Number of spikelets per ear	Number of grains per ear	Number of grains per spikelet	Ear yield	1000-grain weight	Grain yield per plant
Sums (L_{11} + L_{21})	16	222.97**	7.128**	284.81**	5.726**	2.71**	411.076**	2.412*	4.916**	291.51**	0.409**	1.614**	208.346**	154.128**
Error	32	0.536	3.859	22.77	0.398	0.66	88.947	0.672	0.989	50.59	0.087	0.443	64.884	55.107
Difference (L_{11}+L_{21})	16	28.92**	2.265	44.052**	1.001**	1.318**	231.67**	0.531*	1.35**	78.28**	0.106	0.221	26.552**	38.426**
Error	32	0.166	1.304	7.728	0.261	0.418	45.08	0.207	0.42	34.74	0.066	0.126	14.044	23.215
D		296.56	4.352	349.36	7.104	2.728	429.44	2.32	5.232	321.2	0.424	1.56	191.28	132.024
H		38.32	1.280	48.432	0.984	1.20	248.72	0.432	1.24	58.0	0.048	0.126	16.672	20.28
$(H/D)^{0.5}$		0.359	0.542	0.372	0.372	0.663	0.761	0.431	0.486	0.424	0.336	0.284	0.295	0.391
r		0.26	-0.420	-0.25	0.18	0.15	0.42	0.19	0.43	0.35	0.27	-0.11	-0.11	0.19

*, ** Significant at 0.05 and 0.01 probability levels, respectively.

r = correlation coefficients between sums (L1i + L2i) and differences (L1i – L2i) be biased by epistasis to unknown extent as in the present materials (Sood and Dawa 1999). It could therefore be concluded that additive × additive epistatic type coupled with additive genetic variance were found to be preponderant for mostly all traits studied and hence the possible improvement of these traits through standard hybridization and selection in early generations. Also additive × dominance and dominance × dominance (J + L) types of epistasis coupled with additive and dominance gene actions were preponderant for number of grains per main culm ear, number of spikelets per ear, number of grains per ear and number of grains per spikelet, in such situation, biparental matings may be attempted in F_2 and subsequent generations and selection may be postponed till late generation to allow sufficient epistatic effect to get fixed, same conclusion was also drawn by Comber (2001).

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تحليل التلقيح الإختبارى الثلاثى لبعض الصفات الكمية فى قمح الخبز

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الملخص العربى

أُجرى هذا البحث فى مزرعة كلية الزراعة بشبين الكوم جامعة المنوفية وذلك فى الثلاثة مواسم المتتالية ٢٠٠٢/٢٠٠١ ، ٢٠٠٣/٢٠٠٢ ، ٢٠٠٤/٢٠٠٣ ، وقد تم استخدام تسعة عشر صنفاً من أقماح الخبز المختلفة هى جيزة ١٥٧ ، جيزة ١٦٤ ، جيزة ١٦٧ ، جيزة ١٦٨ ، سخا ٦١ ، سخا ٦٩ ، سخا ٩٣ ، سخا ٢٠٢ ، سخا ٢٠٦ ، جميزة ٥ ، جميزة ٧ ، جميزة ٩ ، سدس ١ ، سدس ٤ ، سدس ٦ ، سدس ٨ ، سدس ٩ ، شام ٤، وفيز. تم التهجين بين (سخا ٦٩ × فيز) للحصول على الجيل الأول لعمل موديل الهجين الاختبارى الثلاثى ، وفى الموسم الثانى تم التهجين بين الصنفين (سخا ٦٩ ، فيز وكذا الجيل الأول الناتج منهما) مع السبعة عشر صنفاً للحصول على ٥١ عائلة وذلك لاستخدامهما فى موديل الهجين الاختبارى الثلاثى . وفى الموسم الثالث تم تقييم الموديل فى ثلاث قطاعات كاملة العشوائية وذلك بهدف دراسة كلٍ من :

دور التفوق فى وراثة صفة المحصول ومكوناته ، تقدير التباين الوراثى المضيف والتباين الوراثى السيادى .

وتم تحليل البيانات باستخدام طريقة كرسى وجنكز عام ١٩٦٨ وبركنز عام ١٩٧٠ لتحليل الهجين الاختبارى الثلاثى ، وكانت الصفات المدروسة هى : ميعاد طرد السنابل – عدد الفروع المنتجة – ارتفاع النبات(سم) – طول السنبلة الرئيسية(سم) – عدد السنيبلات فى سنبلة الساق الرئيسى – عدد الحبوب فى سنبلة الساق الرئيسى – محصول سنبلة الساق الرئيسى – عدد السنيبلات فى السنبلة – عدد الحبوب فى السنبلة – عدد الحبوب بالسنيبلة - محصول السنبلة(جم) – وزن الألف حبة(جم) ومحصول النبات الفردى(جم) .

واظهرت النتائج ان قيم التباين الراجعة إلى الكشافات الثلاثة المستخدمة كانت معنوية لصفات ميعاد طرد السنابل وارتفاع النبات وعدد السنيبلات فى سنبلة الساق الرئيسية وعدد السنيبلات فى السنبلة كما كانت الاختلافات بين الأصناف السبعة عشر والكشافات الثلاثة عالية المعنوية لجميع الصفات المدروسة عدا صفة ميعاد طرد السنابل كما كانت الاختلافات بين الكشافين سخا ٦٩ وفيز معنوية وذلك لأربعة صفات من الصفات المدروسة . كان الفعل الجينى التفوقى معنوياً لكل الصفات المدروسة وكان التباين الراجع إلى طرز التفوق المضيف × المضيف (I) معنوى لمعظم الصفات المدروسة كما كان طرز التفوق المضيف × السائد ، والسائد × السائد معنوياً لمعظم الصفات المدروسة.

كان التباين الوراثى المضيف معنوياً لكل الصفات المدروسة بينما كان التباين الوراثى السيادى معنوياً لجميع الصفات تحت الدراسة فيما عدا كلٍ من صفات عدد الفروع المنتجة وعدد الحبوب بالسنيبلة ومحصول السنبلة . كانت قيم التباين الوراثى المضيف أعلى من قيم التباين الوراثى السيادى وذلك لجميع الصفات المدروسة كما لعبت السيادة الجزئية دوراً هاماً فى وراثة جميع الصفات المدروسة . كان معامل الارتباط سالباً لصفات عدد الفروع المنتجة وطول النبات ومحصول السنبلة ووزن الألف حبة بينما أظهرت بقية الصفات قيماً موجبة لمعامل الارتباط على الرغم من أن قيم معامل الارتباط السالبة والموجبة كانت غير معنوية وبالتالى كانت الجينات السائدة فى كل الصفات غير مُحددة الاتجاه .