Minufiya J. Agric. Res. Vol. 34 No.3:1165-1176 (2009) "http://www.mujar.net"

COMBINING ABILITY ANALYSIS OF SOME QUANTITATIVE CHARACTERS IN FABA BEAN

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(Received: Dec. 30 , 2008)

ABSTARCT : *Six faba bean varieties were used in a dialed cross to study (i) The relative magnitude of both general and specific combining ability and their interactions with the two years as two different environmental conditions and (ii) The evaluation of the six faba bean varieties according to their general combining ability effects. The obtained results con be summarized as follows: Genotypes, parents and the resultant fifteen crosses mean squares were found to be highly significant for all traits studied at the two years and the combined data. Parent vs. crosses mean squares as an indication to average heterosis overall crosses were found to be significant for number of branches per plant at the two years and their combined data, number of pods per plant at the second year and the combined data, number of seeds per pod at the combined data, yield of pods per plant at the first year and seed yield per plant at the first year and the combined data. Various types of interactions i.e., genotypes with years, parent with years, crosses with years and parent vs. crosses with years were found to be insignificant for mostly traits studied. Both general and specific combining ability variances were highly significant at the two years and their combined data for mostly traits studied. GCA/SCA ratios were found to be greater than unity for seeds per pod and yields of pod at the two years and their combined data, number of pods and seed yield at the first year and the combined data. GCA/SCA mean squares were less than unity for plant height, branches per plant and pod length at the two years and their combined data, pods per plant and seed yield at the second year only. The interactions of both types of combining ability with years were insignificant for most traits studied. The faba bean varieties Giza 402 and G 461 proved to be excellent general combiner for yielding ability. The two hybrid combinations Giza 843 x Giza 716 and Giza 429 x Giza 461 exhibited highly significant estimates of SCA effects at the two years and their combined data for yield of pods per plant and seed yield per plant.*

Key words: *General and specific combing ability, Diallel cross, Gene action and Faba bean.*

INTRODUCTION

Field bean is considered to be one of the most important legume crops in Egypt, because it is a good sourse of protein. The development of more efficient breeding procedures is mainly dependent upon a better

understanding of the types of gene action controlling the inheritance of quantitative characters. Also, one of the main objectives of any plant breeding programme is the development of genotypes which consistently shows superiority over a series of environments, consequently the understanding of genotype-environment interaction is a matter of importance.

The main objectives of this investigation are to study (i) the relative magnitude of both general and specific combining ability and their interactions with the two years and (ii) evaluating the six field beans varieties according to their general and specific combining ability effects.

MATERIALS AND METHODS

The experiment was carried out at Experimental Farm, Faculty of Agriculture, Shebin El-Kom, Minufiya University during the two successive seasons 2004/2005, 2005/2006 and 2006/2007. Six faba bean varieties were used as parental lines in the present investigation i.e., Giza 843, Giza 429, Giza 716, Giza 402, Giza 461 and Giza3.

A diallel crosses set excluding reciprocals was carried out among the six parents in the winter of 2004/2005. The fifteen possible F_1 hybrids with their respective six parents were evaluated in two years 2005/2006 and 2006/2007 which will designated in the text as y_1 and y_2 respectively. The experiments were arranged in a randomized complete block design with three replications per each year. Each plot comprised two ridges of 4 m. length and 60 cm. width. Hills were spaced by 20 cm. with two seeds per hill in one side of the ridge. Hills were later thinned leaving one plant per hill. The rest of cultural practices were followed as usual for the ordinary faba bean fields in the area.

Data were recorded on an individual guarded plants of the twenty one genotypes for plant height, number of branches per plant, number of pods per plant, pod length (cm.), number of seeds per pod, yield of pods per plant and yield of seeds per plant. The data were first analyzed to test the significance of the twenty one different genotypes and if the genotype mean squares are found to be significant, there in need to proceed for further analysis, i.e. Griffing's approach method 2 model 1 (1956).

The combined analysis was calculated over the two years to test the interaction of both general and specific combining abilities with years and that was done whenever the homogeneity of variances was detected.

RESULTS AND DISCUSSION

The analysis of variance of each year and the combined data for all traits studied are presented in Table (1). Genotypes, parents and crosses mean squares were found to be highly significant for all traits studied at the two years as well as the combined data. However, parent mean square estimate for number of pods per plant at the first year and crosses mean squares at

Table (1): Mean square estimates of ordinary analysis, cpmbined analysis and combining ability analysis for all traits studied at the two different years y_1 and y_2 .

Source of variance	D.F		Plant height (cm)			No. of branches/ plant			No. of pods/ plant			Pod length (cm)			No. of seeds Pod			Yield of pods/ plant			Yield of seeds/ plant		
	Single	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb
Years	-	1	-	-	2.63	-	-	0.746*	-	-	23.68**	-	-	0.384	-	-	0.069	-	-	88.02**	-	-	48.89*
Rep within year	2	4	38.38	15.41	26.89	0.22	0.037	0.126	0.13	1.82	.974	0.122	0.063	0.092	0.444	0.159	0.302	0.061	2.74	1.139	1.79	2.49	2.117
Genotypes	20	20	63.88*	84.55**	133.51**	1.22**	0.93**	2.05**	15.53*	21.67*	3.69**	0.346*	0.390*	0.677**	1.049*	0.781*	1.742**	81.27**	79.66**	146.68**	52.32*	51.65*	90.85**
Parents	5	5	30.62*	77.26**	88.59**	0.517*	0.496*	0.901**	6.67	5.77*	10.06**	0.455*	0.371*	0.772**	3.04**	2.56**	5.58**	64.55**	31.21*	83.29**	35.77*	26.87*	56.34**
Crosses	14	14	80.12*	93.01**	159.27**	1.40**	1.075*	2.38**	19.42*	28.08*	43.41**	0.33**	0.422*	0.686**	0.352	0.122	0.352	87.78**	102.61*	177.62**	57.05*	63.47*	104.96*
Par. Vs. crosses	1	1	2.86	2.58	0.02	2.09**	1.151*	3.163**	5.38	11.29*	15.97**	0.019	0.038	0.056	0.879	1.143	2.003**	73.65	0.758	30.48	68.98*	10.01	65.78**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Genotypes x Years	-	20	-	-	14.92	-	-	0.099	-	-	3.49**	-	-	0.059	-	-	0.088	-	-	14.24	-	-	13.13
Par x Years	-	5	-	-	19.78	-	-	0.112	-	-	2.38	-	-	0.051	-	-	0.0098	-	-	12.47	-	-	6.304
Crosse x Years	-	14	-	-	13.86	-	-	0.097	-	-	4.09**	-	-	0.067	-	-	0.122	-	-	12.76	-	-	15.56
Par.Vs.crossesxYears	-	1	-	-	5.42	-	-	0.074	-	-	0.701	-	-	0.001	-	-	0.019	-	-	43.93	-	-	13.21
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GCA	5	5	26.69*	29.19*	41.44**	0.83**	0.599*	1.362**	27.43*	16.91*	41.99**	0.286*	0.347	0.621**	2.278*	1.25**	3.427**	158.29*	80.85**	212.16**	99.75*	46.29*	131.53*
SCA	15	15	76.28*	103.01*	164.20**	1.34**	1.05**	2.278**	11.56*	23.25*	30.93**	0.366*	0.405*	0.696**	0.64	0.62	1.18**	55.59**	79.27**	124.86**	36.52*	53.44*	77.29**
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GCA x Years	-	5	-	-	14.43	-	-	0.336	-	-	2.34	-	-	0.012	-	-	0.106	-	-	26.99*	-	-	14.51
SCA x Years	-	15	-	-	15.08	-	-	0.111	-	-	3.88**	-	-	0.076	-	-	0.083	-	-	9.99	-	-	12.66
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Error	40	80	10.003	11.19	10.59	0.097	0.126	0.1115	3.09	1.98	1.56	0.125	0.149	0.137	0.465	0.312	0.388	11.304	11.41	11.36	6.65	9.06	7.85
GCA/SCA			0.35	0.28	0.25	0.62	0.57	0.59	2.37	0.73	1.35	0.78	0.856	0.892	3.56	0.02	2.90	2.85	1.02	1.69	2.73	0.87	1.70

* and ** significant at and levels of probability respectively.

Y_1 = First season Y_2 = Second season Comb. = Combined data

Table (2): The genotypes mean performance at the first and second growing season and combined data for all traiys studied.

Genotypes	Plant height (cm)			No. of branches/ plant			No. of pods/ plant			Pod length (cm)			No. of seeds Pod			Yield of pods/ plant			Yield of seeds/ plant		
	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb
1	93.08	89.17	91.12	3.82	3.62	3.72	13.90	14.03	13.96	7.73	7.59	7.66	3.66	3.62	3.64	39.70	40.17	39.93	28.92	30.35	29.63
2	95.67	97.0	96.33	3.07	2.92	2.99	15.80	14.75	15.27	7.06	6.92	6.99	5.85	5.66	5.75	38.28	36.38	37.33	28.65	26.44	27.54
3	91.78	97.33	94.55	2.94	3.00	2.97	15.28	12.80	14.04	7.22	6.79	7.01	3.44	3.47	3.45	28.45	32.52	30.48	21.61	23.76	22.68
4	99.23	101.77	100.5	3.07	3.43	3.25	16.27	16.75	16.51	6.54	6.64	6.59	3.11	3.14	3.12	39.75	41.56	40.65	31.12	32.24	31.68
5	93.67	90.15	91.91	3.24	2.80	3.02	18.47	15.91	17.19	7.29	7.33	7.31	3.36	3.38	3.37	41.31	3715	39.23	30.19	27.49	28.84
6	99.25	99.47	99.36	3.90	3.78	3.84	16.05	16.11	16.58	7.06	7.02	7.04	3.56	3.59	3.57	38.34	39.19	38.76	30.01	28.91	29.46
1 x 2	92.15	88.02	90.08	3.64	3.33	3.48	14.62	12.88	13.75	7.43	7.27	7.35	4.67	3.64	4.15	29.73	28.63	29.18	21.02	21.50	21.26
3	96.72	93.28	94.50	5.96	5.44	5.70	18.67	21.97	20.32	7.13	7.53	7.33	3.46	3.50	3.48	39.14	42.43	40.78	29.66	32.08	30.87
4	92.59	91.69	92.14	3.16	2.61	2.88	14.54	12.06	13.30	6.83	6.59	6.71	3.39	3.19	3.29	33.69	29.16	31.42	27.73	22.5	25.11
5	99.61	103.88	101.74	3.63	3.58	3.61	17.48	14.92	16.20	7.44	7.22	7.33	3.42	3.52	3.47	40.93	34.73	37.83	32.67	28.28	30.47
6	100.43	103.00	101.72	3.39	3.67	3.53	17.47	16.93	17.20	6.87	7.03	6.95	3.58	3.64	3.61	42.44	44.17	43.31	32.26	34.07	33.16
2 x 3	94.17	93.60	93.88	3.62	3.50	3.56	11.82	12.56	12.19	7.22	6.99	7.11	3.62	3.54	3.58	31.28	31.28	31.28	24.06	27.19	25.62
4	102.87	101.87	102.37	3.26	3.1	3.18	15.86	14.22	15.04	6.95	6.67	6.81	3.37	3.43	3.40	39.58	34.52	37.05	30.48	26.31	28.39
5	96.39	96.00	96.19	4.22	3.8	4.01	17.10	16.27	16.68	8.06	8.01	8.03	3.68	3.69	3.68	45.74	42.88	44.31	35.61	34.27	34.94
6	91.88	93.24	92.56	3.57	3.56	3.56	14.54	12.32	13.43	6.85	6.81	6.83	3.29	3.24	3.26	36.15	28.85	32.50	27.06	20.84	23.95
3 x 4	102.43	100.77	101.60	3.07	3.15	3.11	15.68	14.08	14.88	7.41	7.54	7.47	3.79	3.84	3.81	41.14	39.41	40.27	33.03	29.59	31.31
5	103.69	101.90	102.79	3.93	3.6	3.76	21.49	20.28	20.88	6.97	6.84	6.91	3.48	3.38	3.43	45.08	42.33	43.70	33.85	31.39	32.62
6	85.75	91.67	88.71	3.77	3.33	3.55	13.98	14.46	14.22	7.17	7.15	7.16	3.57	3.64	3.61	38.92	38.41	38.66	29.97	29.44	29.70
4 x 5	93.22	87.63	90.42	3.80	3.53	3.66	20.31	17.77	19.04	7.20	6.87	7.03	3.64	3.81	3.72	47.75	43.35	45.55	36.44	32.08	34.26
6	97.5	94.53	96.01	3.67	3.50	3.58	18.31	19.26	18.78	7.59	7.19	7.39	3.38	3.38	3.38	42.86	41.77	42.31	31.47	34.75	33.11
5 x 6	90.38	89.44	89.90	3.43	3.65	3.54	17.23	17.34	17.28	7.10	6.88	6.99	3.22	3.24	3.23	46.04	42.27	44.15	35.73	31.91	33.82
X	95.78	95.49	95.63	3.63	3.47	3.55	16.42	15.55	15.98	7.19	7.09	7.14	3.64	3.59	3.62	39.35	37.67	38.51	30.07	28.82	29.45
L.S.D. 0.05	5.22	5.52	3.76	0.514	0.588	0.385	2.90	2.32	1.46	0.58	0.64	0.42	1.125	0.92	0.71	5.54	5.57	3.89	4.25	4.97	3.23
L.S.D. 0.01	6.98	7.38	4.99	0.687	0.784	0.513	3.88	3.11	1.94	0.78	0.86	0.57	1.505	1.233	0.96	7.422	7.46	5.18	5.69	6.64	4.30

Y_1 = First season Y_2 = Second season Comb. = Combined data

the two years and their combined data were found to be insignificant. Parent vs. crosses mean square estimates as indication to average heterosis overall crosses were found to be significant for number of branches per plant at the two years and their combined data, number of pods per plant at the second year and combined data, number of seeds per pod at the combined data only, yield of pods per plant at the first year and yield of seeds per plant at the first year and combined data.

Various types of interaction i.e. genotypes with years, parent with years, crosses with years and parent vs. crosses with years were found to be insignificant for all traits studied except genotypes with years and crosses with years for number of pods per plant and crosses with years for yield of seeds per plant which were found to be significant. The insignificant interactions of these genotypes with years would indicate the stable behavior of these genotypes from one year to another.

Both general and specific combining ability variances were found to be highly significant at the two years and their combined data for all characters studied. However, general combining ability estimate for pod length and specific combining ability estimates for number of seeds per pod at the two years did not reach the significant level. This would indicate the importance of both additive and non-additive genetic variance in determining the performance of these characters. The question remains would be about the relative importance of both general and specific combining ability. Therefore, GCA/SCA ratio was used to clarify the nature of genetic variance involved in the inheritance of the seven traits studied. The GCA/SCA variances were found to be greater than unity indicating that additive and additive x additive types of gene action were of greater importance in the inheritance of number of seeds per pod and yield of pods per plant at the two years and their combined data and number of pods per plant and seed yield per plant at the first year and the combined data. As for plant height, number of branches per plant and pod length at the two years and their combined data, number of pods per plant and seed yield per plant at the second year only, GCA/SCA mean squares were found to be less than unity indicating that non-additive genetic variance were of greater importance in the inheritance of these characters. Therefore it could be concluded that to improve all characters studied, breeding procedures which are known to be effective in shifting gene frequency when both additive and non-additive genetic variation are involved should be used. The obtained results are in general agreement with those obtained by Mahmoud *et al.* (1984), El-Hosary (1988), Hendawy *et al.* (1988), Abul Nass *et al.* (1991), Dawwam (1991), Hendawy *et al.* (1994), Rabie (2001), El-Rodeny (2006), El-Hady *et al.* (2006), Abd El-Maksoud *et al.* (2007) and Farag *2007).

The interations of both types of combining ability with years were found to be insignificant for all traits studied except general combining ability with years for yield of pods per plant and specific combing ability with years for number of pods per plant. The insignificant interaction of years with GCA for all traits studied except yield of pods per plant would indicate that selection for mostly all characters studied will be effective in a single environment.

Estimates of the general combining ability effects (gi) for individual parental line in each character at the two years and their combined data are presented in Table (3). High positive values of general combining ability effects would be of interest in all traits under investigation. The faba bean variety Giza 402 showed significant positive general combining ability effects for plant height proving to be good general combiner for tallness at the two years and their combined data. Giza 461 exhibited highly significant positive general combining ability effects for number of pods per plant, yield of pods per plant and seed yield per plant at the two years and their combined data proving to be excellent general combiners for these traits. The variety Giza 429 showed highly significant estimates of general combining ability for number of seeds per pod at the two years and their combined data. The faba bean variety proved to be good combiner for yield of pods per plant at the second year and the combined data only indicating that the additive genetic variance fluctuated from growing season to another. Giza 843 proved to be good general combiner for number of branches per plant at the two years and their combined data. As for yield of seeds per plant, the variety Giza 402 showed highly significant general combining ability effects at the first year and the combined data proving to be good general combiner for yielding ability. It is of interest to mention that the varieties which proved to be good combiners for some traits under investigation were found to be on the top of the examined parental varieties according to their mean performance of these characters. For instance, Giza 402 proved to be good combiners for plant height and seed yield per plant and it was found to be on the top of the studied parental varieties according to its mean performance of these two characters (Table 2). Also, Giza 461 which proved to be good combiners for pod number, yield of pods per plant and seed yield per plant was found to have the highest mean performance for these three traits (Table 2). Consequently, it could be concluded that the general combining ability effect of a parent might be associated with its own mean performance. GCA effect was previously reported in faba bean by Hendawy *et al.* (1988), Dawwam (1991), Hendawy *et al.* (1994), El-Galaly (1997), Omer *et al.* (1998), Yamani (1998), Abdalla *et al.* (1999), Abou Zeid (1999), Darwish *et al.* (2005), Sabah *et al.* (2006) and Farag (2007).

Specific combining ability effects for the parental combinations at the two years and their combined data are given in Table (4). Four of the fifteen hybrid combinations showed highly significant desirable SCA effects for

Table (3): Estimates of general combining ability effects for the parental lines evaluated at the two growing seasons.

Parental variety	Plant height (cm)			No. of branches/ plant			No. of pods/ plant			Pod length (cm)			No. of seeds Pod			Yield of pods/ plant			Yield of seeds/ plant		
	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb
Giza 843	-0.48	-1.28*	-0.88*	0.25**	0.20**	0.23**	-0.56	-0.26	-0.41*	0.09	0.159	0.119*	0.041	-0.055	-0.007	-1.26	-0.532	-0.89*	-1.17*	-0.332	-0.751*
Giza 429	-0.21	-0.22	-0.215	0.12	0.15*	0.13*	-1.18**	-1.39**	-1.28**	0.04	-0.004	0.018	0.601**	0.459**	0.53**	-2.05**	-3.103**	-2.58**	-1.87**	-2.351**	-2.110**
Giza 716	-0.65	0.93	0.14	0.11	0.09	0.100*	-0.35	0.01	-0.17	-0.01	0.001	-0.0045	-0.090	-0.043	-0.066	-2.67**	-0.599	-1.73**	-2.09**	-0.573	-1.33**
Giza 402	2.07**	1.44*	1.755**	-0.29**	-0.19**	-0.24**	0.29	0.25	0.27	-0.16*	-0.185*	-0.172**	-0.215	-0.158	-0.186*	1.13	0.949	1.039*	1.361**	0.989	1.175**
Giza 461	0.02	-1.16	-0.57	0.02	-0.07	-0.045	1.95**	1.18**	1.56**	0.12	0.107	0.113*	-0.168	-0.096	-0.132	-4.09**	2.016**	3.053**	3.022**	1.389*	2.206**
Giza 3	-0.75	0.29	-0.23	0.03	0.120	0.075	0.16	0.21	0.025	-0.08	-0.068	-0.074	-0.169	-0.107	-0.138	0.96	1.269*	1.114*	0.747	0.878	0.812*
L.S.D. (gi) 0.05	1.19	1.26	0.86	0.118	0.13	0.088	0.66	0.48	0.33	0.13	0.15	0.097	0.26	0.21	0.164	1.27	1.27	0.888	0.97	1.13	0.74
L.S.D. (gi) 0.01	1.59	1.69	1.14	0.158	0.18	0.117	0.89	0.65	0.44	0.18	0.19	0.129	0.34	0.28	0.218	1.69	1.70	1.181	1.29	1.52	0.98
L.S.D. (gi-gj) 0.05	1.84	1.95	1.33	0.18	0.21	0.136	1.03	0.76	0.51	0.21	0.23	0.151	0.39	0.33	0.254	1.96	1.97	1.37	1.50	1.76	1.14
L.S.D. (gi-gj) 0.01	2.46	2.61	1.77	0.24	0.28	0.181	1.37	1.01	0.68	0.28	0.30	0.201	0.53	0.44	0.338	2.62	2.64	1.83	2.01	2.35	1.52

* and ** significant at and levels of probability respectively.

Y_1 = First season Y_2 = Second season Comb. = Combined data

Table (4): Estimates of specific combining ability effects of the 15 F_1 hybrid combinations evaluated at the two growing seasons.

Crosses	Plant height (cm)			No. of branches/ plant			No. of pods/ plant			Pod length (cm)			No. of seeds Pod			Yield of pods/ plant			Yield of seeds/ plant		
	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb	Y_1	Y_2	Comb
1 x 2	-2.94	-5.97**	-4.45**	-0.12	-0.189	-0.154	-0.078	-1.020	-0.599	0.106	0.035	0.070	0.389	-0.362	0.013	-6.309**	-5.411**	-5.86**	-6.018	-4.641**	-5.329**
3	1.06	-1.86	-0.40	1.98**	1.68**	1.83**	3.138**	6.669**	4.903**	-0.161	0.287	0.063	-0.140	0.001	-0.069	3.928*	5.889**	4.908**	2.845*	4.157**	3.501**
4	-4.79**	-3.97*	-4.38**	-0.44**	-0.86**	-0.65**	-1.618	-3.489**	-2.55**	-0.300	-0.457**	-0.378**	-0.081	-0.195	-0.138	-6.626**	-8.930**	-7.228**	-2.636	-5.984**	-4.76**
5	4.28*	10.83**	7.55**	-0.27	-0.018	-0.14	-0.342	-1.567	-0.954*	0.018	-0.125	-0.053	-0.095	0.077	-0.009	-1.239	-4.430*	-2.83*	0.743	-1.606	-0.431
6	5.88**	8.49**	7.18**	-0.62**	-0.123	-0.32**	1.757	1.430*	1.593**	0.341	-0.145	-0.243	0.063	0.208	0.135	3.393	5.761**	4.577**	2.605	4.699**	3.652**
2 x 3	-0.76	-2.60	-1.68	0.002	0.084	0.043	-3.082**	-1.614*	-2.35**	-0.001	-0.093	-0.047	-0.537	-0.471	-0.504*	-3.146	-2.694	-2.92*	-2.053	1.289	0.382
4	5.22**	5.14**	5.18**	0.038	-0.032	0.003	0.329	-0.196	0.067	-0.116	-0.230	-0.173	-0.664	-0.473	-0.568**	1.146	-1.006	0.07	0.919	-1.156	-0.118
5	0.78	1.89	1.34	0.696**	0.542**	0.619	-0.095	0.917	0.408	0.711**	0.821**	0.766**	-0.401	-0.274	-0.337	4.347*	6.294**	5.32**	4.388**	6.400**	5.394**
6	-2.94	-2.33	-2.63*	0.034	0.118	0.076	-0.537	-2.049**	-1.293**	-0.291	-0.209	-0.25	-0.791*	-0.707*	-0.749**	-2.105	-6.992**	4.54**	-1.887	-6.619**	-4.203**
3 x 4	5.22**	2.90	4.06**	-0.377*	-0.219	-0.298**	-0.884	-1.729	-1.306**	0.337	0.361**	0.484**	0.446	0.440	0.443	3.533*	1.384	2.46*	3.689**	0.349	2.019*
5	8.54**	6.64**	7.59**	0.187	0.105	0.146	3.468**	3.529**	3.497**	-0.343	-0.358	-0.350**	0.096	-0.075	0.010	4.511*	3.237	3.87**	2.841**	1.752	2.296*
6	-8.63**	-6.06**	-6.84**	0.006	-0.349	-0.172	-1.933	-1.313	-1.623**	0.065	0.122	0.093	0.180	0.196	0.188	1.486	0.094	0.79	1.236	0.303	0.769
4 x 5	-4.66**	-8.14**	-6.39**	0.447**	0.322	0.384**	1.666	0.776	1.22**	0.046	-0.145	-0.049	0.382	0.469	0.426	3.176	2.706	2.94*	1.987	0.871	1.429
6	0.39	-2.70	-1.16	0.297	0.101	0.199	1.771	3.25**	2.510**	0.643**	0.352	0.497**	0.119	0.043	0.081	1.418	1.872	1.645	-0.715	4.051*	1.668
5 x 6	-4.66**	-5.18**	-4.92**	-0.238	0.122	-0.058	-0.973	0.394	-0.289	0.132	-0.253	0.192	-0.084	-0.152	-0.118	1.648	1.306	1.477	1.884	0.814	1.349
L.S.D. (si) 0.05	3.27	3.46	2.43	0.322	0.367	0.240	1.82	1.34	0.899	0.365	0.399	0.266	0.706	0.677	0.448	3.48	3.49	2.43	2.66	3.11	2.017
L.S.D. (si) 0.01	4.38	4.63	2.89	0.431	0.491	0.298	2.43	1.79	1.116	0.189	0.534	0.329	0.944	0.773	0.554	4.65	4.68	3.000	3.56	4.16	2.494
L.S.D. (sij-sik) 0.05	4.88	5.63	3.49	0.481	0.548	0.359	2.71	2.01	1.34	0.546	0.696	0.397	1.053	0.862	0.669	5.19	5.22	3.623	3.98	4.64	3.011
L.S.D. (sij-sik) 0.01	6.53	7.53	4.32	0.643	0.733	0.445	3.63	2.68	1.66	0.730	0.797	0.492	1.409	1.155	0.827	6.94	6.98	4.477	5.32	6.21	3.722
L.S.D. (sij-skl) 0.05	4.62	4.78	3.46	0.445	0.508	0.356	2.51	1.86	1.32	0.506	0.552	0.394	0.975	0.798	0.662	4.80	4.83	3.58	3.68	4.30	2.980
L.S.D. (sij-skl) 0.01	6.05	6.39	4.28	0.595	0.679	0.441	3.36	2.48	1.64	0.676	0.738	0.486	1.304	1.068	0.819	6.43	6.46	4.43	4.93	5.75	3.684

* and ** significant at and levels of probability respectively.

Y_1 = First season Y_2 = Second season Comb. = Combined data

plant height. Two crosses exhibited highly significant SCA effects for number of branches per plant i.e. Giza 843 x Giza 716 and Giza 429 x Giza 461, the only parent which proved to be good general combiner for number of branches per plant was Giza 843 while the other three parents were found to be among the poorest combiners for this trait. As for number of pods per plant, only two crosses showed highly significant SCA effects at the two years and their combined data. The hybrid combination 429 x Giza 461 showed highly significant SCA effect for pod length at the two years and their combined data and the two parental varieties were found to be among the poorest combiners for this trait. The two hybrid combinations 843 x Giza 716 and Giza 429 x Giza 461 exhibited highly significant SCA effects at the two years and their combined data for yield of pods per plant and seed yield per plant. The parental variety 461 was found to be the only parent which considered to be good general combiner for these two characters in the two superior crosses 843 x Giza 716 and Giza 429 x Giza 461. So, the results obtained here concerning both general and specific combining ability effects could indicate that the excellent hybrid combinations were obtained from crossing good general combiner by good general combiner, good by low and low by low combiners. Consequently, it could be concluded that general combining ability effect of the parental cultivars generally unrelated to the specific combining ability estimates of their respective crosses.

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تحليل القدرة على التآلف لبعض الصفات الكمية في الفول البلدى

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الملخص العربى

أجرى هذا البحث في مزرعة كلية الزراعة بشبين الكوم ــ جامعة المنوفية بهدف دراسة كل من الأهمية النسبية للقدرتين العامة والخاصة على التآلف وتفاعلاتها مع السنين وتقييم الأصناف الستة تبعاً للقدرة العامة للتآلف وتم عمل جميع الهجن الممكنة بين الستة أصناف وتم تقييم هذه الأصناف الستة والهجن الناتجة منها وذلك في تصميم قطاعات كاملة العشوائية في ثلاثة مكررات وتم دراسة كل من الصفات التالية طول النبات ــ عدد الفروع على النبات ــ عدد القرون على النبات ــ طول القرن ــ عدد البذور في القرن الواحد ــ محصول القرون للنبات ومحصول البذور للنبات الواحد ، وقد تم تحليل البيانات باستخدام طريقة جرفنج (١٩٥٦) ويمكن تلخيص النتائج المتحصل عليها فيما يلى :

ــ كانت قيم التباين الراجعة إلى التراكيب الوراثية والآباء والهجن عالية المعنوية لجميع الصفات المدروسة في العامين والتحليل المشترك لهما .

ــ كانت قيم التباين الراجعة إلى متوسط قوة الهجين معنوية لصفة عدد الفروع على النبات في العامين والتحليل المشترك لهما وعدد القرون على النبات في العام الثانى والتحليل المشترك وصفة عدد البذور في القرن الواحد في التحليل المشترك ومحصول النبات من القرون في العام الأول ومحصول النبات من الذور في العام الأول والتحليل المشترك .

ــ كانت قيم التفاعل بين التراكيب الوراثية والآباء والهجن ومتوسط قوة الهجين مع السنين غير معنوية لمعظم الصفات المدروسة .

ــ كان التباين الراجع إلى القدرتين العامة والخاصة على التآلف عالى المعنوية في العامين والتحليل المشترك لهما لمعظم الصفات المدروسة .

أظهرت النسبة بين تباين القدرتين العامة والخاصة على التآلف أن التباين الوراثى المضيف وأيضا التفاعل بين الفعل الجينى المضيف × المضيف هما الأكثر أهمية في وراثة عدد البذور

في القرن ومحصول القرون في العامين والتحليل المشترك لهما وكذلك عدد القرون ومحصول البذور في العام الأول والتحليل المشترك ، بينما وجد أن التباين الوراثى الغير مضيف كان الأكثر أهمية لبقية الصفات المدروسة .

أظهرت التفاعلات بين السنين وكل من القدرتين العامة والخاصة على التآلف تأثيرات غير معنوية لمعظم الصفات المدروسة .

أظهرت الأصناف جيزة ٤٠٢ وجيزة ٤٦١ قدرة تآلفيه عالية لصفة المحصول كما تم الحصول على أفضل التأثيرات الخاصة على الائتلاف لصفة محصول القرون على النبات ومحصول البذور على النبات في هجينين هما جيزة ٨٤٣ × جيزة ٧١٦ وجيزة ٤٢٩ × جيزة ٤٦١ وذلك في العامين والتحليل المشترك لهما .