

Estimates of Combining Ability and Cluster Analysis for Some Rice Varieties (*Oryza sativa* L.)

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ABSTRACT

The present study was carried out during 2009 and 2010 growing seasons at Rice Research and Training Center (RRTC) Farm, at Sakha, Kafr El-Sheikh Egypt. Eight Egyptian genotypes i.e., five commercial varieties (Giza177, Sakha101, Sakha104, Sakha105 and Sakha106), one promising lines (Gz 7576-10-3-2-1) and two international deferential varieties (BL1 and Shien2). The eight genotypes were sown in the summer growing season of (2009) in three sowing dates. A half diallel design was conducted among the eight parents to produce twenty eight crosses. Eight genotypes and their 28 hybrids were studied for nine traits e.i, plant height, No. of days to heading, No. of panicles plant⁻¹, grain yield plant⁻¹, 1000-grain weight, spikelets fertility%, hulling%, milling% and head rice%. The mean square of genotypes, parents, crosses and parents vs. crosses revealed highly significant variations for all traits under investigation. Both general combining ability and specific combining ability variances were found to be highly significant for all studies traits. The GCA/SCA variance were found to be greater than unity for No. of days to heading and 1000-grain weight, indicating that, additive and additive × additive types of gene action were of greater importance in the inheritance of these traits but the another studied traits the non-additive type were great important in plant height, No. of panicle plant⁻¹, grain yield plant⁻¹, spikelets fertility%, hulling%, milling% and head rice%. The five rice varieties Sakha105, Sakha106, GZ7576-10-3-2-1, BL1 and Shien2 showed highly significant negative GCA effects for No. of days to heading, while Giza177, Sakha101 and Shien2 exhibited significant negative GCA effects (desirable) for plant height. Sakha 101 exhibited highly significant positive GCA effects for No. of panicles plant⁻¹. The two rice varieties Sakha101 and Sakha104 which proved to be excellent combiners for grain yield plant⁻¹ would be of practical interest in a breeding program towards developing high yielding genotypes. Fourteen out of the twenty eight hybrid combinations showed highly significant negative SCA effects for No. of days to heading. Twenty out of the twenty eight F₁ hybrids exhibited highly significant desirable SCA effects for grain yield plant⁻¹. These superior twenty crosses were previously found to express useful heterosis. Clustering varieties based on similarity of quantitative characters produced tow large groups. The first group, included Sakha 101 and Sakha 104 these two similar varieties in heading average was 107.5 days. The second group included all short days to heading, the average of those varieties was 91.6 days.

INTRODUCTION

Rice is one of the most important staple foods for about one-half of the human race. About one-third of man kind (1.3 billion people) depends on rice more than half of its food (Annual report of International Rice Research Institute, IRRI, 1996). Rice is considered the most popular and important field crop in Egypt for several reason: as a staple food after wheat; as a second exporting crop after cotton; as a land reclamation crop for improving the productivity of the saline soils widely spread in North Delta and coastal area; and finally it is asocial crop in which every person in the farmers family could find work in rice fields and gain money during the growing season. Rice crop plays a significant role in Egypt's strategy for sustaining the food self-sufficiency and for increasing the export. In 2005 season, the total rice production in Egypt reached 6.6 million tons with a national average of 10.00 tons/ha. This average ranked the first among the rice producing countries in the world (RRTC 2006). Further increase in rice production through increased yield per unit area is needed. Continuously, rice breeders and producers looking for new technology and new lines, which increase rice production with acceptable grain quality. Rice production should increase by about 60 % by the year 2025 to feed the additional rice consumers (Duwayri *et al.*, 1999). Increasing rice production has been a problem due to limited land available and water shortage.

MATERIALS AND METHODS

This study was conducted at Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt during 2009 and 2010 growing seasons. The study involving eight rice Egyptian genotypes i.e., five commercial varieties (Giza177, Sakha101, Sakha104, Sakha105 and Sakha106), one promising lines (GZ7576-10-3-2-1) and two international deferential varieties (BL1 and Shien2). The eight genotypes were sown in the summer growing season of (2009) in three sowing dates. A half diallel design was conducted among the eight parents to produce twenty eight crosses. The hybridization technique of Jodon (1938) and modified by Butany (1961), was utilized. The parental varieties and the resulted crosses evaluated in a Randomized Complete Block Design (RCBD) experiment with three

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replications in 2010 growing season. Each replication had twenty five individual plants from each genotype. Data have been collected on plant height (cm), No. of days to heading (days), No. of panicles plant⁻¹, grain yield plant⁻¹ (g), 1000-grain weight (g), spikelets fertility%, hulling%, milling% and head rice% according to the standard evaluation system of IRRI (1996). In 2010 growing season the eight genotypes were crossed in a half diallel design, combining ability analysis were carried out according to model 1, method 2 of Griffing (1956). The cluster analysis was conducted using the Numerical Taxonomy and Multivariate Analysis System, Version 2.1 (NTSYSpc; Rohlf, 2000).

RESULTS AND DISCUSSION

1- Mean performance:

The mean performance of parental varieties and their 28 F₁ hybrids for all studied traits are presented in Table(1). Regarding plant height the shortest plant height is desirable. The two parents Shien2 and Sakha101 gave the lowest mean values of 85.4 and 92.3 cm respectively. The F₁ generation had the highest values compared with parents indicated that the F₁ generation, possess the over dominance for this trait. For days to heading the most desirable mean values towards the earliness were obtained from the parents GZ7576-10-3-2-1, Sakha 106 and shien2 which gave the lowest mean values of 92.0, 93.0 and 93.3 days, respectively. On the other hand, results recorded that the crosses BL1×Shien 2 and Sakha101×Sakha105 gave the same mean values for No. of days to heading (earliness) with the mean values of 92.0 days. While the crosses Sakha 105×Sakha 106, Sakha 106×Shien 2, GZ7576-10-3-2-1× BL1 and GZ7576-10-3-2-1×Shien 2 recorded 93.0 days to heading. These results revealed that the old variety sakha101 was the later parent for No. of days to heading. As for No. of panicles plant⁻¹, the highest mean values were obtained from the parents Sakha101 and Sakha105 (23.0 and 22.0 panicles respectively), but Giza177 gave the lowest mean values 19.6 panicles plant⁻¹. These results were also obtained by Rahimi *et al.*, (2010), Kelah (2012) and El-Malky and Hammoud (2012).

Regarding to grain yield plant⁻¹ the parents Sakha101 and Sakha105 recorded the highest mean values of 52.0 and 46.0 gram plant⁻¹ respectively. While the highest mean values were found in the crosses Giza177 × Sakha106, Sakha101 × Sakha104, Sakha101 × GZ7576-10-3-2-1, Sakha104 × Sakha106, Sakha105 × BL1 and Sakha106 × BL1 with mean values ranged from 81.85 to 87.20 gram plant⁻¹. But the crosses Sakha104×GZ7576-10-3-2-1and GZ7576-10-3-2-1 × BL1 gave the lowest mean values for grain yield plant⁻¹ which were 57.37 and 56.33 gram plant⁻¹, respectively. Concerning to 1000-

grain weight, the mean values of the parental varieties showed that Sakha101 and Sakha106 exhibited highest 1000-grain weight with the mean values 29.0 and 28.5 (g), respectively, but the parent GZ7576-10-3-2-1 gave the lowest mean value 26.2 (g). The hybrid combination GZ7576-10-3-2-1 × BL1 gave the highest 1000 grain weight 29.8g. While, Sakha101 × Shien2 gave the lowest mean value 26.2 (g), for the same trait.

Concerning to spikelets fertility% the parental varieties Sakha105 and Shien2 recorded the lowest mean values of (89 and 82 respectively), but Giza177 and Sakha104 gave the highest mean values of (95 and 96, respectively). On the other hand, the hybrids combinations Giza177 × Sakha104, Sakha106 × Shien2 and GZ7576-10-3-2-1 × Shien2 recorded the highest mean values (93.45, 93.93 and 94.50 %, respectively), but the crosses Sakha104 × Sakha105 and Sakha104 × BL1 gave the lowest mean values of 61.37 and 66.16, respectively.

For hulling%, the parental variety Giza177 exhibited the highest mean value of 82.47%, while Sakha105 exhibited the lowest mean value of 79.58%. On the other hand the crosses Sakha105 × BL1 and Sakha104 × GZ7576-10-3-2-1, exhibited highest mean values of 81.90 and 81.74%, respectively. While, Giza177 × Sakha106 and Sakha101 × Shien2 had the lowest mean values of 79.94 and 79.68%, respectively. Regarding milling %, the parental variety BL1 recorded the highest mean value of 72.36%, while Sakha106 recorded the lowest mean value 70.46%. On the other hand the hybrid combinations Sakha105 × BL1 and Sakha105 × Shien2 gave the highest mean values of 72.38 and 72.21%, respectively. While the four crosses Sakha101 x Shien2, Giza177 x BL1, Sakha x BL1 and BL1 x Shien2 exhibited the lowest mean values for milling % with mean values of 69.71, 70.24, 70.24 and 70.67%, respectively.

For head rice %, the highest mean values were obtained from the parent Giza177 (65.37%) but, Sakha 106 gave the lowest mean value (61.70%). On the other hand the five crosses Giza177 × Shien2, Sakha101 × Sakha 105, Sakha104 × Shien2, GZ7576-10-3-2-1 × BL1 and GZ7576-10-3-2-1 × Shien2 gave the highest mean values ranged from 65.06 to 65.67%, but the crosses Giza177 x GZ7576-10-3-2-1, Giza177 x Sakha105, Skha101 x Sakha106, Sakha104 x GZ7576-10-3-2-1 and Sakha101 x GZ7576-10-3-2-1 gave the lowest mean values 60.95, 61.09, 61.17, 61.47 and 61.61 respectively. These resulted were also obtained by Rahimi *et al.*, (2010) and El-Malkyand Hammoud (2012).

Table 1. Mean performance of parental varieties and their F₁ crosses for all studied characters

No	Genotypes	Plant height (cm)	Days to heading (days)	No-of panicles plant ⁻¹	Grain yield plant ⁻¹ (g)	1000-grain weight (g)	Spikelet fertility %	Hulling (%)	Milling (%)	Head rice (%)
1	Giza 177	98.0	95.0	19.6	45.00	28.0	95.00	82.47	71.88	65.37
2	Sakha 101	92.3	110.0	23.0	52.00	29.0	90.50	81.32	71.51	64.31
3	Sakha 104	105.0	105.0	21.0	44.00	27.1	96.00	81.47	72.01	64.42
4	Sakha 105	95.0	95.0	22.0	46.00	28.0	89.00	79.58	70.89	61.78
5	Sakha 106	105.9	93.0	20.0	45.00	28.5	90.00	80.01	70.46	61.70
6	GZ 7576-10-3-2-1	102.2	92.0	21.0	37.00	26.2	92.00	81.39	70.96	64.63
7	BL 1	98.0	97.0	21.0	35.00	27.7	94.03	81.38	72.36	62.35
8	Shien 2	85.4	93.3	20.9	33.00	27.6	82.00	80.97	71.90	64.87
9	Giza 177×Sakha101	104.7	111.0	26.7	76.15	28.7	85.62	80.67	71.31	64.30
10	Giza 177× Sakha 104	111.1	96.0	25.6	75.32	27.7	93.45	80.67	71.52	62.16
11	Giza 177× Sakha 105	113.9	110.0	26.0	63.17	29.2	80.25	80.62	70.87	61.09
12	Giza 177× Sakha 106	112.3	98.0	27.0	83.87	28.7	82.25	79.94	70.78	64.55
13	Giza 177×GZ7576-10-3-2-1	108.1	97.3	26.8	69.30	28.8	78.43	80.19	71.08	60.95
14	Giza 177× BL 1	109.8	98.0	26.6	65.64	28.5	74.75	80.99	70.24	64.20
15	Giza 177× Shien 2	112.3	100.0	24.3	58.97	28.9	73.40	80.41	71.10	65.10
16	Sakha 101× Sakha 104	117.8	99.0	25.9	81.85	27.3	85.09	80.42	71.27	62.00
17	Sakha 101× Sakha 105	119.3	92.0	27.5	74.20	27.7	78.49	80.91	70.73	65.67
18	Sakha 101× Sakha 106	110.7	116.0	26.9	64.02	28.2	68.74	80.96	71.31	61.17
19	Sakha 101×GZ7576-10-3-2-1	109.6	113.0	25.1	87.20	26.6	70.55	81.16	71.25	61.61
20	Sakha 101× BL 1	110.1	111.0	29.4	74.04	28.0	69.80	81.04	70.24	63.59
21	Sakha 101×Shien 2	112.4	116.0	27.1	77.26	26.2	66.36	79.68	69.71	64.48
22	Sakha 104× Sakha 105	124.9	117.0	26.1	73.27	27.0	61.37	81.40	71.38	62.82
23	Sakha 104× Sakha 106	117.1	99.0	25.6	84.42	27.6	86.45	81.49	70.79	62.83
24	Sakha 104×GZ7576-10-3-2-1	122.0	112.0	23.6	57.37	28.6	85.83	81.74	71.30	61.47
25	Sakha 104× BL 1	115.9	104.0	23.0	73.47	27.1	66.16	80.41	70.91	64.64
26	Sakha 104× Shien 2	116.5	103.0	22.7	72.91	26.9	81.34	81.19	70.70	65.48
27	Sakha 105× Sakha 106	111.3	93.0	25.7	57.76	28.7	77.48	80.52	71.43	64.89
28	Sakha 105×GZ7576-10-3-2-1	112.1	94.0	26.1	68.00	28.4	84.14	80.38	71.39	64.86
29	Sakha 105× BL 1	117.0	97.0	27.2	83.64	28.3	85.43	81.90	72.38	63.38
30	Sakha 105× Shien 2	116.3	94.0	23.5	63.83	28.8	88.24	81.14	72.21	63.09
31	Sakha 106× GZ7576-10-3-2-1	115.4	91.7	28.0	58.17	28.8	77.77	81.29	71.40	62.57
32	Sakha 106 × BL 1	124.4	100.3	27.0	83.24	28.2	82.40	81.07	71.21	63.90
33	Sakha 106 × Shien 2	117.5	93.0	25.4	69.30	28.5	93.93	81.39	71.71	64.03
34	GZ7576-10-3-2-1× BL 1	116.5	93.0	26.5	56.33	29.8	92.69	81.79	71.44	65.06
35	GZ7576-10-3-2-1× Shien 2	115.7	93.0	27.3	79.39	27.8	94.50	81.53	70.86	65.12
36	BL 1× Shien 2	110.8	92.0	23.8	57.34	27.4	91.37	79.98	70.67	63.71

2- Analysis of variation:-

The ordinary analysis of variance for all genotypes and combining ability for the studied characters attributes are presented in Table (2). Highly significant mean squares were observed for genotype, parents, crosses and parent vs. crosses for all studied traits i.e. plant height, days to heading, No. of panicles plant⁻¹, grain yield plant⁻¹, 1000-grain weight, spikelets fertility%, hulling%, milling% and head rice%. This finding indicated the presence of large variation among the studied genotypes and portion of these genotypic variances to its component are varied.

Parent vs. Crosses mean square as an indication to average heterosis overall crosses, were found to be highly significant for all studied characters under investigation. These resulted were also obtained by Rahimi *et al.*, (2010) and El-Malky and Hammoud (2012).

Estimates of both general (GCA) and Specific (SCA) combining ability variances for all studied traits are presented in Table 2. Both general combining ability and specific combining ability variances were found to be highly significant for all characters. This would indicate the importance of both additive and non-additive genetic variances in determining the performance of these nine studied characters. The question remains would be about the relative importance of the type of gene action involved in the inheritance of these traits, therefore, GCA/SCA ratio was used to charity the nature of the gene action involved. The

GCA/SCA variance were found to be greater than unity for days to heading and 1000-grain weight, indicating that, additive and additive × additive types of gene action were the greater importance in this traits but for the other traits the non-additive type, were great important in plant height, No. of panicle plant⁻¹, grain yield plant⁻¹, spikelets fertility%, hulling%, milling% and head rice%.

It could be concluded that selection procedures based on the accumulation of additive effects would be successful in improving the days to heading and 1000-grain weight traits. However, to maximize selection advance, procedures which are known to be effective in shifting gene frequency when both additive and non-additive genetic variance are involved, would be preferred. Both general and specific combining ability variances were also found for all traits by El-Refae (2002); Huang *et al.*, (2008); El-Agamy *et al.*, (2008) Saidaiah *et al.*, (2010) and Kelah (2012).

3-1- General combining ability effects:-

Estimates of general combining ability effects (gi) for individual parental line for all characters are presented in Table (3). Theoretically, an estimate of GCA effects of a line depends upon the group of lines to which it was crossed in the diallel crossing system. If the line is exactly as the average in its general combining ability effect, the expected estimate of (gi) would be zero. Significant departure from zero, where ever the direction would indicate that the line is much better or much worse than the overall average of the parental lines involved.

Table 2. Mean squares estimates of ordinary analysis and combining ability for all studied characters

S . V	d.f	Plant height (cm)	Days to heading (days)	No. of panicles plant ⁻¹	Grain yield plant ⁻¹ (g)	1000-grain weight (g)	Spikelets fertility %	Hulling (%)	Milling (%)	Head rice (%)
Replications	2	0.057	0.009	0.186	0.861	0.221	0.185	0.192	0.062	0.053
Genotypes	35	229.9**	199.2**	19.20**	685.7**	2.154**	264.0**	48.11**	54.09**	6.154**
Parents	7	986.7**	97.69**	23.81**	878.6**	15.16**	412.2**	17.21**	9.140**	5.142**
Crosses	27	1818**	649.6**	203.8**	7505**	58.11**	6775**	27.64**	24.94**	18.817**
P vs. F ₁	1	5244**	6227**	444.6**	15618**	2.12**	2052**	1639**	1859**	191.4**
Error	70	3.944	1.152	0.695	3.348	0.356	1.441	0.354	0.244	0.471
G.C.A	7	61.96**	134.0**	4.026**	95.42**	1.109**	36.11**	0.299**	0.169**	1.563**
S.C.A	28	80.34**	49.51**	6.996**	261.8**	0.620**	100.9**	19.971**	22.49**	2.173**
Error	70	1.314	0.384	0.231	1.116	0.118	0.480	0.118	0.081	0.157
GCA/SCA		0.771	2.707	0.575	0.364	1.788	0.357	0.014	.0075	0.719

*and**, significant and highly significant, respectively.

Table 3. General combining ability effect for all studied characters

Parents	Plant height (cm)	Days to heading (days)	No. of panicles plant ⁻¹	Grain yield plant ⁻¹ (g)	1000-grain weight (g)	Spikelets fertility %	Hullin g (%)	Milling (%)	Head rice (%)
Giza 177	-2.86*	-0.30	-0.14	0.08	0.550*	1.19**	-0.196	1.190**	1.108**
Sakha 101	-2.74*	7.45**	1.08**	5.71**	-0.13	-4.05**	-1.135**	-0.148	-0.057
Sakha 104	3.83*	3.65**	-0.92**	2.49**	-0.57*	0.54	1.213**	0.086	1.178**
Sakha 105	0.78	-1.64**	0.24	-0.57	0.20	-1.27**	-0.056	1.038**	1.265**
Sakha 106	2.36*	-2.64**	0.18	0.91	0.34	0.28	-1.163**	1.129**	-0.467
GZ 7576-10-3-2-1	0.71	-2.54**	0.16	-3.18**	-0.19	2.16**	0.077	0.154	1.112**
BL 1	0.36	-1.40**	0.18	-1.79**	0.048	0.44	0.267	1.010**	0.116
Shien 2	-2.45*	-2.57**	-0.77*	-3.66**	-0.24	0.69	-1.008	-0.103	0.856*
L.S.D. 5%	1.008	0.426	0.594	1.027	0.546	0.720	0.740	0.652	0.802
1%	1.491	0.630	0.879	1.519	0.808	1.065	1.096	0.965	1.187

*and**, significant and highly significant, respectively.

General combining ability effects computed herein were found to be differing significantly from zero in most cases. High positive values of GCA effects would be of interest in most traits under investigation. However, high negative values for days to heading and plant height would be useful from the breeder's point of view. The five rice varieties Sakha105, Sakha106, GZ7576-10-3-2-1, BL1 and Shien2 showed highly significant negative GCA effects for days to heading, revealing that these varieties could be considered as good combiners for developing early genotypes. As for plant height, Giza177, Sakha101 and Shien2 exhibited significant negative GCA effects. Proving to be good combiners for dwarfism. This conclusion was also drawn by Singh and Kumar (2005); Saidaiah *et al.*, (2010) and Selvaraj *et al.*, (2011).

As for No. of panicles plant⁻¹, Sakha 101 exhibited highly significant positive GCA effects, proving to be good combiner for this trait. Giza177, showed significant positive GCA effect for 1000-grain weight, proving to be good combiner in this concern. The two rice varieties Sakha101 and Sakha104 showed highly significant positive GCA effects for grain yield plant⁻¹, proving to be excellent combiners for this trait. It could be concluded that the two rice varieties Sakha101 and Sakha104 which proved to be excellent combiners for grain yield plant⁻¹ would be of practical interest in a breeding program towards developing high yielding genotypes because of their superiority in at least two of the grain yield contributory. This conclusion was also drawn by Abd Allah (2008) and Kelah (2012).

Sakha104 showed highly significant desirable GCA effects for hulling %, proving to be good combiners in this concern. As for milling %, two rice varieties Giza177, Sakha105 and Sakha106 showed highly significant desirable GCA effects proving to be good general combiner for this character. Concerning head

rice % two rice varieties, Sakha101 and Sakha106 showed negative significant GCA effects indicated that two varieties good combiners in this concern. It is of interest to mention that Giza177 and Sakha106 proved to be good combiner for most grain character studied. The results reported by Hammoud (2004) and Hassan *et al.*, (2011).

3-2- Specific combining ability effects (Sij):-

Estimates of the specific combining ability effects (Sij) for the parental combinations for all studied characters are given in Table (4). The significant desirable interallelic interaction would only be discussed here. Fourteen of the twenty eight hybrid combinations studied showed highly significant negative SCA effects for days to heading. Two of these thirteen crosses were found to show useful heterosis Sakha101xSakha104 and Sakha106xGZ7576-10-2-3-1 (Table 4). It is of interest to note that some of the rice varieties which were involved in these superior thirteen crosses were found to be among the best combinations and others were among the poorest combiners for days to heading. For plant height, one hydride combination Sakha105 x Sakha106 was detected to exhibited negative highly significant desirable SCA effects. Eighteen out of the twenty eight hybrid combinations in vestigated showed significant and highly significant SCA effects for No. of panicles plant⁻¹. These excellent eighteen crosses were previously found to express useful heterosis.

Twenty out of the twenty eight hybrid combinations studied exhibited highly significant desirable SCA effects for grain yield plant⁻¹. These superior twenty crosses were previously found to express useful heterosis. As for 1000-grain weight, two crosses showed highly significant SCA effects Sakha105 x Shien2 and Gz7576-10-3-2-1 x BL1 these crosses which showed highly significant heterosis. It is for interest to mention that the four rice varieties Sakha105, Shein2, Gz7576-

10-3-2-1 and BL1 were found to be among the poor combiner for 1000-grain weight. However, ten of the twenty eight hybrid combinations exhibited highly significant SCA effects spikelets fertility%. Twenty six crosses showed significant and highly significant desirable SCA effects for hulling %, three crosses were previously found to express useful heterosis.

Also some of the parental varieties which involved in these crosses were found to be among the best combiner for hulling % and the other were among the poorest combiners for this trait except Sakha101 x Shein2 and BL1 x Shein2. Nine out of the twenty eight hybrid combination investigated showed highly significant SCA effects for milling %. Six crosses from these nine

crosses which showed highly significant heterosis. It is of interest to mention that the three rice varieties Sakha101, Sakha104 and Sakha105 were found to be among the poor combiners for milling%. As for head rice %, six hybrid combinations showed significant and highly significant SCA effects, three of them were previously showed highly significant desirable heterosis.

The results obtained here concerning general and specific combining ability effects could indicate that the excellent crosses which showed desirable SCA effects were obtained from crossing good by good, good by low and low by low combiners. Consequently, it could be

Table 4. Estimates of specific combining ability effects (Sij) for all studied characters

Crosses	Plant height (cm)	Dayso heading (days)	No.of panicles plant ⁻¹	Grain yield plant ⁻¹	1000-grain weight	Spikelet fertility %	Hulling (%)	Milling (%)	Head rice (%)
Giza 177×SaKha101	-0.41	3.47**	0.90*	5.734**	0.403	5.569**	2.196**	-2.05**	0.695
Giza 177× Sakha 104	-0.66	-7.73**	1.81**	8.119**	-0.16	8.798**	1.854**	-2.08**	-1.330*
Giza 177× Sakha 105	5.19**	11.57**	1.04*	-0.96	0.567	-2.58**	2.073**	-2.60**	-2.31**
Giza 177× Sakha 106	2.044*	0.57**	2.103**	18.25**	-0.08	-2.14**	1.500*	-2.60**	1.356*
Giza 177×GZ 7576-10-3-2-1	-0.5	-0.2**	1.92**	7.784**	0.43	-7.85**	1.503*	-2.58**	-2.60**
Giza 177× BL 1	1.517	-0.66**	1.73**	2.723**	-0.01	-9.8**	2.113**	-3.26**	0.419
Giza 177× Shien 2	6.87**	2.50**	0.4	-2.07**	0.654	-11.4**	1.813**	-2.31**	0.57
Sakha 101× Sakha 104	5.983**	-12.49**	0.85	9.012**	-0.01	5.688**	1.543**	-1.99**	-1.32*
Sakha 101× Sakha 105	10.5**	-14.2**	1.35**	4.439**	-0.35	0.914	2.303**	-2.40**	2.439*
Sakha 101× Sakha 106	0.354	10.8**	0.74	-7.23**	-0.06	-10.4**	2.453**	-1.73**	-1.85**
Sakha 101×GZ 7576-10-3-2-1	0.907	7.70**	-1.04*	20.05**	-1.16**	-10.5**	2.41**	-2.08**	-1.77**
Sakha 101× BL 1	1.69*	4.57**	3.30**	5.499**	0.099	-9.5**	2.109**	-2.93**	-0.026
Sakha 101×Shien 2	6.84**	10.74**	1.93**	10.59**	-1.44**	-13.2**	1.025	-3.36**	0.127
Sakha 104× Sakha 105	9.487**	14.6**	1.93**	6.718**	-0.68	-20.8**	2.440**	-1.99**	-0.290
Sakha 104× Sakha 106	0.107	-2.4**	1.48**	16.38**	-0.23	2.711**	2.634**	-2.49**	-0.085
Sakha 104×GZ7576-10-3-2-1	6.66**	10.5**	-0.49	-6.57**	1.28	0.196	2.650**	-2.26**	-1.79**
Sakha 104× BL 1	0.914	1.37**	-1.11*	8.135**	-0.43	-17.8**	1.130*	-2.49**	1.145
Sakha 104× Shien 2	4.367**	1.53**	-0.48	9.445**	-0.26	-2.82**	2.186**	-2.60**	1.248*
Sakha 105× Sakha 106	-2.64**	-3.1**	0.45	-7.21**	0.1	-4.44**	1.940**	-1.72**	2.062*
Sakha 105×GZ 7576-10-3-2-1	-0.16	-2.2**	0.84*	7.136**	0.274	0.335	1.556**	-2.05**	1.681*
Sakha 105× BL 1	5.064**	-0.33	1.88**	21.38**	0.067	3.355**	2.886**	-0.894	-0.031
Sakha 105× Shien 2	7.217**	-2.16**	-0.82	3.445**	0.864*	5.919**	2.406**	-0.972	-1.058
Sakha 106× GZ 7576-10-3-2-1	1.564*	-3.53**	2.76**	-4.19**	0.559	-7.59**	2.573**	-1.95**	-0.411
Sakha 106 × BL 1	10.95**	4.004**	1.77**	19.49**	-0.18	-1.24*	2.163**	-1.98**	0.698
Sakha 106 × Shien 2	6.87**	-2.16**	1.13*	7.421**	0.383	10.05**	2.760**	-1.38**	0.084
GZ 7576-10-3-2-1× BL 1	4.704**	-3.43**	1.29**	-3.31**	1.793**	7.166**	2.643**	-2.03**	1.496*
GZ 7576-10-3-2-1× Shien 2	6.724**	-2.26**	3.06**	21.61**	0.09	8.723**	2.662**	-2.52**	0.816
BL 1× Shien 2	2.11**	-4.4**	-0.43	-1.83*	-0.45	7.316**	0.916	-2.54**	-0.822
L.S.D. 5%	1.528	0.647	0.901	1.557	0.828	1.092	1.123	0.989	1.217
1%	2.062	0.872	1.216	2.101	1.117	1.473	1.515	1.334	1.642

*and**, significant and highly significant, respectively.

concluded that GCA effects of the parental varieties were generally unrelated to the specific combining ability effects of their respective crosses. This conclusion was also drawn by Aidy and Maximos (2006); Sedeek (2006) and Chakraborty *et al.*, (2010).

Cluster analysis:

Clustering of varieties based on similarity of morphological characters. Table (5) showed the similarity matrix of nine morphological agronomic characters for eight parents. Clustering varieties based on similarity of quantitative characters produced two groups (Figure1). The first included; Sakha101 and Sakha104, this in group one, two varieties were similar in heading (average is 107.5 days), and highest grain yield plant⁻¹. These tow varieties were similar at hulling% and head rice%. While, the second group included; Giza177, Gz 7576-10-3-2-1, BL1, Sakha105, Sakha106 and Shien2. This group included all short days to heading varieties (average is 91.6 days) and were similar at No. of panicles plant⁻¹. This group was

divided into two sub groups, the first sub group included Shien2 alone. This variety has the lowest values for plant height, spikelets fertility% and grain yield plant⁻¹ characters. The second sub group included; Giza177, GZ7576-10-3-2-1, BL1, Sakha105 and Sakha106. this group divided into two sub group, the sub sub group included Sakha105 and Sakha106 in which both varieties were similar at 1000-grain weight, milling % and head rice %. Second sub sub groups included Giza177, GZ7576-10-3-2-1 and BL1. This group divided into two sub groups, the first sub sub sub groups included GZ7576-10-3-2-1 and BL1 in which both varieties gave the same values for No. of panicle plant⁻¹, and hulling %. Finally, the results gave Giza177 variety in one bereuch because this variety recorded the lowest values for No. of panicles plant⁻¹. These resulted were also obtained by El-Moghazy (2007); Anees (2009) and Sedeek *et al.*, (2009).

Dendrogram of eight rice varieties based on 9 quantitative charaters

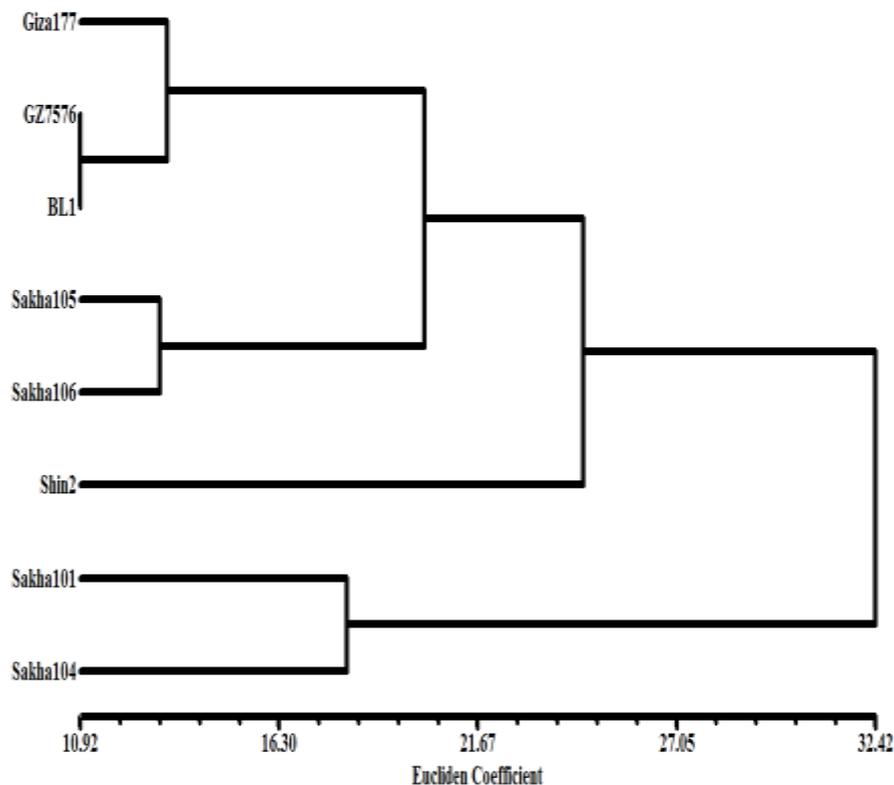


Figure 1. Cluster diagram for eight varieties classified by nine morphological quantitative characters

Table 5. Similarity matrix for eight varieties based on nine morphological characters

	Giza177	Sakha101	Sakha104	Sakha105	Sakha106	GZ7576-10-3-2-1	BL1	Shien2
Giza177	0.00							
Sakha101	3.691	0.00						
Sakha104	3.273	1.813	0.00					
Sakha105	1.782	2.489	2.260	0.00				
Sakha106	2.405	2.747	1.759	1.307	0.00			
GZ7576-10-3-2-1	1.326	3.651	2.900	1.615	1.831	0.00		
BL1	1.328	3.980	3.371	1.994	2.510	1.092	0.00	
Shien2	2.304	4.436	4.340	2.486	3.393	2.238	1.835	0.00

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الملخص العربي

تقدير القدره العامه علي الأتلاف وتحليل الشجره الوراثية لبعض أصناف الأرز

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المثوية للتبييض وكذلك النسبة المثوية للتدرج. وكان هناك خمسة أصناف سخا105 وسخا106 ووجي زد 7576 و ب ل 1 وشين2 أعطت معنويه عالية سالبة للقدره العامه علي التالف لصفة عدد الأيام الازمه حتي التزهير، وكان الصنف جيزه 177 وسخا101 وشين2 عالي المعنوية بالنسبة لصفة طول النبات وأعطى الصنف سخا101 معنوية عاليه موجبة بالنسبة للقدره العامه علي التالف لصفة عدد الافرع الحاملة للسنابل. وكان الصنف سخا101 وسخا104 أفضل الأباء المانحة لصفة محصول الحبوب/ نبات الفردي ولذلك يمكن استخدام تلك الاصناف في برنامج التربية في الأرز لتحسين صفه المحصول واستنباط تراكيب وراثية عالية المحصول. أظهرت النتائج أن هناك 14 تركيب وراثيا أعطت معنوية عالية سالبة بالنسبة للقدره الخاصة علي التالف لصفة عدد الايام الازمه التزهير وايضا وجود 20 تركيب وراثيا مرغوب بالنسبة لصفة محصول الحبوب/ نبات. وبدراسة العلاقة الوراثية بين الثماني أصناف والسلالات فان الشجرة الوراثية الناتجة من التحليل أوضحت أن هناك تباعد بين الأصناف قسمت الى مجموعتين رئيسيتين. وهذا التقسيم يرجع الى التباين في النضج حيث تم وضع الصنفين سخا101 وسخا104 في مجموعة مستقلة نظرا لطول فترة نضجه.

أجريت هذه الدراسة بالمزرعة البحثية بمركز البحوث والتدريب في الأرز- سخا- كفرالشيخ- مصر، خلال الموسمين 2009 و2010 خلال هذه الدراسة تم التهجين بين ثماني تراكيب وراثية (جيزة 177, سخا101, سخا104, سخا105 وسخا106, والسلالة جي زد 7675 والاصناف الاجنبية ب ل 1 و شين2) بنظام التهجين الدوري(غير شامل الهجن العكسية) وذلك للحصول منها علي ثمان وعشرين هجيناً، وتم دراسة الصفات التالية(طول النبات- عدد الايام الازمة للتزهير- عدد الفروع الحاملة للسنابل/ النبات- محصول الحبوب نبات- وزن الألف حبة- النسبة المثوية لخصوبة السنبيلات- النسبة المثوية للتقشير- النسبة المثوية للتبييض- النسبة المثوية للتدرج). وكان التباين الوراثي الراجع الي التركيب الوراثية والاباء والهجن الناتجة منها وكذلك الاباء مقارنه بالمهجن عالية المعنوية لكل الصفات تحت الدراسة وكانت تقديرات القدره العامه والخاصة للأتلاف عالية المعنوية لكل الصفات محل الدراسة وكانت قيمة القدره العامه على الخاصة أكبر من الواحده بالنسبة لصفة عدد الايام حتي التزهير ووزن الالف حبة وهذا يدل علي تأثير التباين الوراثي المضيف حيث يلعب دور هاماً في وراثه تلك الصفات. وعلي الجانب الاخر فان التباين الوراثي غير المضيف شاملاً لسياده كان له دور هام في وراثه صفة طول النبات وعدد الافرع الحاملة للسنابل/ نبات ومحصول الحبوب لكل نبات والنسبة المثوية لخصوبة السنبيلات والنسبة المثوية للتقشير والنسبة