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SUMMARY

The present investigation was carried out at the Rice Research and Training Center (RRTC), Sakha, Kafr El-sheikh, Egypt during 2006-2007 seasons.

The main objectives of this study are:

1- study the magnitude of both general and specific combining ability for vegetative characters, grain yield and its components and grain quality characters.

2- the potentiality of different types of heterosis expression for the studied characters of different genotypes of rice.

3- estimates of the genetic components and heritability in broad and narrow sense according to Hyman (1954).

4- estimates of correlation among all studied characters.

5- estimates of cluster analysis for nine rice varieties.

To achieve these objectives, nine rice varieties and lines were used in these study and classified into very early varieties HR5824-B-3-2-3 and moderate early varieties Giza 177, Gz7685-8-1-3-2 and Gz6522-15-1-1-3, late varieties Sakha 101, Sakha 104, Gz6910-28-1-3-1 and Gz6903-1-2-2-1 and very late variety Giza 171. These varieties were studied in half diallel cross, therefore, thirty six F_1^s were obtained and different characters were studied. These characters were:

*Vegetative characters:(days to maturing, elongation period of panicle initiation, plant height, number of tillers per plant, flag leaf area and chlorophyll content).

*Grain yield and its components characters: (panicle length, number of primary branches per panicle, spikelet fertility percentage, panicle weight, 1000-grain weight, number of panicles per plant, grain yield per plant and harvest index).

*Grain quality characters: (hulling %, milling % and head rice %).

The results obtained in this investigation could be summarized as follows:

1- Vegetative characters:

Diallel analysis:

A- Griffing approach:

1- Genotypes, parents and the resultant crosses mean squares were found to be highly significant for all vegetative characters studied.

2- General combining ability (GCA) and specific combining ability (SCA) variances were found to be highly significant for all vegetative characters. The GCA/SCA ratios were detected to be greater than unity for days to maturing, elongation of panicle initiation and plant height characters under investigation, indicating that the importance of additive and additive x additive in the inheritance of this traits. 3- According to the results of general combining ability effects, the rice varieties identified as best combiners for vegetative characters were Giza 177, HR5824-B-3-2-3, Gz7685-8-1-3-2 and Gz6522-15-1-1-3 for days to maturing. Giza 177, HR5824-B-3-2-3, Gz6910-28-1-3-1, Gz7685-8-1-3-2 and Gz6522-15-1-1-3 for elongation of panicle initiation. Giza 177, Sakha 101, HR5824-B-3-2-3 and Gz6903-1-2-2-1 for plant height. Giza 171, Gz6522-15-1-1-3 and Gz6903-1-2-2-1 for number of tillers per plant. Giza 171 and Gz6903-1-2-2-1 for flag leaf area. Sakha 101 and Gz6522-15-1-1-3 for chlorophyll content.

4- The highest desirable specific combining ability effects of vegetative characters were detected for the crosses Giza 177 x HR5824-B-3-2-3 and HR5824-B-3-2-3 x Gz6522-15-1-1-3 for days to maturing, Sakha 101 x Gz6522-15-1-1-3 and Giza 171 x Gz6522-15-1-1-3 for elongation of panicle initiation, Sakha 101 x Gz6910-28-1-3-1 for plant height, Giza 177 x Gz6522-15-1-1-3 and Giza 171 x HR5824-B-3-2-3 for number of tillers per plant, Sakha 101 x HR5824-B-3-2-3 and HR5824-B-3-2-3 x Gz6903-1-2-2-1 for flag leaf area and Giza 177 x Gz6910-28-1-3-1, Sakha 101 x Gz6522-15-1-1-3 and Sakha 104 x Gz6522-15-1-1-3 for chlorophyll content.

5- The hybrids Sakha 101 x Giza 171 and Giza 171 x Gz6910-28-1-3-1 recorded the highest positive significant values of heterosis over standard parent, Giza 177 x Gz6522-15-1-1-3 and Sakha 101 x Sakha 104 over better parent and Giza 171 x Gz7685-8-1-3-2 for days to maturing character. Giza 171 x Gz6522-15-1-1-3 gave the highest value for elongation of panicle initiation. Sakha 104 x Giza 171 gave the highest value over commercial variety and Sakha 101 x Giza 171 over better parent for plant height. Giza 177 Gz6522-15-1-1-3 for number of tillers per plant. The crosses Sakha 104 x Gz6903-1-2-2-1, Sakha 104 x Gz6910-28-1-3-1 and HR5824-B-3-2-3 for flag leaf area. Gz6910-28-1-3-1 x Gz6522-15-1-1-3 for chlorophyll content.

B- Hyman approach:

1- The additive components (D) was found to be highly significant for days to maturing, elongation panicle initiation, plant height and chlorophyll content, while, was significant for flag leaf area.

2- (F) values were found to be positive for all vegetative characters except plant height.

3- The dominance genetic components H_1 and H_2 were detected to be highly significant for all vegetative characters studied. Moreover, the estimated values of dominance components H_1 and H_2 were found to be greater in their magnitudes than the corresponding additive genetic variance (D) for most vegetative traits under study.

4- The average degree of dominance $(H_1/D)^{1/2}$ was found to be greater than unity for all vegetative characters except days to maturing, elongation of panicle initiation and plant height.

5- The proportion of dominant and recessive alleles in the parents K_D/K_R was greater than unity for all vegetative characters except plant height.

6- High heritability values in broad sense (Hbs) were detected for all vegetative characters studied. While, heritability in narrow sense (Hns) values were found to be lower than those of broad sense for most vegetative characters studied.

2- Grain yield and its components:

Diallel analysis:

A- Griffing approach:

1- Genotypes, parents and the resultant crosses mean squares were found to be highly significant for all grain yield and its components characters studied.

2- The general combining ability and specific combining ability variances were found to be highly significant for all grain yield and its components. The GCA/SCA ratios were detected to be lower than unity for all yield traits under investigation, indicating that the importance of non-additive for this traits.

3- According to the results of general combining ability effects, the rice varieties identified as best combiners for yield and its components were Giza 171 for panicle length, number of primary branches per panicle and filled grains per panicle percentage. Sakha 101 for panicle weight, Gz7685-8-1-3-2 for 1000-grian weight, Gz6910-28-1-3-1 for number of panicles per plant, Sakha 101 and Sakha 104 for grain yield per plant and Gz6903-1-2-2-1 for harvest index.

4- The highest desirable specific combining ability effects of yield and its components characters were detected for the crosses Sakha 101 x Gz7685-8-1-3-2 for panicle length, Giza 177 x Gz6910-28-1-3-1 for number of primary branches per panicle and filled grains per panicle percentage. Sakha 101 x Giza 171 for panicle weight, Sakha 101 x HR5824-B-3-2-3 for 1000-grian weight, Giza 177 x Gz6522-15-1-1-3 for number of panicles per plant, Gz6910-28-1-3-1 x Gz6903-1-2-2-1 for grain yield per plant and Giza 171 x Gz6903-1-2-2-1 for harvest index.

5- The hybrid Sakha 104 x Giza 171 recorded the highest positive significant values of heterosis over standard parent, Sakha 101 x Gz7685-8-1-3-2 over mid parent and better parent for panicle length character. Sakha 101 x Giza 171 gave the highest value over standard parent, Giza 177 x Gz6910-28-1-3-1 over better parent and mid parent for number of primary branches per panicle. While, Sakha 104 x Giza 171 recorded the highest value over commercial variety, Giza 177 x

Sakha 101 over better parent and mid parent for filled grains percentage, also, Giza 177 x Gz6903-1-2-2-1 gave the highest significant positive value over standard parent, better parent and mid parent for panicle weight. Sakha 101 x Giza 171 recorded the highest value over commercial variety, Sakha 104 x Gz6903-1-2-2-1 over better parent and Giza 177 x Sakha 104 over mid-parent for grain yield per plant.

B- Hyman approach:

1- The additive components (D) was found to be highly significant for all yield and its components characters studied except panicle weight, number of panicles per plant and grain yield per plant.

2- Positive (F) values were found to be all yield and its components characters except panicle weight and harvest index.

3- The dominance genetic components H_1 and H_2 were detected to be highly significant for all yield and its components characters studied. Moreover, the estimated values of dominance components H_1 and H_2 were found to be greater in their magnitudes than the corresponding additive genetic variance (D) for most traits under study.

4- The average degree of dominance $(H_1/D)^{1/2}$ was found to be greater than unity for all yield and its components characters except panicle length.

5- The proportion of dominant and recessive alleles in the parents K_D/K_R was greater than unity for all yield characters except panicle weight and harvest index.

6- Highly heritability values in broad sense (Hbs) were detected for all yield and its components characters studied. While, heritability in narrow sense (Hns) values were found to be lower than those of broad sense for most yield characters studied.

3- Grain quality characters:

Diallel analysis:

A- Griffing approach:

1- the mean square estimates showed highly significant variation among genotypes, parents and the resultant crosses for all grain quality characters studied.

2- The general combining ability and specific combining ability variances were found to be highly significant for all grain quality characters. The GCA/SCA ratios were detected to be lower than unity for all grain quality traits under investigation, indicating that the importance of non-additive for this traits.

3- According to the results of general combining ability effects, the rice varieties identified as best combiners for grain quality characters were Gz6522-15-1-1-3 for hulling percentage and the parents Gz6522-15-1-1-3 and Gz6903-1-2-2-1 for milling and head rice percentage.

4- The highest desirable specific combining ability effects of grain quality characters were detected for the crosses HR5824-B-3-2-3 x Gz6522-15-1-1-3 for hulling percentage and the cross Giza 171 x Gz7685-8-1-3-2 for milling percentage. and Giza 177 x Sakha 101 for head rice percentage.

5- The cross HR5824-B-3-2-3 x Gz6522-15-1-1-3 recorded the highest positive significant values of heterosis over standard parent, better parent and mid-parent for hulling percentage. Also, Giza 171 x Gz7685-8-1-3-2 gave the best value over commercial variety, better parent and mid parent for milling percentage and HR5824-B-3-2-3 x Gz7685-8-1-3-2 over mid parent for head rice percentage.

B- Hyman approach:

1- The additive components (D) was found to be highly significant for all grain quality characters studied except hulling percentage.

2- Positive (F) values were found to be all grain quality characters studied.

3- The dominance genetic components H_1 and H_2 were detected to be highly significant for all grain quality characters studied except hulling percentage. Moreover, the estimated values of dominance components H_1 and H_2 were found to be greater in their magnitudes than the corresponding additive genetic variance (D) for most traits under study.

4- The average degree of dominance $(H_1/D)^{1/2}$ was found to be greater than unity for all grain quality characters studied.

5- The proportion of dominant and recessive alleles in the parents K_D/K_R was greater than unity for all grain quality characters.

6- Highly heritability values in broad sense (Hbs) were detected for all grain quality characters studied. While, heritability in narrow sense (Hns) values were found to be lower than those of broad sense for most grain quality characters studied.

4-correlation coefficients:

Highly significant correlation coefficients were obtained among most studied characters. Five yield characters were significant and highly significant correlation coefficients with days to maturing; panicle length, number of panicles per plant, filled grains per panicle percentage, panicle weight and grain yield per plant. Also, correlation coefficients indicated that early maturing affects mainly the 1000-grain weight and harvest index.

5- Cluster analysis:

Genetic relationships among the nine varieties and lines. The cluster analysis diagram showed that the varieties formed to major groups. The results revealed this formed due to maturity so the cluster analysis selected the variety Giza 171 in only group because it was very late maturing.

Conclusion

Finally, it can be concluded that the present materials might provide the rice breeders with some good genotypes for their breeding programmes. The genotypes, Giza 177, Sakha 101, HR5824-B-3-2-3, Gz7685-8-1-3-2 and Gz6522-15-1-1-3, having high potentialities can be used in breeding programme conducted to maximize the genetic gains for grain yield/plant and earliness. The multiple crossing, involving HR5824-B-3-2-3, Giza 177, Sakha 101 and Gz6910-28-1-3-1, would probably be optimum to constitute a base populations for improving rice for earliness and yielding ability in the advanced generations.