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SUMMARY AND CONCLUSSION

This investigation was carried out at the Experimental Farm of the Rice Research and Training Center (RRTC), Sakha, Kafr El-sheikh, Egypt. during the three successful growing seasons from 2004 to 2006. The six lines (Giza178R, Giza182R, GZ5121-5-2R, HVR2, PR2 and PR78) and their 15 F_1 combinations were evaluated in the two seasons and data were recorded on the following traits: agronomic characters i.e.: days to heading, plant height, panicle length (cm) and spikelets panicle $^{-1}$, yield and its component characters i.e.: grain yield plant $^{-1}$, panicles plant^{-1}, filled grains panicle^{-1}, 1000-grain weight (g) and spikelet fertility percentage, floral charactaristics i.e.: anther length (mm), anther width (mm), feathery stigma length (mm), feathery stigma width (mm), angle of floret opening (^{o}), filament elongation (mm) and duration of spikelet opening (min). The main objectives of this investigation to study

- The combining ability in diallel crosses of six rice , *Oryza sativa* L., cultivars According to **Griffing (1956)**, method 2 model 1 and **Hayman (1954).**
- The potentiality of different types of heterosis expression through three formulas used in this purpose i.e. mid-parents heterosis, better parent heterosis and standard heterosis.
- The relationship between heterosis and combining ability effects and the importance which should be given to this materials in a breeding programe according to their general combining ability and heterosis effects.
- Estimation of the genetic component and heritability in broad and narrow senses according to **Hayman approach (1954).**

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

I- Agronomic characters:

- Analysis of variance showed highly significant differences for all agronomic characters for each year and their combined data. The results showed highly significant variances for plant height, panicle length, and spikelets panicle^{-1} .

- The general combining ability was highly significant and differ for most of parents , it showed a high and positive values for most of studied characters. Also high negative values for days to heading and plant height. The cultivars Giza182R and Giza178R was the best combiners in combined data for days to heading , GZ5121-5-2R and HVR2 which had the highest values and significant estimates for combining ability effects and PR2, PR78. The parental lines Giza182R and Giza178R were the best combiner (restorer lines) for cytoplasmic male sterile lines. The cultivars Giza178R and Giza182R were the best combiners for plant height. The aromatic restorer lines PR2 and PR78 gave positive and highly significant values for GCA. Moreover, the same cultivars showed highest positive values for panicle length,

- The highest desirable SCA effects, six crosses showed negative significant values for days to heading character, 12 crosses for plant hight. While eight crosses for panicle length , 12 crosses for spikelet panicle^{-1} , all these crosses showed positive significant values for SCA.

- Estimate of genotypes of crosses for breeding for heterosis , For days to heading, estimates of heterosis over-the better parent to be highly significant and negative for 13 crosses while the other two crosses showed highly significant and positive values. The highest negative estimates were determined for Giza182R x HVR2 (-10.72%), Giza178R x

PR78 (-9.906%) and Giza178R x PR2 (-9.228%), while the lowest values were -2.127, -2.423 and -2.458% for the crosses HVR2 x PR2, PR2 x PR78 and Giza178R x GZ5121-5-2R, respectively.

- The additive genetic component “D” was positive highly significant for days to heading , plant height and panicle length in the two years and their combined data while it was insignificant in the first year and combined for spikelets panicl^{-1}. Moreover, the dominance genetic components was positive and highly significant for plant height, panicle length and spikelets panicl^{-1}, according to **Hayman approach (1954).**
- The average degree of dominance was in the over dominance in behavior of spikelets panicle^{-1} character.
- The estimator of the average frequency of positive vs negative alleles was lower than 0.25 suggesting that positive vs negative alleles were not equally distribution among the parental varieties.
- The ratio of dominance to recessive alleles (KD/KR) in the parents was greater than one for days to heading and panicle length a t the two years and their combined data and for spikelets panicle^{-1} at the second year and combined data , which indicates asymmetry of the parents ,this implies excess of dominant genes in the parents of these traits.
- Heritability estimates in broad sen se were high for agronomic characters. While heritability estimates in narrow sense were high for days to heading and plant height , this ideated that the greater part of phenotypic variance related to the additive genetic effects.

II- Yield and its component characters :

- Analysis of variance showed highly significant difference among all genotypes at the two years and their combined data this result indicated that a wide genetic variance among them. Moreover, the variance of GCA and SCA were highly significant for all characters, this indicates that the

importance of additive and non-additive genetic variance in the inheritance of yield and its component characters.

- The best parents in GCA for yield characters was the two of aromatic restorer line PR2 and PR78 , while other cultivars Giza178R and GZ5121-5-2R were the best combiner for panicles plant^{-1}, Giza182R and HVR2 for filled grains panicle^{-1} , PR2,PR78 and HVR2 for 1000-grain weight, GZ5121, Giza182 and PR2 for spikelet fertility%.
- The highest promising values for SCA effects were ten crosses for grain yield of individual plant and the best crosses were GZ5121-5-2R x PR2, GZ5121-5-2R x PR78, Giza178R x Giza182R, GZ51251-5-2R x HVR2 and Giza178R x PR78. While nine crosses gave highly significant estimates of SCA for panicles plant^{-1} , nine crosses for filled grain panicle^{-1}, five crosses for 1000-grain weight, three crosses were promising for spikelet fertility%.
- The estimates of additive variance were insignificant positive for all yield characters except 1000-grain weight, while it was highly significant for spikelet fertility %. The values of dominance variance were highly significant for that characters.
- The average degree of dominance was in the over dominance range for all yield and its component characters.
- The ratio of dominant to recessive alleles in the parents was greater than one for all yield characters except for 1000-grain weight which indicates asymmetry of the parents, this implies excess of dominant genes in the parents of these characters, but for 1000-grain weight, the ratio was less than one, so, it is partial dominance for this character.
- The dominance variance over all loci (h^2) was high for all characters except spikelet fertility%.
- The dominance genetic variance had more important than the additive variance.

- The estimator of the average frequency of positive vs negative alleles was lower than 0.25 suggesting that positive vs negative alleles were not equally distributed among the parental varieties.
- Heritability estimates in broad sense were high for all yield characters, while heritability estimates in narrow sense was relatively low for all yield characters except for 1000-grain weight character which was high.

III- Floral traits:

- The analysis of variance for floral traits, at the two years and their combined data for all genotypes showed significant or highly significant values for all studied traits the variance between years was insignificant for all traits except anther length and anther width showed highly significant values. Also for the variance of GCA and SCA for all characters at the two years and their combined data were highly significant except GCA for feathery stigma width and SCA for anther width.
- The general combing ability had been estimated for all parents for all floral traits and the best parents combiner were restorer lines PR78 and PR2 for anther length, PR2, GZ5121-5-2R and PR78 for anther width, PR2 for feathery stigma length, also Giza178, Giza182 and PR78 for feathery stigma width, PR2 and PR78 for filament elongation, so it is useful in hybrid rice breeding programe to develop new restorer lines have a long filament. Also the cultivars Giza178R and HVR2 were the best parents for angle of floret opening, PR78, PR2, GZ5121-5-2R and HVR2 for duration of spikelets opening.
- Among 15 crosses the results showed that the two crosses recorded positive significant values of SCA for anther length were Giza182R x GZ5121-5-2R and GZ5121-5-2R x HVR2. Six crosses gave positive and significant values for anther width. While, nine crosses showed negative

values of SCA effects. Three crosses for feathery stigma length, four crosses for feathery stigma width, three crosses for feathery stigma length, two crosses for filament elongation, ten crosses for angle of floral opening , and one cross for duration of spikelet opening, these crosses can be used to improve these floral traits to increase out crossing rate in hybrid rice seed production.

- Estimate of genotypes of crosses for breeding for heterosis , anther length showed significant and positive heterotic effects as deviation from the better parent values. three crosses exhibited highly significant and positive heterosis over better parent while other 12 crosses showed highly significant and negative better parent heterosis for feathery stigma length.
- Highly significant and positive values of additive component “D” for all floral traits except for anther width at the first year and feathery stigma width at the first year and combined data.
- The dominance component values were highly significant for anther width, feathery stigma width, angle of floret opening and duration of spikelets opening. This indicate the importance of dominance effects more than additive effects in the inheritance of this traits. While additive effect was more important than that of the dominance effect in the inheritance of anther length and filament elongation.
- The values of dominance variance for over heterozygous loci was significant for anther length and anther width, feathery stigma length, feathery stigma width, angle of floret opening and duration of spikelets opening indicating that dominance effect is unidirectional way.
- Mean degree of dominance for all floral traits greater than one except for anther length and feathery stigma length which was less than one. This indicated that over dominance and effects of recessive genes play a major role in the inheritance of most of floral traits.

- The estimation of the average frequency of positive vs negative alleles was lower than 0.25 suggesting that positive vs negative alleles were not equally distributed among the parental varieties.

- Heritability estimates in broad sense were high for all floral traits while in narrow sense were relatively low for feathery stigma width, filament elongation and duration of spikelets opening . This suggested that the major part of the total phenotypic variance for these traits was due to dominance genetic variance and environmental effects. These findings lead to conclusion that the selection for such traits might be done in the late generation.