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GENETIC VARIABILITY, CORRELATION AND PATH COEFFICIENT ANALYSIS FOR YIELD AND SOME YIELD-RELATED TRAITS FOR SOME GENOTYPES OF RICE.

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ABSTRACT

The current study was carried out at Rice Research and Training Center, Sakha, Kafr El-Sheikh, Egypt during the two successive seasons; 2011 and 2012. It aimed to investigate the performance of fourteen rice genotypes, including six newly elite lines, as well as seven commercial rice varieties to estimate the genetic parameters i.e. phenotypic, genotypic coefficients of variations, heritability and genetic advance from selection, to estimate the type and magnitude of associations among yield and thirteen yield-related characters. These characters were measured as phenotypic correlation as well as using path coefficients to detect the contributions of different traits to yield variations. Significant differences were detected among rice genotypes for all studied traits. The estimates of grain yield were highest in case of Giza 178 and Sakha 101 rice cultivars. Rice lines involved in this study recorded reliable estimates for yield components but, the lack of their yields may be due to high infestation by the rice stem borer. The genetic variance was highly significant for all the studied traits, indicating a wide range of genetic variability. Dead heart and white head percentages exhibited the highest phenotypic coefficients variability and genotypic coefficients variability estimates, indicating large variations among the tested rice genotypes in such traits. High heritability estimates coupled with high genetic gain were recorded for dead heart and white head. High heritability estimates coupled with moderate genetic gain were recorded for flag leaf area, no. of filled grains/panicle, no. of spikelet's/panicle and grain yield. Grain yield was significantly correlated with no. of tillers/panicle (0.556) and no. of panicles/plant (0.49). Strong positive associations were recorded between plant height and each of heading date, flag leaf area, dead heart and white head while, no. of panicles/plant had significant positive correlation with No. of tillers/plant(0.83), third internode length (0.39) and grain yield (0.49). Path coefficients analysis indicated that no. of spikelets/panicle followed by flag leaf area, no. of tillers/plant, heading date and panicle length had desirable direct effects on grain yield variations. While, white head percentage and no. of filled grains panicle played an important role on the genotypic variations of no. of tillers/panicle. From the previous results, it is evident that the five aforementioned characters could be used as selection criteria to improve grain yield.

INTRODUCTION

Rice (*Oryza sativa L.*) is considered one of the principal food crops for about one third of world population. Rice production must be increased to face the increasing population. Rice production can be enhanced either by increasing its yield per unit area and or by expanding the cultivated area. Significant increase in rice growing area are not easy , and to produce extra amounts from the same area, productivity per unit area has to be increased (Babar *et al*. 2007). Yield is not the only criterion to be considered for selection. Grain yield is a complex, multiplicative character and is a product of main factors of yield components. In population improvement programs, plant breeders must consider the other yield contributing traits in their consideration. Knowledge of the inter-relationships among yield and its components are necessary for planning an effective improvement program.

Rice grain yield is significantly correlated with each of plant height, number of panicles/plant (Oad *et al*., 2002), number of productive tiller per square meter, and number of filled grains/panicle (Surek and Beser, 2002), days to heading, flag leaf length, flag leaf width, panicle length, plant height and number of panicles/plant (Babar *et al*.,2007), days to heading, number of grains/panicle, uppermost internodes, total tillers and flag leaf length (Agahi *et al*.,2007). Number of filled grains/panicle has shown to have direct positive and moderate effect on rice yield (Gravios and Hilms, 1992), while, panicle length has a negative association with number of panicles/plant (Ise, 1992).

Path analysis has been used by many investigators to assist in identifying traits that are useful as selection criteria to improve grain yield as reported by Mishra *et al*., (1973), Rao *et al*. (1976), Nigem and Eissa (1988), El-Hity and Keredy (1992), El-Hity (1994) and Samonte *et al.* (1998), Oad *et al.* (2002), Surek and Beser (2002), Zahid *et al.* (2006), Agahi *et al.* (2007) and Babar *et al*. (2007). Information regarding genotypic, phenotypic coefficients of variability, heritability broad or narrow and genetic advance from selection are of great value to plant breeders. It enables to choose the most efficient breeding method. Such parameters took a considerable attention from many investigators viz., Zahid *et al.* (2006) and Babar *et al*. (2007).

The current investigation was conducted to obtain the following information:

1- The mean performance of fourteen rice genotypes including six exotic new plant type varieties.
2- Estimation of relative importance characters to agronomic yield variations.
3- Phenotypic (PCV), genotypic (GCV) coefficients of variations, heritability (Hb) and genetic advance from selection for the studied characters.
4- Estimation of path coefficient analysis for fourteen agronomic characters

MATERIALS AND METHODS

The present investigation was conducted during of 2011 and 2012 summer seasons at Rice Research and Training Center Farm, Sakha, Kafr El-Sheikh, Egypt. Fourteen rice cultivars and lines (Table 1) having diverse morphological and agronomical traits were involved in this study. Thirty-days old seedlings of genotypes were individually transplanted in a Randomized Complete Block Design with three replications. Each plot consisted of five rows, one meter long and 20 cm apart. Sowing dates were 1^{st} and 7^{th} May in the two seasons, respectively. All standard agronomic practices were adapted. Readings for the individual characters were recorded on the inner rows of each plot.

Observations were recorded for plant height, days to heading, number of tillers/plant, flag leaf area, number of panicle/plant, panicle length, number of filled grains/panicle, number of total grains/panicle, dead heart(%),white head(%), stem diameter, third internode thickness, third internode length and grain yield t/h.

Analysis of variance was conducted for each season according to Sendecor and Cochran (1967). Error variances from separate analysis of the data were tested for homogeneity using Bartlett's Test (Bartlett, 1937). Data over the two seasons were analyzed according to Cochran and Cox (1957).Phenotypic (PCV) and genotypic (GCV) coefficients of variability were estimated according to the method of Borton (1952). The expected genetic advance from selection (Δg) for a given traits as well as the phenotypic correlation between any pairs of traits was calculated according to Johnson *et al.* (1955). Moreover, path analysis was calculated as illustrated by Dewey and Lu (1959).Dead hared were evaluated 40 days after transplanting .The damaged plant by dead heart were counted and percentage of infestation was calculated depending on the total number of tillers per sample.

Stem borer infestation was observed and recorded at maturity stage by accounting the number of white head per plant. The reaction of evaluated genotypes was classified into five categories to standard evaluation of Rice Research and training center (RRTC), Sakha, Egypt, (2006) as follows: Resistant (R): 0-3%, white head, Moderately resistant (MR.):>3-6%, Moderately Susceptible (MS): > 6-9%, Susceptible (S): >9-12%, and highly Susceptible (HS): >12% white head. Anonymous (2009). Rice Research and Training Center Proceeding. Results of Entomology Component of. 2008 Season.

RESULTS AND DISCUSSION

Mean performance:

Mean performance for agronomic characters of 14 genotypes are presented in Table (1). The most of the traits under study had a wide range of variability. This range was reflected in a wide variation among the tested genotypes. Egyptian Yasmine gave the highest desirable values for flag leaf area, number of filled grains/panicle and number of spikelet's/panicle at the two years and their combined data. Sakha 101 showed the lowest plant height, highest grain yield and least levels of dead heart and white heads at the two years and their combined data.. The promising line, GZ7414-8-7-3-1 was detected as an early heading entry. The exotic varieties of IR6923-3-1-3-2-3, IR 66158-38-3-2-1, IR66159-189-5-5-3, IR66160-5-2-3-2-1 and IR69138-13-2-2-3gave the lowest values for number of tillers and panicles, and proved to be highly susceptible to stem borer at the two years and their combined data.. The length and thickness of the third internode indicate the tolerance to lodging. The two rice varieties; Sakha 102 and Sakha 104 had the thinnest and longest third internodes indicating that these rice cultivars are sensitive to lodging. The entries had the lowest stem borer infestations. The same results were found by Hammoud (2004).

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Wide variations among rice genotypes were detected for all studied characters (Table 1). Egyptian Jasmine rice variety significantly surpassed all other genotypes, with the highest values for plant height (111.85 cm), No. of days to heading (115.8 day), flag leaf area (63.73 cm^2), panicle length (26 cm), No. of filled grains/panicle (192), No. of spikelets/panicle(214),stem diameter(6.3 mm) and third internodes thickness (8.30 mm). However, such superiority was coupled with detecting the highest rice stem borer infestation (7.27 % dead heart and 18.43 % white head). However, some morphological characters of Egyptian Jasmine are known to enhance the level of rice stem borer infestation, e.g. large flag leaf area and thick stem diameter (Sherif *et al.* 1999).

Giza 178, Sakha 101, Sakha 102, Sakha104 and Giza 182 rice cultivars exhibited the highest number of tillers/plant and highest number of panicles/plant, but the differences were not significant. Wide variations among rice genotypes were detected for stem borer percentage. White head levels ranged between 2.83 % in case of Sakha 101 to about 24.56 % in case of IR 66158 rice line. Giza 178 and Sakha 101 rice cultivars exhibited the highest grain yield (12.21 and 12.04 t/ha.). The superiority in grain yield in case of Giza 178 and Sakha 101 were due to the high number of panicles/plant and somewhat to high number of filled grains/panicles. Low values of grain yield in case of IR 66158, IR 66159 and IR 66160 rice lines, in spite of high values of tiller number and number of filled grains/panicle may be due to stem borer infestation, which characterized by their large stem diameter. (Sherif *et al.* 1999).

Variation and interaction with years:

Mean square estimates of ordinary analysis of the 14 genotypes for agronomic traits for the two years and their combined data are presented in Table (2). Years and genotypes mean square were found to be highly significant for most of agronomic traits studied, indicating overall differences among these genotypes in both years (2011 and 2012). The interactions between genotypes and years were found to be highly significant for all traits under investigation except flag leaf area. It could be concluded that the test of genotypes under the different environmental conditions would be required. Similar results were previously obtained by Hammoud (1996 and 2004).

Correlations:

The correlations among characters are shown in Table 3. It is clear from the results that grain yield appears to be positively and significantly correlated with each of number of tillers/plant (0.556) and number of panicles/plant (0.49). The association between grain yield and number of tillers/plant is highly significant (Surek *et al.*, 1998 and Agahi *et al.*, 2007). Previous studies have mentioned that the correlation coefficients of grain yield were positive and significant with flag leaf width, panicle length, plant height, days to heading and number of panicles/plant (Babar *et al.*, 2007). Grain yield was negatively correlated with most of other traits. In general, Japonica rice suffer lower rice stem borer than do indica rices, (Sherif and Bastawisi 1997). This manifest the high stem borer infestation, recorded herein, for Giza 178, Egyptian Jasmine and IR cultivars Table (3). A strong negative significant association of grain yield and stem borer (-0.83), suggesting that the three elite rice lines; IR66158, IR 66159, IR 66160 should have further improvement to reduce the stem borer severity for aximizing their grain yield.

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Previous investigation showed that rice grain yield is a function of number of panicles per square meter (Miller *et al*., 1991). Positive association of grain yield with number of panicles has been reported earlier (Ashvani *et al.*, 1997). Grain yield was negatively correlated with plant height as was also reported by Amirthadevarathinam (1983) and Zahid *et al,*. (2006) and heading date (Surek and Beser, 2002). Plant height was significantly positively correlated with each of heading date (0.338), flag leaf area (0.545), dead heart (0.454) and white head (0.355). While, it was negatively correlated with number of tillers/plant, grain yield and number of panicles/plant. Such results indicate that grain yield could be improved by selecting short stature and good tillering ability entries and/or entries of high number of panicles /plant.

Previous studies showed that plant height was negatively correlated with number of tillers/plant and grain yield (Tahir *et al.,* 1988 and Zahid *et al.,* 2006) but, it was positively correlated with heading date (El-Hity, 1994). Strong positive association was detected between white head and each of plant height (0.355), heading date (0.616), flag leaf area (0.725), dead heart (0.313) and stem diameter (0.705). Such results may clear that we can get further improvement in grain yield through reducing white head severity by selecting early short stature cultivars with intermediate flag leaf area and stem diameter.

Path coefficient analysis

Information on the interrelationships among the studied characters were obtained by path coefficient analysis of the phenotypic correlations. Path coefficient analysis was practiced in order to find out the relative importance of each studied characters towards grain yield variations. Grain yield was considered the resultant variable and the other traits the causal variable. Path coefficient analysis between grain yield and each of the other traits are presented in Table (4). Each component had a direct effect, acting alone, and indirect effect acting in combination with the other variables. Heading date, number of tillers/plant, flag leaf area, panicle length and number of spikelets/panicle proved to have sizable direct effects on grain yield. The direct effect of heading date was positive and moderate on grain yield. Also, the indirect effects of heading date via flag leaf area and number of spikelets/panicle were positive and had moderate values while, the other indirect effects of heading date were negligible or had negative values. The positive correlation of number of tillers/plant with grain yield (0.556) could mainly be attributed to its direct effect on grain yield. Also, the indirect effects of number of tillers/plant were positive via plant height (0.122), number of filled grains/panicle (0.125), white head (0.588) and stem diameter (0.219).Grain yield has been reported to be influenced by high direct effects of total tillers and days to flowering (Amirthadevarathinam, 1983). Flag leaf area showed relatively high direct effect (0.357). Also its indirect effects via heading date, number of panicles /plant and number of spikelets/panicle were moderate and had positive values (0.163, 0.168, and 0.326, respectively). The direct effect of panicle length was positive and relatively low on grain yield (0.114). The indirect effects of panicle length via heading date, number of panicles/plant, flag leaf area and number of spikelets/panicle were moderate and had positive values. Previous results showed a positive direct effect of panicle length on grain yield (El-Hity and El- Keredy, 1992).

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Also, grain yield has been reported to be influenced by high direct effect of panicle length and flowering time (Ibrahim *et al.,* 1990)

Number of spikelets/panicle had the largest direct effect on grain yield(0.446). The direct effects via heading date, flag leaf area and number of panicles/plant were positive. While, the other indirect effects were negligible or had negative values. These results are in accordance with those obtained by Samonte *et al.* (1998). Number of spikelets/panicle showed the largest positive direct effect on rice grain yield (Song and Cho, 2008). Previous results showed that grain yield was influenced by the direct effect of number of spikelets/panicle (Lin and Wu, 1981). Stem borer proved to have a sizable negative direct effect on grain yield (-0.996).So, it seems an important variable towards grain yield. This also was confirmed by the highly significant and negative phenotypic correlation coefficient between the two characters (-0.83). Also the indirect effects via the most important growth characters such as heading date and flag leaf area were positive. The direct effects of dead heart, third internode thickness as well as third internode length on grain yield were relatively low and appear to be negligible 0.052, 0.004 and 0.072 for the aforementioned traits, respectively.

Genetic parameters:

Estimates of variance components, phenotypic (PCV) and genotypic (GCV) coefficients of variability and genetic advance (GA) are presented in Table (5). Genotypic variance (δ^2g) was highly significant for all studied traits, indicating that wide range of genetic variability among rice genotypes. The phenotypic coefficient of variability was, in general, higher than genotypic coefficient of variability, indicating into less environmental influence on the expression of different traits. Stem borer and dead heart percentage exhibited the highest PCV (47.43 and 60.67%) and GCV estimates (45.25 and 59.36%) for the two characters, respectively. This result may be due to the large variability in white head infestation among the studied rice genotypes. High heritability estimates in broad sense were detected for most of the studied traits. Such estimates were above 95% for heading date (98.59%), flag leaf area (95.28%) and stem borer (95.43%). On the other hand, number of tillers/plant and number of panicles/plant exhibited moderate broad sense heritability estimates (66.44 and 67.19%, respectively), indicating that these traits were more responsible for environmental changes. These results are in accordance with those obtained by Reddy (2002) and El-Abd (2007). The expected genetic advance is presented in Table 4. The genetic advance under selection as a percentage of mean was found to be high in magnitude for white heads and dead hearts % (88.93 and 118.91%, respectively) as a result of large variations among the materials involved in this study. Johnson *et al.* (1955) reported that heritability estimates along with genetic gain upon selection were more valuable than the former alone in predicting the effect of selection. Dixit *et al.* (1970) reported that the high heritability is not always associated with high genetic gain, but in order to make effective selection, high heritability should be associated with high genetic gain. Moderate genetic gain from selection coupled with high heritability estimates were recorded for flag leaf area (37.61%), grain yield (30.02%), number of filled grains/panicle (27.35%), number of spikelets/panicle (27.38) and third internode length (28.95). So, selection for these traits could be effective and satisfactory for successful breeding objective. These results are, in general, agree with those reported by El-Hity and El- Keredy (1992), Saravanan and Senthil (1997), Reddy (2002),Hammoud (2005) and Zahid *et al.* (2006).

Table 5 : Genetic parameters of the studied characters averaged over14 rice genotypes and the two seasons.

Characters	Grand mean	$\sigma^2 g$	$\sigma^2 e$	P.C.V.%	G.C.V. %	$h^2_{b.s}$	Δg	g(% of mean)
Plant height	99.39	15.96	2.97	4.34	4.02	84.31	7.56	7.6
Heading date.	101.20	38.43	0.55	6.17	6.13	98.59	12.68	12.53
No.of tillers/plant.	19.70	1.92	0.97	8.63	7.03	66.44	2.33	11.81
Flag leaf area.	44.44	69.09	3.42	19.16	18.7	95.28	16.71	37.61
No.of panicles/ Plant.	18.26	2.13	1.04	9.75	7.99	67.19	2.46	13.47
Panicle length.	22.30	2.58	0.42	7.77	7.20	86.00	3.07	13.76
No.of filled grains/ Panicle.	145.68	402.43	30.54	14.28	13.77	92.95	39.84	27.35
No.of spikelets/ Panicle.	158.98	481.00	37.04	14.32	13.80	92.85	43.53	27.38
Stem borer.	11.70	28.22	2.78	47.43	45.25	91.03	10.44	88.93
Dead heart.	2.30	1.88	0.09	60.76	59.36	95.43	2.75	118.91
Stem diameter.	4.65	0.19	0.02	9.86	9.37	90.48	0.85	18.27
Third internode thickness.	1.09	0.017	0.008	14.51	11.96	68.00	0.22	20.32
Third internode length.	11.68	3.00	0.34	15.65	14.83	89.82	3.38	28.95
Grain yield	9.60	1.24	0.05	15.16	14.86	96.12	2.25	30.02

REFERENCES

Agahi, K., M.H. Fotokian and E. Farshadfar (2007). Correlation and path coefficient analysis for some yield – related traits in rice genotypes (*Oryza sativa* L.). .). Asian Journal of Plant Sciences, 6 (3): 513-517.

Amirthadevarathinam, A. (1983). Genetic variability, correlation and path analysis of yield components in upland rice. Madras Agric. J., 70: 781-785.

Anonymous (2007). Proceedings of the 11th National Rice Workshop (Entomology Component, Final Results of 2006 Sea.son), pp: 58-65. Rice Research and Training Center

Ashavani, P., R.K. Sharma; R.P.S. Dhaka; K.P.S. Arya and A. Panwar (1997). Correlation of yield and yield components in rice (*Oryza sativa* L.). Advances in Plant Sciences, 10(1): 217-220.

Babar, M., A.L. Khan, A. Arief, Y. Zafar and M. Arief (2007). Path analysis of some leaf and panicle traits affecting grain yield in doubled haploid lines of rice (*Oryza sativa* L.). J. Agric. Res., 45(4): 245-252.

Bartlett, M.S. (1937). Properties of sufficiency and statistical tests. Proc. Roy. Soc. London, Series A. (160): 268-282.

Dewey, D.R. and K.H. Lu (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. Agron. J., 51: 515-518.

Dixit, P.K., P.D. Saxena and A. Bhatia (1970). Estimation of genotypic variability of some quantitative characters in groundnut. India J. Agric. Sci., 40: 197-201.

El-Abd, A.B., A.A. Abd-Allah, S.M. Shehata, A.S.M. Abd El-Latef and B.A. Zayed (2007). Heterosis and combining ability for yield and some root characters in rice under water stress conditions. Proc. 5th Plant Breeding Conf., Giza, Egypt, May 27, Vol 11(2):593-609.

El-Hity, M.A. (1994). Performance of some rice cultivars (*Oryza sativa* L.) as affected by fertilization and plant spacing. II. Path coefficient analysis for yield and some yield components under different environmental conditions. J. of Agric. Res., Tanta Univ., 20(4): 688-701.

El-Hity, M.A. and M.S. El-Keredy (1992). Genotypic variability, phenotypic correlations and path coefficient analysis for grain yield and its components in rice (*Oryza sativa* L.). J. of Agric. Res., Tanta Univ.,18(2): 299-312.

Gravois, K.A. and R.S. Hilms. (1992). Path analysis of rice yield and yield components as affected by seeding rate. Agron. J., 84: 1-4.

Hammoud, S.A.A.(2005). Genetic behavior of some agronomic characters in two rice crosses. Egypt J. Agric. Res., 83(5B):305-322.

Ibrahim, S.M., A. Ramalingam and M. Subramanian (1990). Path analysis of rice grain yield under rain fed low land rice conditions. IRRN, 15:11.

Ise, K. (1992). Inheritance of low tillering plant type in rice. IRRN, 17: 5-6.

Johnson, H.W., H.F. Robinson and R.E. Comstock (1955). Estimates of genetic and environmental variability in Soybean. Agron. J., 47: 314-318.

Lin, F.H., and W.L. Wu (1981). Relationships between harvest index and grain yield of rice in Taiwan. J. Agric. Assoc. China, 115: 33-41.

Miller, B.C.; J.E. Hill and S.R. Roberts (1991). Plant population effects on growth and yield in water seeded rice. Agron. J., 83: 291-297.

Mishra, K.N.; J.S. Nanda and R.C. Chaudhary (1973). Correlation, path coefficient and selection indices in dwarf rice. Indian. J. Agric. Sci., 43: 306-311.

Nigem, S.A. and M.M.I. Eissa (1988). Genotypic association and path coefficient analysis in some rice crosses. Zagazig. J. Agric. Res., 15(2): 441-458.

Oad, F.C., M.A. Samo, Z.U. Hassan, P. S. Cruz and N.L. Oad (2002). Correlation and path analysis of quantitative characters of rice ratoon cultivars and advance lines. Int. J. Agric. Biol., 4(2): 204-207.

Rao, C.S., K. Sahu and A.K. Ghosh (1976). Association of morphological characters and path coefficient analysis in rice. Oryza (13): 81-85.

Reedy, J.S. (2002). Combining ability for grain yield and its components in low land rice(*Oryza sativa L*.).Indian J.Genet. 62(3):251-252

Samonte, S.O.; L.T. Wilson and A.M. McClung (1998). Path analysis of yield and yield related traits of fifteen diverse rice genotypes. Crop Science, 38: 1130-36.

Saravanan, R. and N. Senthil (1997). Genotypic and phenotypic variability, heritability and genetic advance in some important traits in rice. Madras Agric. J., 84(5): 276-277.

Sherif, M.R and A.O. Bastawisi (1997). Comparative observation on infestation of japonica, indica, and indica x japonica rices by rice stem borer and rice leaf miner and their population fluctuations. J.Agric.Sci., Mansoura Univ., 22(3):907-915.

Sherif, M.R., F.E. Abdallah and A.M. Soliman (1999). Major insects of rice plants in Egypt and their management. Adv.Agric.Res. In Egypt, 2(3):188-219.
Snedecor, G.W. and W.G. Cochran (1967). Statistical methods. Iowa State Univ., Press, USA.
Song, Y.J. and S.H. Cho (2008). Stability and path analysis for yield and yield components of rice varieties released in Jeonbuk Province. Journal of the Korean Society of International Agriculture, 20 (3): 225-230.
Surek, H. and N. Beser (2003). Correlation and path analysis for some yield related traits in rice (*Oryza sativa* L) under Thrace conditions. Turk. J. Agric., 27: 77-83.
Surek, H., Z.K. Korkut and O. Bilgin(1998). Correlation and path analysis for yield and yield components in rice in a 8-parent half diallel set of crosses. *Oryza* 35(1): 15-18.
Tahir, G.R., A.A. Cheema and M.A. Awan (1988). Path coefficient analysis in rice. Pak. J. Sci. Ind. Res.,31: 780-783.
Zahid, A.M., M. Akhter, M. Sabar, Z. Manzoor and T. Awan (2006). Correlation and path analysis studies of yield and economic traits in Basmati rice (*Oryza sativa L*.). Asian Journal of Plant Sciences, 5 (4): 643-645.

تحليل الاختلافات الوراثية باستخدام معامل الارتباط ومعامل المرور لبعض صفات المحصول ومكوناته فى بعض التراكيب الوراثية فى الارز

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أجريت هذه الدراسة بالمزرعة البحثية لمركز البحوث و التدريب فى الأرز- سخا – كفر الشيخ- مصر خلال موسمى 2011 و2012 . و تهدف الدراسة إلى تقدير الاختلافات الوراثية و كفاءة التوريث و التحسين الوراثى المتوقع من الإنتخاب لبعض الصفات الزراعية فى الأرز، و كذلك تقدير العلاقات المتبادلة بين المحصول و مساهماته مقاسة كمعامل ارتباط بالإضافة إلى استخدام معامل المرور لتحديد الأهمية النسبية لأهم صفات المحصول ومكوناته. اشتملت الدراسة على أربعة عشر تركيبا وراثيا من بينها ستة من السلالات الجديدة المبشرة. واستخدم تصميم القطاعات الكاملة العشوائية فى ثلاث مكررات. و يمكن تلخيص **أهم النتائج كما يلى.**

أظهرت النتائج وجود اختلافات معنوية بين الأصناف موضع الدراسة وقد سجل الصنفين سخا 101 و جيزة 178 أعلى القيم لمحصول الحبوب ، فى حين سجلت السلالات المختبرة محصولا أقل رغم تميزها فى معظم مكونات المحصول وربما يرجع ذلك إلى قابليتها الشديدة للإصابة بالثاقبات. كانت قيم التباين الوراثى عالية المعنوية لجميع الصفات موضع الدراسة، دليلا على وجود مدى واسع من الاختلافات الوراثية بين هذه التراكيب الوراثية. سجلت صفتى نسبة الإصابة بالثاقبات (السنابل البيضاء) أعلى القيم لمعامل الاختلاف المظهرى و الوراثى مما يعكس الاختلافات الوراثية الواسعة بين الأصناف المستخدمة فى هاتين الصفتين. سجلت صفات مساحة الورقة العلم و عدد الحبوب الممتلئة بالدالية و عدد السنيبلات بالدالية و صفة محصول الحبوب قيما عالية لدرجة التوريث بالمفهوم الواسع مصحوبة بقيم متوسطة للتحسين الوراثى المتوقع، فى حين أظهرت صفتا نسبة الإصابة بالثاقبات و القلب الميت أعلى القيم لدرجة التوريث المصحوبة بالقيم العالية للتحسين الوراثى المتوقع. أظهرت البيانات وجود علاقة ارتباط موجبة بين محصول الحبوب

مع صفتى عدد الأشطاء لكل نبات (0.556) و عدد الداليات لكل نبات(0.49)، فى حين سجلت صفة ارتفاع النبات علاقة ارتباط موجبة بين كل من تاريخ الطرد و مساحة ورقة العلم و نسبة الإصابة بالثاقبات و القلب الميت، أما صفة عدد الداليات لكل نبات فقد سجلت علاقة ارتباط معنوية مع صفة عدد الاشطاء لكل نبات (0.83) وطول السلامية الثالثة (0.39) و محصول الحبوب (0.49). أوضحت نتائج تحليل معامل المرور الأهمية النسبية العالية لكل من عدد السنيبلات بالدالية و مساحة ورقة العلم و عدد الاشطاء لكل نبات وعدد ايام التزهير و طول الدالية على التباين الوراثى لمحصول الحبوب، فى حين كان لصفة نسبة الإصابة بالثاقبات و عدد الحبوب الممتلئة بالدالية أهمية نسبية كبيرة بالنسبة لتباين صفة عدد الاشطاء لكل نبات ، أما صفات مساحة ورقة العلم و عدد الداليات لكل نبات و طول الدالية و عدد السنيبلات بالدالية أهمية نسبية كبيرة بالنسبة لصفة عدد الحبوب الممتلئة بالدالية. من هنا .. يتضح أهمية كل من عدد السنيبلات بالدالية و مساحة ورقة العلم و عدد الأشطاء وعدد ايام التزهير وكذلك طول الدالية فى برامج تحسين محصول الأرز.

قام بتحكيم البحث

أ.د / عادل محمد سلامه	**كلية الزراعة – جامعة المنصورة**
أ.د / عبد السلام عبيد دراز	**مركز البحوث الزراعية**

Table (1): The mean Performance of 14 rice genotypes for 14 agronomic traits during 2011 and 2012 seasons and their combined data.

	Plant height (cm)			Days to heading (day)			No. of tillers/plant			Flag leaf area (cm)			No.of filled grains/panicle		
	Y1(2011)	Y2(2012)	Comb.	Y1(2011)	Y2(2012)	Comb.	Y1(2011)	Y2(2012)	Comb.	Y1(2011)	Y2(2012)	Comb.	Y1(2011)	Y2(2012)	Comb.
Giza177	95.67	98.47	97.07	91.33	91.00	91.17	19.37	21.70	20.57	34.80	29.58	32.20	110.00	105.33	107.67
Giza178	97.92	102.75	100.42	99.33	100.67	100.00	21.05	23.69	22.39	44.82	39.94	42.38	162.67	155.33	159.00
Sakha101	92.24	93.92	93.08	109.67	111.00	110.33	21.36	22.51	21.95	41.83	29.24	31.37	125.00	134.67	129.83
Sakha102	107.70	106.58	107.14	90.33	90.67	90.50	20.43	22.21	21.33	34.38	26.39	30.39	108.33	104.00	106.17
Sakha103	90.37	97.33	93.85	88.33	88.00	88.17	19.53	20.01	19.87	33.09	24.73	28.91	131.67	109.00	120.33
Sakha104	108.42	103.59	106.00	99.00	98.00	98.50	19.94	22.51	21.24	37.59	31.10	34.35	124.00	120.00	122.00
Giza182	97.07	89.83	93.55	100.33	99.67	100.00	21.38	21.35	21.38	51.41	74.15	49.29	159.00	146.67	152.83
IR6923-3-1-3-2-3	97.20	89.42	93.31	111.00	111.33	111.17	14.58	18.75	16.67	50.70	50.09	50.40	183.33	160.33	171.83
IR66158-38-3-2-1	105.53	90.92	98.23	107.00	107.00	107.00	16.42	16.49	16.46	62.78	65.46	62.62	155.67	167.67	161.67
IR66159-189-5-5-3	105.11	90.83	97.97	106.00	106.00	106.00	19.60	18.08	18.85	50.77	52.06	51.42	161.67	192.33	177.00
IR66160-5-2-3-2-1	102.27	101.92	102.09	103.33	103.67	103.50	18.72	18.22	18.49	54.23	51.02	52.65	174.33	181.33	177.83
IR69138-13-2-2-3	108.73	95.83	102.38	105.00	105.33	105.00	17.04	20.99	19.02	51.94	61.34	51.66	138.33	149.67	144.00
GZ7414-8-7-3-1	97.38	93.08	95.23	89.67	89.67	89.67	20.64	21.29	20.99	38.00	42.32	40.83	118.00	116.67	117.33
Egyptian Jasmine	110.71	111.85	111.18	117.00	116.33	115.83	14.27	19.04	16.67	74.67	52.79	63.73	179.33	204.67	192.00
Range	90.37	89.42	93.08	88.33	88.00	88.17	14.27	18.08	16.46	33.09	24.73	28.91	108.33	104.00	106.17
	110.71	111.85	111.18	117.00	116.33	115.83	21.36	23.69	22.39	74.67	65.46	63.73	179.33	204.67	192.00
L.S.d	1.979	3.809	3.035	3.030	1.265	1.144	1.638	2.499	2.099	3.182	5.330	4.398	15.195	9.861	12.809
	2.875	5.533	4.410	6.030	1.838	1.662	3.277	4.983	4.198	6.364	10.657	8.795	20.539	13.329	17.314

cont

	No. of panicles/plant			Grain yield (t/ha.)			Panicle length(cm)			No. of spikelet/panicle			White head %		
	Y1	Y2	Comb.	Y1	Y2	Comb.	Y1	Y2	Comb.	Y1	Y2	Comb.	Y1	Y2	Comb.
Giza177	19.03	20.33	19.68	9.88	9.52	9.70	19.90	18.73	19.32	120.00	117.67	118.84	6.56	5.91	6.24
Giza178	18.67	22.20	20.43	12.60	11.82	12.21	23.40	23.90	23.65	185.00	171.33	188.17	10.21	13.15	11.68
Sakha101	17.60	21.79	19.70	12.16	11.92	12.04	22.27	23.37	22.82	136.00	144.33	140.17	1.97	1.69	1.83
Sakha102	18.55	20.62	19.59	10.58	10.48	10.53	19.97	20.73	20.35	131.67	118.33	125.00	6.41	5.24	5.83
Sakha103	19.15	17.83	18.49	10.50	10.54	10.52	19.69	18.47	19.08	137.33	120.67	129.00	6.99	7.67	7.33
Sakha104	20.80	21.47	21.15	10.67	10.64	10.61	20.23	20.87	20.55	137.67	125.000	131.34	3.96	2.94	3.45
Giza182	20.07	20.53	20.30	11.68	11.05	11.37	24.70	24.13	24.42	169.00	154.00	161.40	8.34	9.71	9.03
IR6923-3-1-3-2-3	13.47	17.00	15.23	8.46	9.04	8.75	25.03	24.20	24.62	197.33	170.00	183.67	22.84	18.56	20.70
IR66158-38-3-2-1	13.80	15.25	14.53	9.22	8.62	8.92	22.12	23.87	22.83	169.33	181.33	175.33	24.15	24.96	24.56
IR66159-189-5-5-3	17.07	16.17	16.62	6.97	7.56	7.27	23.59	22.83	23.21	189.33	205.00	197.17	26.61	21.64	24.13
IR66160-5-2-3-2-1	18.18	16.22	17.20	7.05	6.87	6.96	22.84	23.20	23.02	190.00	193.33	191.67	23.08	18.00	20.54
IR69138-13-2-2-3	16.15	19.72	17.94	8.10	8.93	8.52	23.97	23.40	23.68	145.00	161.33	153.17	13.00	8.38	10.69
GZ7414-8-7-3-1	19.24	19.50	19.37	9.74	10.36	9.92	18.57	18.63	18.60	129.00	124.33	126.67	4.85	4.62	4.74
Egyptian Jasmine	12.62	18.11	15.37	8.72	9.01	8.87	25.67	26.33	26.00	196.67	231.33	214.00	18.76	18.09	18.43
Range	13.47	15.25	14.53	6.97	6.87	6.96	18.57	18.47	18.60	120.00	117.67	118.84	1.97	1.69	1.83
	20.80	22.20	21.15	12.60	11.92	12.21	25.03	26.33	26.00	197.33	231.33	214.00	26.61	24.96	24.56
L.S.d	1.45	2.74	2.19	0.400	0.630	0.530	1.350	2.07	2.09	16.40	10.97	13.95	2.14	4.54	3.39
	1.96	3.70	2.96	0.540	0.850	0.710	2.00	3.50	2.86	22.17	14.83	18.86	2.90	6.14	4.58

cont

	Dead heart (%)			Stem diameter (mm)			Third internodes thickness(mm)			Third internodes length (mm)		
	Y1	**Y2**	**Comb.**	**Y1**	**Y2**	**Comb.**	**Y1**	**Y2**	**Comb.**	**Y1**	**Y2**	**Comb.**
Giza177	0.75	0.86	0.80	4.20	4.12	4.16	1.32	1.12	1.22	12.26	12.02	12.14
Giza178	4.04	4.73	4.38	4.67	4.89	4.78	1.97	1.010	0.99	11.76	11.91	11.83
Sakha101	0.18	0.24	0.21	4.41	4.69	4.55	0.96	1.03	1.00	10.48	10.58	10.53
Sakha102	0.38	0.44	0.41	3.66	3.86	3.76	0.83	0.78	0.85	14.28	15.70	14.99
Sakha103	0.33	0.31	0.32	4.01	4.44	4.23	0.91	0.49	0.92	16.28	16.66	16.47
Sakha104	3.50	3.33	3.42	3.48	3.69	3.59	0.78	0.98	0.88	13.36	14.09	13.72
Giza182	1.87	2.32	2.11	5.60	5.12	5.36	0.95	0.94	0.95	10.41	10.01	10.21
IR6923-3-1-3-2-3	3.94	4.03	3.98	5.00	5.10	5.05	0.96	1.27	1.11	9.81	10.30	10.06
IR66158-38-3-2-1	1.46	1.67	1.57	5.10	5.50	5.30	1.15	1.30	1.26	11.59	11.68	11.64
IR66159-189-5-5-3	1.44	1.47	1.45	5.30	5.21	5.26	1.01	1.02	1.02	15.36	14.35	14.86
IR66160-5-2-3-2-1	2.21	2.52	2.37	5.42	5.53	5.48	1.39	1.53	1.38	9.72	9.87	9.80
IR69138-13-2-2-3	2.33	2.73	2.53	5.10	4.90	5.00	1.18	1.23	1.21	9.53	8.87	9.20
GZ7414-8-7-3-1	1.43	1.50	1.47	4.19	4.39	4.29	1.05	1.08	1.07	9.36	10.10	9.73
Egyptain Yasmine	7.33	7.20	7.27	6.40	6.70	6.55	1.39	1.61	1.50	7.96	8.64	8.30
Range	0.18	0.24	0.21	3.48	3.69	3.59	0.78	0.87	0.85	9.36	8.64	8.30
	7.33	7.20	7.27	6.40	6.70	6.55	1.97	1.61	1.50	16.28	16.66	16.47
L.S.d	0.0121	0.0010	0.010	0.320	0.400	0.36	0.210	0.150	0.18	1.58	0.28	1.28
	0.060	0.0020	0.020	0.430	0.550	0.49	0.280	0.210	0.25	2.13	0.38	1.73

Table (2): Mean square estimates of ordinary analysis for agronomic traits over the two years, 2011 and 1012

S.O.V	d.f.		Plant height (cm)			Days to heading (day)			No.of tillers/plant			Flag leaf area (cm)			No.of filled grains/panicle		
		Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 (2011)	Y2 (2012)	Comb.
Years		1			9.928**			30.71**			10.71**			60.17**			506.71
Reps with	2		0.1201	2.51	1.310	0.412	0.123	0.281	0.112	0.221	0.177	2.670	0.999	1.822	3.77	60.35	39.15
year		13	130.37**	143.16**	899.78**	233.93**	240.59**	660.69**	17.12**	13.10**	34.75**	461.65**	433.49**	894.60**	2023.88**	3245.45**	6586.6**
Genotypes		13			626.25**			186.17**			4.53*			0.540			1221.57**
Genotypes																	
x years																	
Error	26	-	2.69	2.97	2.93	0.70	1.029	0.55	1.231	0.938	0.97	4.79	13.513	3.450	109.251	46.01	30.59

S.O.V	d.f.		No.of panicles/plant			Grain yield (t/ha.)			Panicle length(cm)			No.of spikelet/panicle			Stem borer (%)		
		Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 (2011)	Y2 (2012)	Comb.	Y1 2011)	Y2 (2012)	Comb.
Years	-	1	-	-	16.73**	-	-	182.97**	-	-	0.913	-	-	158.78**	-	-	13.31**
Reps with year	2	-	1.387	1.335	1.445	0.8322	2.362	1.597	0.016	0.037	0.026	2.735	67.03	34.33	1.13	2.31	3.15
Genotypes	-	13	19.49**	15.60**	40.55**	7.93**	6.83**	18.45**	200.27**	231.193**	539.33**	2415.22**	3860.59**	7844.78**	214.23**	161.56**	469.75**
Genotypes x years	-	13	-	-	5.46**	-	-	3.69**	-	-	107.87**	-	-	1568.97**	-	-	93.96**
Error	26	-	0.995	3.55	1.07	0.076	0.185	0.05	12.582	26.494	19.93	127.28	56.98	37.043	1.043	5.765	2.78

S.O.V	d.f.		Dead hard (%)			Stem diameter (mm)			Third internode thickness(mm)			Third internode length (mm)		
		Comb.	Y1(2011)	Y2(2012)	Comb.	Y1(2011)	Y2(2012)	Comb.	Y1(2011)	Y2(2012)	Comb.	Y1(2011)	Y2(2012)	Comb.
Years		1			5.11			19.71**			10.31**			**20.14****
Reps with year	2		0.115	0.116	0.216	1.110	0.817	0.715	0.017	0.116	0.076	7.11	7.01	**6.750**
Genotypes		13	1.77**	1.01**	1.88**	1.336**	1.480**	3.52**	0.116**	0.156**	0.436**	18.170**	19.08**	**46.58****
Genotypes x years		13			0.91**			0.704**			0.164**			**9.33****
Error			0.16	0.08	0.09	0.047	0.077	0.02	0.021	0.0109	0.008	1.171	0.374	**0.34**

*** and ** Significant at 0.05 and 0.01 probability respectively**

Table (3): Phenotypic simple correlation coefficient values among the studied characters averaged over 14 rice genotypes and the two seasons.

Characters	2	3	4	5	6	7	8	9	10	11	12	13	14
1-Grain yield.	-.46**	-.36*	0.56**	-0.57*	0.49**	-0.29	-0.45**	-0.46*	-0.83**	-0.18	-0.57**	-0.50**	0.16
2-Plant height		.39*	-0.39*	0.56**	-0.31*	0.26	0.17	0.25	0.36*	0.45**	0.27	0.15	-0.17
3-Heading date.			-0.58*	0.74**	-0.72**	0.81**	0.68**	0.66**	0.62**	0.59**	0.73**	0.29	-0.49**
4-No.of tillers/plant.				-0.66**	0.83**	-0.49**	-0.51**	-0.44**	-0.59**	-0.56**	-0.50**	-0.40**	0.35**
5-Flag leaf area.					-0.69**	0.72**	0.75**	0.73**	0.73**	0.67**	0.85**	0.49**	-0.49**
6-No.of panicles/ Plant.						-0.6**	-0.53**	-0.51**	-0.66**	-0.48**	-0.63**	-0.35*	0.39*
7-Panicle length.							0.76**	0.74**	0.57**	0.61**	0.71**	0.21	-0.45**
8-No.of filled grains/ Panicle.								0.96**	0.73**	0.59**	0.75**	0.26	-0.35*
9-No.of spikelets/ Panicle.									0.76**	0.60**	0.71**	0.20	-0.28
10-Stem borer.										0.31*	0.71**	0.38*	-0.14
11-Dead heart.											0.53**	0.23	-0.49**
12-Stem diameter.												0.64**	-0.57**
13-Third internode thickness.													-0.45**
14-Third internode length.													

*** and ** significant at 0.05 and 0.01 levels, respectively.**

Table (4): Path coefficient analysis of direct and indirect effects on grain yield for over fourteen rice genotypes and the two seasons.

Character	1	2	3	4	5	6	7	8	9	10	11	12	13	Total r (X. , y)
1- Plant height	-0.311	0.074	-0.13	0.195	0.076	0.03	-0.041	0.111	-0.354	0.024	-0.119	0.001	-0.012	-0.455**
2- Heading date.	-0.105	0.22	-0.191	0.264	0.176	0.092	-0.168	0.296	-0.613	0.031	-0.323	0.001	-0.036	-0.356*
3- No.of tillers/plant.	0.122	-0.127	0.33	-0.237	-0.203	-0.056	0.125	-0.198	0.588	-0.029	0.219	-0.002	0.025	0.556**
4- Flag leaf area.	-0.169	0.163	-0.219	0.357	0.168	0.082	-0.185	0.326	-0.722	0.035	-0.375	0.002	-0.035	-0.573**
5- No.of panicles/ Plant.	0.096	-0.159	0.274	-0.246	-0.245	-0.068	0.131	-0.227	0.653	-0.025	0.277	-0.002	0.028	0.49**
6- Panicle length.	-0.081	0.178	-0.161	0.257	0.146	0.114	-0.187	0.331	-0.572	0.032	-0.316	0.001	-0.032	-0.29
7- No.of filled grains/ Panicle.	-0.051	0.15	-0.167	0.268	0.13	0.086	-0.247	0.429	-0.728	0.031	-0.33	0.001	-0.025	-0.452**
8- No.of spikelets/ Panicle.	-0.078	0.146	-0.147	0.261	0.124	0.085	-0.238	0.446	-0.758	0.031	-0.315	0.001	-0.02	-0.461**
9- White head %	-0.11	0.136	-0.195	0.259	0.161	0.066	-0.18	0.339	-0.996	0.016	-0.312	0.002	-0.01	-0.83**
10- Dead heart.	-0.141	0.131	-0.184	0.238	0.117	0.07	-0.147	0.265	-0.312	0.052	-0.232	0.001	-0.035	-0.176
11- Stem diameter.	-0.084	0.161	-0.162	0.303	0.153	0.082	-0.184	0.318	-0.702	0.027	-0.442	0.003	-0.041	-0.57**
12- Third internode thickness.	-0.046	0.063	-0.131	0.176	0.086	0.024	-0.063	0.091	-0.375	0.012	-0.281	0.004	-0.032	-0.496**
13- Third internode length.	0.052	-0.109	0.115	-0.173	-0.095	-0.051	0.086	-0.125	0.143	-0.025	0.253	-0.002	0.072	0.157

*** and ** significant at 0.05 and 0.01 levels, respectively.**