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GENETIC BEHAVIOR OF YIELD, GRAIN QUALITY, STEM BORER AND STORAGE INSECT INFESTATION TRAITS FOR SOME RICE GENOTYPES AT DIFFERENT SOWING DATES.

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ABSTRACT

The present investigation was carried out at Rice Research and Training Center and lab of Plant Protection Institute, Sakha, Kafr EL-Sheikh, Egypt, during ٢٠١١ and ٢٠١٢ seasons. The objectives of this investigation is amid to study the genetic behavior of ten rice genotypes under three sowing dates (May١st, May ١٥th and May٣٠th), the effect of different sowing dates on grain quality characters, and on the infestation by stem borer and to evaluate the susceptibility of certain rice varieties against the infestation by Lesser grain borer, *Rhizopertha dominica* (F.). The tested genotypes were; Giza١٧٧, Giza ١٧٨, Sakha ١٠١, Giza ١٨٢, GZ ٩٠٥٧-٦-١-٣-٢, GZ ٩٥٧٧-٤-١-١, GZ ٩٥٢٣-٢-١-١-١, GZ ٩٤٦١-٤-٢-٣-١, Egyptian Yasmin, and SK٢٠٣٤ H١. Giza ١٧٨ cultivar produced maximum grain yield and it remained statistically at par with SK٢٠٣٤ genotype. Egyptian Yasmin gave minimum grain yield. Grain yield averaged across all the genotypes seems to be maximum at sowing date of ١st May. However, the lowest yield was recorded in sowing date of ٣٠th May. Sowing dates significantly affected the milled rice % in the first season only and highest milled rice % belonged to the second planting date in the first season. Highest milled rice % were obtained for Giza ١٧٧ and GZ ٩٥٢٣-٢-١-١-١; the lowest percentages were observed for GZ ٩٥٧٧-٤-١-١ and Giza ١٧٨. For Stem borer (*Chilo agamemnon* Bles.), Giza ١٧٨, Sakha١٠١, GZ ٩٥٧٧-٤-١-١ and GZ ٩٤٦١-٤-٢-٣-١ were resistant (R) with ١,٤٤, ٠,٨٣, ٢,٦٦ and ١,٩٣ WH%, respectively. While, five genotypes (Giza١٧٧, Giza١٨٢, GZ ٩٠٥٧, GZ ٩٥٧٧-٤-١-١ and SK٢٠٣٤ H١) were moderately resistant (MR) with ٤,١٨, ٤,١٤, ٥,٩٤, ٣,٤٦, and ٥,٣٦ WH%, respectively. On the other hand, one genotype (Egyptian Yasmin) was moderately susceptible (MS) with ٦,٣٢ WH%. The number of adult emergence of *Rhizopertha dominica* ranged from ١,٠٨ insects (Sakha١٠١) to ٨,٢٥ insects (GZ٩٥٧٧-٤-١-١) (low susceptibility varieties to insect infestation). Also, the number of adult emergence ranged from ١٣,٠٨ insects (Giza١٨٢) to ١٧,٥٨ insects (Giza١٧٧) for moderate susceptibility varieties to insect infestation. Also, the number of adult emergence ranged from ٢١,٠٨ insects (Egyptian Yasmin) to ٢٢,٥٨ insects (GZ ٩٠٥٧-٦-١-٣-٢) which proved to be high susceptibility varieties to insect infestation. Clustering analysis for varieties, based on similarity of quantitative characters, produced two large distinct groups. The first one included five rice genotypes; Giza ١٧٨, Giza ١٨٢, GZ ٩٥٢٣-٢-١-١-١, Egyptian Yasmin and SK٢٠٣٤ H١. These genotypes were Indica and Indica-Japonica types except Gz ٩٥٢٣-٢-١-١-١ was Japonica type. While, the second group included Giza ١٧٧, Sakha ١٠١, GZ ٩٠٥٧-٦-١-٣-٢, GZ ٩٥٧٧-٤-١-١ and GZ ٩٤٦١-٤-٢-٣-١, these genotypes were Japonica types and similar in duration and grain yield characters.

Keywords: rice, genetic behavior, yield, grain quality, *Chilo agamemnon* Bles., *Rhizopertha dominica* (F.)

INTRODUCTION

Rice (*Oryza sativa* L.) is the main food for about ٣ billion people of the world and is the most common staple food of many countries, however ٩٠٪ of the world's rice is produced and consumed in Asia, (Wassmann *et al*., ٢٠٠٩). In Egypt, rice is an important cash crop after cotton and average yield of rice is ١٠,٤ t/ha (RRTC ٢٠٠٦). The potentiality of the varieties expressed differently due to planting in different dates (Ganajaxi *et al.* ٢٠٠١ and Metwally *et al.* ٢٠١٢). Also, optimum planting time is a major factor in rice cultivation and indirectly determines soil temperature and weather conditions (Ashrafuzzaman *et al.* ٢٠٠٩). Transplanting rice in the optimum period of time is critical to achieve high grain yield. However, optimum rice planting dates are regional and vary with location and genotypes (Sha and Linscombe, ٢٠٠٥; and Bruns and Abbas, ٢٠٠٦). Yoshida, (١٩٨١) reported that rice plants require a particular temperature for its phonological affairs such as panicle initiation; flowering, panicle exertions from flag leaf sheath and maturity and these are very much influenced by the planting dates during the season. Early planted photoperiod sensitive rice varieties passed lag vegetative phase which increased tallness as well as biomass that tended to lodge during grain filling stage (Akhter *et al,.* ٢٠٠٧). On the other hand, the delay sowing date is effected on the grain quality, flowering and yield per unit area of rice (Rashid *et al*., ٢٠٠٣).

The major components of rice grain quality its effected by environmental temperature during kernel development plays an integral role in causing the observed, unexplained fluctuations in rice grain quality (Cooper *et al*., ٢٠٠٦ and Zheng *et al*., ٢٠٠٨). Also, delay sowing date in rice increasing attacking by insect species and types specially the stem borer (*Chilo Agamemnon* Bles.) which is one of the most destructive and important rice pest in Egypt. In general, the occurrence and prevalence of an insect is affected by host plant availability, growth stage, population dynamics, sowing and transplanting dates (Chen *et al*. ٢٠٠٣ and Krell *et al*. ٢٠٠٥). Synthetic insecticides have been used since the ١٩٥٠$_s$ to control stored-products insects (Subramanyan and Hagstrum ١٩٩٥). Pesticide residues in human and animal food, and environment is common, therefore alternative methods are needed to control stored-products insects. Since ١٩١١, about ١٤٠ varieties of rice have been released in the United States of America (USA), with improved characteristics for agronomic production, field tolerance to insects and diseases, milling and cooking quality, and industrial cooking preferences (Moldenhauer *et al*., ٢٠٠٤). *Rhizopertha dominica* (F.) the lesser grain borer, is an important pest of most stored raw grains, including rough rice. The developing larva feeds inside grain kernels, and can cause weight loss and damage to the germ and endosperm in wheat as well as rice (Gundu Rao and Wilbur, ١٩٥٧; Campbell and Sinha, ١٩٧٦).

Genetic diversity can reduce vulnerability to stresses and it constitutes the raw material for plant breeders. Relative divergence measures among accessions can be based on quantitative morphological traits. Genetic relationships among individuals and populations can be measured by similarity of number of quantitative characters (Souza and Sorrells (١٩٩١), Dinghuhn and Asch (١٩٩٩), Bahrman *et al.*, (١٩٩٩) and El-Malky (٢٠٠٤). A better knowledge of the genetic behavior of some aromatic varieties under different sowing dates would help to classify and identify varieties that would be grown successfully under late sowing date. The objectives of the present investigation were aimed to study the genetic behavior of ten rice genotypes under three sowing dates and the effect of different sowing dates on grain quality characters. ٣) to evaluate the effect of different sowing dates on the infection by stem borer.٤) to evaluate the susceptibility of certain rice varieties against the infestation by Lesser grain borer,*Rhizopertha dominica* (F.)

MATERIALS AND METHODS

Ten entries were selected to perform this study, and were classified into three categories, six entries as Japonica type, two entries as Indica type and two entries Indica–Japonica type as shown in (Table ١). These entries were inbreed lines except SK٢٠٣٤ the out breeding as hybrid variety and namely as Egyptian hybrid one. Three dates of sowing, i.e. May١st, May ١٥th and May٣٠th were used in ٢٠١١ and ٢٠١٢ seasons. At each sowing date, each entry were grown in ١٠ m^{٢} in a randomized complete block design (RCBD) experiments with three replications. All the entries were evaluated for agronomic characters and stem borer at the experimental farm of Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt, during the rice growing seasons; ٢٠١١–٢٠١٢. While, grain quality characters evaluated at Rice Research Technology Center, Alexandria. On the other hand, insects storage were studied at the lab. of Plant Protection Institute, Sakha, Kafr El-Sheikh.

Table ١ : Tested rice entries with parentage, origin and type.

N٠.	Entries	Parentage	Origin	Type
١	Giza ١٧٧	Giza١٧١ / Yomji No.١//PiNo.٤	Egypt	Japonica
٢	Giza ١٧٨	Giza١٧٥ / Milyang٤٩	Egypt	Indica - Japonica
٣	Sakha ١٠١	Giza١٧٦ / Milang٧٩	Egypt	Japonica
٤	Giza ١٨٢	Giza١٨١ / IR٣٩٤٢٢-١٦٣-٢٤٧-٢-٣//Giza١٨١	Egypt	Indica
٥	GZ ٩٠٥٧-٦-١-٣-٢(Giza١٧٩)	Gz١٣٦٨ / Gz٦٢٩٦	Egypt	Japonica
٦	GZ ٩٥٧٧-٤-١-١	Gz٦٩١٠ / Yunlong١٩١	Egypt	Japonica
٧	GZ ٩٥٢٣-٢-١-١-١	Gz٦٥٢٢ / Zhang Jia١٢٩	Egypt	Japonica
٨	GZ ٩٤٦١-٤-٢-٣-١	Doey٢ Beyo / Gz٦٢٩٦	Egypt	Japonica
٩	Egyptian Yasmin	(Jasmin٨٥) IR٨٤١-٦٧	IRRI	Indica
١٠	SK٢٠٣٤ H١	IR٦٩٦٢٥ A/ Giza١٧٨ R	Egypt	Indica - Japonica

Agronomic and grain quality characters:

Duration (days), number of panicles/hill, number of filled grains/panicle, number of unfilled grains/panicle and grain yield (t/ha) were evaluated under different sowing dates and each entry was grown in ١٠ m^{٢} in a randomized complete block design (RCBD) experiment with three replications. Grain quality characters i.e. brown rice percentage, milled rice percentage, head rice percentage and chalky & green grain percentages.

Insects tests:

a- Stem borers

Stem borer damage was recorded as white head percentage at the maturity stage by counting the number of white head per ١٠٠ plants according to the standard evaluation system of Rice Research and Training Center (RRTC), Sakha, Egypt. Resistance (R) = ٠ -٣٪, Moderately resistance (MR) = ٣-٦٪, Moderately susceptible (MS) = ٦-٩٪, Susceptible (S) = ٩-١٢٪ and highly susceptible (HS) = ١٢٪ (Anonymous ٢٠٠٩).

b- Insects storage test:

The original strains of all tested insects were obtained from the Department of Stored Product Pests, Plant protection Research Institute, Agricultural Research Center, Dokki, Egypt. Insect species were tested and their life cycles were identified according to the method mentioned by Badawy and Doraeham (١٩٩١).

Lesser grain borer, *Rhizopertha dominica* (F.) (Fam. Bostrichidae):

About ٣٠٠ adults were added to a mixture of ١٥٠ gm wheat kernels and ١٠ gm wheat flour in a small jar and covered with muslin. Jars were maintained under conditions of ٣٤ ± ٣°C and ٧٠ ± ١ R.H. Adults were left for two weeks for egg laying in the jars and were then removed. After two weeks, newly insects were collected by sieving and were used for experimentation.

For exposure the tested rice grains to insects, three ٢٠ g-grain samples were placed in small plastic jars (٦ x ١٠ cm diameter). Twenty of newly emerging *Rhizopertha dominica* adults (٠-٢٤ hours old) were released in each jar and allowed to lay eggs. The jars were kept in the laboratory at constant conditions (٣٠ ± ٢°C, ٧٠ ± ٥٪ r.h.). After ٢٠ days, the parents were removed. After emergence (٢٣-٢٥ days), No. of emerging adults, were recorded.

Statistical analysis:

A analysis of variance was carried out as a combined analysis for the four sowing dates in each season according to Gomez and Gomez (١٩٨٤). Treatment means were compared by Duncan's Multiple Range Test (Duncan, ١٩٥٥). All statistical analysis was performed using analysis of variance technique by means of "MSTATC" computer software package. The analysis was conducted using the Numerical Taxonomy and Multivariate Analysis system, Version ٢,١ (NTSYSpc; Rolhf, ٢٠٠٠). The output was analyzed using an agglomerative hierarchical clustering method with complete linkage strategy. Firstly, the data was subjected to analysis to produce a matrix of dissimilarity values and the phenotypic distance between each pair of varieties was estimated as Euclidean distance. Secondly, cluster analysis was then conducted on the Euclidean distance matrix with un-weighed pair-group method based on arithmetic average (UPGMA) to develop a dendogram.

RESULTS AND DISCUSSION

Plant growth duration is very important parameter as flowering behavior used as a criterion for identifying a rice genotype to be photoperiod sensitive. Duration was significant when assessed through the yardstick of statistics (Table ٢). The longest duration mean (١٣٨ and ١٥٦ days) was noted for Egyptian Yasmin (١٥٦ days) followed by Sakha ١٠١ which was followed by SK٢٠٣٤. The effect of different sowing dates on duration also remained significant. More number of days to maturity was taken by late sowing date in comparison with those in early sowing dates. The interaction between different genotypes and sowing dates remained statistically significant. It can be depicted from that plant growth duration behavior of all the rice genotypes that days to maturity decrease by delaying sowing. These results are in close agreement with that of Maiti and Sen (٢٠٠٣) who found that the growth duration exhibited an increasing trend of early planted crop and decreasing trend of late planted crop.

Table ٢. Duration (days) of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	١٢٥	١٢٢	١١٥	١٢٠,٧	١٢٥	١٢٢	١١٦	١٢١
Giza ١٧٨	١٣٥	١٣٢	١٢٩	١٣٢,٠	١٣٥	١٣٢	١٢٧	١٣١
Sakha ١٠١	١٤١	١٣٨	١٣٥	١٣٨,٠	١٤١	١٣٨	١٣٩	١٣٩
Giza ١٨٢	١٢٧	١٢٤	١٢١	١٢٤,٠	١٢٧	١٢٤	١١٨	١٢٣
GZ ٩٠٥٧-٦-١-٣-٢	١٢٣	١٢٠	١١٧	١٢٠,٠	١٢٣	١٢٠	١١٧	١٢٠
GZ ٩٥٧٧-٤-١-١	١٢٧	١٢٣	١٢٠	١٢٣,٣	١٢٧	١٢٣	١١٩	١٢٣
GZ ٩٥٢٣-٢-١-١-١	١٢٦	١٢١	١١٧	١٢١,٣	١٢٦	١٢١	١١٦	١٢١
GZ ٩٤٦١-٤-٢-٣-١	١٢٥	١٢١	١١٨	١٢١,٣	١٢٥	١٢١	١١٥	١٢٠
Egyptian Yasmin	١٥٣	١٥٦	١٥٩	١٥٦,٠	١٥٣	١٥٥	١٦٠	١٥٦
SK٢٠٣٤ H١	١٣٦	١٣٣	١٣٠	١٣٣,٠	١٣٦	١٣٣	١٢٩	١٣٣
Mean	١٣١	١٢٩	١٢٦.		١٣١	١٢٨	١٢٥	

L.S.D. ٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	١,٦	١,٤	٢,٨
٢٠١٢	١,٨	١,٣	٢,٨

The ability of various rice genotypes to produce productive tillers was affected significantly with different sowing dates. Maximum panicles were produced by most genotypes sown on ١٥th May, whereas, the minimum number of panicles hill$^{-١}$ was recorded in sowing date on ٣٠th May irrespective of various genotypes (Table ٣). When results were averaged across dates for the comparison of various genotypes, it was noted that genotype SK٢٠٣٤ hybrid produced maximum tillers (٢٣,١١ and ٢٣,٠٠) in the two seasons respectively, which was followed by Giza ١٧٨ and GZ ٩٥٢٣-٢-١-١-١. However, minimum panicles numbers (١٦,٠٠ and ١٦,٨٩) were produced by Egyptian Yasmin in the two seasons, respectively. The interaction between various genotypes and sowing dates indicated that SK٢٠٣٤ hybrid gave maximum number of fertile tillers hill$^{-١}$ when sown on ١٥th May against minimum number of fertile tiller shown by GZ ٩٤٦١-٤-٢-٣-١ in ٣٠th May sowing date. These results are in consonance with the findings of Pandey *et al.* (٢٠٠١) and Safdar *et al*. (٢٠٠٨). This was due to the fact that rice genotypes planted earlier had longer period for their vegetative growth compared to those sown later. Dawadi and Chaudhary (٢٠١٣) indicated that significantly higher effective tiller per square meter in early sowing might be due to favorable environmental conditions which enabled the plant to improve its growth and development as compared to other sowing dates. It can be observed from (Table ٤) that number of filled grains per panicle of different rice genotypes was affected significantly when assessed through the interaction of genotypes and sowing dates. SK٢٠٣٤ genotype showed maximum number of filled grains per panicle (٢٠٦ and ٢٠٠) an ١٥th May and ١st May sowing dates in the two seasons respectively, which was significantly different from all other treatment combinations. However, minimum number of filled grains per panicle was recorded in GZ ٩٤٦١-٤-٢-٣-١ genotype (٦٣,٧ and ٧٨,٧) when sown on ٣٠th May in the two seasons, respectively.

Table ٣.Number of panicles per hill of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	١٨,٣	٢٠,٣	١٦,٠	١٨,٢	١٩,٦	١٩,٦	١٨,٠	١٩,١
Giza ١٧٨	٢٠,٠	٢٤,٣	١٨,٦	٢١,٠	٢١,٦	٢١,٣	١٩,٣	٢٠,٧
Sakha ١٠١	١٧,٦	١٩,٦	١٤,٣	١٧,٢	١٨,٦	١٩,٣	١٥,٦	١٧,٨
Giza ١٨٢	١٨,٠	١٦,٦	١٨,٦	١٧,٧	١٨,٣	١٧,٦	٢٥,٣	٢٠,٤
GZ ٩٠٥٧-٦-١-٣-٢	١٨,٦	١٩,٣	١٨,٠	١٨,٦	١٩,٠	١٨,٠	١٩,٦	١٨,٨
GZ ٩٥٧٧-٤-١-١	١٩,٠	١٨,٦	٢٠,٦	١٩,٤	٢٢,٦	١٩,٣	٢١,٣	٢١,١
GZ ٩٥٢٣-٢-١-١-١	١٨,٦	٢٠,٦	٢١,٠	٢٠,١	١٦,٦	١٨,٣	١٨,٦	١٧,٨
GZ ٩٤٦١-٤-٢-٣-١	١٧,٠	١٨,٠	١٦,٠	١٧,٠	٢٠,٠	٢٠,٠	١٥,٦	١٨,٥
Egyptian Yasmin	١٧,٠	١٧,٣	١٣,٦	١٦,٠	١٧,٣	١٧,٣	١٦,٠	١٦,٨
SK٢٠٣٤ H١	٢٣,٠	٢٦,٠	٢٠,٣	٢٣,١	٢٣,٣	٢٦,٠	١٩,٦	٢٣,٠
Mean	١٨,٧	٢٠,١	١٧,٧	١٨,٨	١٩,٧	١٩,٧	١٨,٩	١٩,٤

L.S.D. ٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	١,١١	١,٧	٣,٠
٢٠١٢	N.S	١,٤	٢,٤

Means of genotypes across three sowing dates showed that genotype SK٢٠٣٤ produced maximum number of filled grains per panicle (١٨٢,٤ and ١٧٤,٨) in the two seasons, respectively, which was significantly different from all other genotypes. However minimum number of filled grains per panicle (٩٤,٧ and ١٠٨,٤) were recorded in rice genotype GZ ٩٥٧٧-٤-١-١ in the two seasons, respectively. In the same way, average number of filled grains per panicle across ١٠ rice genotypes indicated that rice sowed on ١st May produced maximum number of filled grains per panicle of ١٥١,٢ and ١٥٣,١ in the two seasons respectively, which remained statistically at par with that sowed in ١٥th May. Nazir (١٩٩٤) reported that earlier transplanting in rice causes lower number of grains panicle^{-1} due to grain sterility because of high temperature at the time of grain filling and maturation. Transplanting at its optimum time reduces grain sterility. Sha X. and Linscombe (٢٠٠٥) and Dawadi and Chaudhary (٢٠١٣) reported that more number of filled grains per panicle was visualized in the early seeding and declined gradually in the successive seeding dates.

Table ٤. Number of filled grains per panicle of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	١٤٥,٧	١١٨,٣	١٢٠,٣	١٢٨,١	١٤٥.٧	١٢٣,٣	١٢١,٠	١٣٠,٠
Giza ١٧٨	١٧٣,٠	١٦١,٧	١٤٣,٠	١٥٩,٢	١٨٣,٠	١٨٦,٧	١٤٥,٠	١٧١,٦
Sakha ١٠١	١٥٢,٣	١٠٤,٠	١١٨,٣	١٢٤,٩	١٥٧,٧	١٣١,٣	١٢٠,٧	١٣٦,٦
Giza ١٨٢	١٣٤,٠	١٥٠,٣	١١٣,٧	١٣٢,٧	١٥٠,٠	١٦٣,٣	١٠٦,٧	١٤٠,٠
GZ ٩٠٥٧-٦-١-٣-٢	١٣٨,٣	١٢٣,٣	٩١,٠	١١٧,٦	١١٦,٣	١١٥,٣	١٠٤,٧	١١٢,١
GZ ٩٥٧٧-٤-١-١	١١٤,٣	٩٠,٣	٧٩,٣	٩٤,٧	١٢٣,٧	١٠٧,٠	٩٤,٧	١٠٨,٤
GZ ٩٥٢٣-٢-١-١-١	١٧٦,٣	١٧٨,٠	١٠٦,٧	١٥٣,٧	١٦٤,٣	١٧٥,٧	١٢٤,٧	١٥٤,٩
GZ ٩٤٦١-٤-٢-٣-١	١٤٢,٠	١١٢,٠	٦٣,٧	١٠٥,٩	١٣٣,٧	١١٣,٣	٧٨,٧	١٠٨,٦
Egyptian Yasmin	١٣٩,٧	١٦٤,٧	١٥٧,٣	١٥٣,٩	١٥٦,٧	١٩٣,٠	١٤٦,٧	١٦٥,٤
SK٢٠٣٤ H١	١٩٦,٧	٢٠٦,٠	١٤٤,٧	١٨٢,٤	٢٠٠,٠	١٦٣,٧	١٦٠,٧	١٧٤,٨
Mean	١٥١,٢	١٤٠,٩	١١٣,٨	١٣٥,٣	١٥٣,١	١٤٧,٣	١٢٠,٣	١٤٠,٢

L.S.D. ٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	١٠,٥	١٢,٧	٢٢,٣
٢٠١٢	١٣,١	١١,٩	٢١,٨

Results presented in Table ٥ indicated that difference among various genotypes for unfilled grains per panicle was significant statistically irrespective of transplanting dates. Egyptian Yasmin produced unfilled grains per panicle with maximum values of ٢٠,٦٧ and ٢٥,٤٤ in the two seasons respectively, in contrast to GZ ٩٥٧٧-٤-١-١ which produced minimum values at ٥,١١ and ٦,٤٤ in the two seasons respectively. Similarly, means of transplanting dates across genotypes expressed that maximum values for unfilled grains per panicle (٢١,٥٨ g) were noted for genotypes sowed on ١st May while genotypes transplanted on ٣٠th May. Interaction between various genotypes and sowing dates, as depicted in Table ٥, also remained significant when examined through statistics. Egyptian Yasmin produced maximum values of unfilled grains per panicle (٣١,٦٧) in ١st May sowing date in the first season and (٣٨,٠٠) in ١٥th May in the second season, in contrast with GZ ٩٠٥٧-٦-١-٣-٢ which gave minimum unfilled grains per panicle valued at ١,٦٧ and ٤,٣٣ in ٣٠th May in the two seasons, respectively.

Table ٥. Number unfilled grains per panicle of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	١٦,٦	٤,٦ ١٢,٠	٩,٠ ٣,٠	١٠,١	٩,٠ ٨,٦	٤,٠ ٩,٠		٦,٦ ٧,٠
Giza ١٧٨	٧,٠	١١,٦	٥,٠	٧,٣	٢٦,٦	١٢,٣		١٥,١
Sakha ١٠١	١٦,٠	١١,٠	١٠,٣	١٠,٨	١٨,٦	١٠,٣	٧,٠ ٣,٣	١١,٧
Giza ١٨٢	٢٩,٣	١١,٣	١,٦ ٤,٠	١٦,٨	٢٣,٠	١٥,٠	٦,٣ ٦,٣	١٤,١
GZ ٩٠٥٧-٦-١-٣-٢	١٠,٦	٣,٣	٥,٦	٧,٨ ٥,١	١٠,٣	٤,٠	٤,٣ ٥,٠	٦,٤
GZ ٩٥٧٧-٤-١-١	٨,٠	١٤,٠	١٠,٠	١٣,٠	١٤,٦	٩,٣	٦,٦ ٦,٣	١٠,٢
GZ ٩٥٢٣-٢-١-١-١	١٩,٣	٢١,٠	١٢,٦	١٥,٣	١٥,٣	١٩,٠	٦,٣	١٣,٥
GZ ٩٤٦١-٤-٢-٣-١	١٥,٠	١٧,٦	١٣,٣	٢٠,٦	٣٢,٠	٣٨,٠	١٦,٠	٢٥,٤
Egyptian Yasmin	٣١,٦	١٣,٣		١١,٦	٩,٣	١٣,٣		١٢,٨
SK٢٠٣٤ H١	٨,٣							
Mean	١٦,٢٠	١٢,٠	٧,٤		١٦,٧	١٣,٤	٦,٧	

L.S.D. ٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	٢,٨	٢,٨	٩,٤
٢٠١٢	٣,٢	٥,٠	٨,٦

The most important parameter and ultimate task of farming is grain yield which was affected significantly with various genotypes as well as sowing dates. It can be observed from results presented in Table ٦ that Giza

١٧٨ produced maximum grain yield of ٩,٠٤٠ and ٨,٩٩ t ha$^{-١}$ and it remained statistically at par with SK٢٠٣٤ genotype with ٨,٨٧ and ٨,٨١ t ha$^{-١}$ grain yield in the two seasons, respectively. Egyptian Yasmin gave minimum grain yield (٦,١٨ and ٦,١٢ t ha$^{-١}$) in the two seasons, respectively. Grain yield averaged across all the genotypes seems to be maximum (٩,٠٩ and ٨,٩٣ t ha$^{-١}$) in sowing date on ١st May. However, the lowest yield (٥,٣١ and ٥,١٨ t ha$^{-١}$) was recorded in sowing date on ٣٠th May. Interaction between sowing dates and genotypes showed that rice Giza ١٧٨ gave highest paddy yield of ١٠,٨٥ and ١٠,٧١t ha$^{-١}$ in ١st May sowing date in the two seasons, respectively, which is statistically similar with that obtained by SK٢٠٣٤. The lowest grain yield (٢,٩٣ and ٣,٠١ t ha-١) in the two seasons, respectively were recorded by Egyptian Yasmin when sowing on ٣٠th May. Similar results were reported by Akram *et al*., (٢٠٠٧) who found higher paddy yield in earlier transplanting dates compared with the late transplanting. The findings of Munda *et al*., (١٩٩٤), and Safdar *et al*., (٢٠٠٨). were also in the same direction. Dawadi and Chaudhary (٢٠١٣) indicated the higher yield in case of early sowing was attributed to increased cumulative mean value of temperature and sunshine hour due to early sowing, more number of productive tillers, more number of grains per panicle, and higher test weight.

Table ٦. Grain yield (t ha$^{-١}$)of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	٨,١	٧,٩	٥,٣	٧,١	٧,٩	٧,٨	٤,٧	٦,٨
Giza ١٧٨	١٠,٨	٩,٨	٦,٤	٩,٠	١٠,٧	٩,٧	٦,٥	٨,٩
Sakha ١٠١	٨,٧	٨,٥	٥,٢	٧,٥	٨,٣	٨,٤	٤,٦	٧,١
Giza ١٨٢	٩,٢	٨,٢	٥,٥	٧,٦	٩,١	٨,١	٥,٦	٧,٦
GZ ٩٠٥٧-٦-١-٣-٢	٩,٨	٩,٤	٦,٥	٨,٦	٩,٧	٩,٣	٦,٦	٨,٥
GZ ٩٥٧٧-٤-١-١	٨,٤	٧,٢	٥,١	٦,٩	٨,٣	٧,١	٤,٥	٦,٧
GZ ٩٥٢٣-٢-١-١-١	٨,٧	٧,٥	٤,٨	٧,٠	٨,٥	٧,٤	٤,٩	٦,٩
GZ ٩٤٦١-٤-٢-٣-١	٨,٢	٧,٠	٤,٣	٦,٥	٨,١	٦,٩	٤,٤	٦,٥
Egyptian Yasmin	٨,١	٧,٤	٢,٩	٦,١	٧,٩	٧,٣	٣,٠	٦,١
SK٢٠٣٤ H١	١٠,٥	٩,٣	٦,٧	٨,٨	١٠,٤	٩,٢	٦,٧	٨,٨
Mean	٩,١	٨,٢	٥,٣		٨,٩	٨,١	٥,١	

L.S.D.٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	٠,٣٣	٠,٤١	٠,٧٢
٢٠١٢	٠,٣٢	٠,٣٧	٠,٦٥

These differences among the sowing dates were probably related to differences in weather conditions (air temperature Fig. ١). The differences in average air temperature were markedly pronounced among sowing dates at early growth stage from ١ to ٦٠ days after sowing (DAS) and at the late growth stage from ٦٠ DAS to maturity. Where, air temperature tended to be lower at the first period (up to ٦٠ DAS) in the first sowing date than the others. The inverse was true in the second period (from ٧٥ DAS to maturity) in both seasons. Suitable solar radiation together with lower soil temperature in the first and second sowing dates might have increased photosynthesis and decrease respiration, thereby increased the amount of assimilates, available for growth which was reflected in more dry matter accumulation (more tillers and leaf area per unit area).

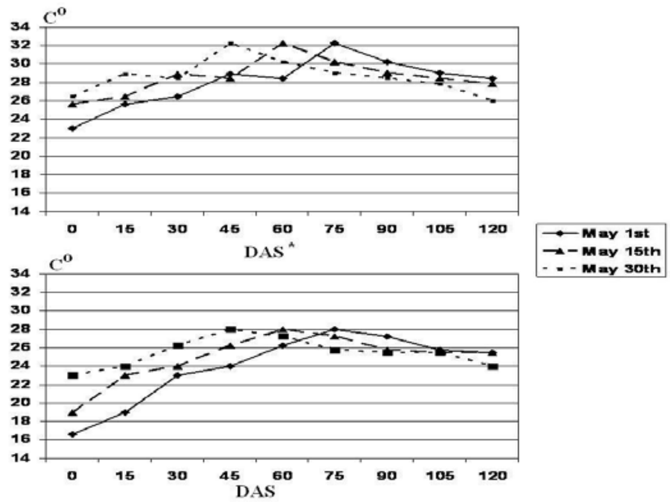

Fig ١. Mean temperature at the three sowing dates in ٢٠١١ and ٢٠١٢ seasons. *** Number of days after sowing (DAS).**

The influence of sowing date on brown rice percentage was not significant but the difference among genotypes and also the interaction effect of sowing date and genotype were significant in terms of brown rice percentage (Table ٧). The lowest brown rice percentage was observed in Giza ١٧٨ while the highest percentage was produced by GZ ٩٠٥٧-٦-١-٣-٢ genotype. The interaction effects of sowing date and genotype were significant on brown rice percentage. The highest percentage belonged to GZ ٩٠٥٧-٦-١-٣-٢ genotype in the first sowing date with an average of ٨١,٩٠ and ٨٢,٥٠ in the two seasons respectively. Brown rice percentage analysis indicates this percentage is completely influenced by genetic background of the genotypes because each genotype exhibited its highest fertility percentage under the optimum sowing date.

Table ٧. Brown rice % of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١ st	May ١٥th	May ٣٠th	M	May ١ st	May ١٥th	May ٣٠th	M
Giza ١٧٧	٧٩,٢	٨١,٤	٧٨,٨	٧٩,٨	٧٩,٨	٨٠,٩	٧٩,٤	٨٠,٠
Giza ١٧٨	٧٨,٦	٧٩,١	٧٨,٤	٧٨,٧	٧٩,٢	٧٨,٦	٧٩,٠	٧٨.٩
Sakha ١٠١	٨٠,٣	٧٩,٤	٧٩,٩	٧٩,٨	٨٠,٩	٧٨,٩	٨٠,٥	٨٠,١
Giza ١٨٢	٨٠,٧	٨١,٤	٧٨,٤	٨٠,١	٨١,٣	٨٠,٩	٧٩,٠	٨٠,٤
GZ ٩٠٥٧-٦-١-٣-٢	٨١,٩	٨٠,٩	٨٠,١	٨٠,٩	٨٢,٥	٨٠,٤	٨٠,٧	٨١,٢
GZ ٩٥٧٧-٤-١-١	٧٨,٨	٨٠,٥	٧٩,١	٧٩,٤	٧٩,٤	٨٠,٠	٧٩,٧	٧٩,٧
GZ ٩٥٢٣-٢-١-١-١	٨٠,٩	٨٠,٢	٨٠,٣	٨٠,٤	٨١,٥	٧٩,٧	٨٠,٩	٨٠,٧
GZ ٩٤٦١-٤-٢-٣-١	٧٩,٨	٨٠,٢	٨١,٢	٨٠,٤	٨٠,٤	٧٩,٧	٨١,٨	٨٠,٦
Egyptian Yasmin	٨١,٢	٧٩,٥	٨٠,٠	٨٠,٢	٨١,٨	٧٩,٠	٨٠,٦	٨٠,٥
SK٢٠٣٤ H١	٧٦,٧	٨٠,٧	٧٩,١	٧٨,٨	٧٧,٣	٨٠,٢	٧٩,٧	٧٩,١
Mean	٧٩,٨	٨٠,٣	٧٩,٥	٧٩,٨	٨٠,٤	٧٩,٨	٨٠,١	٨٠,١

L.S.D.٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	N.S	٠,٧٤	١,٥٤
٢٠١٢	N.S	٠,٨٤	١,٥٥

Planting date significantly affected milled rice % in the first season only (Table ٨). Highest milled rice % belonged to the second planting date in the first season. There was a significant difference among genotypes in terms of milled rice % . The highest milled rice % were obtained from Giza ١٧٧ and GZ ٩٥٢٣-٢-١-١-١; the lowest percentages were observed for GZ ٩٥٧٧-٤-١-١ and Giza ١٧٨ cultivar. This disparity was caused by the difference between genotypes in terms of the starch accumulation ability.

The interaction effects of planting dates and genotypes were significant on milled rice % (Table ٨). Highest milled rice % were observed in the second planting date for Giza ١٧٧ (٧٠,٣ and ٧٢,٦ %in ٢٠١١ and ٢٠١٢ resp.)on the other hand, GZ ٩٥٧٧-٤-١-١genotype gave the lowest percentage in the first planting date (٦٧,٠ and ٦٧,٥٪ resp.). Most genotypes exhibited their largest milled rice % in the second planting date. This may be due to that excessive heat during the pollination period and grain filling stage caused disorder in grain formation and grain weight which reduced the milled %.

Table ٨. Milled rice % of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١ st	May ١٥th	May ٣٠th	M	May ١ st	May ١٥th	May ٣٠th	M
Giza ١٧٧	٦٩,٠٠	٧٣,٣٠	٦٨,٢٠	٧٠,١٧	٦٩,٥٥	٧٢,٦٥	٦٨,٩٠	٧٠,٣٧
Giza ١٧٨	٦٧,٨٠	٦٨,١٠	٦٨,٤٠	٦٨,١٠	٦٨,٣٥	٦٧,٤٥	٦٩,١٠	٦٨,٣٠
Sakha ١٠١	٧٠,٣٠	٦٩,٠٠	٦٩,٣٠	٦٩,٥٣	٧٠,٨٥	٦٨,٣٥	٧٠,٠٠	٦٩,٧٣
Giza ١٨٢	٦٩,٥٠	٧١,١٠	٦٧,٨٠	٦٩,٤٧	٧٠,٠٥	٧٠,٤٥	٦٨,٥٠	٦٩,٦٧
GZ ٩٠٥٧-٦-١-٣-٢	٧٠,٣٠	٦٩,٨٠	٦٩,٨٠	٦٩,٩٧	٧٠,٨٥	٦٩,١٥	٧٠,٥٠	٧٠,١٧
GZ ٩٥٧٧-٤-١-١	٦٧,٠٠	٦٩,٠٠	٦٨,٢٠	٦٨,٠٧	٦٧,٥٥	٦٨,٣٥	٦٨,٩٠	٦٨,٢٧
GZ ٩٥٢٣-٢-١-١-١	٦٩,٩٠	٧٠,٣٠	٦٩,٩٠	٧٠,٠٣	٧٠,٤٥	٦٩,٦٥	٧٠,٦٠	٧٠,٢٣
GZ ٩٤٦١-٤-٢-٣-١	٦٨,١٠	٧٠,٦٠	٦٩,٣٠	٦٩,٣٣	٦٨,٦٥	٦٩,٩٥	٧٠,٠٠	٦٩,٥٣
Egyptian Yasmin	٧٠,٣٠	٦٨,٦٠	٦٩,٥٠	٦٩,٤٧	٧٠.٨٥	٦٧,٩٥	٧٠,٢٠	٦٩,٦٧
SK٢٠٣٤ H١	٦٧,٨٠	٧٠,٤٠	٦٧,٧٠	٦٨,٦٣	٦٨,٣٥	٦٩,٧٥	٦٨,٤٠	٦٨,٨٣
Mean	٦٩,٠٠	٧٠,٠٢	٦٨,٨١		٦٩,٥٥	٦٩,٣٧	٦٩,٥١	٦٩,٤٨

L.S.D. ٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	٠,٧٩	٠,٩٢	١,٢٩
٢٠١٢	N.S.	١,٠٥	١,٩٥

Sowing date significantly influenced broken rice percentage in the two seasons (Table ٩). Rice plants sown on the early and late dates and recorded higher broken rice percentage than those sown on the ١٥th May in the two seasons. Rice genotypes revealed a significant difference on broken rice percentage in the two seasons. Grains of Giza ١٨٢ and GZ ٩٠٥٧-٦-١-٣-٢ genotype recorded highest broken rice percentage in the two seasons. However, Egyptian Yasmin recorded the lowest one. The interaction between sowing dates and rice genotypes had a significant effect on broken rice percentage in the two season (Table ٩). Giza ١٨٢ cultivar sown on ١st May recorded the highest broken rice percentage in the two seasons while Egyptian Yasmin produced the lowest percentage when sowed on the first sowing dates.

Table ٩. Broken rice % of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	٧,٩٠	٥,٧٥	٩,٤٠	٧,٦٨	٨,٣٠	٦,٢٥	١٠,٠٠	٨,١٨
Giza ١٧٨	٧,١٠	٥,٠٥	٧,٤٠	٦,٥٢	٧,٥٠	٥,٥٥	٨,٠٠	٧,٠٢
Sakha ١٠١	٩,١٠	٨,٠٥	٩,٥٠	٨,٨٨	٩,٥٠	٨,٥٥	١٠,١٠	٩,٣٨
Giza ١٨٢	١٤,١٠	٨,٦٥	٧,١٠	٩,٩٥	١٤,٥٠	٩,١٥	٧,٧٠	١٠,٤٥
GZ ٩٠٥٧-٦-١-٣-٢	٩,٦٠	١٠,٢٥	٩,٠٠	٩,٦٢	١٠,٠٠	١٠,٧٥	٩,٦٠	١٠,١٢
GZ ٩٥٧٧-٤-١-١	١١,٦٠	٨,٠٥	٧,٨٠	٩,١٥	١٢,٠٠	٨,٥٥	٨,٤٠	٩,٦٥
GZ ٩٥٢٣-٢-١-١-١	٨,٣٠	٢,٨٥	٩,٣٠	٦,٨٢	٨,٧٠	٣,٣٥	٩,٩٠	٧,٣٢
GZ ٩٤٦١-٤-٢-٣-١	٧,١٠	٣,٦٥	١٠,٨٠	٧,١٨	٧,٥٠	٤,١٥	١١,٤٠	٧,٦٨
Egyptian Yasmin	٣,٥٠	٧,٠٥	٥,٩٠	٥,٤٨	٣,٩٠	٧,٥٥	٦,٥٠	٥,٩٨
SK٢٠٣٤ H١	٥,٢٠	٩,٠٥	٥,٥٠	٦,٥٨	٥,٦٠	٩,٥٥	٦,١٠	٧,٠٨
Mean	٨,٣٥	٦,٨٤	٨,١٧		٨,٧٥	٧,٣٤	٨,٧٧	٨,٢٩

L.S.D. ٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	٠,١١	٠,١٣	٠,٢٢
٢٠١٢	٠,١٣	٠,١٦	٠-٣١

Sowing dates significantly influenced chalky and green grain percentage in the two seasons. Rice plants sown on ١٥th May recorded higher chalky and green grain percentage than those sown on the early and late sowing dates in the two seasons. Rice genotypes revealed a significant difference on chalky and green grain in the two seasons. Giza ١٨٢, Sakha ١٠١ and SK٢٠٣٤ H١cultivar exceeded the other genotypes in percentage in the two seasons. The interaction between sowing date and rice genotypes had a significant effect on chalky and green grain percentage in the two seasons (Table ١٠). GZ ٩٤٦١-٤-٢-٣-١ genotype sown on ١st May recorded highest chalky and green grain in the two seasons.

Table ١٠. Chalky and green grain % of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	١,١٠	١,٥٥	١,٣٥	١,٣٣	١,٣٠	١,٨٥	١,٦٥	١,٦٠
Giza ١٧٨	١,٤٠	١,١٥	١,٦٥	١,٤٠	١,٦٠	١,٤٥	١,٩٥	١,٦٧
Sakha ١٠١	١,٨٠	١,٩٥	١,٩٥	١,٩٠	٢,٠٠	٢,٢٥	٢,٢٥	٢,١٧
Giza ١٨٢	٢,٠٠	١,٩٥	١,٨٥	١,٩٣	٢,٢٠	٢,٢٥	٢,١٥	٢,٢٠
GZ ٩٠٥٧-٦-١-٣-٢	١,٦٠	١,٦٥	٢,٠٥	١,٧٧	١,٨٠	١,٩٥	٢,٣٥	٢,٠٣
GZ ٩٥٧٧-٤-١-١	٠,٨٠	١,٩٥	١,٦٥	١,٤٧	١,٠٠	٢,٢٥	١,٩٥	١,٧٣
GZ ٩٥٢٣-٢-١-١-١	٠,٦٠	١,٣٥	١,٠٥	١,٠٠	٠,٨٠	١,٦٥	١,٣٥	١,٢٧
GZ ٩٤٦١-٤-٢-٣-١	٢,٢٠	١,٤٥	١,١٥	١,٦٠	٢,٤٠	١,٧٥	١,٤٥	١,٨٧
Egyptian Yasmin	١,٥٠	١,٠٥	٠,٩٥	١,١٧	١,٧٠	١,٣٥	١,٢٥	١,٤٣
SK٢٠٣٤ H١	١,٨٠	٢,٣٥	١,٥٥	١,٩٠	٢,٠٠	٢,٦٥	١,٨٥	٢,١٧
Mean	١,٤٨	١,٦٤	١,٥٢		١,٦٨	١,٩٤	١.٨٢	

L.S.D. ٠,٠٥	Sowing S	Genotypes G	S x G
٢٠١١	٠,٠٥	٠,٠٦	٠,٦٥
٢٠١٢	٠,٠٦	٠,٠٦	٠,٦٦

Evaluation of rice varieties to insects test:

Stem borer (*Chilo agamemnon* Bles.)

For white head % (stem borer, *Chilo agamemnon* Bles.) in season ٢٠١١, results presented in Table ١١ revealed that genotypes (Giza ١٧٨, Sakha١٠١, GZ ٩٥٧٧-٤-١-١ and GZ ٩٤٦١-٤-٢-٣-١) were resistant (R) with ١,٤٤, ٠,٨٣, ٢,٦٦ and ١,٩٣ WH%, respectively. These genotypes were belonged to true Japonica types except Giza ١٧٨ cultivar that was Indica-Japonica. While, five genotypes (Giza١٧٧, Giza١٨٢, GZ ٩٠٥٧, GZ ٩٥٧٧-٤-١-١ and SK٢٠٣٤ H١) were moderately resistant (MR) with ٤,١٨, ٤,١٤, ٥,٩٤, ٣,٤٦, and ٥,٣٦ WH%, respectively. On the other hand, one genotype (Egyptian Yasmin) was moderately susceptible (MS) with ٦,٣٢ WH%. these genotypes including one Indica type (Giza١٨٢), two Indica-Japonica (GZ ٩٠٥٧-٦-١-٣-٢ and SK٢٠٣٤ H١) and two true Japonica types (Giza١٧٧ and GZ ٩٥٢٣-٢-١-١-١). It was found that the japonica types were more resistant to stem borer. This was previously conformed by Pathak (١٩٦٧), Tantawi (١٩٨٥) and Bleih *et al* (١٩٩١) who concluded that rice verities belonging to Indica type are more susceptible to stem borer than those belonging to japonica or Indica x Japonica types. Djamin and Pathak (١٩٦٧) concluded that japonica rices have more silica content than Indica rices. The high level of silica seemed to interface with feeding and boring of the rice stem borer larvae and could cause defacing of the mandibles. In ٢٠١٢ season, the rice stem borer infestation was the highest with genotypes GZ ٩٥٧٧-٤-١-١ and GZ ٩٤٦١-٤-٢-٣-١comparing with the data in ٢٠١١ rice seasons. This could by attributed that inset populations, in general, fluctuated from one season to another, and may appear in outbreak in some seasons. This could by attributed to imbalance in the ecosystem due to distraction of nature entries, for example as a result to high applications of pesticides. These results are in agreement with those of **Hammoud *et al* (٢٠١٢) and El-Malky *et al* (٢٠١٣).**

Table ١١. White head % of different rice genotypes as affected by sowing dates in ٢٠١١ and ٢٠١٢ seasons.

Genotypes (G)	Sowing dates (S)							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	٧,١٧	١,٦٦	٣,٧٠	٤,١٨	٨,٦٧	٣.١٦	٥,٢٠	٥,٦٨
Giza ١٧٨	١,٨٠	١,٥٠	١,٠٢	١,٤٤	٣,٣٠	٣,٠٠	٢,٥٢	٢,٩٤
Sakha ١٠١	٠,٩٨	٠,٧٥	٠,٧٥	٠,٨٣	٢,٤٨	٢,٢٥	٢,٢٥	٢,٣٣
Giza ١٨٢	١,٩٦	٦,٨٠	٣,٦٥	٤,١٤	٣,٤٦	٨,٣٠	٥,١٥	٥,٦٤
GZ ٩٠٥٧-٦-١-٣-٢	٤,٨٨	١٠,٦٣	٢,٣١	٥,٩٤	٦,٣٨	١٢,١٣	٣,٨١	٧,٤٤
GZ ٩٥٧٧-٤-١-١	٤,٤٨	٢,٣٢	١,١٧	٢,٦٦	٥,٩٨	٣,٨٢	٢,٦٧	٤,١٦
GZ ٩٥٢٣-٢-١-١-١	٤,٢٦	٥,٣٨	٠,٧٥	٣,٤٦	٥,٧٦	٦,٨٨	٢,٢٥	٤,٩٦
GZ ٩٤٦١-٤-٢-٣-١	١,٧٨	٣,٠٠	١,٠٠	١,٩٣	٣,٢٨	٤,٥٠	٢,٥٠	٣,٤٣
Egyptian Yasmin	٧,٠٠	٨,٢٧	٣,٦٩	٦,٣٢	٨,٥٠	٩,٧٧	٥,١٩	٧,٨٢
SK٢٠٣٤ H١	٨,٥٥	٤,٠٧	٣,٤٥	٥,٣٦	١٠,٠٥	٥,٥٧	٤,٩٥	٦,٨٦
Mean	٤,٢٩	٤.٤٤	٢,١٥		٥,٧٩	٥,٩٤	٣,٦٥	

Insects storage (*Rhizopertha dominica*):

For evaluate susceptibility of rice varieties to insect infestation in storage, *Rhizopertha dominica* were released on tested varieties. The results in (Table ١٢) showed that significant differences among the mean numbers of adult emergence of *Rhizopertha dominica.* The number of adult emergence ranged from ١,٠٨ insect (Sakha١٠١) to ٨,٢٥ insect (GZ٩٥٧٧-٤-١-١) (low susceptibility varieties to insect infestation). Also, the number of adult emergence ranged from ١٣,٠٨ insect with Giza١٨٢ to ١٧,٥٨ insect with Giza١٧٧ as moderate susceptibility varieties to insect infestation). Also, the number of adult emergence ranged from ٢١,٠٨ insect with Egyptian Yasmin to ٢٢,٥٨ insect with GZ ٩٠٥٧-٦-١-٣-٢ as (high susceptibility varieties to insect infestation). There is no effect of cultivation time on susceptibility, except (Giza١٧٧) at (May ١st), number of adult emergence was increased to ٢٨,٧٥, ٣٠,٢٥ insect, (GZ ٩٠٥٧-٦-١-٣-٢) and (Egyptian Yasmin) at (May ١٥th) was increased to ٣٤,٧٥, ٣٦,٢٥ insect at ٢٠١١،٢٠١٢ season, respectively.

Table ١٢. Mean numbers of adult emergence of *Rhizopertha dominica* in ٢٠١١ and ٢٠١٢ seasons at differences sowing dates.

Genotypes	Mean numbers of adult emergence							
	٢٠١١ season				٢٠١٢ season			
	May ١st	May ١٥th	May ٣٠th	M	May ١st	May ١٥th	May ٣٠th	M
Giza ١٧٧	٢٨,٧٥	٥,٧٥	١٣,٧٥	١٦,٠٨	٣٠,٢٥	٧,٢٥	١٥,٢٥	١٧,٥٨
Giza ١٧٨	٥,٧٥	٣,٧٥	١,٧٥	٣,٧٥	٧,٢٥	٥,٢٥	٣,٢٥	٥,٢٥
Sakha ١٠١	١,٧٥	٠,٧٥	٠,٧٥	١,٠٨	٣,٢٥	٢,٢٥	٢,٢٥	٢,٥٨
Giza ١٨٢	٥,٧٥	٢٣,٧٥	٩,٧٥	١٣,٠٨	٧,٢٥	٢٥,٢٥	١١,٢٥	١٤,٥٨
GZ ٩٠٥٧-٦-١-٣-٢	١٧,٧٥	٣٤,٧٥	١٠,٧٥	٢١,٠٨	١٩,٢٥	٣٦,٢٥	١٢,٢٥	٢٢,٥٨
GZ ٩٥٧٧-٤-١-١	١٠,٧٥	٦,٧٥	٢,٧٥	٦,٧٥	١٢,٢٥	٨,٢٥	٤,٢٥	٨,٢٥
GZ ٩٥٢٣-٢-١-١-١	١٦.٧٥	٢٥,٧٥	٠,٧٥	١٤,٤٢	١٨,٢٥	٢٧,٢٥	٢,٢٥	١٥,٩٢
GZ ٩٤٦١-٤-٢-٣-١	٥,٧٥	٩,٧٥	١,٧٥	٥,٧٥	٧,٢٥	١١,٢٥	٣,٢٥	٧,٢٥
Egyptian Yasmin	١٩,٧٥	٣٤,٧٥	٨,٧٥	٢١,٠٨	٢١,٢٥	٣٦,٢٥	١٠,٢٥	٢٢,٥٨
SK٢٠٣٤ H١	١٦,٧٥	١٥,٧٥	١١,٧٥	١٤,٧٥	١٨,٢٥	١٧,٢٥	١٣,٢٥	١٦,٢٥
Mean	١٢,٩٥	١٦,١٥	٦,٢٥	١١,٧٨	١٤,٤٥	١٧,٦٥	٧,٧٥	١٣,٢٨

Genetic parameters for yield character:

Estimates of genotype variance, phenotypic and genotypic coefficient of variability percentages, heritability and genetic advance percentage for grain yield (t/ha) character in two years (٢٠١١ and ٢٠١٢) are presented in Table (١٣). The ten rice genotypes showed a wide range of mean performance under different seasons. Mean squares for all traits of all genotypes were highly significant in different years. Thus, the selection for all traits among these cultivars would be effective to improve traits of all genotypes. Similar results were obtained by Han *et al.,* (١٩٩٥), Tang (١٩٩٥), Veillet *et al.,* (١٩٩٦), Hammoud *et al* (٢٠١٢) and El-Malky *et al.,* (٢٠١٣). The phenotypic coefficient of variability (PCV%) was higher than genotypic coefficient variability (GCV%) in different years in all genotypes, indicating that the most portion of PCV% was more contributed by environmental conditions and cultural practices. Relatively, high genetic coefficient of variability was found to be higher for grain yield (t/ha), and gave ١٥,٨٢ in season ٢٠١١and ١٦,٧٧ in season ٢٠١٢, respectively indicating that this traits might be more genotypically predominant, and it would be possible to achieve further improvement in both traits. The genetic coefficient of variability refers to the additive and non additive genetic variance played an important role in inheritance of these traits. These results are in agreement with those of Han *et al.,* (١٩٩٥), Tang (١٩٩٥), Veillet *et al.,* (١٩٩٦), Hammoud *et al* (٢٠١٢) and El-Malky *et al.,* (٢٠١٣).

Heritability and genetic advance under selection were computed and the obtained results are illustrated in Table (١٣). High estimates of heritability were found in this characters under investigation in different two years, which ascertains the presence of both additive and non additive genetic variance in the inheritance of most traits except panicle weight which ranged from ٨٧,٧٣٪ to ٩١,١٧٪. These traits were stable under different condition and culture practices. Therefore, it could be concluded that its selection procedures are successful in improving the most traits under examination. Some results were previously obtained Han *et al*., (١٩٩٥), Tang (١٩٩٥), Veillet *et al.,* (١٩٩٦), Hammoud *et al.,* (٢٠١٢) and El-Malky *et al.,* (٢٠١٣).

Genetic advance under selection which presented in (Table ١٣) showed the possible gain from selection when the most desirable ٥٪ of the plants are selected. Relatively, moderate genetic gains were obtained for grain yield (t/ha), which gave more than ٢٠٪. Low genetic advance were found in remaining characters less than ١٠٪ under different years. Johnson *et al* (١٩٥٥) revealed that heritability estimates along with genetic gain upon selection were more valuable than the former alone in predicting the effect of selection. On the other hand, Dixit *et al*. (١٩٧٠) pointed out that 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. In this investigation, high genetic gain was found to be associated with high heritability estimates for gain. Consequently, selection for these traits should be effective and satisfactory for successful breeding purposes. Moderate estimates of both heritability and genetic advance were obtained for plant height and grain yield (t/ha). Therefore, selection for these traits in these two characters will be effective, but probably of less success than in the former characters. Low genetic gain was associated with low heritability values for the rest of the characters studied. Hence, selection for these traits would be of less effectiveness. Similar results were obtained by Han *et al.,* (١٩٩٥), Tang (١٩٩٥), Veillet *et al.,* (١٩٩٦), Hammoud *et al.,* (٢٠١٢) and El-Malky *et al*.,(٢٠١٣).

Table ١٣:Estimates of phenotypic (PCV) and genotypic coefficient of variability (GCV), heritability (H. bs) and expected genetic advance (Δg%) for grain yield (t/ha) traits in ١٠ genotypes of rice.

Genetic parameters	grain yield (t/ha)	
	٢٠١١	٢٠١٢
Mean	٧,٥٥٨	٧,٤٢٦
Variance	٨,٧٩**	٩,٤٥**
M.S. Error	٠,١٩	٠,١٥
GV	١,٤٣	١,٥٥
PV	١,٦٣	١,٧٠
GCV%	١٥,٨٢	١٦,٧٧
PCV%	١٦,٨٩	١٧,٥٦
H. bs	٨٧,٧٣	٩١.١٨
Δg	٢,٣١	٢,٤٥
Δg%	٣٠,٥٣	٣٢,٩٩

Clustering of the varieties based on agronomic characters:

The characters used for this purpose in the present study were the same morphological agronomical quantitative characters. Normality was checked for all traits, which indicated that all traits had good approximations of normal distributions (Fahmi *et al* ٢٠٠٥ and El-Malky *et al* ٢٠١٣). Clustering varieties, based on similarity of quantitative characters, produced two large groups (Fig.٢). The first one included five rice genotypes Giza ١٧٨, Giza ١٨٢, GZ ٩٥٢٣-٢-١-١-١, Egyptian Yasmin and SK٢٠٣٤ H١. These genotypes were Indica and Indica-Japonica types except Gz ٩٥٢٣-٢-١-١-١ genotype and also simlar in filled grains character. While, the second group included Giza ١٧٧, Sakha ١٠١, GZ ٩٠٥٧-٦-١-٣-٢, GZ ٩٥٧٧-٤-١-١ and GZ ٩٤٦١-٤-٢-٣-١ genotypes were Japonica types and similar in duration and grain yield characters.

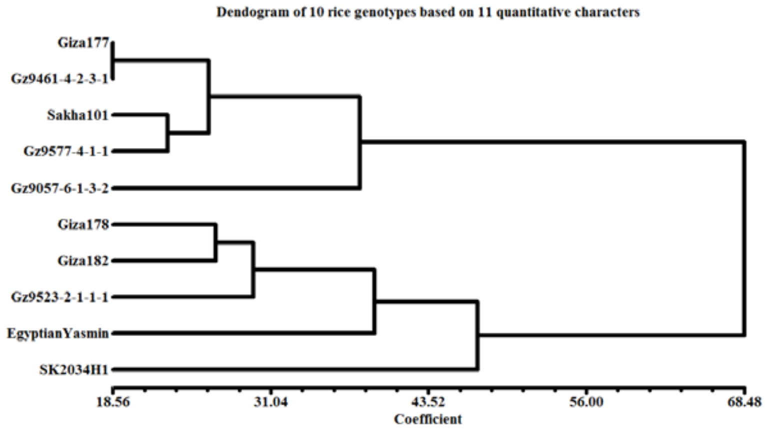

Fig. ٢: Cluster diagram for ten rice cultivars classified by ١١ morphological quantitative characters.

CONCLUSION

It could be concluded that there is a significant effect of sowing dates on the yield, yield components and days taken to complete maturity of grain rice genotypes. Sowing on first May maximized yield of rice genotypes. All the rice genotypes under studies were found to be photoperiod sensitive. For white head %, the japonica genotypes were more resistant to stem borer this du to that Japonica type has more silica content than Indica type as well as, the high level of silica seemed to interface with feeding and boring of the rice stem borer larvae and could cause defacing of the mandibles.

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السلوك الوراثي لصفات المحصول وجودة الحبوب والإصابة بثاقبة ساق الأرز وسوسة المخزن لبعض التراكيب الوراثية فى الأرز تحت مواعيد زراعة مختلفة

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أجريت هذه الدراسة في مركز البحوث والتدريب فى الأرز ومعهد بحوث وقاية النباتات – سخا – كفر الشيخ خلال الموسمين ٢٠١١ و ٢٠١٢ وتهدف هذه الدراسة دراسة السلوك الوراثي لعشرة تراكيب وراثية مختلفة من الأرز تحت ثلاث مواعيد زراعة (أول مايو ، ١٥ مايو، ٣٠ مايو) ودراسة تأثير مواعيد الزراعة على المحصول وصفات وجودة الحبوب والإصابة بالثاقبات وحشرات المخازن (ثاقبة الحبوب الصغرى). وكانت التراكيب الوراثية من الأرز هي الصنف جيزة ١٧٧ و جيزة ١٧٨ و جيزة ١٨٢ و ٩٠٥٧- ٢-٣-١-٦ و ١-١-٤-٩٥٧٧ و ١-١-١-٢-٩٥٢٣ و ١-٣-٢-٤-٩٤٦١ والصنف ياسمين المصري وهجين مصري واحد. و يمكن تلخيص أهم النتائج فيما يلي:

١ - أن الصنف جيزة ١٧٨ وهجين مصري واحد كانا أعلى الأصناف في صفة محصول الحبوب بينما الصنف ياسمين المصري كان اقل الأصناف محصولا.

٢ - أشارت النتائج أن صفة محصول الحبوب لكل التراكيب الوراثية كان عاليا عند الزراعة في الأول من مايو بينما سجل ميعاد الزراعة في ٣٠ من مايو انخفاض في المحصول.

٣ - أظهرت النتائج أن التراكيب الوراثية جيزة ١٧٨ وسخا ١٠١ و ١-١-١-٢-٩٥٢٣ و ١-٣-٢-٤-٩٤٦١ أظهرت مقاومة لثاقبات الساق بنسب ١,٤٤ و ٢,٦٦ و ١,٩٣ كنسبة مئوية على التوالي. كما وجد خمسة طرز وراثية هي جيزة ١٧٧ و جيزة ١٨٢ و٢-٣-١-٦ -٩٠٥٧ و١-١-٤-٩٥٧٧ و هجين مصري واحد كانوا متوسطي المقاومة بنسب ٤,١٨ و ٤,١٤ و ٣,٤٧ و ٥,٣٦ % على التوالي. في حين سجل الياسمين المصري إصابة متوسطة بنسبة ٦,٣٢ %.

٤ - أوضحت النتائج أن عدد الحشرات الكاملة الناتجة من الإصابة بحشرة المخازن (ثاقبة الحبوب الصغرى) تراوحت من ١,٠٨ مع الصنف سخا ١٠١ إلى ٨,٢٥ حشرة مع الصنف ١-١-٤-٩٥٧٧ وهذه اقل التراكيب إصابة. أيضا كان عدد الحشرات الكاملة الناتجة من الإصابة تراوحت من ١٣,٠٨ مع الصنف جيزة ١٨٢ إلى ١٧,٠٨ حشرة مع الصنف جيزة ١٧٧ وهذه تمثل أصناف متوسطة الإصابة. كما أوضحت النتائج أيضا أن أعداد الحشرات الكاملة الناتجة من الإصابة تراوحت من ٢١,٠٨ مع الصنف ياسمين المصري إلى ٢٢,٥٨ حشرة مع الصنف ٢-٣-١-٦-٩٠٥٧ وهذه تعتبر أعلى الأصناف حساسية للإصابة بالحشرة.

٥ - أظهرت النتائج أن هناك تأثير معنوي لمواعيد الزراعة بالنسبة لصفة الأرز الأبيض حيث كانت النسبة المئوية لهذه الصفة عالية فى الميعاد الأول يليها الميعاد الثاني ، وكانت أعلى الطرز تحت الدراسة هي الصنف جيزة ١٧٧ والسلالة ١-١-١-٢-٩٥٢٣ بينما كانت اقل الطرز السلالة ١-١-٤-٩٥٧٧ والصنف جيزة ١٧٨.

٦ - انقسمت هذه الطرز الوراثية فى تحليل الشجرة الوراثية إلى مجموعتين كبيرتين وشملت المجموعة الأولى خمسة طرز هي جيزة ١٧٨ و جيزة ١٨٢ و والسلالة ١-١-١-٢-٩٥٢٣ وياسمين المصري و هجين مصري واحد وهذه الطرز جميعها هندي وهندي – ياباني ماعدا السلالة ١-١-١-٢-٩٥٢٣ وهى من الطراز الياباني. بينما شملت المجموعة الثانية الطرز اليابانية وهى جيزة ١٧٧ و سخا ١٠١ و والسلالة ٢-٣-١-٦-٩٠٥٧ و١-١-٤-٩٥٧٧ و ١-٣-٢-٤-٩٤٦١ ويرجع هذا إلى تساويهم فى طول فترة النمو وصفة محصول الحبوب.

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