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Allelopathy, genetic parameters and cluster analysis of some (*Oryza sativa* L.) genotypes

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ABSTRACT

The present investigation was conducted at Rice Research and Training Center (RRTC), Sakha, Kafr El Egypt during 2012 and 2013 seasons to evaluate twenty-one rice genotypes for allelopathic activity. The genotypes were classified into three categories, eight entries as Japonica type, nine entries as Indica and four e Indica/Japonica type. The results showed that some rice genotypes showed allelopathic activity against *Echinochl galli* L. (barnyard grass) in the field after planting. These varieties showed biologically active suppression of *E. c* L. by 80-90 % in the field. These genotypes are important and suitable for direct seeded rice; also it could be ut breeding programs to transfer this trait to commercial varieties. For agronomic traits, the most of traits under stu wide range of variability. This range was reflected differences among these genotypes. Four genotypes namely; G Milyang 97, Giza 181 and Suweon 339 were very early. Five genotypes namely; Giza 178, Giza 177, Milyang 181 and IET 1444 scored high values for harvest index. Giza 177 and Giza 178 are cultivated in more than 50 cultivated area with rice in Egypt. Clustering varieties, based on similarity of quantitative characteristics, produ large groups. The first one included seven rice genotypes, *i.e.*; Giza 171, Giza 176, Suweon 339, IET 1444, IF Giza 178 and Giza 181. This group divided into two sub-groups, the first one included Giza 178 and Giza 18 were similar in plant height, No. of tillers plant^{-1}, Flag leaf area, grain yield plant^{-1}, No. of spikelets panicle^{-1} a reaction. The phenotypic coefficient of variability (PCV %) was higher than genotypic coefficient variability (GC all genotypes, indicating that the most portion of PCV% was more contributed by environmental conditions and practices. Relatively, high genetic coefficient of variability was found to be higher for all traits, indicating that the might be more genetically predominant, and it would be possible to achieve further improvement in both tra genetic coefficient of variability refers to the additive and non-additive genetic variance which played an importa the inheritance of these traits.

Key words: Rice (*Oryza sativa* L.), allelopathy, cluster analysis, genetic parameters.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereal crops all over the world, and represents a staple food for more than half of the global population (FAO, 2009). In Egypt, rice is the second food crop after wheat, and also is the second one for cash money (Badawi, 1999).

Rice productivity has remarkably increased year after year according to the percentage replacement of the rice area with the modern varieties to realize a maximum yield average (10t ha^{-1}) in the year 2014 against (5.7 t ha^{-1}) for the period 1986-1998. Because of adopting of the new short duration rice varieties, about 30% of the irrigation water consumption was saved every year (Aidy and Maximos, 2006). However, the weeds grown in rice fields are the main suppressor of rice growth and significantly affecting rice grain yield. Also the chemical treatments or herbicides for weed control are very dangerous due to the pollution and high production costs. Allelopathy is the result of biochemical interactions between plant represents an economic way to control weeds fields. It is caused by toxic chemicals rele the plant through volatilization, leaching, a exudation or produced during decomposi plant residues in the soil (Chou, 1995). Alle rice varieties suppress weed emergence, r shoot development, tillering capacity and t canopy (Hassan and Rao, 1996). Alle compounds for some weeds may be produ other plant species. The genes responsible f allelochemicals could be cloned and int through genetic transformation, leading development of rice cultivars with a broad s of allelopathic properties against rice wee should be remembered, however, that ove weeds develop resistance to allelopathic ch (Khush, 1996). Success of breeding p depends on the magnitude of genetic variabi the extent to which the advantageous charac are heritable (Mruthunjaya and Mahad

1993). Therefore, the study of genetic variability in rice is not only essential for selecting valuable genotypes and predicting the effect of selecting best genotypes but it will also aid breeders in simultaneous improvement of characteristics through selection (Patil *et al*., 1993). Using quantitative traits in genetic relationships has valuable advantages, especially in rice: (i) rice has many quantitative traits with high heritability values that can be easily scored (ii) rice databases are available that can be used (Dingkhun and Asch, 1999), and (iii) computer analyses for quantitative traits are available. The study of genetic relationships is important in selection and prediction of progeny as well as for the conservation and characterization of restrained germplasm (Fahmi *et al*., 2005).

In this study, twenty-one rice genotypes were studied for nineteen agronomic characteristics to explore their genetic variability by determining the magnitude of mean performance to calculate heritability, genotypic coefficient variability, phenotypic coefficient variability and genetic advance. Also, averages of two years of quantitative characteristics were used for constructing genetic relationships among studied rice genotypes. The genetic relationships among individuals and populations could be constructed using similarity values of some quantitative characteristics (Souza and Sorrells (1991), Zhang *et al*., (1995), Dinghuhn and Asch (1999), Bahrman *et al*., (1999) and El-Malky (2004).

The aims of this investigation were to evaluate twenty-one rice genotypes for allelopatic activity against *E. crus-galli* L. and study the genetic parameters and phylogenetic relationships using nineteen quantitative characteristics for the studied rice genotypes.

MATERIALS AND METHODS

Twenty-one rice genotypes were selected to conduct this study, and were classify into three categories, eight entries as Japonica type, nine entries as Indica type and four entries as Indica/Japonica type (Table 1). All genotypes were evaluated at the experimental farm of Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt, during the two rice growing seasons; 2012 and 2013.

Studied characteristics

Nineteen quantitative characteristics were studied as following:

Allelopathic activity: Rice genotypes were screened in two field experiments, in 2012, 2013 to identify genotypes possessing allelopathic properties around *Echinochloa crus-galli* L. at RRTC, Sakha, Kafr Elsheikh. Pre-germinated seeds of each genotype were planted in five rows with 20cm space in $1m^2$ plots in randomized complete block design with three replicates. Each plot was infest the selected weed before seeding rice. Other were controlled with specific herbicide appl followed by hand weeding. Plots were dr days after seeding, flooded every 3-4 da permanently flooded 30 days after s Allelopathic activity was recorded 30-40 da seeding based on reduction in dry weight weeds between rows.

Vegetative characteristics: included d heading, plant height (cm), No. of tillers plar leaf area (cm^2), total chlorophyll content (r measured by using chlorophyll analytical ap as amount of total chlorophyll per square de (chlorophyll meter 5 PAD-502 Minolta cam Ltd., Japan), and blast reaction which ev according to the Standard Evaluation Systen for rice, International Rice Research Institute 1996).

Yield and its component characteristics: i No. of panicles plant^{-1}, grain yield plant^{-1} (g), weight (g), 1000-grain weight (g), No. o grain panicle^{-1}, No. of unfilled grain p panicle length (cm) and harvest index %.

Grain quality characteristics: which were percentage, milling percentage, gel con which was determined based on the consist milled rice paste that has been gelatinized by in dilute alkali and then cooled to room temp then tubes were laid horizontally on a tab with millimeter graph paper and total length gel measured in millimeters, and a percentage. All these characteristics were ca according to the Standard Evaluation Systen for rice (IRRI, 1980). Each studied genoty grown in $10m^2$ in a randomized complet design (RCBD) experiment with three re Weeds were chemically controlled by Satu using recommended dose. Monthly temperat relative humidity are shown in Table (2) ac to Sakha Meteorological Station.

Cluster analysis

Genetic relationships among studied ge were measured by similarity of studied quan characteristics as reported by Zhang *et al*., Dinghuhn and Asch (1999) and El-Malky Analysis for clustering was conducted us Numerical Taxonomy and Multivariate A system, Ver. 2.1 (NTSYS-PC; Rolhf, 200 output was analyzed using an agglor hierarchical clustering method with complete strategy. Firstly, a matrix of dissimilarity val produced and the phenotypic distance betwe pair of lines was estimated as Euclidean d Secondly, cluster analysis was then conducted Euclidean distance matrix with un-weighe group method based on arithmetic (UPGMA) to develop a dendogram.

Table 1: The studied twenty-one rice genotypes with their parentage, origin and types.

No.	Entries	Parentage	Origin	Types
1	Giza 177	Giza 171 / Yamji No.1 //PiNo.4	Egypt	Japonica
2	Giza 178	Giza 175 / Milyang 49	Egypt	Indica/Japonica
3	Dular	Dumai / Larkoch	IRRI	Indica
4	TKY 1014	J692153X / Fukunishi // Taichung	China	Japonica
5	Giza 181	IR 28 / IR 22	Egypt	Indica
6	IET 1444	TN1 / Co29	India	Indica/Japonica
7	IET 11754	na*	India	Indica/Japonica
8	Suweon 339	SR 9373-71-3 / Pungsan Byeo	Korea	Japonica
9	IR 65598	na	IRRI	Indica
10	IR 65603	na	IRRI	Indica
11	IR 31775-30-3-2-2	IR 10154-23-3-3 / IR 9129-209-2-2	IRRI	Indica
12	IR 2037-93-1-3-1-1	IR 1697-47-2-2 / IR 1818-2	IRRI	Indica
13	IR 62155-138-3-3-2	na	IRRI	Indica
14	IR 29	IR833-6-1-1/IR1561-149-1//IR1737	IRRI	Indica
15	Giza 171	Nahda / Calady 40	Egypt	Japonica
16	Giza 176	Calrose 76 / Giza 172 // GZ 14	Egypt	Japonica
17	Giza 159	Giza 14 / Agami M1	Egypt	Japonica
18	Agami	Pure line selection	Egypt	Japonica
19	Milyang 97	na	Korea	Japonica
20	GZ 1368-S-5-4	IR 1615-31-3 / BG 94-2	Egypt	Indica/Japonica
21	IR 65829-28-H-P	GZ 2175 / GYEHWA 7	IRRI	Indica

* na, not available.

Table 2: Monthly average temperature and relative humidity at RRTC, Sakha, Kafr Elsheikh two rice growing seasons 2012 and 2013.

Month	Temperature (°c)				Relative humidity (%)	
	2012		2013		2012	2013
	Max.	Min.	Max.	Min.		
April	26.04	15.87	27.50	16.40	43.90	42.85
May	31.43	21.81	30.47	19.57	45.78	48.60
June	32.44	23.97	32.65	20.60	51.27	52.30
July	32.32	24.31	33.15	23.64	54.70	55.11
August	33.79	24.76	34.10	21.80	60.63	53.50
September	32.50	22.93	32.49	20.67	56.60	52.20
October	27.79	19.42	29.75	18.75	57.36	53.39
November	27.34	18.91	28.43	18.20	55.34	52.67

Statistical analysis and Genetic parameters

The analysis of variance was computed using IRRISTAT for Windows statistical program Ver. 5 (IRRI, 2005). Estimation of genotypic variance ($б^2$ g), environmental variance ($б^2$ e), phenotypic variance ($б^2$ ph) and percentage of genotypic (GCV %) and phenotypic (PCV%) coefficients of variability were computed according to the formula suggested by Burton (1952). Genetic advance upon selection (ΔG) as percentage of the mean (ΔG %) was computed according to Johanson *et al.*, (1955). All recommended agricultural practices were applied for the permanent rice field.

RESULTS AND DISCUSSION.

In this study twenty-one rice genotypes (Tables 1 and 3) originating from different sources were evaluated for allelopathic activity against *I galli* L. and also eighteen quantitative charac in direct seeded rice experiment.

1- Allelopathic activity

The obtained results showed that sor genotypes had allelopathic activity against *I galli* L. at the field after planting (Table 3) genotypes had the biological capability to s germination and growth of *E. crus-galli* L. b % at the field. The most of these genoty indica and indica/japonica types and dem their allelopathic properties at 3-4 leaf sta mechanism is to inhibit the root developm emergence at first or second leaf stage of th So, it could be suggested and recommend these genotypes are very useful as allelopathic rice genotypes suitable for direct seeded rice.

The highest activity was recorded for IR 62155-138-3-3-2 (90%) followed by TKY 1014 (89%), IR 31775-30-3-2 (88%), GZ 1368-S-5-4 (88%), IR 65829-28-H-P (85%), IET 1444 (80%) and IR 2037-93-1-3-1-1 (80%). Moreover, incorporating residues of some of these genotypes in the soil reduced soil seed bank of *E. crus-galli* L. These genotypes could be utilized in breeding programs as donors of this trait. On the other hand, five genotypes namely; Dular, IET 11754, IR 65598, Giza 159 and Giza 181 scored allelopathic activity ranged from 70% to 78%. The rest of the studied genotypes were non-allelopathic and that was very clearly for Giza 176, which scored zero allelopathic activity. Similar results were obtained by Hassan and Rao, (1996) and Hassan and Abou El-Darag, (2000).

2- Vegetative characteristics

Twenty-one rice genotypes were evaluated in two seasons under Egyptian conditions and the mean performances of these genotypes for vegetative characteristics are presented in Table (4). Results showed that, the most of the characteristics under study had a wide range of variability. This range was reflected that four genotypes namely; Giza 171, Giza 176, Giza 159 and Agami were highly susceptible to blast reaction and these varieties are old Egyptian varieties, the other genotypes were resistant to blast reaction. As for short duration, varieties Giza 177, Milyang 9 181 and Suweon 339 were very early and 93, 95, 97 and 98 days to heading, respectiv could be utilized in breeding programs for e For plant height, the results showed tha genotypes (IR65603, Giza 181, IR 65598, Gi Suweon 339, Milyang 97, Giza 177 and IR 2 short stature and could be utilized as donors trait.

For No. of tillers plant^{-1} both genotyp 178 and Giza 181 recorded the highest val also were resistant to blast. Generally, the v Giza 177, Giza 178 and Giza 181 were t varieties for all studied vegetative charac and could be utilized as donors for transf characteristics in breeding programs. Similar were obtained for most studied traits by El-A Abdalla (2004); Babu *et al*., (2006); Ha (2005); Hammoud *et al.,* (2006 and 200 Mohapatra and Mohanty, (2008).

3- Yield and its component characteristics

Eight characteristics were investigated twenty-one rice genotypes and the resu presented in Table (5). The genotypes Gi Giza 181, IET 11754 and Dular scored the values for No. of panicle plant^{-1} (24 pa panicle weight (3.84 g), No. of filled grains p (200 grains) and panicle length (28 respectively. These genotypes could be util donors for these characteristics.

Table 3: Twenty-one rice genotypes with origin, types and weed control percentage.

No.	Entries	Origin	Types	Weed Control %
1	Giza 177	Egypt	Japonica	40
2	Giza 178	Egypt	Indica -Japonica	66
3	Dular	IRRI	Indica	70
4	TKY 1014	Japan	Japonica	89
5	Giza 181	Egypt	Indica	78
6	IET 1444	Indian	Indica -Japonica	80
7	IET 11754	India	Indica -Japonica	70
8	Suweon 339	Korea	Japonica	27
9	IR 65598	IRRI	Indica	73
10	IR 65603	IRRI	Indica	65
11	IR 31775-30-3-2-2	IRRI	Indica	88
12	IR 2037-93-1-3-1-1	IRRI	Indica	80
13	IR 62155-138-3-3-2-2	IRRI	Indica	90
14	IR 29	IRRI	Indica	45
15	Giza 171	Egypt	Japonica	39
16	Giza 176	Egypt	Japonica	0
17	Giza 159	Egypt	Japonica	74
18	Agami	Egypt	Japonica	30
19	Milyang 97	Korea	Japonica	35
20	GZ 1368-S-5-4	Egypt	Indica -Japonica	88
21	IR 65829-28-H-P	IRRI	Indica	85
L.S.D.	0.05			0.80
	0.01			1.15

Table 4: Mean performance of 21 rice genotypes for six vegetative morphological characteristics.

Entries		BR	DH	Ht	TiP	FLA	Chl
Giza 177		2	93	99	21	34	29
Giza 178		2	105	97	26	38	37
Dular		1	115	120	19	37	32
TKY 1014		2	118	112	24	42	37
Giza 181		1	97	95	26	43	27
IET 1444		2	107	108	25	38	28
IET 11754		2	109	107	24	37	29
Suweon 339		2	98	97	24	30	33
IR 65598		2	107	96	18	52	40
IR 65603		2	108	89	21	41	35
IR 31775-30-3-2-2		2	107	85	22	39	34
IR 2037-93-1-3-1-1		2	119	112	21	46	33
IR 62155-138-3-3-2-2		2	117	107	22	42	36
IR 29		1	104	100	20	49	34
Giza 171		7	122	134	23	32	33
Giza 176		6	112	104	25	31	34
Giza 159		7	115	113	24	37	41
Agami		6	110	108	19	32	40
Milyang 97		2	95	98	19	25	33
GZ 1368-S-5-4		2	110	104	22	38	39
IR 65829-28-H-P		2	112	94	23	45	37
L.S.D.	0.05	0.37	0.48	0.61	2.68	2.68	3.47
	0.01	0.53	0.69	0.87	3.85	3.85	5.00

Abbreviations: BR, Blast Reaction; DH, Days to Heading; Ht, Plant Height (cm); TiP, No. Tillers Plant^{-1}; FLA, F Area (cm^2); Chl, Chlorophyll content (mg/ds^2).

Table 5: Mean performances of 21 rice genotypes for yield and its component characteristics.

Genotypes		PaP^{-1}	PnL	PaW	NFG	NUG	TGW	GYP^{-1}	HI%
Giza 177		19	20	3.30	120	5.41	27.3	39	50
Giza 178		24	24	3.58	198	6.18	22.1	41	55
Dular		17	28	2.70	156	17.0	30.0	41	33
TKY 1014		22	24	3.30	184	5.10	32.0	35	45
Giza 181		23	25	3.84	176	8.71	26.5	46	49
IET 1444		22	25	3.56	181	3.80	23.7	36	47
IET 11754		21	21	2.97	200	3.60	24.0	43	44
Suweon 339		19	19	3.61	152	13.6	22.2	44	44
IR 65598		17	24	3.75	145	28.1	22.5	32	33
IR 65603		19	24	3.44	121	5.78	27.3	33	41
IR 31775-30-3-2-2		20	23	3.50	168	4.90	30.0	32	42
IR 2037-93-1-3-1-1		21	27	2.70	139	17.0	28.0	39	39
IR 62155-138-3-3-2		20	25	2.90	188	21.0	24.0	47	31
IR 29		18	22	2.19	99	13.5	22.7	45	41
Giza 171		21	23	3.40	158	6.34	26.7	42	38
Giza 176		23	24	3.48	156	9.66	27.1	40	40
Giza 159		20	24	2.81	112	9.80	26.5	39	40
Agami		17	16	2.26	119	12.6	23.7	34	38
Milyang 97		18	24	3.03	115	8.21	25.4	33	50
GZ 1368-S-5-4		20	21	2.49	110	11.4	21.6	42	43
IR 65829-28-H-P		22	25	3.70	144	5.65	29.0	32	43
L.S.D.	0.05	2.22	1.38	0.79	7.32	3.76	0.68	3.55	3.18
	0.01	3.19	1.99	1.13	10.53	5.42	0.98	5.11	4.57

Abbreviations: PaP^{-1}, No. of panicles plant^{-1}; PaW, panicle weight (g); NFG, No. of filled grains panicle^{-1}; NUG unfilled grains panicle^{-1}; PnL, panicle length (cm); TGW, 1000-grain weight (g); GYP^{-1}, grain yield plant^{-1} (g harvest index %.

The lowest value for No. of unfilled grains panicle^{-1} was recorded with IET 11754 (3.6 grains). For 1000-grain weight, six genotypes recorded high values and the highest was TKY 1014 (32.0 g). For grain yield plant^{-1}, nine genotypes yielded more than 40g plant^{-1} and the highest values recorded for IR 62155-138-3-3-2 (47 g), and Giza 181 (46 g). For harvest index %, five genotypes namely; Giza 178, Giza 177, Milyang 97, Giza 181 and IET 1444 scored the highest values. The highest varieties were Giza 178 (55) and Giza 177 (50) which cultivated at about 50% of the total rice area in Egypt. Same results were obtained for most studied characteristics by El-Abd and Abdalla (2004), Babu *et al* (2006), Hammoud (2005), Hammud *et al* (2006 and 2008), and Mohapatra and Mohanty (2008).

4- Grain quality characteristics

Four grain quality characteristics were investigated; the results are presented in Table (6). For hulling percentage, the results showed that the percentage of hulling was ranged from 74% to 81% and the highest value was for Giza 177, while the lowest values were for Agami and GZ 1368. Also, Giza 177 scored the highest value for milling percentage (74%). For gel consistency, if it is hard, then cooked rice tends to be less sticky. Harder gel consistency is associated with harder cooked rices and this feature is particularly evident in high-amylose rice. While, if gel consistency is soft, then cooked rice has a higher degree of tenderness. This is a preferred characteristic. The trend of classification is hard ranged from 27-35, medium hard 36-40, medium 41-60 and soft 61-100 le gel (mm). The results in Table (6) showed three genotypes; *i.e*., Giza 181, IR 65603 an were belonged to medium gel consisten ranged from 45 to 49 (mm) length of the gel. the other genotypes belonged to soft catego ranged from 62 to 93 (mm) length of the gel.

The amylose content % for the genotypes is presented in Table (6). The showed that the amylose % was ranged fro 28%, with a mean value of 17%. Both ge Giza 171 and IR 65598 had the highest perc of amylose %, followed by IR 29, IR 656 1444 and Giza 181. Generally, the amylos starches usually ranges from 15 to 35% amylose content rice has high volume ex (not necessarily elongation) and high de flakiness. The cooked grains are dry, less ten become hard upon cooling. In contrast, low-a cooked rice is moist and sticky. Inter amylose rice is preferred in most rice-growin Similar results were obtained by Magdy (2010) and Oko *et al.,* (2012).

5-Cluster analysis for studied genotypes on quantitative characteristics

The characteristics used for this analys the same agronomic quantitative charact Normality was checked for all traits, indicated that all traits had good approxima normal distributions (Fahmi *et al*., 2005 a Malky *et al.,* 2013).

Table 6: Mean performance of 21 rice genotypes for grain quality characters.

Genotypes		Hulling%	Milling%	Gel Consistency	Amylose%
Giza 177		81	74	79	18
Giza 178		77	71	64	21
Dular		76	63	44	24
TKY 1014		79	72	71	19
Giza 181		78	71	49	23
IET 1444		79	72	92	24
IET 11754		78	71	61	23
Suweon 339		76	68	93	20
IR 65598		76	67	48	28
IR 65603		77	71	64	26
IR 31775-30-3-2-2		77	71	64	28
IR 2037-93-1-3-1-1		77	65	41	27
IR 62155-138-3-3-2		79	65	44	28
IR 29		75	68	45	27
Giza 171		80	73	68	17
Giza 176		79	71	71	19
Giza 159		78	70	72	18
Agami		74	69	62	22
Milyang 97		77	69	72	21
GZ 1368-S-5-4		74	71	70	20
IR 65829-28-H-P		78	70	63	26
L.S.D.	0.05	2.48	2.62	0.54	0.25
	0.01	3.57	3.76	0.78	0.36

Clustering genotypes, based on similarity of quantitative characteristics, produced two large groups (Figure 1). The first one included almost Japonica genotypes and divided into two sub-groups, the first sub-group included three rice genotypes; *i.e.*,Giza 177, Milyang 97 and Agmi which were similare in non allolopathy, No. of tillers plant^{-1}, No. of panicles plant^{-1}, No. of filled grains panicle^{-1} and harvest index %. While, the second sub-group included three genotypes; *i.e.*, Suweon 339, Giza 176 and Giza 171 in one branch, these genotypes had the highest stature.

The second large group divided into two sub-groups, the first one included Dular, IR 2037-93-1-3-1-1 and IR 65598 these genotypes were similare in allolopathy, resistance to blast, days to heading, No. of tillers plant^{-1}, hulling percentage, milling percentage, gel consistency and amylose percentage, while the second sub-group divided into two sub-sub groups the first one included two indica genotypes; *i.e*., IR 65598 and IR 65603 which were similare in allolopathy, days to heading, plant height, flage leaf area, grain yield plant^{-1}, panicle weight, gel consistency and amylose percentage, while the second sub-sub group included Giza 159 and GZ 1368 these two genotypes are belnoged to Japonica and Indica/Japonica types and similare in allolopathy, plant height, flage leaf area, chlorophll content, No. of panicles plant^{-1}, panicle weight, No. of filled grains panicle^{-1}, No. of unfilled grains panicle^{-1} and amylose percentage. Meanwhile, the second sub-group divided into two sub-sub groups the first one included IR 62155 and IR 29 which were indica type and similar in blast reaction, days to heading, flage leaf area, chlorphll conten yield plant^{-1}, hulling percentage, milling perc gel consistency and amylose percentage. Wl second one incuded TKY 1014 and IET 144 branch this is due to the similarity in allo blast reaction, No. of tillers plant^{-1}, No. of p plant^{-1}, grain yield plant^{-1}, panicle weight, filled grains panicle^{-1}, harvest index %, percentage and milling percentage. Als genotypes Giza 178 and IET 11754 were branch because these two genotypes are belo Indica/Japonica type and were simi allolopathy, blast resistant, days to heading height, flage leaf area, panicle weight, 10(weight, No. of filled grains panicle^{-1} and a percentage. The last branch included Giza 1 IR 31775, which were Indica type and sin allolopathy, blast resistant, plant height, weight and milling percentage.

6- Genetic parameters for yield characteri

The results of genotypic variance, phe and genotypic coefficient of variability perc heritability and genetic advance percentage characteristics are presented in Table (7 studied twenty-one rice genotypes showed range of mean performances. Mean square es for all studied characteristics of all genotyp highly significant, thus the selection fo characteristics among these genotypes wo effective to improve the performance o genotypes. Similar results were obtained by *al.,* (1995), Tang (1995); Veillet *et al.,* Hammoud *et al.,* (2012) and El-Malky *et al.,*

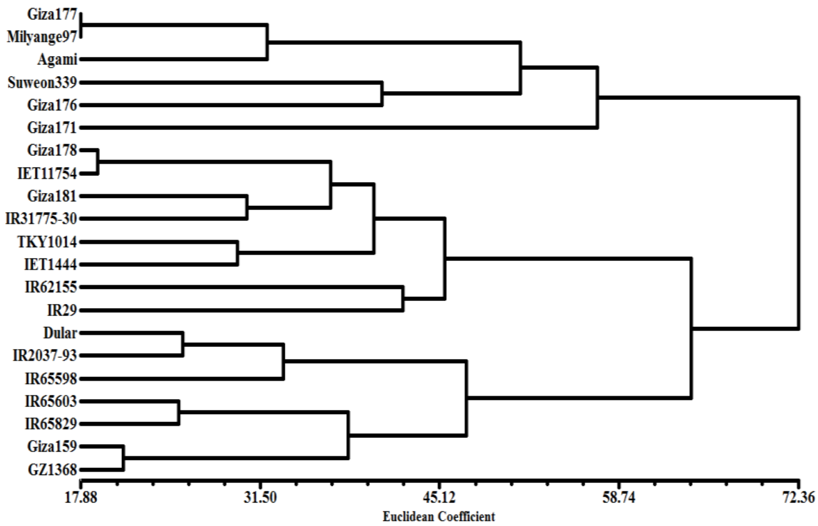

Figure 1: Cluster diagram for the studied 21 rice genotypes classified by nineteen quan characteristics.

Table 7: Estimates of genetic parameters for nineteen quantitative characteristics for the studi genotypes.

Traits	MS	(MSe)	Grand Mean	GV	PV	GCV	PCV	H_{bs}	GA	GA%
Blast reaction	10.6	0.07	3	3.5	3.6	71.6	72.3	97.9	3.8	116.3
Days to heading	186.3	0.12	109	62.1	62.2	7.2	7.2	99.8	16.2	56.9
Plant height (cm)	357.2	0.19	104	119.0	119.2	10.5	10.5	99.8	22.5	114.4
No. of tillers $plant^{-1}$	17.3	3.79	22	4.5	8.3	9.5	12.9	54.3	3.2	20.4
Flag leaf area (cm^2)	130.3	3.80	39	42.2	45.9	16.8	17.5	91.8	12.8	108.1
Chlorophyll content	44.9	6.38	34	12.8	19.2	10.4	12.7	66.8	6.0	37.8
No. of panicles $plant^{-1}$	12.9	2.60	20	3.5	6.1	9.3	12.3	57.0	2.9	17.3
Grain yield $plant^{-1}$	73.1	6.67	39	22.2	28.8	12.1	13.8	76.9	8.5	56.8
Panicle weight(g)	0.4	0.33	4	0.02	0.4	4.4	17.6	6.4	0.1	0.6
1000-grain weight(g)	26.6	0.25	26	8.8	9.0	11.5	11.6	97.3	6.0	33.9
Filled grains $panicle^{-1}$	2871.1	28.37	151	947.8	976.2	20.4	20.7	97.1	62.5	627.7
Unfilled grains $panicle^{-1}$	120.0	7.51	10	37.5	45.0	58.5	64.1	83.3	11.5	375.1
Panicle Length (cm)	24.2	1.01	23	7.7	8.7	12.3	13.0	88.4	5.4	34.0
Harvest index %	109.9	5.33	42	34.9	40.2	13.9	15.0	86.7	11.3	82.5
Hulling %	9.8	3.25	78	2.2	5.4	1.9	3.0	40.1	1.9	2.8
Milling %	14.7	3.62	69	3.7	7.3	2.8	3.9	50.6	2.8	5.3
Gel consistency	643.7	0.16	64	214.5	214.7	23.0	23.0	99.9	30.2	337.3
Amylose %	40.2	0.03	23	13.4	13.4	16.1	16.2	99.8	7.5	58.9
Weed control %	1683.7	0.34	61	561.1	561.5	39.2	39.2	99.9	48.8	927.5

Abbreviations: MS, Mean squares; GV, Genotypic variance; PV, Phenotypic variance; GCV, Genotypic coeff variability; PCV, Phenotypic coefficient of variability; H_{bs}, Heritability (broad sense); GA, Genetic advance Genetic advance %.

The phenotypic coefficient of variability (PCV %) was higher than genotypic coefficient of variability (GCV %) for all genotypes, indicating that the most portion of PCV % was more contributed to environmental conditions and cultural practices. Relatively, genetic coefficient of variability was found to be higher for all studied characteristics, indicating that these characteristics might be more genotypically predominant, and it would be possible to achieve further improvements. The genetic coefficient of variability refers to the additive and non-additive genetic variance which played an important role in the inheritance of these characteristics. These results are in agreement with those obtained by Han *et al.*, (1995); Tang (1995); Veillet *et al.*, (1996); Hammoud *et al*., (2012) and El-Malky *et al.*, (2013).

Heritability and genetic advance under selection were computed and the obtained results are illustrated in Table (7). High estimates of heritability were found in all characteristics except for panicle weight. These results indicated that the presence of both additive and non additive genetic variance in the inheritance of most traits except panicle weight and also these traits were stable under different conditions and culture practices. Therefore, it could be concluded that selection procedures could be successful to improve the most of studied characteristics. Same results were previously obtained by Han *et al*., (1995); Tang (1995); Veillet *et al.*, (1996); Hammoud *et al.*, (2012) and El-Malky *et al*., (2013).

Genetic advance under selection presented in (Table 7) showed the possib from selection when the most desirable 5% plants are selected. Relatively, moderate gains were obtained for grain yield, which more than 20%. Low genetic advance were f remaining characteristics which were less tha Johnson *et al* (1955) revealed that her estimates along with genetic gain upon s were more valuable than the former al predicting the effect of selection. On the othe Dixit *et al*. (1970) pointed out that high her is not always associated with high genetic g in order to make effective selection, high her should be associated with high genetic gain. investigation, high genetic gain was found associated with high heritability es Consequently, selection for these traits sh effective and satisfactory for successful b purposes. Moderate estimates of both her and genetic advance were obtained for plan and grain yield. Therefore, selection for th characteristics using these two genetic par will be effective, but probably with less succ for the former characteristics. Low genetic g associated with low heritability values for th the characteristics studied. Hence, select these traits would be of less effectiveness. results were obtained by Han *et al.*, (1995 (1995); Veillet *et al.*, (1996); Hammoud (2012) and El-Malky *et al*., (2013).

~~1- Yield/ vine:~~

Data in Table (1) clearly show that spraying clusters of Early sweet grapevines with GA_3 at 10 to 40 ppm or Sitofex at 2.5 to 10 ppm was significantly effective in improving the yield relative to the check treatment. The promotion on the yield was accompanied with increasing concentrations of each plant growth regulator. Using GA_3 at 10 to 40 was significantly preferable than using Sitofex at 2.5 to 10 ppm in improving the yield. A slight and unsignificant promotion on the yield was attributed to increasing concentrations of GA_3 from 20 to 40 ppm and Sitofex from 5 to 10 ppm. The maximum yield was produced on the vines that received one spray of GA_3 at 40 ppm but the best treatment from economical point of view was the application of GA_3 at 20 ppm (since no measurable promotion on the yield was recorded between 20 and 40 ppm of GA_3). Under such promised treatment, yield/ vine reached 13.6 and 14.0 kg during both seasons, respectively. The control vines produced 9.1 and 9.6 kg during 2013 and 2014 seasons, respectively. The percentage of increase on the yield due to application of GA_3 at 20 ppm over the check treatment reached 49.5 and 45.8 % during both seasons, respectively. The beneficial effects of GA_3 on the yield might be attributed to their positive action on increasing cluster weight. The promoting effects of GA_3 on the yield was supported by the results of Dimovska *et al*., (2011) and Abu- Zahra and Salameh (2012) on different grapevine cvs.

The results regarding the beneficial effects of Sitofex on enhancing the yield are in harmony with those obtained by Juan *et al*. (2009); Abdel- Fattah *et al*., (2010) and Al- Obeed (2011).

2- Harvesting date:

It is clear from the data in Table (1) that all GA_3 and Sitofex treatments had significantly delayed on the harvesting date of Early Sweet grapevines rather than the control treatment. The degree of delayness on harvesting date was correlated to the increase of the concentrations of both GA_3 and Sitofex. Using GA_3 significantly delayed harvesting date comparing with using Sitofex. Increasing concentrations of GA_3 from 20 to 40 ppm and Sitofex form 5 to 10 ppm failed to show significant delay on harvesting date. A considerable advancement on harvesting date was observed on untreated vines the great delay on harvesting date was observed on the vines that received GA_3 at 40 ppm during both seasons. GA_3 and Sitofex were shown by many authors to retard the release of ethylene and the disappearance of pigments such as chlorophylls and carotenoids and onest of maturity start. Also they were responsible for prolonging pre-maturity stages Nickell (1985). These results regarding the delaying effect of GA_3 and Sitofex on harvesting date were in harmony with those obtained by Wassel *et al*., (2007), Kassem *et al*. (2011), Abu- Zahra and Salameh (2012) anc *et al*. (2012).

3- Cluster weight and dimensions:

It is evident from the data in Table (treating clusters with GA_3 at 10 to 40 Sitofex at 2.5 to 10 ppm was signi accompanied with enhancing weight, leng width of cluster relative to the control treatm

The promotion was significantly associate increasing concentrations of GA_3 and Sitofex GA_3 was significantly favourable than using in this respect. The maximum values were r on the vines that received one spray of GA ppm. Meaningless promotion was detecte increasing concentrations of GA_3 from 20 to and Sitofex from 5 to 10 ppm. The untreate produced the minimum values during both s The positive action of GA_3 on cluster wei dimensions might be attributed to its essen on stimulating cell division and enlargem cells, the water absorption and the biosynth proteins which will lead to increase berry Dimovska *et al.,* (2011); Abu- Zahra and S (2012) and Dimovska *et al.,* (2014).

The previous essential role of CPPU on weight was attributed to its higher con cytokinin when applied to plants (Nickell, 19

4- Shot berries %:

Data in Table (2) obviously reve percentage of shot berries in the clusters o Sweet grapevines was significantly controll spraying GA_3 at 10 to 40 ppm or Sitofex at 2 ppm relative to the check treatment. Using G preferable than using Sitofex in reduci percentages of shot berries. There was a reduction on the percentage of shot berri increasing concentrations of GA_3 and Sitofex was a slight reduction on such unfav phenomenon with increasing concentrations form 20 to 40 ppm and Sitofex from 5 to 1 The minimum values of shot berries (7.3 and during both seasons, respectively) were reco the clusters harvested from vines treated wi at 40 ppm. The maximum values of shot (12.0 & 12.5 %) during both seasons were r on the untreated vines during both seasons reducing effect of GA_3 on shot berries m attributed to its important role on enhanci division and the biosynthesis of proteins (1985). These results were supported by the of wassel *et al*. (2007) and Abu-Zahra and S (2012).

5- Fruit quality:

Data in Tables (2, 3 & 4) clearly sho spraying clusters with GA3 at 10 to 40 Sitofex at 2.5 to 10 ppm significant accompanied with enhancing weight, long and equatorial of berry, total acidity%, pro and percentages of P, K and Mg and T.S.S. %, reducing sugars %, T.S.S. / acid and total carotenoids relative to the check treatment. The effect either increase or decrease was associated with increasing concentrations of each auxin. Using GA_3 significantly changed these parameters than using Sitofex. A slight effect was recorded on these quality parameters with increasing concentrations of GA_3 from 20 to 40 ppm and Sitofex from 5 to 10 ppm. From economical point of view, the best results with regard to fruit quality were observed due to treating clusters with GA_3 at 20 ppm. Untreated vines produced unfavourable effects on fruit quality. These results were true during both seasons. The effect of GA_3 on increasing berry weight and dimensions might be attributed to its effect in promoting cell division and enlargement of cells, water uptake and the biosynthesis of proteins Nickell (1985). These results were in concordance with those obtained by Williams and Ayars (2005) and Dimovska *et al*., (2014).

The higher content of Sitofex from cytokinins surly reflected on enhancing cell division and the elongation of berries Nickell (1985). These results were in agreement with those obtained by Abu-Zahra (2013) and Retamales *et al*. (2015).

CONCLUSION

Treating Early Sweet grapevines once when the average berries reached 6mm with GA_3 at 20 ppm was responsible for promoting yield and fruit quality.

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الملخص العربى

لأليلوباثي، المكونات الوراثية وتحليل القرابة الوراثية لبعض التراكيب الوراثية من الأرز

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~~رش حامض الجبريليك والسيتوفكس فى تحسين المحصول وجودة حبات العنب الايرلى سويت فى منطقة المنيا= مصر~~

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ي هذا البحث بمركز البحوث والتدريب في الأرز، سخا، كفرالشيخ، مصر خلال موسمي الزراعة 2012 لتقييم واحد وعشرون تركيباً وراثياً من الأرز لصفة الأليلوباثي وعدد من الصفات الوراثية الأخرى. وقد تم تقسيم الوراثية المنتخبة للدراسة الي ثلاث أقسام؛ ثمانية تتبع الطراز الياباني، تسعه تتبع الطراز الهندي وأربعة تتبع

هندي/الياباني. وقد أوضحت النتائج المتحصل عليها أن بعض التراكيب الوراثية المدروسة أظهرت نشاط
لمقاومة حشيشة الدنيبة *E. crus-galli* L. في الحقل بعد الزراعة. وأظهرت هذه الأصناف تثبيطاً بيولوجياً لهذه
يقدر بـ 80 – 90% في الحقل. وتعتبر هذه الأصناف مهمة ومناسبة لطريقة الزراعة بالبذرة مباشرةً وكذلك
تخدامها في برامج التربية لنقل هذه الصفة للأصناف التجارية. كما أوضحت أغلب الصفات المدروسة مدي
التباين. ويعكس هذا المدي درجة الإختلافات بين هذه التراكيب الوراثية. وكانت أربعة أصناف مبكرة جداً ألا
زة 177، ميليانج 97، جيزة 181 وسيون 339. بينما أعطت خمسة أصناف تقديرات عالية لدليل المحصول
زة 177، جيزة 178، ميليانج 97، جيزة 181 وأي إي تي 1444. وقد أظهرت دراسة درجة القرابة بين
المدروسة من خلال التشابة بين الصفات الكمية انقسامها الى مجموعتين أساسيتين. إشتملت المجموعة الأولى
ة أصناف هي؛ جيزة 171، جيزة 176، سيون 339، أي إي تي 1444، أي أر 65598، جيزة 178 وجيزة
قد إنقسمت هذه المجموعة لتحت مجموعتين، أحتوت الأولى على الصنفين جيزة 178 وجيزة 181 والمتشابهين
النبات، عدد الفروع، مساحة الورقة العلم، محصول الحبوب، عدد السنيبلات وتفاعل اللفحة. وكان معمل
مظهري أعلى من معامل التباين الوراثي في كل التراكيب الوراثية المدروسة وهو مايدل على أن الجزء الأغلب
ل التباين المظهري يعود للظروف البيئية والمعاملات الزراعية. في حين كانت تقديرات معامل التباين الوراثي
الصفات المدروسة، مما يشير الى أن هذه الصفات ربما تكون سائدة وراثياً ويمكن التحسين الوراثي فيها.
ر معامل التباين الوراثي الى كلا من التباين المضيف والتباين الغير مضيف ويلعب دوراً مهماً في توارث هذه
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