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INDUCTION OF GENETIC VARIATION IN TWO VARIETIES OF WHEAT BY ELECTRIC AND HEAT SHOCK

Laith M.J. Al-Shamma and Mohammed M. H.

Department of Biology, College of Science, University of Baghdad, Baghdad, Iraq.
E. mail: dr.prof1976@yahoo.com, Jawad2201@yahoo.com

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ABSTRACT

The aim was to study the effect of electric shock (ES) and heat shock (HS), yield, yield components for two varities of wheat (*Triticum aestivun* L.). Seeds of two varities were germinated to initial appearance the radical of 2-5 mm length, some of the seedling treatment for different periods with electric current (220 AC) used were (2.5, 5 and 7.5 mins.). While heat shock treatment for another seedling with heat shock at(35˚C,40˚C and 45˚ C) for one hour and then the seedling were transferred to the cold shock condition (7˚C) for three hours. Factorial experiment was used (RCBD) with 3 replications for each treatment. Heat shock at 45 ºC gave a significant increases in weight of (1000)grain was 37.4 (g), While heat shock at 40ºC treatment gave highest grains number per spike was 83.1. The highest average spike number /m^2 was 340.3, grain yield was 8.94 (ton.ha^{-1}) when seeds treatment with electric shock for (5 mins.). An increase of the grain yield (37 %). Which the latter was no significant differences with heat shock at 40 ºC. Baghdad 1 variety gave the spike have highest number of spikelet is19.5, quantity of grain in spike 73.5, grain yield 7.89 (ton.ha^{-1}). While Babylon 113 variety superimposes in asspike number/m^2 301.28. Significant differences also showed for the interactions between varieties and treatments in most of the studied traits, (Baghdad 1 at Hs 40 ºC) gave highestgrain number per spike 93.6, grain yield was 10.59 (ton.ha^{-1}), whereas (Babylon 113 for Es 5 minutes) gave highest value of nd spike number /$m^2$385.3.

Key word: electric and heat shock, Yield Components, grain yield, Wheat

INTRODUCTION

Genetic development to build up variety with high yield potential and resistance/tolerance to abiotic and biotic stress with satisfactory end use qualities is the most viable and environment forthcoming option to increase wheat yield in a sustainable style. Such development of crops require creation and introduction of genetic variation, to identify adapted and stable geno-types with desirable agronomic traits (Baenziger and DePauw, 2009). According to (sail et al., 2005) studies on sarsabs vraiety) showed high effect of heat stree on grain filling period and plant height, grain wieght, higher grain yield of sowing and heat stress on yield and yeil asociated traits of wheat genotype. The expersion of heat shock proteins (HSPs) is recognized to be an important adaptive strategy. Their expression varies in different species as well as in different cultivars of similar species. (Trivedi, 2015). The effect of water stress tolerance in wheat genotype and drought tolerance, newly evolved genotype showed some geneticl improvement in various traits (Sail et al., 2010). Mutagens are the tools used to study the nature and function of genes that are basis of plant growth and development (Adamu and Aliyu, 2007). Several mutagens have been known to us that are used in mutation breeding and proved to be valuable in the achievement of crops with beneficial and desired traits such as high yield and resistant mutant (Srivastava et al., 2011). Mutation induction offers significant increase in crop production (Kharkwal and Shu, 2009). Internal energy of the seed responds positively, which stimulates the seeds much more as shown to study the effect of temperature on induced dipole moment (developed inside the seed), the entire experiment was repeated at three different temperature, at this voltage there is the maximum stimulating effect of the electric field on the seed (Vashisth and Nagarajan, 2010). The effect of electric field on vegetative, flowering growth characters of *Antirrhinummajus* L. Three levels of electric currrent severity AC (6,8,10 Ampere) and three timing of electric shock (2,4,6 minutes) were tested sprouted seeds and seedlings exposed to 8A for 4 or 2mins significantly increased plant height, but when they exposed to (10Am X 6mins) number of branches per plant and main stem diameter were increased. The leaf area and dry matter percentages of vegetative growth were higher when sprouted seeds was exposed to (10Am X 4mins). The treatments (6Am X 4mins) and (8Am X 4mins) Hussein *et al.*, (2008). Dymek *et al.*, (2012) reported the effect of pulse exciting field (PEF) of varying voltages on radicle emergence without affecting the gross metabolic movement of barley seeds. Elsahookie and Elsubahi, (2001a, b) Found that different genotypes gave different responses to periods of electric shock, indicating that one period of electric shockcan·t be recommended for

all genotypes to induce variations through the use of electric shock to open a power supply 220 AC for periods 2, 4 and 6 min. The purpose of this study was to investigate know the role of electric shock ininducing genetic variation and studytheir effects on morphological traits, protein percentage, yield components and seed yield. Refers that treatment of yield wheat and barley seeds through alternate electric sphere before sowing, leads to prove increasing inbarley yield by (15% - 20%) and total yield of vegetative plant of wheat by (10 – 30%) to increasing seeds weight (Nelson 2000, Khan *et al*., 2015). On heat of 35- 40ºC. It was found thatcv. The cumulative response of cv. AS-2002 was better on the basis of physiological and yield attributes. In addition to yield, high temperature significantly affected total proline, In an earlier study executed by Farooq et al., (2005) on *japonica* and *indica*rice in which seeds were exposed to dry heat treatment at 40°C for 72 hours and at 60 °C for 24 hours and chilling treatment for 72 hours at –19 °C. In *indica*rice, dry heat treatment at 40 °C for 72 hours resulted in increased germination as well as seed vigor. Sikder et al., (2001).

MATERIALS AND METHODS

Field experiment grains were sprouting and then planted in the field at land nearly 80 km west of Baghdad. (RCBD) was used with factorial experiment with 3 replicates for each treatment. The area of experimental unit was (1.5m*1m). The space between lines was 0.15m , with six lines, and at seed rate of 4.5 g per line (180 kg/ha). Fertilizers used were urea (46% N) at (200 kg ha^{-1}) and (46% P2O5) triple super phosphate at (100 kg ha^{-1}). All phosphorus fertilizer was applied at planting during seed bed preparation, while urea was divided into three equal amounts. The first amount was added for the period of the land grounding prior to planting, the second was additional 30 days after sow and the concluding quantity was added at 26 15 panicle initiation. Weeds were hand weed during the course of study The other required culture practices for growing wheat were followed as recommended.

Grains of both cultivar, Baghdad 1and Babylon 113 were use. Grain weighed from both cultivars and germinated inside cloth for two days until the appearance of the root of 2-5 mm length. The seeds sprouted placed inside slabs of aluminum perforated with the addition of the weight of iron to make them sink in aqueous solution (1% sodium chloride) for three hours. So that introduces salt in the plant tissue to facilitate the delivery of electrical current in the cells. And then transferred to plastic vessel capacity 15 liters, which cont-ains the same solution. Connected by two poles of carbon related to electricity power source AC 220 volt. Different periods 2.5, 5 and 7.5 minutes for the treatments samples. As for the comparison shall be treated in the same way except electric shock. After the completion of the process of shock treatment samples moved to running water for three hours to flush out the salt so that does not affect them in the percentage of germinations (Elsahookie, 1992, Al-Sabahi, 1996).

Germinated grain was put on a filter paper wet basins plastic at a temperature of 25°C and relative humidity of 60%. Seedling with two days age were offered to heat 35°C, 40°C and 45°C for one hour and then the seedling was transferred to the cold shock condition (7°C) for three hours (Sabbouh, and Al-ouda 2001, Agostini, et al., 2013 and Al-shamma, 2015).

The seeds were treated by using electric shock (es) and heat shock (hs) as following:

*Es 2.5minutes: Seeds were shocked byElectricfor 2.5 minutes.

*Es5minutes: Seeds were shocked byElectricfor 5 minutes.

*Es 7.5minutes: Seeds were shocked byElectricfor 7.5 minutes.

*Hs 35 ºC: Seeds were shockedby Heat at 35 ºC.

*Hs 40ºC: Seeds were shockedby Heat at 40ºC.

*Hs 45 ºC: Seeds were shockedby Heat at 45 ºC.

Yield and yield component:

Spike number/m^2: They guess from harvesting sample then changed according to (m2).

Number of spikelet / spike

Grains number/spike: It is an average of grain number for ten spike which are choosen randomly from every practical unit under minor.

Weight of 1000 grains (g): Five samples, each of 1000-grain, were taken from the produce of each experimental unit. These samples were weighed on an electric balance and average 1000-grain weight was calculated.

GRAINS YIELD (TON/HA^{-1}): The harvested and sun-dried crop was threshed manually. The grains weight for each treatment was record in gram and later expressed in tons per hect-are (t/ha^{-1}). At 12% m moisture content.

RESULTS AND DISCUSSION

Spike number/ m^2: Data in (Table 1) showed significant effects of varieties and their treatments on spike number /m^2. Es 5 minutes gave maximum spike number /m^2 was 340.3, compared with

another treatments. Lowest spike number /m^2 reached to (273.3) in Hs 45ºC (Heat shock at 45 ºC). Both hormones and genes have a role in determining the branching pattern of plants, can be related to the inhibitory effect of ions that binds to the enzymes involved in cellular energy production. Electric current break bonds of molecule cells and make electric energy free and increasing for plant energy much reflect on plant growth. It doesn't need to separate bonds completely to liberalize energy. Every changing happens in bond shape or in it's place leads to liberalize the storing energy. The energy must be free gradually to interest the cell well an to store it in need time. If this energy get's out all at once leads to damage and deform in the cell formation and products a new poisonous compound in the cell which leads to die. This show through shock sprouted seed or seedling by high electric and heat which cause killing most of sprouted seed and seedling directly or after plant and growing with short time (Sherbash, 1996). These results were agree with (Elsahookie and Elsubahi 2001a). Significant differences between varieties were observed in (Table 1), Babylon 113 variety had highest average spike number /m^2(301.28) while Baghdad 1 varieties was 291.58. Results presented showed that the interaction between varieties and treatments had significant effect on spike number /m^2 (Babylon 113 X Es 5 minutes) gave highest interactions (385.3).While (Babylon 113 X Hs 45ºC) gave Lowest interactions (254). This may be as a result of higher difference between voltage low in seeds from 6 to 26 mV, or seedling high voltage and current used in the process of shock (Al-Subahi, 1996).

Number of spikelet / spike: Data in (Table 2) showed that Hs 35 ºC increased number of spikelet/ spike, and which no significant difference with a control plants were 19.8, 19.5 respectively. While Es 7.5 minutesgave the lowest number of spikelet per spike was 18.4.These results didn't agree with (Elsahookie and Elsubahi 2001a). This may be attributed to various factors such as changes in the metabolic activity of the cells, the inhibitory effects of shocks and to disturbance of the balance between promoter and inhibitors of growth regulators include both enzyme activity and hormonal balance. Showed that there were significant differences between varieties in number of spikelet per spike Baghdad 1 varieties showed the highest number of spikelet per spike 19.5. While in Babylon 113 variety was the lowest (18.9). Perhaps the parents contributed different, indicating that most genetic variation. Data presented showed that the interaction between varieties and treatments were significant effect on number of spikelet per spike. (Baghdad 1 X Hs 35 ºC) gave highest was 21.2, while (Baghdad 1 X Es 7.5 minutes) gave lowest was 18.

Grains number/spike: The grains number per spike reflects a number of fertilized ovules which grow to grains. Results recorded in (Table 3) showed that Hs 40 ºCrevealed significant increase in number of grains per spike 83.1, compared with another treatments. Thisresult could be due to the high adaptation of this genotypes to the environmental conditions or might due to increase the number of grains per spike, frequency of ovules fertilization should be increased, GA_3 increased the number of ovules per spike, and reduced the number of grain abortion this result in agreement with (AL-Shamma, 2015). Significant differences between varieties were observed in (Table 3), Baghdad 1 variety had highest average number of grain per spike 73.5 while Babylon variety was 66.7, compared with control treatment was 55.6. Results presented showed that the interaction between varieties and treatments had no significant difference was found between (Baghdad 1 X Hs 40ºC) gave highest interactions was 93.6, while (Babylon 113 X Es 2.5) gave lowest was 53.3. Trend of increasing or decreasing was observed in wheat seed germination This could be predicted due to genetic potentiality of the wheat varieties to withstand the temperature fluctuation.

Weight of 1000 grains (g): Data in (Table 4) showed significant effects of varieties and their treatments on the grain weight. Hs 45ºC, gave maximum grain weightwas 37.4 (g)and which not differsignificantly with Hs 35ºC and Hs 40ºC and Es 7.5 minutes were 36.95, 36.9 g and 36.7 respectively.Lowest grain weight reached to 36.1 (g) in Es 2.5 minutes.Increasing the rate of grain weight correlated adversely with spike number /m^2, the smaller spikenumber /m^2 decreased competition for nutrients between them, that's leading to nutrients distribution to a small number of grain, so the grain weight will increases. In this result, no specific trend of increasing or decreasing was observed in wheat grain germination. This could be predicted due to genetic potentiality of the wheat varieties to withstand the temperature fluctuation. Showed that Babylon 113 and Baghdad 1 varieties, gave grain weight 36.74, 36.65 g respectively. Likewise, (Aksouh et al. 2001), compared the effects of sudden and gradual heat stresses on the yield and quality. Showed that there was significant interaction between wheat varieties and treatments, (Baghdad1 X 7.5 minutes), (Bab-ylon 113 X Hs 45ºC) and (Babylon 113 X Hs 35 ºC) have heaviest grain weight39, 38.7 and 38.3g

compared with least grain weight for interaction (Babylon 113 X Es 7.5 minutes) 34.4g. High potential grain weight in heat stress may alsobe a better criterion for selection of cultivars for heat tolerance (Dias et al., 2009). Strong positive association across cultivars between grain weight per spike and cell membrane stability as ameasure of heat tolerance (Fokar et al.1998).

Grains yield (ton/ha^{-1}): Yield components include spike number/m^2, grains number per spike and grain weight. grain yield is a complex inheritance and are greatly influenced by various environmental conditions. Test of heritability and genetic advance is very useful in order to estimate the yield are shown in (Table 5). Es 5 minutes gave highest grain yield was 8.94 ton/ha^{-1} followed by Hs 40^{o}C was 8.78 ton/ha^{-1}) whereas Control treatment gave lowest grain yield was 5.71ton/ha^{-1}. Es 5minutes, recordedit superiority in the grain yield was 56.5% compared to control treatment, due to Es 5minutes gave highest spike number /m^2 and flag leaf area. Increasing of flag leaf area is essential because it determines the rate of plant photosynthesis, capacity expansion that resulting an increase ofgrains yield. The most important yield component was the spike number /m^2, our results is agree with Al-Sammariae and Al-jebory (2011); Nelson,2000) showed increases in yield of over 30% in half of the experiments and yield increases in another 28% of them. Indicated that grain yield differed significantly between varieties due to genetic nature, the greater grain yield was obtained by Baghdad1 variety 7.89 ton.ha^{-1}. Due toit ssuperiority in the number of grain/spike as result to increased number of spikelet per spike.While Babylon 113 gave lowest was 7.32 ton.ha^{-1}, this results of genetic variation betweenvarietiesorgenotypes are agreement with finding of (Nelson, 2000). Baghdad 1 X Hs 40 ^{o}C significantly showed highest interaction between varieties and treatments grain yield was10.59 ton. ha^{-1} because superiority in the grains number per spike, while Baghdad 1 X Es7.5 gave low estinter action was 6.14 ton/ha^{-1}, it also was lowest interaction in number of spikelet/ spike.

Table 1: Effect of electric shock and heat shock on spike number/m^2 of two wheat cultivars.

T / V	ES2.5	ES5	ES7.5	HS35	HS40	HS45	CONT.	MEAN
BAGHDAD1	289.3	295.3	294	300	308.6	292.6	261.3	291.58
BABYLON 113	341.3	385.3	308.6	260.6	258.6	254	300.6	301.28
MEAN	315.3	340.3	301.3	280.3	283.6	273.3	280.95	296.43
LSD (5%) LSD(V)= 5.148 LSD(T)= 9.630 LSD(V*T)= 13.619								

Table 2: Effect of electric shock and heat shock on number of spikelet per spike of two wheat cultivars.

T / V	ES2.5	ES5	ES7.5	HS35	HS40	HS45	CONT.	MEAN
BAGHDAD1	20.2	19.4	18	21.2	19.2	19.4	19.2	19.5
BABYLON 113	18.2	19.2	18.8	18.4	19.2	18.8	19.8	18.9
MEAN	19.2	19.3	18.4	19.8	19.2	19.1	19.5	19.2
LSD (5%) LSD(V)= 0.241 LSD(T)= 0.452 LSD(V*T)= 0.639								

Table 3: Effect of electric shock and heat shock on grains number per spike of two wheat cultivars.

T / V	ES2.5	ES5	ES7.5	HS35	HS40	HS45	CONT.	MEAN
BAGHDAD1	69.3	76.3	53.6	88.3	93.6	84.3	49.6	73.5
BABYLON 113	53.3	68.3	63.6	72.6	72.6	75.3	61.6	66.7
MEAN	61.3	72.3	58.6	80.4	83.1	79.8	55.6	
LSD (5%) LSD(V)= 0.274 LSD(T)= 0.512 LSD(V*T)= 0.725								

Table 4: Effect of electric shock and heat shock on weight of 1000- grains (g) of two wheat cultivars.

T / V	ES2.5	ES5	ES7.5	HS35	HS40	HS45	CONT.	MEAN
BAGHDAD1	36.5	36.1	39	35.6	36.7	36.1	36.6	36.65
BABYLON 113	35.7	37	34.4	38.3	37.1	38.7	36	36.74
MEAN	36.1	36.55	36.7	36.95	36.9	37.4	36.3	
LSD (5%) LSD (V)= 0.385 LSD (T)= 0.721 LSD (V*T) = 1.019								

Table 5: Effect of electric shock and heat shock on grain yield (ton. ha-1) of two wheat cultivars.

T / V	ES2.5	ES5	ES7.5	HS35	HS40	HS45	CONT.	MEAN
BAGHDAD1	7.32	8.14	6.14	9.43	10.59	8.91	4.75	7.89
BABYLON	6.48	9.74	6.76	7.26	6.97	7.39	6.67	7.32
MEAN	6.9	8.94	6.45	8.34	8.78	8.15	5.71	
LSD (5%) LSD (V)= 0.173 LSD (T)= 0.325 LSD (V*T) = 0.459								

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