European Journal of Research Development and Sustainability (EJRDS)
Available Online at: https://www.scholarzest.com
Vol. 3 No. 4, April 2022
ISSN: 2660-5570

GENETIC PARAMETERS, CORRELATIONS, AND PATH COEFFICIENT FOR YIELD AND SOME OF ITS COMPONENTS IN MAIZE AT CONCENTRATIONS OF SALICYLIC ACID.

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Article history:
Received: 30th January 2022
Accepted: 28th February 2022
Published: 13h April 2022

Abstract:
A factorial experiment was conducted in the autumn season 2020-2021, which included the study on two factors: the first: three concentrations of salicylic acid (0, 100, and 200) ppm placed in the main plots, while the second factor is ten hybrids introduced from (Sagunto, Pl472, Simon Pl538, Podio, Pl700, Torro, 426t6099, Dario, and local hybrid Nehrin) randomized complete block design according to the split-plot and with three replication. The results showed significant phenotypic variance in the traits of ear diameter if it reached 1.894. The phenotypic variance was significant in the two traits of plant height and ear length if it amounted to 1.217-0.321, respectively, while the coefficient of phenotypic variation was medium. The highest direct effect of the weight of 300 grains on the yield was 0.06602 at the concentration (0), and the highest direct effect of the traits of the ear weight on the yield, which amounted to 0.96506 at the concentration (100), and the highest direct effect on the yield of the ear weight, which amounted to 0.47730. The grains per ear were the ear weight and the weight of 300 grains, which amounted to 0.466, 0.839, 0.501, 0.636, 0.982, and 0.63, respectively at a concentration (100), and the highest phenotypic correlation with the yield for ear diameter was a number of grains per ear, the ear weight and the weight of 300 grains at the concentration (200).

Keywords: Genetic Parameters, Correlations, Path Coefficient, Maize, Salicylic Acid.

INTRODUCTION

The maize is *Zea mays* L. It is one of the most important cereal crops in the world in general and in Iraq in particular and comes in third place after wheat and rice, The cultivated area of it the world is 1,580,340,035 hectares, and in Iraq, 100,000 hectares (FAO, 2007), and its importance is due to its multiple uses, as it enters into human food directly or indirectly, by using it as a basic ingredient in animal feed, as well as for various other industrial purposes.

Genetics and plant breeding scientists have been interested in studying the components of phenotypic variance for economically important quantitative traits, such as yield and its components, because knowledge of those components, which are genetic and environmental variance, is necessary for estimating the values of heritability and coefficients of genetic and phenotypic variation. (Sudaric et al., 2003).

The path coefficient analysis, which is based on the assumption that there is a linear relationship between cause and effect, was used by the American scientist Wright to measure the degree of symmetry of genetic factors and the degree of kinship to partial each correlation between the yield and its components into direct and indirect effects, and that it provides a clearer understanding of the cause and effect relationship between the pairs of tested traits and thus determines the component with a direct and significant effect on the yield to be an index for selection to improve the yield. FTheresearchers who found significant, unimportant, high, and very high direct and indirect effects on the yield and its components, (Srivastava and Singh, 2012).

MATERIAL AND METHOD

The field experiment was conducted at latitude 35.37334 North - 43.757671 East) in the fall season of 2020-2021. The study included two factors, the first: three concentrations of salicylic acid (0, 100, and 200) ppm placed in the main plot, while the second factor is nine hybrids introduced from (Sagunto, Pl472, Simon Pl538, Podio, Pl700, Torro, 426t6099, Dario) as well as the local hybrid Nehrin, Using random complete block design according to split-plot and with three replication (Dawod and Abdulyas, 1990), the 5.25m, the distance between one line and another is 0.75m, and the distance between one plant and another is 0.17 m, Tri-phosphate fertilizer P_2O_5 was added as a source of phosphate at the rate of 200 kg.ha^{-1} all of it when planting, and the nitrogen fertilizer represented by urea 46%N as a nitrogen source 200 kg. ha^{-1}, the plants were sprayed with salicylic acid three sprays after two weeks of planting on 17/8/2021 and the second spray on 3/9/2021 and the third on 9/22/2021. To study, the ear length, diameter, the number of grains per row, the number of grains per ear, ear weight, the weight of 300 grains, the grains yield of the plant, The components of phenotypic variance were estimated. Phenotypic, genetic, and environmental variances were estimated according to the method explained by Walter (1975): $\sigma^2 v = \sigma^2 g = (Msg/Mse)/r$, $\sigma^2 E = Mse/r, \sigma^2 P = \sigma^2 G + \sigma^2 E$ and estimate the standard error of each of the above components to find out its contents according to Kempthorne (1969) method and according to the following equations. . $V(\sigma^2_G)=\frac{2}{r^2}[\frac{(MSG)^2}{K+2}+\frac{(MSE)^2}{K+2}]$; $V(\sigma^2_E)=\frac{2(MSE)^2}{K+2}$ The phenotypic variance (σ2P)V was calculated as in the equation studied and presented by Mather and Jinks (1982). . $V(\sigma^2_P) = \frac{2(\sigma^2 P)^2}{N}$, as K = degrees of freedom for each source of variance, N = degrees of freedom for classes + degrees of freedom for experimental error and by taking the square root of the aforementioned variations, we get the standard error Standard Error(SE) for each variance, The values of the phenotypic and genetic variation coefficients were calculated according to the method explained by Falconer (1981), and based on GCV=(σG/y ̅)*100 ECV=(σE/y ̅)*100 PCV=(σP/y ̅)*100 and according to the ranges. Which were used by Agarwal and Ahmed (1982) less than 10% low, 10-30% medium and more than 30 high and quantitative, and heritability in the broad sense $\Delta G = K.H2\,B.s.\sigma P$ according to the method of Hanson et al. (1956) and based on Over the ranges described, less than 40% is low, 40-60% is medium, and more than 60% is high, and the expected genetic improvement (GA) is based on the limits of expected genetic improvement that are less than (10) low and between (30) -10) medium and more than (30) high, as mentioned by (Agarwal and Ahmed, 1982) from the following equation, $\Delta G = K.H2\,B.s.\sigma P$ and the expected genetic improvement as a percentage (Δ G %) of the mean of the trait, according to the Kempthorne method (1969). $\Delta G\% = (\Delta G/\bar{y}) * 100$ The phenotypic correlation coefficients (rP) were estimated. The genetics (rG) and the environment (rE). The path factor analysis which was established by Wright (1921) was used to divide the correlation coefficient (r) between two variables into direct effects of the cause (Cause) in the effect, and indirect effects (Indirect effect) of the cause on the effect through the path (path) i.e. through other causes in the way explained by Dewey and Lu (1959) and explained by the (Al-Zubaidy and Al-jubory, 2016), The model, which included (7) independent variables, was tested for the grain yield with its components (plant height, ear length, ear diameter, number of grains in the row, number of grains per ear, weight of the ear and weight of 300 grains), as well as the dependent variable, which is the grain yield and according to the path coefficient. The description is given by Lenka and Mishra (1973) for the values of direct and indirect effects, which are (0-0.09) neglected, (0.1-0.19) low or low, (0.2-0.29) medium, (0.3-0.99) high, and more than (1) very high. Computer programs were used, including (SAS, EXCEL, Opstat)

RESULT AND DISSECTION

Table (1) shows the analysis of variance for the studied traits. It is noted significantly that plant height, number of grains per row, the weight of 300 grains, and not the significant traits rest at concentration (0) ppm, as well as the significance of ear length, ear diameter, number of grains per ear, ear weight, the weight of 300 and grain yield and traits rest at a concentration (100) ppm, and significant for plant height, ear length, number of grains per row, the weight of 300 grains, and traits rest at a concentration (200) ppm.

Table (1): analysis of variance for the yield and some of its components at every concentration

concentration 0									
Source of Variance	d.f	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains	Grain yield
Replication	2	188.599	1.716	0.036	6.008	5060.016	1103.433	4.230	1234.800
Genotypes	9	641.632*	12.962	0.141	41.358*	7657.778	7050.996	32.487*	4637.115
Error	18	261.836	10.019	0.096	13.356	4799.396	4565.174	9.775	2647.948
concentration 100									
Source of Variance	d.f	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains	Grain yield
Replication	2	41.856	0.144	0.225	8.233	12555.172	10254.533	9.712	6819.100
Genotypes	9	3.471	0.316**	4.003**	25.604	5790.907*	8539.663**	45.629**	4668.611**
Error	18	2.906	0.045	0.935	12.149	2321.048	563.385	6.345	372.989
concentration 200									
Source of Variance	d.f	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains	Grain yield
Replication	2	168.270	12709.749	0.021	10.551	10058.069	2439.633	7.932	1248.300
Genotypes	9	810.616*	176747.7**	0.136	39.521*	8166.806	6102.207	50.239**	4225.441
Error	18	252.373	9091.664	0.134	15.400	5354.015	3437.819	7.984	1868.041

This result was in agreement with the results (Mohammed and Aziz, 2007), ((Mohammed and Aziz, 2008), (Mohammed, 2017), and (Rabie and Mohammed, 2021), they found significant differences in most of the studied traits.

Table (2) shows the estimation of some genetic parameters, it is noted that significant genetic variation in the ear diameter, reached 0.015, and this is evidence of the importance of genetic influences in the emergence of this trait and a small role for environmental influences, which allows the plant breeders to improve the traits through genetic improvement and this will give an opportunity for the plant breeder for effective selection to improve this trait, which has a significant role in improving the grain yield, and environmental variance there is significant for ear diameter, a weight of 300 grains, with a 0.096, 9.775, if the environmental variance is higher the genetic variance of trait indicates this trait is more closely related to the environmental conditions which means that it is better to improve it when improving environmental conditions. As for phenotypic variance, there is a high significance in traits of ear diameter if it reached 1.894, and this gives a great opportunity for plant breeders to increase the efficiency of the breeding process, improvement, and selection for superior traits and to select the best of them directly due to their low impact on environmental factors. The coefficients of genetic variation were low for all the studied traits, while a coefficient of environmental variation was high for all traits studied except for ear diameter if it reached 1.877. As for the coefficient of phenotypic difference, all of them were medium, except for plant height and ear diameter traits, which were low if they were 7.09 and 6.52, respectively. As for the degree of heritability, all traits were low, and this may be attributed to the low value of genetic variance compared to environmental variance, and that low heritability values indicate that this trait is greatly affected by environmental conditions and makes the selection for this trait difficult, except a number of grains per row and weight of 300 grains, which were average and amounted to 41.136, and 43,647, respectively, and this may be due to the convergence of the values of genetic and environmental variance, and this trait can be improved by environmental conditions such as fertilization, irrigation and other environmental factors controlled in these two traits. The expected genetic advance as a percentage. It was low in all traits except for the number of grains per row and the weight of 300 grains, as it was medium and it reached 10.58-13.06, respectively.

Table (2) Estimation of some genetic parameters at a concentration (0) ppm

traits	$\sigma^2 G$	$\sigma^2 E$	$\sigma^2 P$	$CV\ G$	$CV\ E$	$CV\ P$	$H.B.S\%$	ΔG	$\%\Delta G$
plant height	126.598 ±9078.75	261.836 ±6855.80	220.8 ±3611.30	4.048	94.20	7.09	32.592	13.23	4.76
ear length	0.981 ±4.509	10.019 ±10.03	48.291 ±172.74	4.677	47.31	15.66	8.919	0.6	2.887
ear dimeter	0.015 ±0.0005	0.096 ±0.0009	1.892 ±0.265	2.383	1.87	6.52	13.358	0.09	1.79
No. of grains per row	9.334 ±36.537	13.356 ±17.83	45.259 ±151.73	8.218	35.92	12.81	41.136	4.03	10.85
No. of grains per ear	952.794 ±1440614	4799.396 ±2303420	1786.688 ±236463.3	5.363	833.8	13.17	16.564	25.87	4.49
ear weight	828.607 ±1235939	4565.174 ±2084081	2183.137 ±353043	8.541	1354.5	21.79	15.362	23.24	6.89
weight of 300 grains	7.57 ±22.382	9.775 ±9.55	41.68 ±128.63	9.602	34.11	14.53	43.647	3.74	13.06
Grain yield	663.055 ±512308.7	2697.948 ±701158.6	1677.2 ±208370	9.862	1014.1	22.03	20.026	23.73	9.09

Table (3) shown the noted that there is a significant genetic variance for ear length and ear diameter if it reached 0.09 and 1.022 respectively, and this means the importance of genetic influences in the emergence of this trait and a small role for environmental influences, which allows plant breeders for effective selection to improve this trait. The trait that has a significant role in improving the grain yield, as for environmental variance there is significant in plant height, ear diameter, number of grains per row, and weight of 300 grains from 2.906 to 6.345, respectively. This means that the improvement of these traits is better when improving the environmental conditions and phenotypic variance, there is significant to plant height and ear length if reach 1.217 - 0.321 respectively, this means that the high phenotypic and genetic variance for the trait gives a great opportunity for plant breeders to increase the efficiency of the process of breeding, improvement, and selection superior traits and the selection of the best of them directly because of their low impact on environmental factors. As for the coefficient of genetic variation, it was low for all traits except for ear weight and weight 300 grains, and grain yield was medium if it reached 15.995, 12.176, and 15.166, respectively. The environmental coefficient of variation was low for plant height and ear length if they were 1.029 and 0.231 respectively, the medium for ear diameter and weight of 300 grains amounted to 18.478 and 22.253 respectively, it was high for all the remaining traits. As the coefficient of phenotypic, all traits were medium except for plant height, ear length, and ear diameter, which were low they reached 8.716 to 9.5, respectively. The degree of heritability, all traits were high, which indicates the importance of genetic variance as one of the main components of the phenotypic variance of these traits, they are indicators possibility of inferring the genotype with the desired genes through phenotypic form of the trait thus, the plant breeder can select the superior genotype from its phenotypic form and rely on the overall selection to improve these traits without resorting to progeny testing, except ear diameter and number of grains per ear, which were medium they were 52.25 and,

Table (3) Estimation of some genetic parameters at a concentration (100) ppm

Traits	Genetic Parameter								
	$\sigma^2 G$	$\sigma^2 E$	$\sigma^2 P$	$CV\ G$	$CV\ E$	$CV\ P$	$H.B.S\%$	ΔG	$\%\Delta G$
plant height	0.188 ± 0.337	2.906 ± 0.844	1.217 ± 0.109	2.101	1.029	8.716	6.09	6.221	1.093
ear length	0.09 ± 0.00203	0.045 ± 0.0002	0.321 ± 0.0076	5.993	0.231	7.34	66.66	0.505	10.08
ear dimeter	1.022 ± 0.333	0.935 ± 0.08	19.5 ± 28.16	6.795	18.47	9.4	52.25	1.506	10.11
No. of grains per row	4.485 ± 14.883	12.142 ± 14.75	37.87 ± 106.23	5.738	33.39	11.05	26.96	2.256	6.138
No. of grains per ear	1156.619 ± 737326.03	2321.04 ± 538726	1583.139 ± 185654	6.186	426.5	10.72	33.25	40.40	7.399
ear weight	2658.759 ± 1476775	563.385 ± 31740.2	2842.853 ± 598652	15.99	184.0	17.60	82.51	96.48	29.93
weight of 300 grains	13.094 ± 42.508	6.345 ± 4.025	35.347 ± 92.54	12.17	22.25	14.83	67.36	6.118	20.58
Grain yield	1431.874 ± 441867.3	372.989 ± 13912.0	1590 ± 187266	15.16	158.1	17.02	79.33	69.43	27.82

33.25, and this may be due to the convergence values of genetic and environmental variance, and other environmental factors control these two traits. It was low in the traits of plant height and number of grains per row if it reached 6.09 and 26.29, respectively, this may be due to the low value of genetic variance compared to environmental variance, low heritability values indicate that is greatly affected by environmental conditions and make the selection for this trait difficult. This result agrees with **(**Muneeb et al. 2013) and (Al-Rawi et al. 2016) they found most traits were median. The expected genetic advance as a percentage was medium in all traits except for plant height, number of grains per row, and the number of grains per ear was low if it reached 1.093, 6.138, and 7.3399, respectively.

Table (4) shows noted the genetic variance is not significant for all traits, the environmental variance, there is significant for ear diameter and weight of 300 grains they reach 0.134 and 7.98 respectively, which indicates that this trait is more closely related to the environmental conditions, which means Its improvement is better when environmental conditions are improved. As the phenotypic variance, there is a significant for ear diameter if it reaches 0.1346, from the foregoing, it is clear that the high phenotypic variance of the trait gives a great opportunity for plant breeders to increase the efficiency of the process of breeding, improvement, and selection for superior traits and to directly select the best ones for the trait due to the lack of affected by environmental factors. The coefficient of genetic variation was low for all traits except for the weight of 300 grains, and grain yield was medium, which amounted to 12.17 and 11.15 respectively, and ear length was described as high if it reached 126.72, while the coefficient of environmental variation was high for all traits except for ear diameter, it was low if it reached 2.66 and the weight of 300 grains was a medium of 27.03 or coefficient of phenotypic was all the traits medium except for plant height and ear diameter were low if they reached 7.16, and 7.30 respectively, and ear length was high, amounting to 136.64. As the degree of heritability, all traits were low, and this may be attributed to low value of genetic variance compared to environmental variance, and low heritability values indicate that this trait is greatly affected by environmental conditions and makes the selection for this trait difficult, except for plant height was medium as it reached 42.44 and this may be due to the values of genetic and environmental variance are close, and this trait can be improved by setting up a breeding program with improving environmental conditions such as and it was high in ear length and the weight of 300 grains if it reached 86.00 and 63.82 respectively, and high values

Table (4) Estimation of some genetic parameters at a concentration (200) ppm

Traits	Genetic Parameter								
	$\sigma^2 G$	$\sigma^2 E$	$\sigma^2 P$	$CV\ G$	$CV\ E$	$CV\ P$	$H.B.S\%$	ΔG	$\%\Delta G$
plant height	186.08 ± 13982.4	252.37 ± 6369.21	438.45 ± 14239.8	5.05	93.56	7.76	42.44	18.3	6.78
ear length	55885.37 ± 63202511	9591.66 ± 8265835	66977.03 ± 296559	126.72	4873.83	136.64	86.00	5410	242.11
ear dimeter	0.0006 ± 0.00057	0.134 ± 0.0017	0.1346 ± 0.0013	0.528	2.66	7.30	0.52	0.004	0.079
No. of grains per row	8.04 ± 34.188	15.4 ± 23.716	23.44 ± 40.69	7.69	41.77	13.113	34.3	3.42	9.28

No. of grains per ear	937.59 ±318537.4	5354.01 ±286654	6291.6 ±293165	5.54	969.06	14.35	14.9	24.35	4.4
ear weight	888.12 ±883579.8	3437.81 ±118185	4325.93 ±138619	9.22	1064.1	20.35	20.53	27.81	8.61
weight of 300 grains	14.08 ±51.697	7.98 ±6.37	22.06 ±36.04	12.17	27.03	15.19	63.82	6.17	20.92
Grain yield	785.8 399466.8±	1868.04 ±348957	2653.84 ±521693	11.15	743.35	20.50	29.61	31.42	12.50

of heritability in the broad sense of the above traits may be attributed to high values of genetic variance compared to environmental variance and that the high values of heritability indicate the possibility of improving the trait by mass selection because this trait is affected by environmental conditions not big. The expected genetic advance as a percentage, was low in all the studied traits except for the weight of 300 grains, and grain yield if it reached 20.92 and 12,504, respectively, and ear length was high, amounting to 242.11. This result agrees with (Muneeb et al. 2013) and (Al-Rawi et al. 2016) they found most traits were median.

Table (5) shows in plant height, the correlation was significant with traits of ear weight of the environmental correlation, it was significant, reaching 0.362*, and phenotypic and genetic correlation was significant with ear weight, which amounted to 0.437* and 0.953**, respectively. For ear length, genetic, phenotypic, and environmental correlations were all signed with the ear diameter, reaching 0.454*, 0.571** and 0.441*, respectively, and with number of grains per row, only the genetic correlation was significant, reaching 1.326**, and phenotypic and genetic correlation was significant, with the number of grains per ear, which amounted to 0.439* and 2.806**, respectively, and all the correlations were significant, the ear weight reached 0.693**, 2.060** and 0.515**, respectively, and phenotypic and genetic correlation was significant with the weight of 300 grains, it reached 0.364* and 0.746**, respectively, and significant phenotypic, genetic and environmental correlation with grain yield was 0.697**, 1.866** and 0.525**, respectively. As the ear diameter, the values of phenotypic, genetic, and environmental correlation were significant with the number of grains per ear, which amounted to 0.443*, 0.701** and 0.398*, respectively, and also significant with ear weight, which amounted to 0.712**, 0.579** and 0.734** respectively, and correlation Phenotypic and genetic with the weight of 300 grains, which amounted to 0.369* and 0.667**, respectively, and significant with grain yield the phenotypic, genetic and environmental, which amounted to 0.702**, 0.703** and 0.705**, respectively. The number of grains per row was a phenotypic, genetic, and environmental correlation with the number of grains per ear, which amounted to 0.494**, 0.727** and 0.434*,

Table (5) the phenotypic, genetic, and environmental correlations at the concentration of salicylic acid (0) ppm.

Traits	R	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains
ear length	rP	-0.045^{NS}						
	rG	-0.066^{NS}						
	rE	-0.043^{NS}						
ear dimeter	rP	0.157^{NS}	0.454*					
	rG	-0.333^{NS}	0.571**					
	rE	0.297^{NS}	0.441*					
No. of grains per row	rP	0.106^{NS}	0.244^{NS}	0.124^{NS}				
	rG	-0.131^{NS}	1.326**	0.294^{NS}				
	rE	0.245^{NS}	-0.014^{NS}	0.078^{NS}				
No. of grains per ear	rP	0.136^{NS}	0.439*	0.443*	0.494**			
	rG	-0.254^{NS}	2.806**	0.701**	0.727**			
	rE	0.260^{NS}	0.112^{NS}	0.398*	0.434*			
ear weight	rP	0.211^{NS}	0.693**	0.712**	0.284^{NS}	0.567**		
	rG	-0.281^{NS}	2.060**	0.579**	0.883**	1.859**		
	rE	**0.362***	0.515**	0.734**	0.088^{NS}	0.322^{NS}		
weight of 300 grains	rP	**0.437***	0.364*	0.369*	0.091^{NS}	0.098^{NS}	0.489**	
	rG	**0.953****	0.746**	0.667**	0.470**	0.749**	0.774**	
	rE	0.125^{NS}	0.303^{NS}	0.297^{NS}	-0.188^{NS}	-0.151^{NS}	0.418*	
Grain yield	rP	0.169^{NS}	0.697**	0.702**	0.278^{NS}	0.496**	0.982**	0.526**
	rG	-0.188^{NS}	1.866**	0.703**	0.818**	1.806**	1.010**	0.663**
	rE	0.295^{NS}	0.525**	0.705**	0.063^{NS}	0.204^{NS}	0.978**	0.491**

respectively, and genetically significant with ear weight and weight of 300 grains, and the grain yield, which was 0.883** and 0.470* * and 0.818**, respectively. The number of grains per ear, correlation was significant phenotypic and genetic with ear weight, which amounted to 0.567** and 1.859**, respectively, and genetically significant with weight of 300 grains, which amounted to 0.749**, and with grain yield, the phenotypic and genetic correlation was significant, and its value was 0.496* * and 1.806**, respectively. The phenotypic, genetic, and environmental correlation was significant for ear weight with weight of 300 grains, which amounted to 0.489**, 0.774** and 0.418*, respectively, and with the grain yield, the correlation was also significant, as it reached 0.982**, 1.010** and 0.978 ** respectively. The weight of 300 grains was also significant phenotypic, genetic, and environmental with grain yield, its values reaching 0.526**, 0.663**, and 0.491**, respectively. This result agrees with (Muneeb et al. 2013) and (Al-Rawi et al. 2016) they found most traits were median.

Table (6) shows it is noted in plant height, the correlation was genetic with the ear length, which amounted to 0.451*, phenotypically, genetically and environmentally with the number of grain per row, their values reached 0.603**, 1.770** and 0.454*, and with a number of grains per ear, phenotypic and genetic correlation was significant, reaching 0.430* and 1.392**, as well as significant with ear weight morphologically, genetically and environmentally, which amounted to 0.480**, 1.137**, and 0.556**, and with a weight of 300 grains, the genetic correlation was significant, reaching 1.040**, and phenotypic, genetic and environmental correlation was significant with grain yield, which amounted to 0.466**, 1.263** and 0.427*. For ear length, the genetic correlation was significant with an ear diameter of 0.337*, and the correlation was with the number of grains per ear, as the correlation was phenotypic and genetic and amounted to 0.527** and 0.847**, respectively, and with ear weight the association was also significant and amounted to 0.856**, 0. 981** and 0.534**, respectively, and phenotypic, genetic, and environmental correlation was significant with the weight of 300 grains, which amounted to 0.511**, 0.574 and 0.382*, respectively, and with the grain yield, the phenotypic, genetic, and environmental correlation reached a significant limit and its value was 0.839 **, 0.952** and 0.559**, respectively. A found a desirable and significant genetic correlation of yield traits with most studied traits, this result agrees with (Nzuve et al, 2014), (Al-Rawi et al. 2016), (Wuhaib et al. 2017), (Soumya, and Kamatar, 2017)

Table (6) the phenotypic, genetic, and environmental correlations at the concentration of salicylic acid (100) ppm

traits	R	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains
ear length	rP	0.268^{NS}						
	rG	0.451^{*}						
	rE	0.317^{NS}						
ear dimeter	rP	0.005^{NS}	0.176^{NS}					
	rG	0.196^{NS}	0.377^{*}					
	rE	-0.045^{NS}	-0.116^{NS}					
No. of grains per row	rP	0.603^{**}	0.281^{NS}	0.101^{NS}				
	rG	1.770^{**}	0.282^{NS}	-0.116^{NS}				
	rE	0.454^{*}	0.327^{NS}	0.244^{NS}				
No. of grains per ear	rP	0.430^{*}	0.527^{**}	0.556^{**}	0.536^{**}			
	rG	1.392^{**}	0.847^{**}	0.664^{**}	0.886^{**}			
	rE	0.292^{NS}	0.271^{NS}	0.495^{**}	0.387^{*}			
ear weight	rP	0.480^{**}	0.856^{**}	0.169^{NS}	0.490^{**}	0.676^{**}		
	rG	1.137^{**}	0.981^{**}	0.116^{NS}	0.614^{**}	0.828^{**}		
	rE	0.556^{**}	0.534^{**}	0.323^{NS}	0.561^{**}	0.708^{**}		
weight of 300 grains	rP	0.252^{NS}	0.511^{**}	-0.294^{NS}	0.302^{NS}	0.160^{NS}	0.600^{**}	
	rG	1.040^{**}	0.574^{**}	-0.565^{**}	0.683^{**}	0.497^{**}	0.776^{**}	
	rE	0.075^{NS}	0.382^{*}	0.105^{NS}	0.022^{NS}	-0.161^{NS}	0.091^{NS}	
Grain yield	rP	0.466^{**}	0.839^{**}	0.103^{NS}	0.501^{**}	0.636^{**}	0.982^{**}	0.631^{**}
	rG	1.263^{**}	0.952^{**}	0.029^{NS}	0.653^{**}	0.769^{**}	0.992^{**}	0.823^{**}
	rE	0.427^{*}	0.559^{**}	0.268^{NS}	0.512^{**}	0.650^{**}	0.942^{**}	0.114^{NS}

The ear diameter, the correlation was significant phenotypically, genetically, and with a number of grains per ear, which amounted to 0.556**, 0.664**, and 0.495**, respectively. grains per row, the phenotypic, genetic, and environmental correlation was significant with the number of grains per ear, and it amounted to 0.536**, 0.886** and 0.387*, respectively, and with ear weight, the phenotypic, genetic, and environmental correlation was significant, as it reached 0.490**, 0.614**, and 0 561**, respectively, and the genetic correlation was only significant with the weight of 300 grains, which amounted to 0.683**, and with the grain yield, the correlation was significant phenotypically, genetically, and environmentally, reaching 0.501**, 0.653** and 0.512**, respectively. The number of grains per ear was phenotypic, genetic, and environmental correlation was significant with ear weight, and it amounted to 0.676**, 0.828**, and 0.708**, respectively, and genetic correlation with weight of 300 grains, which amounted to 0.497**, and with grain yield, the correlation was phenotypic, genetic and environmental, as they were 0.636**, 0.769** and 0.650**, respectively. For ear weight, there was a significant phenotypic and genetic correlation with weight of 300 grains, which amounted to 0.600** and 0.776**, respectively, and also a phenotypic, genetic, and environmental correlation with grain yield, which amounted to 0.982**, 0.992** and 0.942**, respectively. The weight of 300 grains, the correlation was phenotypically and genetically with the grain yield, which was 0.631** and 0.823**, respectively. A found a desirable and significant genetic correlation of yield traits with most of the studied traits, this result agrees with (Nzuve et al, 2014), (Al-Rawi et al. 2016), (Wuhaib et al. 2017), (Soumya, and Kamatar, 2017).

Table (7) shows is noted in plant height, the environmental correlation was significant with ear length, which amounted to 0.371*, and phenotypic and environmental correlation was significant with ear diameter, which amounted to 0.432*, and 0.582**, respectively, and the correlation is genetic with the number of grains per row, which amounted to 0.680**, and with the number of grains per ear, the correlation was only environmental, reaching 0.419*, and with ear weight, the phenotypic and environmental correlation was significant, reaching 0.363* and 0.509** respectively, and with the weight of 300 grains, the correlation was phenotypic and genetic, reaching 0.402* and 0.570**, respectively, and with grain yield, the correlation was environmental, reaching 0.484**. The correlation was not significant or negative for all other traits for the ear length trait.

Table (7) the phenotypic, genetic, and environmental correlations at the concentration of salicylic acid (200) ppm.

Traits	R	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains
ear length	rP	0.095^{NS}						
	rG	-0.017^{NS}						
	rE	0.371*						
ear dimeter	rP	0.432*	-0.076^{NS}					
	rG	-0.178^{NS}	-0.870**					
	rE	0.582**	-0.048^{NS}					
No. of grains per row	rP	0.115^{NS}	0.028^{NS}	0.278^{NS}				
	rG	0.680**	0.227^{NS}	5.075**				
	rE	-0.235^{NS}	-0.314^{NS}	0.077^{NS}				
No. of grains per ear	rP	0.267^{NS}	0.062^{NS}	0.510**	0.440*			
	rG	-0.102^{NS}	-0.006^{NS}	1.400**	1.708**			
	rE	0.419*	0.186^{NS}	0.512**	0.072^{NS}			
ear weight	rP	0.363*	-0.225^{NS}	0.865**	0.392*	0.633**		
	rG	0.063^{NS}	-0.538**	2.553**	1.232**	0.967**		
	rE	0.509**	0.003^{NS}	0.879**	0.091^{NS}	0.565**		
weight of 300 grains	rP	0.402*	-0.103^{NS}	0.551**	0.217^{NS}	0.129^{NS}	0.523**	
	rG	0.570**	-0.041^{NS}	4.336**	0.407*	-0.017^{NS}	0.716**	
	rE	0.231^{NS}	-0.322^{NS}	0.500**	0.056^{NS}	0.242^{NS}	0.492**	
Grain yield	rP	0.357^{NS}	-0.255^{NS}	0.841**	0.456*	0.614**	0.985**	0.513**
	rG	0.137^{NS}	-0.504**	3.162**	1.118**	0.969**	1.023**	0.652**
	rE	0.484**	0.000^{NS}	0.856**	0.146^{NS}	0.531**	0.980**	0.454*

As the ear diameter, the genetic correlation was significant with the number of grains per row and amounted to 5.075**, and phenotypic, genetic and environmental correlation was significant with number of grains per ear, which amounted to 0.510**, 1.400**, and 0.512**, respectively, and with ear weight the correlation reached the phenotypic, genetic, and environmental limits were significant, as it reached 0.865**, 2.553**, and 0.879**, respectively, and the phenotypic, genetic and environmental correlation was significant with weight of 300 grains, which amounted to 0.551**, 4.336**, and 0.500**, respectively, with grain yield, the phenotypic, genetic, and environmental correlation was also significant, reaching 0.841**, 3.162**, and 0.856**, respectively. The phenotypic and genetic correlation was significant with the number of grains per row, which amounted to 0.440* and 1.708**, respectively, and also with ear weight, the phenotypic and genetic correlation was 0.392* and 1.232**, respectively, and the environment correlation with the weight of 300 grains was 0.407*, and the phenotypic and genetic correlation was significant with grain yield, which amounted to 0.456* and 1.118**, respectively. The number of grains per ear, the phenotypic, genetic, and environmental correlation was 0.633**, 0.967**, and 0.565**, respectively, and with grain yield, the phenotypic, genetic, and environmental correlation was significant, reaching 0.614**, 0.969**, and 0.531 ** respectively. The ear weight was phenotypically, genetically, and environmentally correlation significant with the weight of 300 grains, which amounted to 0.523**, 0.716**, and 0.492**, respectively, and also significant with grain yield, which reached 0.985**, 1.023**, and 0.980** respectively. The weight of 300 grains, the phenotypic, genetic, and environmental correlations were significant, as they were 0.513**, 0.652**, and 0.454*, respectively. A found a desirable and significant genetic correlation of yield traits with most of studied traits, this result agrees with (Nzuve et al, 2014), (Al-Rawi et al. 2016), (Wuhaib et al. 2017), (Soumya, and Kamatar, 2017).

Table (8) path coefficient analysis for phenotypic into direct effects (diagonal values) and indirect effects (above and below diagonal) at the concentration (0) ppm.

Traits	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains
plant height	**-0.06103**	0.00276	-0.00960	-0.00648	-0.00831	-0.01285	-0.02664

ear length	-0.00056	**0.01247**	0.00566	0.00304	0.00547	-0.01285	0.00454
ear dimeter	0.00316	0.00911	**0.02008**	0.00250	0.00889	0.00864	0.0074
No. of grains per row	0.00436	0.01001	0.00500	**0.04104**	0.02029	0.01429	0.00373
No. of grains per ear	-0.01267	-0.04085	-0.04117	-0.04598	**-0.93030**	0.01164	-0.00911
ear weight	0.20650	0.67983	0.69763	0.27816	0.55617	**-0.05277**	0.47989
weight of 300 grains	0.28820	0.020404	0.02433	0.00600	0.00646	0.98045	**0.06602**
Total Effect	0.42796	0.693734	0.70193	0.27828	-0.34133	0.93655	0.52583
Residual	0.02498						

Table (8) between the analysis of the phenotypic path of grain yield and some of its components, where the direct effect was neglected for all traits except the weight of 300 grains was a direct positive effect, reaching 0.06602. As for the indirect effects on plant height through the ear weight and weight of 300 grains, there was a low with grain yield, which amounted to 0.20650 and 0.28820, respectively. For ear length, there is an indirect effect through ear weight, its value was 0.69763. The ear diameter, indirect effect through ear weight was high in effect, reaching 0.69763, and the number of grains per row, indirect effects were neglected by the rest of the traits, except ear weight if it was high, as it reached 0.55617, and ear weight, the indirect effect was negligible by all the traits except for the weight of 300 grains, which was high, reaching 0.98045 and low by number grain per row, and for ear weight, the effects were also all neglected by the rest traits, except the weight of 300 grains, which was high as it reached 0.98045. As for the weight of 300 grains, the effects were high using the ear weight, which amounted to 0.47989. The total effects for all traits were medium values in plant height, ear length, ear diameter, ear weight, and weight of 300 grains, which amounted to 0.42796, 0.693734, 0.7193, 0.93655, and 0.52583 respectively, as for the number of grains per row, it was low and amounted to 0.27828, and number of grains per ear, its value was negative and amounted to -0.34133, while the value of the residual amounted to 0.02498

Table (9), the analysis of the phenotypic path of grain yield and some of its components showed that the direct effects were negligible for all traits except for ear weight, which was high at 0.96506, and weight of 300 grains, it was low, reaching 0.0274. As indirect effect of plant height, it was all neglected by the rest of the traits except for number of grains per row and ear weight, which was neglected, and it amounted to 0.02601 and ear weight, which amounted to 0.046323, as for ear length, the indirect effect through the ear weight was high, which amounted to 0.82654, and by the rest traits they were all negligible, and for ear diameter, the effect was low through ear weight, which amounted to 0.16340, and through rest traits the effects were negligible, and for number of grains per row, ear weight was high and neglected by the rest traits, and for number of grains per ear, the effect was high by ear weight, reaching 0.65201, and by the rest traits, it was neglected, except number of grains per row, which was low, reaching 0.02312, and for ear weight, the effect was negligible through other traits, and the weight of 300 grains, the effect was high, through ear weight, which amounted to 0.57983, and through the rest traits, the effect was negligible. The total effects of plant height were negligible and amounted to 0.030793, as for ear length was high, it was 0.83879, and ear diameter was low, which amounted to 0.21762, and it was high in the number of grains per row, the number of grains per ear, ear weight and weight of 300, it amounted to 0.49955, 0.634105, 0.89249 and 0.53400, respectively. The residual value was 0.03034.

Table (9) path coefficient analysis for phenotypic into direct effects (diagonal values) and indirect effects (above and below diagonal) at the concentration (100) ppm

Traits	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains
plant height	**-0.03131**	-0.00841	-0.00015	-0.01887	-0.01345	-0.01503	-0.07900
ear length	-0.01310	**0.00483**	0.00085	0.00136	0.002855	0.00414	0.00247
ear dimeter	-0.00270	-0.01008	**0.05733**	-0.00578	-0.03189	-0.09710	0.01683
No. of grains per row	0.02601	0.01214	0.00435	**0.04316**	0.02312	0.02116	-0.01303
No. of grains per ear	-0.00130	-0.00015	-0.00016	-0.00160	**-0.00290**	-0.00210	-0.00050
ear weight	0.046323	0.82654	0.16340	0.47305	0.65201	**0.96506**	0.57983
weight of 300 grains	0.00687	0.01392	-0.00800	0.00823	0.00436	0.01636	**0.02740**
Total Effect	0.030793	0.83879	0.21762	0.49955	0.634105	0.89249	0.53400
Residual	0.03034						

In Table (10) between the analysis of the phenotypic path of grain yield and some of its components, the ear weight showed a direct, high, positive effect, which amounted to 0.4773, and some traits were taken in a disparity between these two values. As the indirect effects of plant height, the effect was high through ear weight and rest effects were all negligible, and for ear length, the effects through other traits were negligible, and for ear dimeter, the effect was high through ear weight, which amounted to 0.84586, and for the number of grains per row, the effect was high through ear weight and the rest traits the effects were negligible, and the number of grains per ear, the effect was also high through ear weight and rest effects were negligible. For the weight of 300 grains, the effect was high through ear weight, and through rest traits, the effects were negligible. The total effects of all the traits studied, were all high and positive, reaching 0.35683, 0.84085, 0.45981, 0.61411, 0.48455, and 0.51251, respectively, except ear length, which was a negative medium, reaching -0.60678, while the residual values were 0.02122.

Table (10) path coefficient analysis for phenotypic into direct effects (diagonal values) and indirect effects (above and below diagonal) at the concentration (200) ppm

Traits	plant height	ear length	ear dimeter	No. of grains per row	No. of grains per ear	ear weight	weight of 300 grains
plant height	**0.01882**	0.00179	0.00814	0.00216	0.00503	0.00683	0.00756
ear length	-0.00373	**-0.3914**	0.00298	-0.0011	-0.00243	0.00881	0.00402
ear dimeter	-0.00425	0.00075	**-0.00984**	-0.00273	-0.00501	-0.00851	-0.00542
No. of grains per row	0.01116	0.00272	0.02698	**0.09712**	0.04273	0.03811	0.02111
No. of grains per ear	-0.01143	-0.00266	-0.02179	-0.01881	**-0.04276**	-0.02708	-0.00551
ear weight	0.35464	-0.22012	0.84586	0.3877	0.61924	**0.4773**	0.5116
weight of 300 grains	-0.00838	0.00214	-0.01148	-0.00453	-0.00269	-0.01091	**-0.02085**
Total Effect	0.35683	-0.60678	0.84085	0.45981	0.61411	0.48455	0.51251
Residual	0.02122						

CONCLUSION

The significant phenotypic variance in the traits of ear diameter if it reached 1.894 at a concentration (200). The highest direct effect of the traits of ear weight on the yield, at concentration (100), The phenotypic correlation with grain yield was for ear length, the number of grains per ear, ear weight, and the weight of 300 grains, A found a desirable and significant genetic correlation of yield traits with most of the studied traits

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