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STUDIES ON RESISTANCE TO BORER IN CORN I. DEAD HEART%, INTENSITY OF DAMAGE, GRAIN YIELD AND YIELD LOSE

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ABSTRACT

A half diallel cross between eight inbred lines of maize (Zea mays L.) was evaluated under two environments (artificial infestation and normal conditions.) in RCBD with three replications. Highly significant genotypes, parents and crosses were detected for the borer traits. General and specific combining (GCA and SCA) were found to be significant for all studied traits. Non- additive gene effects seem to play an important role in the expression of dead hearts %, intensity of damage, yield losses and grain yield/ plant at infestation and non infestation, where the ratio of GCA/SCA found to be less than unity for all traits. Regarding to grain yield/ plant the crosses P3xP5, P3xP6 and P3xP8 had significant superiority over the check hybrid SC pioneer 30k8 under both environments. Parent No 5 gave significant negative $\hat{g}_i$ effects for percent of dead heart and percentage of resistance to susceptible plants and resistance to damage caused by S. cretica. P3 ranked the first best inbred line in grain yield/ plant in both environments. The best combinations were P3xP5, P3xP6, and P3xP8 for grain yield/plant at both environments

INTRODUCTION

Maize *(Zea mays* L.) is one of the most important cereal crops in Egypt, in terms of cultivated area, total production and cash value. In 2015 growing season, it was grown in about 1,824,000 million feddan (one feddan = 4200 m^2) which produce about 5,788,000 million tons of grain with an average yield of 23.98 ardab per feddan (one ardab = 140 kg) (Economic Affairs Sector, Ministry of Agriculture and Land Reclamation).

Different species of Lepidoptera pests attack maize plants i.e. the pink stem borer Sesamia cretica Led. (Noctuidae), the European corn borer (ECB) *Ostrinia nubilalis* Hubn (pyroustidae) and the purple-lined corn borer

Chilo Agamemnon Bles. (Crambidae). *Sesamia cretica*, the most prevalent corn borer in Egypt attacks young maize plants after emergence, causing death of these plants (dead hearts) and its capable of damaging older plants causing drastic yield losses **(Simeada, 1985).** These losses are mainly attributed to the decrease in number of plants per unit area (Stand) at harvest because of the large number of dead hearts, increase in plant lodging, ear drops and predisposing infested plants to disease organisms. One of the most important methods for controlling insect pests in the context of integrated pest control is to grow insect-resistant cultivars **(Ortega *et al*., 1980 and Pathak 1991).** The first step in designing an efficient breeding program for resistance to a certain insect is to identify sources of resistance and to determine how plant behavior under insect attack is transmitted from the original parents to the improved cultivars **(Pathak and Othieno 1992).** Considerable efforts have been devoted to identifying and developing corn germplasm with resistance to damage by the pink stem borer *Sesamia cretica* **(Al-Naggar *et al*., 2000 ; Saafan, 2003 and Soliman, 2003).** Many F_1 crosses exhibiting significant heterosis values for resistance to *Sesamia cretica* were identified by some investigators, suggesting superiority of heterozygotes over homozygotes in this regard **(Al-Naggar *et al*., 2000 and Saafan, 2003).**

The genetic general combining ability (GCA) and specific combining ability (SCA) were defined by Sprague and Tatum (1942). Both GCA and SCA effects should be taken into consideration when planning maize breeding programs to produce and release new inbred lines and crosses.

Diallel analysis technique is the choice of providing such detailed genetic information for selecting breeding materials that show great promise for success (Lonnquit and Gardner, 1961).

To establish a sound basis for any breeding program, aimed at achieving high yield, breeders must have information on the nature of combining ability of parents, their behavior and hybrid combination performance (Chawla and Gupta, 1984).

It has been reported that both additive and non-additive gene action are responsible for the inheritance of resistance to *Sesamia nonagrioides* and *Ostrinia nubilalis* **(Velasco *et al*., 2002). Scott *et al*., (1967) and Sadehdel *et al*., (1983)** showed that the magnitude of non-additive was greater than that of additive gene action in controlling maize resistance to the second generation of European corn borer (ECB). On the other hand, general combining ability (GCA) was more important than specific (SCA) in the inheritance of resistance to *Sesamia spp.* **(Tususz and Koe, 1995)**; *Ostrinia nubilalis* **(Metawi, 1996);** Fall armyworm and southwestern corn borer **(Williams *et al.*, 1997b);** Asian corn borer **(Shieh *et al*., 1999);**

Southwestern corn borer **(Williams *et al*., 2002)** and African stalk borer **(Andre *et al*., 2003).**

The objectives of this work were to estimate GCA and SCA effects and identify superior genotypes resistant to *S. cretica* in maize with higher yielding ability potentiality and superiority over to the check hybrid pioneer 30k8.

MATERIAL AND METHODS

The experimental work of this investigation during the two successive seasons of 2013 and 2014 was carried out at the Experimental Research Station of Moshtohor, Benha University, Qalyubiya Governorate, Egypt.

A total of eight inbred lines varying in the resistance to corn borer were used to establish the experiment materials for several characters. These lines were selected based on their variability toward corn borers *Sesamia cretica* and other desirable plant aspects. The designation, pedigree and origin of these inbred lines are presented in table (1).

Table (1): The Designation, pedigree and origin of the studied eight inbred lines.

Designation	Pedigree	Origin
P_1	43	Produced by Prof. Dr Ali EL-Hosary Egypt
P_2	83	
P_3	24	
P_4	122	
P_5	CML135	Introduced CIMMYT Mexico
P_6	CML67	
P_7	191	
P_8	193	

In the first early summer season 2013, seeds of the eight inbred lines were split planted in 5th, 12th and 19th May to avoid differences in flowering time and to secure enough hybrid seed. All possible cross combinations without reciprocals were made between the eight inbred lines by hand method giving a total of 28 crosses seeds.

In the second summer, season 2014, two experiments were undertaken in two environments (under artificial infestation conditions and normal conditions.) at the Agricultural Research and Experimental Station of the Fac. of Agric., Moshtohor. Each experiment included the eight inbred lines and 28 crosses as well as Single cross pioneer 30k8 which were sown on 22th of May. A randomized complete block design with three replications was used. Each plot consisted of two ridges of six m length and 70 cm width. Hills were spaced by 25 cm with three kernels per hill on one side of the ridge. The seedlings were thinned to one plant per hill. The dry method of planting was used. The first irrigation was given after 21 days from sowing. The plants were then irrigated at intervals of 10-15 days. The cultural practices were followed as usual for ordinary maize field in the area.

All plants/ plot after thinned artificial infestation conditions were artificially infested by newly hatched larvae of the pink stem borer *S. cretica* artificially reared in the corn Borer Res. Lab., Maize Res. Sec., ARC, Giza, Egypt. Infestation was done using the Bazooka as a mechanical dispenser, such that each plant receives approximately 6-8 larvae at the early whorl stage of plant development (25 days after sowing). Data were recorded on:

1. **Percentage of dead hearts (DH %):**

$$DH\% = \frac{\text{No. of dead hearts / plot}}{\text{No. of artificially infested plants / plot}} \times 100$$

2. **Intensity of damage (ID):**

Six-class rating scale according to Al-Naggar *et al.* **(2000b)** was used for evaluating the amount of plant injury in maize caused by *S. cretica* larvae attack. The description of this scale is as follows:

Class 1: No visible injury on plants (no symptoms).

Class 2: Plants with holes less than 0.5 mm in diameter across partially or fully unfolded whorl leaves.

Class 3: Several folded and unfolded whorl leaves with relatively wider round holes.

Class 4: Several folded and unfolded whorl leaves with relatively larger round and/or elongated holes accompanied with small yellowish-green pellets of frass aggregated in the whorl.

Class 5: Plants with relatively larger round and/or elongated Irregular holes, evident distortion of the leaves (most leaves have long holes), withering of whorl and accumulation of comparatively large size pillets of frass in the whorl or on the ground around the stem.

Class 6: Plants with dead hearts.

The intensity of damage (ID) value for each plot was calculated as follows:

$$ID = \frac{ID_1 + ID_2 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + ID_n}{N}$$

Where ID_1, ID_2, …….. ID_n denote intensity of damage of the tested infested plant No. 1, NO. 2, ………. No. n and N= number of artificially infested plants. Genotypes were classified according to their ID into: resistant (less than 1.6), intermediate (from 1.6 to less than 2.6) and susceptible (2.6 or above).

Data on percentage of susceptible plants and percentage of dead hearts were adjusted by adding a constant number (0.5) to each percentage and totals were transformed into square roots for the purpose of statistical analysis.

Grain yield / plant was calculated after adjusting the data based on 15.5% moisture content. The percentage yield loss by each genotype was calculated as follows: yield loss % = 100x (1-(yield in infected plot ÷ yield in uninfected plot)) according to **Kumar and Gershon (1994)**

The ordinary analysis of variance for RCBD was firstly performed according to **Snedecor and Cochran (1989).** General and specific combining ability estimates were obtained by employing **Griffing's (1956)** diallel cross analysis designated as method 2 mode 1 for yield, its components and losses and grain yield/ plant.

RESULTS AND DISCUSSION

Analysis of variance for percentage of dead heart %, intensity of damage, grain yield/ plant under infestation and non infestation with pink stem borer and yield losses % for grain yield for the F_1 crosses are shown in Table 2.

Table 2: Observed mean squares from analysis of variance, GCA and SCA mean squares for all studied traits.

SOV	df	DH%	ID%	grain yield in infestation	grain yield in control environment	yield losses %
Replication	2	7.96*	0.02	49.60	45.04	29.89
Genotypes	35	107.68**	1.41**	8353.79**	8745.23**	243.01**
parent	7	45.96**	0.47**	67.83	335.15**	575.55**
Cross	27	73.74**	1.50**	1800.98**	1546.95**	149.28**
Par.vs.cr.	1	1456.13**	5.24**	243281.56**	261969.29**	445.91**
Error	70	1.62	0.14	64.17	52.54	49.71
GCA	7	12.99**	0.41**	497.67**	472.47**	98.64**
SCA	28	41.62**	0.48**	3356.33**	3525.73**	76.59**
Error	70	0.54	0.05	21.39	17.51	16.57
GCA/SCA		0.31	0.85	0.15	0.13	1.29

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

Highly significant genotypes, parents and crosses were detected for the borer traits, indicating wide diversity between the parental inbred lines used in this study. Also, highly significant were detected for yield loss and grain yield/ plant except parent mean square for parent in infestation environment.

Mean performance of inbred lines and their F_1 crosses for infested plant, dead heart, intensity of damage at infestation condition and yield losses and grain yield/ plant at infestation and non infestation for F_1 only are presented in Table. 3.

Regarding to dead hearts %, the inbred lines No. 5 produced the highest mean percentage of resistance to dead heart (lower values). Also, the crosses P_1x P_4, P_1xP_5, P_2xP_4, P_2xP_5, P_3xP_8, P_4x P_6, P_4xP_7, P_4xP_8 , P_5x P_7, P_5xP_8, P_6xP_7 and P_7xP_8 had the lower mean percentage of dead heart (high resistance).

Concerning intensity of damage, all the studied parental inbred except No. 6 expressed highest scale for resistance (lower scale intensity). Meanwhile, the crosses P_3xP_5, P_4xP_5, P_4xP_6, and P_4x P_7 gave the highest scale for resistance to intensity of damage and showed significant high mean values to resistance to intensity of damage than the check hybrids.

Regarding to grain yield/ plant the crosses P3xP5, P3xP6 and P3xP8 had significant superiority over the check hybrid SC pioneer 30k8 under both environment. These crosses exhibited significant increase of one or more of traits contributing to grain yield. The fluctuation of crosses from environment to another was detected for most traits. These results would be due to significant interaction between crosses and environments.

As for yield losses the parental inbred line No 7 and the crosses P_1xP_5, P_2xP_3, P_2xP_5, P_3xP_4 and P_7xP_8 exhibited the best crosses which grain yield / plant of these crosses did not affected by damage of borer. At the same time, these crosses did not show superiority over the check hybrid SC pioneer 30k8.

Regarding to Table 2 mean squares for general and specific combining (GCA and SCA) were found to be significant for all studied traits. It is evident that, both additive and non additive gene effects were involved in determine the performance of single progeny. However, non- additive gene effects seems to play an important role in the expression of dead hearts %, intensity of damage, yield losses and grain yield/ plant at infestation, where the ratio of GCA/SCA found to be more than unity only for grain yield/ plant in control environments. These results agrees with the findings of **Turgut *et al*. (1995), El-Shenawy *et al.* (2002), Amer (2003), Mosa (2003) and Amer and Mosa (2004).**

General combining ability effects:

Estimates of general combining ability effects for the eight inbred lines are presented in table 4.

For percent of dead heart parents No 5 and 8 gave significant negative $\hat{g}_i$ effects. Meanwhile, Parents No 4 and 5 exhibited the best combiner for intensity of damage. However, Parents No 2, 5 and 7 exhibited the best combiner for yield loses%.

Table 3: Mean performance for all studied traits.

	DH%	ID%	grain yield in Inf.	drain yield in control	yield loss %
P1	13.5	2.47	36.43	50.53	27.67
P2	14.33	2.23	39.63	42.43	6.01
P3	13.2	2.4	48.6	68.17	28.63
P4	13.23	2.37	44.17	44.9	1.54
P5	6.07	2.13	33.37	33.83	0.7
P6	16.87	3.33	41.53	44.07	5.72
P7	18.43	2.03	43.97	41.6	-6.12
P8	9.43	2.43	41.83	56.47	25.6
1x2	4.03	2.2	141.8	150.27	5.39
1x3	4.97	3.4	138.47	148.63	6.87
1x4	0	2.23	148.2	159.1	6.77
1x5	0	1.4	159.63	158.3	-1.29
1x6	10.77	2.23	126.27	143.9	11.7
1x7	3.47	2.3	157.3	165.57	4.69
1x8	6.07	2.13	153.97	165.47	6.77
2x3	5.63	2.07	159.93	156.33	-2.74
2x4	0	1.23	164.7	166.97	1.16
2x5	0	2.43	170.63	157.4	-8.43
2x6	8.07	1.57	153.47	174.97	12.04
2x7	12.73	3.17	166.07	173.7	4.31
2x8	9.23	1.77	144.9	155.67	6.8
3x4	14.93	3.17	133.23	131.87	-1.24
3x5	6.23	1.07	216.83	221.5	2.15
3x6	0	1.17	215.87	219	1.34
3x7	5.47	1.1	137.7	163.4	15.71
3x8	0	2.33	211.83	217.2	2.54
4x5	11.5	1.07	153.77	169.47	9.26
4x6	0	1.03	135.73	144.43	5.77
4x7	0	1.07	138.53	163.9	15.43
4x8	0	1.73	145.83	170.37	14.38
5x6	14.03	1.23	154.97	172.13	9.64
5x7	0	1.37	148.9	169.63	12.14
5x8	0	1.4	155.6	174.13	10.58
6x7	0	2.93	166.43	168.77	1.13
6x8	3.3	2.27	126.63	171.03	25.83
7x8	0	2	122.7	120.93	-1.43
30K08	12.6	2.8	185.33	163.57	-13.2
mean of parent	13.13	2.43	41.19	47.75	11.22
mean of cross	4.3	1.9	155.35	166.22	6.33
mean of Genotype	6.26	2.01	129.98	139.89	7.42
L.S.D 5%	2.07	0.61	13.01	11.77	11.45
L.S.D 1%	2.74	0.8	17.25	15.61	15.19

Meanwhile**, the other parental inbred lines exhibited either significant undesirable or insignificant $\hat{g}_i$ effects for recent traits.**

The parental inbred line number 5 showed the best combiner for percentage of resistance to susceptible plants and resistance to damage caused by *S. cretica*. This line could be used in maize breeding program to make crosses having high yielding ability and resistance to damage with pink stem borer.

The parental inbred lines No 3, 5 and 8 showed significant positive ($\hat{g}_i$) effects for grain yield/ plant at both and across environments. P3 ranked the first best inbred line in grain yield/ plant in both environments.

Table 4: Estimates of GCA effects of the parental materials for percentage of dead heart %, intensity of damage, grain yield/ plant under infestation and non infestation with pink stem borer and yield losses % for grain yield.

	DH%	ID%	grain yield under Inf.	grain yield under control	yield losses
g1	-0.01	0.27**	-7.14**	-6.67**	2.95*
g2	1.2**	0.08	1.09	-3.88**	-3.62**
g3	0.73**	0.1	14.12**	13.53*	1.51
g4	-0.35	-0.19**	-6.15**	-6.31**	-1.21
g5	-1.25**	-0.39**	5.72**	3.12*	-3.13*
g6	1.35	0.1	-0.74	2.34	1.21
g7	0.22	-0.01	-4.43**	-4.99**	-2.7*
g8	-1.89**	0.04	-2.47	2.87*	4.99**
L.S.D(0.05) gi	0.50	0.13	2.90	2.70	2.60
L.S.D(0.01) gi	0.57	0.17	3.61	3.27	3.18
L.S.D(0.05) gi-gj	0.65	0.19	4.12	3.72	3.62
L.S.D(0.01) gi-gj	0.87	0.25	5.46	4.94	4.81

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

Specific combining ability:

Specific combining ability effects $\hat{S}_{ij}$ for the studied 28 hybrids were computed for all the studied traits **Table 4**. The most desirable inter and intra allelic interactions were presented by nineteen, eight and eight parental combinations expressed significant desirable $\hat{S}_{ij}$ effects for dead heart%, intensity of damage and yield losses, respectively. However the cross P_3xP_6 gave the best $\hat{S}_{ij}$ effects for all studied traits.

Table 4: Specific combining ability for all studied traits.

	DH%	ID%	grain yield under		Yield loss
			Inf.	control	
P1xP2	-3.42**	-0.16	17.86**	20.93**	-1.35
P1xP3	-2.02**	1.02**	1.5	1.89	-5.01
P1xP4	-5.91**	0.13	31.5**	32.19**	-2.38
P1xP5	-5.01**	-0.5*	31.06**	21.96**	-8.52*
P1xP6	3.16**	-0.15	4.16	8.35*	0.12
P1xP7	-3.01**	0.03	38.88**	37.34**	-2.97
P1xP8	1.7*	-0.19	33.59**	29.38**	-8.59*
P2xP3	-2.56**	-0.12	14.74**	6.8	-8.05*
P2xP4	-7.12**	-0.67**	39.78**	37.27**	-1.43
P2xP5	-6.22**	0.73**	33.84**	18.27**	-9.1*
P2xP6	-0.75	-0.62**	23.13**	36.63**	7.03
P2xP7	5.05**	1.09**	39.42**	42.69**	3.21
P2xP8	3.66**	-0.36	16.3**	16.79**	-1.99
P3xP4	8.29**	1.24**	-4.72	-15.24**	-8.95*
P3xP5	0.49	-0.66**	67.01**	64.96**	-3.65
P3xP6	-8.34**	-1.04**	72.5**	63.25**	-8.8*
P3xP7	-1.74*	-1**	-1.98	14.98**	9.48*
P3xP8	-5.1**	0.18	70.2**	60.91**	-11.38**
P4xP5	6.83**	-0.37	24.21**	32.77**	6.19
P4xP6	-7.27**	-0.89**	12.64**	8.52*	-1.64
P4xP7	-6.13**	-0.75**	19.13**	35.31**	11.93**
P4xP8	-4.03**	-0.13	24.47**	33.92**	3.19
P5xP6	7.66**	-0.49*	20**	26.79**	4.14
P5xP7	-5.23**	-0.25	17.62**	31.61**	10.55**
P5xP8	-3.13**	-0.26	22.37**	28.25**	1.31
P6xP7	-7.83**	0.83**	41.62**	31.53**	-4.8
P6xP8	-2.43**	0.12	-0.14	25.94**	12.21**
P7xP8	-4.59**	-0.04	-0.38	-16.84**	-11.13**
LSD5%(sij)	1.33	0.39	8.35	7.55	7.35
LSD1%(sij)	1.76	0.52	11.07	10.02	9.74
LSD5%(sij-sik)	1.96	0.57	12.35	11.17	10.87
LSD1%(sij-sik)	2.6	0.76	16.38	14.82	14.42
LSD5%(sij-ski)	1.85	0.54	11.64	10.53	10.25
LSD1%(sij-ski)	2.45	0.72	15.44	13.97	13.59

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

With regard to grain yield/plant, twenty two, and twenty four crosses showed significantly positive ($\hat{S}_{ij}$) effects at infestation and normal, respectively.

In conclusion, the best combinations were P_3xP_5, P_3xP_6, and P_3xP_8 for grain yield/plant at both environments. These crosses also, had the highest mean values . It could be concluded that the previous crosses seemed to be the best combinations, where they had significant SCA effects for grain yield/plant and most of the yield components over the two environments.

In these crosses showing high specific combining ability involving only one good combiner such combinations would show desirable transgressive segregates, providing that the additive genetic system present in the good combiner as well as the complementary and epistatic effects present in the cross, act in the same direction to reduce undesirable plant characteristics and maximize the character in view. Therefore, the previous crosses might be of prime importance in breeding program for traditional breeding procedures. In most traits, the values of SCA effects were mostly different from environment to another. This finding coincided with that reached above where significant SCA by environment mean squares were detected

REFERENCES

Al-Naggar, A.M.; A.A.El- Ganayni; M.A. El-Lakany; H.Y. El-Sherbeiny and M.S.M. Soliman (2000). Mode of inheritance of maize resistance to the pink stem borer, *Sesamia cretica* Led. under artificial infestation. Egypt. J. Plant Breed. 4: 13-35.

Andre, A.M.; J.B.J. Rensburg; M.T. Labuschagne and J.B. Rensburg (2003). Inheritance of resistance in maize to the African stalk borer, *Busseola fusca* (Fuller) (Lepidoptera: Noctuidae). South African J. of Plant and Soil. 20: 64-71.

El-Shenawy, A.A.; Mosa H.E. and Aly, R.S.H. (2002): Genetic analysis of grain yield/ plant and other traits on maize early inbred lines. J. Agric. Sc. Mansoura Univ., 27(4): 2019-2026.

Griffing, B. (1956). Concept of general and specific combining ability in relation to diallel crossing systems. Austr. J. of Biol. Sci. 9: 463-493.

Kumar H. and Gershon O. A. (1994). Grain yield losses in maize (*Zea mays* L.) genotypes relation to their resistance against Chilo partellus (Swinhoe) infestation at anathesis. Crop Protection 13:136-139

Metawi, A.A.E. (1996). Genetic analysis of resistance to corn borers in some inbreds of maize. M.Sc. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta Unvi., Egypt.

Mosa, H.E. (2003): Heterosis and combining ability in maize (Zea mays L.). Minufiya J. Agric. Vol. 28 No. 5(1): 1375-1386.

Ortega, A.; S.K. Vasal; J.A. Mihm and C. Hcrshey (1980). Breeding for insect resistance in maize. pp. 371-419.

Pathak, R.S. (1991). Genetic expression of the spotted stem borer, *Chilo partellus* (Swinhoe) resistance in three maize crosses. Insect Science and its Applications. 12: 147-151.

Pathak, R.S. and S.M. Othieno (1992). Diallel analysis of resistance to the spotted stem borer *Chilo partellus* (Swinhoe) in maize. Maydica. 37: 347-353.

Saafan, T.A.E. (2003). Contribution to the study of corn resistance to the pink stem borer, *Sesamia cretica*. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt.

Sadehdel, M.M.; P.J. Loesch; A.R. Hallauer and W.D. Guthrie (1983). Inheritance of resistance to the first and second broods of the European corn borer in corn. Proc. Iowa Acad. Sci., 90: 35-38.

Shieh, G.; B.H. Chen; C.L. Ho and H.S. Lu (1999). Genetic variation and inheritance of Taiwan- white maize inbred lines resistance to the Asian corn borer (*Ostrinia furnacalis*). J. of Agric. Res. of China. 48: 24-31.

Simeada, A.M. (1985). Relative susceptibility of certain maize germplasm to infestation with greater sugar cane *Sesamia cretica* Led. (Lepidoptera: Noctuidae). M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

Snedecor, G.W. and W.G. Cochran (1989). Statistical Methods. 8^{th} Ed., Iowa State Univ., Press. Ames Iowa, USA.

Soliman, M.S.M. (2003). Genetics of resistance in maize to pink stem borer (*Sesamia cretica* Led.). Egypt. J. Appl. Sci., 18: 127-151.

Turgut, I.; Yuce, S. and Altinbas, M. (1995) Inheritance of some agronomic traits in a diallel cross of maize inbreds. II. Grain yield and its components. Anadolu 5(1): 74-92.

Tususz, M.A. and N. Koe (1995). Inheritance of resistance to stem borers (*Sesamia spp.*) in maize. Turkish J. of Agric. And Forest. 19: 151-155.

Velasco, P.; P. Revilla; A. Butron; B. Ordas; A. Ordas and R.A. Malvar (2002). Ear damage of sweet corn inbreds and their hybrids under multiple corn borer infestation. Crop Sci., 42: 724-729.

Williams, W.P.; F.M. Davis and J.A. Mihm (1997). Mechanisms and bases of resistance in maize to southwestern corn borer and fall armyworm. Proceedings of an International Symposium held at CIMMYT, 29-36.

Williams, W.P.; F.M. Davis; G.L. Windham and P.M. Buchley (2002). Southwestern corn borer damage and aflatoxin accumulation in a diallel cross of maize. J. of Genetics and Breeding. 56: 165-169.

دراسات على مقاومة الثاقبات في الذرة الشامية

1-القلب الميت، شدة الأصابة ، محصول الحبوب / النبات و الفقد فى المحصول

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الملخص العربى

أجرى تقييم للهجن الناتجة من التهجين النصف دائرى لثمانية سلالات من الذرة وذلك فى تحت بيئتين مختلفتين (تحت ظروف العدوى الصناعية بالثاقبات و تحت الظروف العادية) فى تصميم قطاعات كاملة العشوائية بثلاث مكررات. كان متوسط التباين لكل من التراكيب الوراثية و الاباء و الهجن معنوية فى كل الصفات الخاصة بالثاقبات. و كانت التباينات للقدرة العامة والخاصة على التآلف معنوية لكل الصفات تحت الدراسة. وكانت النسبة بين القدرة العامة والقدرة الخاصة أقل من الوحدة لكل الصفات تحت الدراسة.

أظهرت السلالة الأبوية رقم 6 قدرة جيدة عامة على التوافق لصفة نسبة النباتات المقاومة للأصابة بالثاقبات و المقاومة للقلب الميت و ايضا اظهرت تلك السلالة قدرة عامة على التالف لصفة المحصول تحت ظروف كل من العدوى و الظروف العادية.تفوقت الهجن , P3xP5, P3xP6 P3xP8 فى محصول الحبوب / النبات عن صنف المقارنة 30 ك 8 تحت ظروف العدوى الصناعية و المقاومة. اعطى الاب رقم 5 اعلى قدرة عامة على التالف مرغوبة لكل من صفة القلب الميت و الشدة الأصابة. و السلالة 3 اعطت قدرة اعلى قدرة عامة مرغوبة لصفة محصول الحبوب / نبات فى كلا البيئتين. أعطت الهجن التالية قدرة خاصه على التآلف P5xP3 وP6xP3 وP8xP3 لصفة المحصول تحت ظروف العادية المقاومة الكيماوية للثاقبات.