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STUDIES ON MAIZE GRAINS DETERIORATION UNDER EGYPTIAN CONDITIONS - CORN KERNEL DAMAGE PERCENTAGE AND APPLICATION OF SOME CONTROL TECHNIQUES.

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ABSTRACT

Corn grains collected from North Delta Governerates (Behaira, Sharkya and Menofya), Upper Egypt (Sohag, Assuit and Qena) and imported corn (Argentina, USA and Hungary)were investigated and studied under Egyptian storage conditions. Moisture content and kind of variety are considered the primary factors affecting development of storage fungi in grains and consequently influence grains damage percentage i.e. germ, mold, insect and heat damage.This percentage was increased gradually by increasing storage period (0,2,4,6,8,10,and 12 months)of all tested samples (local or imported). Moisture content increased in all samples up to 8 months storage peroid then decreased gradually.

Using thiourea and propionic acid formula (Salmo-Nil-Dry)as preservative materials led to clear significant decrease in damaged grains percentage compared with untreated ones during storage. After 6-12 months storage peroid, thiourea gave the best effect on stored corn grains, while propionic acid formula proved to be highly effective in preventing damaged grains after 12 months storage period and greatly decreased damage percentage on imported corn samples during all storage periods (0,2,4,6,8,10 and 12 months).

The tested fungicides, (Topsin M70 and Somi 8) successively and significantly decreased the percentage of the total damage. Each fungicide at the tested rate significantly decrease grain invasion. Both fungicides caused the least percentage of damage after storage period 12 months.

Keywords: Grains deterioration, storage, propionic acid, preservative, fungicides

INTRODUCTION

Corn (*Zea maize* L.) is one of the most important grains all over the world. It is used mainly for animal feeding, poultry wealth and human consumption. Moreover there are a new industrial uses of corn such as the industrial corn products for clean environment (biodegradable packing peanuts bunnies diaper, clam shell, daily home uses, ethanol and hydrosorb materials), production of corn oil, dextrose and high fructose corn sweetness (FGIS, 1994). In Egypt, the cultivated area of maize grain production reached about 1.7 million feddan in season 2000, which produced approximately 5.6 million tons of corn grain (Field Crop Inst., ARC, Giza, Egypt).Corn importation play an important role in our annually grain consumption, where Egypt imported about 3.8 million tons of yellow corns during season 2000 (CLFF,ARC, Giza, Egypt).

A wide variety of microorganisms are present on / in grain kernels. The fungi that invade and damage grains and their products are divided into two general groups i.e. field or storage fungi. These mold fungi are make undesirable and measurable effects on grain quality like discoloration, reduced germination, heating, caking, mustiness, sour odors, chemical changes, loss of weight, reduction in grade and mycotoxins contamination (FGIS, 1994).

All mentioned storage and field problems of corn grains which resulting from mold fungi are controlled by different ways to prevent mold growth like resistant varieties, cultural practices, sanitation, monitor grain condition, moisure level adjustment and using chemical mold inhibitors or fungicides (Abol-ela ,2002).

The present study was conducted to study the effect of different storage periods (0,2,4,6,8,10 and 12 months)on corn grains damage (cultivated and imported), studying the effect of using some preservatives (Thiourea and propionic acid formula) and some fungicides (Topsin M70 and Somi 8).

MATERIALS AND METHODS

Sampling:

Samples of different corn (*Zea mays*) varieties namely; Balady, Nab El-gamal (local open pollinated varieties), SC 10, Bashaaier 13 (single cross), TWC 352 (three way cross), and Taba (double cross) were collected from different Egyptian governorates in season 1998, being Behaira, Menofya and Sharkya (represent the Delta area), Assuit, Sohag, and Qena (represent upper Egypt). These varieties were used in this study because of their wide cultivation in those governorates.

Samples of yellow corn (grade 2, Table 1) were taken from imported corn shipments to Egypt from different countries such as USA. Argentina and Hungry. Samples were graded in Feed Grain Inspection Lab., Central Lab. for Food and Feed Agriculture Research Center (ARC), Giza, Egypt. Imported samples were graded by using Carter Dockage Tester, Serial No.1712, USA.

Table (1): characteristic of tested corn grain grade 2.

Grade	Minimum test weight pound/bushel	*% of broken kernels
2	54.0	4

*According to Federal Grain Inspection Service, USA, Dept. of Agriculture (FGIS1994).

Storage Experiment:

Samples of different local varieties (Table2) and three samples of imported yellow corn were used. Three-replicate samples (1500g/replicate)of 15 tested corn varieties and hybrids were used. Samples were kept in cloth bags and stored for 0,2,4,6,8,10 and 12 months at room temperature. The following parameters i.e. kernel damage percentages(mold, germ. insect and sprout and heat damage according to Federal Grain Inspection Services , (FGIS,1994) and moisture content were determined every 2 months storage period.

Table (2):Common name, pedigree and producer of the tested corn grains.

Types of corn grains	Pedigree	Producer
Hybrids		
Three way cross 352 (TWC 352)	+ SC 52 x > Inbred line 121	*ARC
Three way cross 310 (TWC 310)	+ SC 10 x > Inbred line 34	*ARC
Three way cross 320 (TWC 320)	+ SC 120 x > Inbred line 7	*ARC
Single cross 122 (SC 122)	+ Inbred line 628 x > Inbred line Giza 603	*ARC
Single cross 10 (SC 10)	+ Inbred line 7 x > Inbred line Seds 63	*ARC
Bashaaier 13 (SC 13)	(unknown)	Egyptian Agric.Co.
Dahab (Double cross)	(unknown)	Pioneer Company
Taba (Double cross)	(unknown)	Pioneer Company
Varieties		
Balady	Local open pollinated variety (unknown)	
Nab El-Gamal	Local open pollinated variety (unknown)	

*ARC: Agricultural Research Center, Crop Research Institute, Maize Breeding and Genetic.

Determination of kernel damage percentage:

Determination of kernel damage percentage were done by using hand-pick. The most common types of kernel damage were germ, mold, insect, sprout and heat damage. Samples were divided by mechanical divider (Boerner divider) to get three equal portions (replicates). Samples were weighted and examined the portions to detect all types of kernel damage. The inspection of grains were done according to Federal Grains Inspection Service (FGIS, 1994). Percentage of damaged kernels was calculated as follows:

$$\text{Kernel damage \%} = \frac{\text{weight all types of damage/portion}}{\text{weight of the portion}} \times 100$$

Moisture content percentage:

Moisture content percentages were determined in samples of stored corn grains (250 g) at room temperature (25-27 °C) by Motomco apparatus Serial NO. K 3668, USA as recommended by Federal Grain Inspection Services, USA, Dept. of Agric., FGIS,1994). The Motomco Model 919 (Moisture Meter) is a portable electronic measuring instrument designed for the determination of moisture in cereal crops and in a wide variety of other products.

Use of preservatives and fungicides for stored corn grains:

The stored samples of white and yellow corn varieties were treated with two preservatives i.e. thiourea [Cs (NH_2)] 7000 ppm (Eisa *et.al.*,1996) and propionic acid formula (Salmo-Nile-Dry,Nut-R- International Co-,Belgium) at recommended rate (3g / kg grains). Topsin M 70% and Somi 8 fungicides were used as recommended (1000 ppm) by Abdel-Reheem and Tewfic (1999). Samples were treated with the two preservatives and the fungicides in dusted form, kept in cloth bags and stored for 0,2,4,6,8,10 and 12 months under natural infection conditions at room temperature. Percentage of grain

damage (germ, mold, insect, Sprout and heat damage) was determined a' each storage interval period.

Results were compared with untreated samples (control).Data wer statistically analysed by using two factor in complete randomized desig (CRD) as described by Snedcor and Cochran (1980) at Central Lab. for Design and Statistical Computation Section, ARC, Giza, Egypt.

RESULTS AND DISCUSSION

Effect of storage on grain damage:

Data in Table (3) and illustrated in Figs (1, 2, 3& 4) revealed that increasing the storage period from 2 to 12 months has gradually increased the damage grain percentages. It is clear also that there were significant differences in the damage grain percentages between tested corn grains at the different storage periods.

As for stored corn grains (varieties, hybrids and imported grains), the least damage grain percentage was recorded for both TWC 352 hybird (Sharkya) and Bashaaier-13 (Menofya) at zero time and after 12 months storage period. Also, they were 5.3%, 5.6% and 5.3%, for balady (Sharkya), balady (Assiut) and SC 10 (Sohag), respectively after 12 months storage period. On the other hand, the highest grain damage percentages were recorded on corn grains of balady (Behaira), balady (Menofya) and Taba (Behaira) to be 30.3, 28.0 and 23.3%, respectively after 12 months storage period. Meanwhile, the grain damage percentages recorded 4.0, 2.6 and 2.0 %, respectively on the imported corn grains from Argentina, Hungary and USA at zero time while, they were 13.6%,15.0% and 15.3% respectively after 12 months storage period.

Generally, it could be concluded that storage interval periods at room temperature affected the grain damage percentage, whereas the grain damage percentages have significantly increased by the increase of storage period.

These findings are in harmony with the previously recorded results of Al-Yahya (1995) who found that grain infection percentages by fungi and rate of dry matter loss increased with increasing period of storage. Therefore, the deterioration in the resistant maize hybrid were significantly less than in the susceptible hybrid of stored maize for 50 days at 22% moisture content at storage temperature of 26°C.

Table (3): Damage percentage of stored grains at room temperature for different periods.

Stored corn grains	Sources	after storage periods (in months)						
		zero	2	4	6	8	10	12
Local varieties								
Balady	Behaira	7. 3	11. 0	16. 6	16. 6	18. 6	28. 6	30. 3
Balady	Sharkya	0. 0	0. 0	1. 0	2. 3	3. 3	4. 0	5. 3
Balady	Menofya	4. 0	7. 3	7. 6	8. 6	13. 6	25. 0	28. 0
Balady	Assuit	0. 0	0. 0	0. 0	1. 6	3. 3	4. 0	5. 6
Balady	Sohag	3. 6	5. 6	10. 0	11. 0	12 . 0	12 . 0	12 . 0
Balady	Qena	0. 0	1. 6	5 0	12 . 0	18 . 6	19 . 6	21.0
Nab El-Gamal	Qena	0. 0	0. 0	0. 0	2. 0	3. 0	6. 0	6. 3
Local hybrids								
Taba	Behaira	9. 0	13 . 0	16. 6	15. 3	16. 9	19. 0	23. 3
SC 10	Sharkya	1. 0	1. 6	3. 0	3. 6	4. 3	8. 6	10. 0
TWC 352	Sharkya	0. 0	0. 0	0. 0	0. 6	1. 6	2. 0	3. 0
Bashaaier 13	Menofya	0. 0	0. 0	0. 0	2. 3	2. 3	3. 0	3. 0
SC 10	Sohag	0. 0	0. 0	1. 6	2. 6	4. 3	5. 0	5. 3
Imported corn grains								
USA		2. 0	8. 0	9. 3	9. 6	14. 6	15. 0	15. 3
Argentina		4. 0	4. 6	9. 3	12 . 6	13 . 0	13 . 6	13. 6
Hungary		2 . 6	3. 0	8. 0	10. 3	12 . 6	14.6	15.0
L.S.D. at 5% for tested grains		1. 3 2	1. 47	1. 4	2. 54	3. 04	4. 06	3 51

Effect of storage periods on moisture content percentage of stored corn grains:

Data presented in Table (4) indicated that increasing the storage periods to 12 months had decreased grain moisture content. Meanwhile, the only exception was clear in moisture content of stored corn grains of balady variety collected from Menofya during 0-12 months storage periods where slight changes happened. On the other hand, the moisture content increased in all samples up to 8 months storage period then decreased gradually.

Data indicated that moisture content and kind of variety are considered the primary factors affecting development of storage fungi in grains and consequently influence grain damage percentage (germ, mold, insect and heat damage). This percentage was increased by increasing storage period of all tested samples (local or imported). In this respect, Ashour *et al.* (1970) found that the decrease in seed viability was depended on storage time and varieties. Tang *et al.* (1999) reported that deterioration rate was greatly influenced by storage environment and increased by increasing storage treatment and seed moisture or both.

Table (4): Moisture content percentage of stored grains at room temperature for different periods.

Cultivars	Sources	Storage periods (in months)						
		zero	2	4	6	8	10	12
Local varieties								
Balady	Behaira	15.00	16.35	17.55	15.50	15.50	14.81	13.00
Balady	Sharkya	10.50	13.00	14.00	14.00	13.90	12.50	12.40
Balady	Menofya	15.99	16.32	16.40	16.08	16.38	15.96	15.90
Balady	Assiout	10.00	10.89	12.00	11.76	11.60	10.80	10.10
Balady	Sohag	14.88	16.00	16.80	17.40	15.88	15.11	14.60
Balady	Qena	16.10	16.86	17.11	16.50	16.10	15.20	15.00
Nab El-Gamal	Qena	8.52	8.86	10.11	10.50	10.10	9.20	8.80
Local hybrids								
Taba	Behaira	16.50	17.21	17.60	16.40	16.89	15.70	15.00
SC 10	Sharkya	11.00	11.79	12.11	11.89	11.30	10.60	10.10
TWC 352	Sharkya	10.80	11.03	11.35	11.10	11.00	10.20	10.00
Bashaaier 13	Menofya	11.00	11.34	11.88	11.70	11.40	10.60	10.10
SC 10	Sohag	10.50	12.01	12.90	12.50	12.00	11.30	10.00
Imported corn grains								
USA		14.36	14.41	15.00	15.99	14.60	14.60	12.00
Argentina		14.88	15.90	15.80	15.60	14.90	14.89	12.99
Hungary		14.18	14.65	14.95	15.81	15.20	14.60	12.80

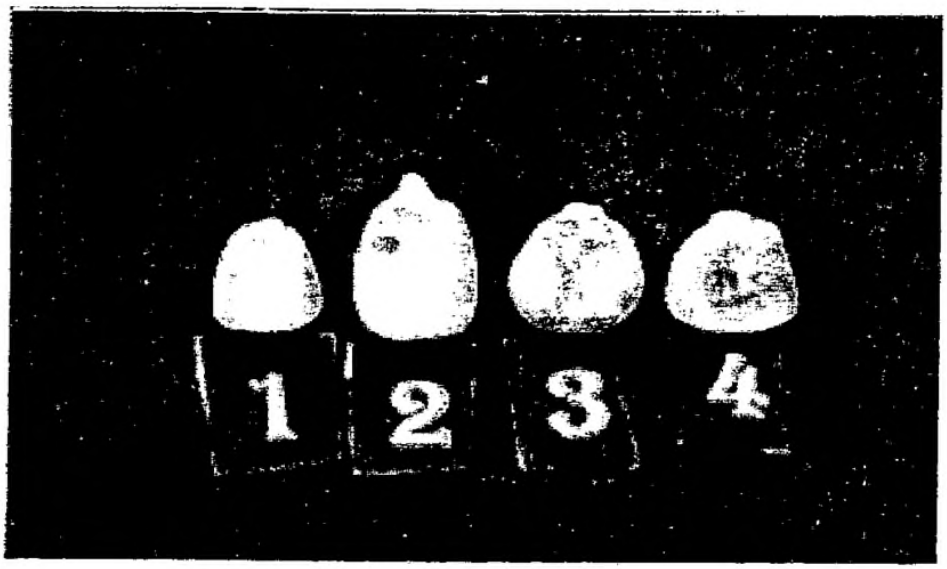

Fig. (1): Types of white corn grains damage
1- Control (sound) 2- Insect damage
3-Mold damage 4-Germ damage

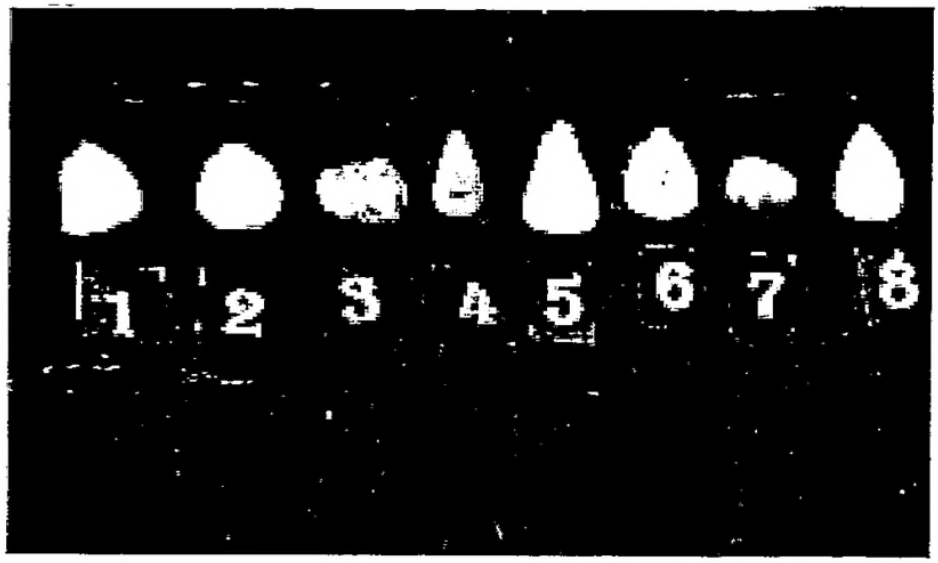

Fig. (2): Types of mold
1- Control (sound) 2- 8 type of mold damage

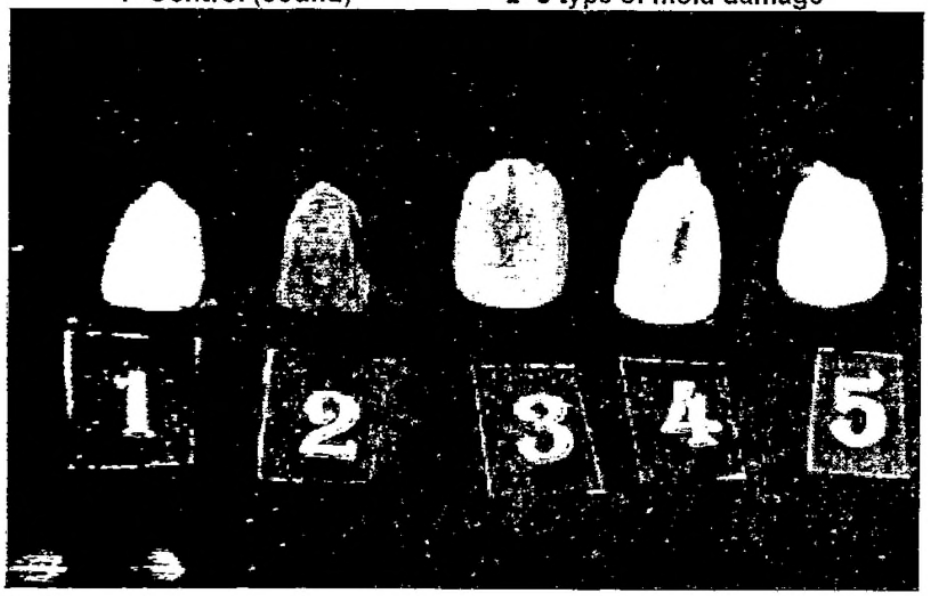

Fig. (3): Types of yellow corn grains damage
1- Control (sound) 2-Heatdamage

3-Germ damage 4- Mold damage
5- Insect damage

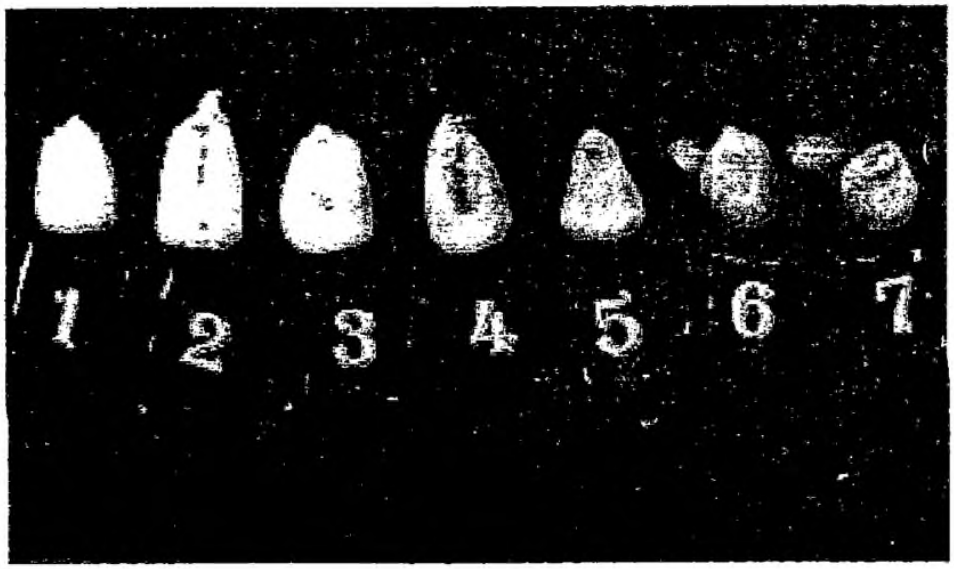

Fig. (4): Types of yellow corn grains mold
1-Control (sound) 2-7 type of mold damage

Application of some control techniques:

1-Effect of some preservatives on damage percentage at grains during storage:

Results in Tables (5A,B & C) indicated that, both preservatives i.e., thiourea and propionic acid formula (Salmo-Nil-Dry) have decreased damaged grains. It was noticed that all treated samples stored at room temperature have significantly less damaged grains compared with the untreated ones. No clear differences were noticed between treated and untreated samples after 2 and 4 months. While after 6-12 months storage, thiourea gave the best effect on stored corn grains. In this respect, grain damage percentage on balady (Menofya) reached 5.0% comparing with the un-treated one (28%) after 12 months storage while, it was on treated grains of balady (Qena) 8% comparing with the control (21%) after the same storage period. The same trend was noticed on imported corn samples as on grains treated with thiourea comparing with the untreated ones.

Regarding the effect of propionic acid formula (Salmo-Nil-Dry) on grain damage percentage, it proved to be highly effective in preventing damaged grains where, the best results were obtained after 12 months storage period on treated grains of balady (Behaira), balady (Sharkya), balady (Menofya), balady(Qena), TWC.352 (Sharkya), and Bashaaier 13 (Menofya) to be 18.9, 3.0, 6.0, 6.3, 1.6 and 1.6%, respectively comparing with untreated ones which were 30.3, 5.3, 28.0, 21.0, 3.0 and 3.0% for the same samples. On the other hand, it is also clear that propionic acid formula has

greatly decreased grain damage percentage on imported corn samples during all storage periods. These results are in agreement with Ahmed (1971), and Abdel-Reheem and Tewfic (1999) who reported that thiourea was the most effective preservative for corn grains and affected growth, aflatoxins production and infection percentage of *A.flavus* the causal agent of corn grains deterioration. Also, Bangkok,(1986), Cardone *et al.* (1992), Paeker *et al.* (1992) and White and Coates (1998) emphasized the efficiency of propionic acid in controlling storage fungi (*Aspergillus* spp and *Penicillium* spp).

Table (5A): Effect of some preservatives on deterioration percentage in locally produced corn grains stored at room temperature (20°C) for different interval periods (local varieties, Delta area).

Treatment	Storage periods (months)	Behaira		Sharkya			Menofya		Mean C	Mean B
		Balady	Taba	Balady	SC 10	TWC 352	Balady	Bashaaier 13		
Control	0	7.3	9.0	0.0	1.0	0.0	4.0	0.0	3.04	8.12
	2	11.0	13.0	0.0	1.6	0.0	7.3	0.0	4.70	
	4	16.0	16.0	1.0	3.0	0.0	7.6	0.0	6.23	
	6	16.6	15.3	2.3	3.6	0.6	8.6	2.3	7.04	
	8	18.6	16.9	3.3	4.3	1.6	13.6	2.3	8.66	
	10	28.6	19.0	4.0	8.6	2.0	25.0	3.0	12.89	
	12	30.3	23.3	5.3	10.0	3.0	28.0	3.0	13.40	
		18.34	16.07	2.70	4.59	1.03	13.40	1.09		
Thiourea	0	7.3	9.0	0.0	1.0	0.0	4.0	0.0	3.04	5.44
	2	11.0	10.0	0.0	3.0	0.0	4.0	0.0	4.00	
	4	12.0	10.0	0.0	5.0	1.0	4.3	1.0	7.76	
	6	13.0	11.3	1.0	6.0	1.0	4.3	2.0	5.51	
	8	18.0	13.0	1.0	6.0	1.6	4.6	2.3	6.64	
	10	22.0	13.3	2.0	8.6	1.8	4.0	2.0	7.67	
	12	22.0	13.0	2.0	10.0	2.0	5.0	2.3	8.04	
		15.04	11.37	0.86	6.09	1.06	4.31	1.51		
Propionic acid formula 20%	0	7.3	9.0	0.0	1.0	0.0	4.0	0.0	3.04	5.70
	2	11.0	11.0	0.0	3.0	0.0	4.0	0.0	4.14	
	4	13.0	13.0	2.0	4.0	1.0	4.0	0.0	5.14	
	6	14.0	15.0	2.0	6.0	1.0	4.0	1.0	6.14	
	8	18.0	15.0	2.0	6.0	1.0	6.0	1.6	7.09	
	10	18.0	16.0	3.0	6.0	1.3	6.0	1.6	7.41	
	12	18.9	18.0	3.0	7.0	1.6	6.0	1.6	8.39	
		14.31	13.86	1.71	4.80	0.70	7.43	0.83		

L.S.D. at 0.05 for:
Cultivars (A)= 0.358
Treatments (B)= 0.234
Periods (C) = 0.358
A x B = 0.621
A x C = 0.948
B x C = 0.621
A x B x C = 1.642

Table (5B): Effect of some preservatives on damage percentage in stored grains at room temperature for different periods

Treatment	Storage periods (months)	Assiout	Sohag		Qena		Mean C	Mean B
		Balady	Balady	SC 10	Balady	Nab El-Gamal		
Control	0	0.0	4.0	0.0	0.0	0.0	0.80	6.29
	2	3.0	5.6	0.0	1.6	0.0	2.64	
	4	3.0	10.0	1.6	5.0	0.0	4.58	
	6	4.0	11.0	2.6	12.0	2.0	6.72	
	8	4.3	12.0	4.3	18.6	3.0	9.02	
	10	4.0	12.0	5.0	19.6	6.0	9.72	
	12	5.6	12.0	5.3	21.0	6.3	10.50	
		3.41	9.51	3.30	11.10	4.07		
Thiourea	0	0.0	4.0	0.0	0.0	0.0	0.80	3.61
	2	3.0	4.0	2.0	2.0	1.0	2.40	
	4	3.0	4.6	3.0	3.0	1.0	2.92	
	6	1.6	4.6	4.0	5.0	2.0	3.44	
	8	4.3	4.6	5.0	5.3	3.0	4.44	
	10	4.3	4.6	6.0	7.3	5.4	5.38	
	12	4.3	5.0	6.0	8.0	6.0	5.86	
		2.3	4.40	3.71	4.37	2.63		
Propionic acid formula 20%	0	0.0	4.0	0.0	0.0	0.0	0.80	3.39
	2	0.0	4.0	2.0	2.0	1.0	1.80	
	4	1.0	4.3	3.0	3.0	2.0	2.66	
	6	2.0	4.6	4.0	3.3	3.0	3.38	
	8	3.3	4.6	5.3	4.0	5.3	4.45	
	10	4.0	4.6	6.0	5.6	6.0	5.24	
	12	4.0	5.0	6.3	6.3	6.0	2.52	
		2.04	4.44	3.80	3.46	3.33		

L.S.D. at 0.05 for: Cultivars(A)= 0.607 A x C = 1.604
Treatments (B)= 0.469 B x C = 1.243
Periods (C) = 0.717 A x B x C = 2.779 A x B = 1.050

Table (5C): Effect of some preservatives on damage percentage in stored grains (imported samples) at room temperature for different periods.

Treatment	Storage periods (months)	USA	Argentina	Hungary	Mean C	Mean B
Control	0	3.0	3.0	2.6	2.86	10.03
	2	8.0	4.6	3.0	3.86	
	4	9.3	9.3	8.0	8.86	
	6	9.6	12.6	10.3	10.83	
	8	14.6	13.0	12.6	13.40	
	10	15.0	13.6	14.6	14.40	
	12	15.3	13.6	15.0	14.60	
		10.68	9.96	9.44		
Thiourea	0	3.0	3.0	2.6	2.86	3.28
	2	3.0	3.0	2.6	2.86	
	4	3.0	3.0	2.6	2.86	
	6	4.0	3.6	2.6	3.40	
	8	4.0	3.3	2.6	3.30	
	10	4.3	3.3	3.0	3.50	
	12	4.9	3.9	3.6	4.10	
		3.7	3.3	2.8		
Propionic acid formula 20%	0	3.0	3.0	2.6	2.86	3 54
	2	3.0	3.0	2.6	2.86	
	4	3.0	3.0	3 0	3.10	
	6	4.9	3.0	3.0	3.83	
	8	5.0	4.0	3.3	4.10	
	10	5.0	3.6	3.3	3.96	
	12	5.3	3.6	3.6	4.20	
		4.21	3.40	3.04		

L.S.D. at 0.05 for: Cultivars(A)= 0.310 A x C = N.S
Treatments (B)= 0.309 B x C = 0.819
Periods (C) = 0.472 A x B x C = N.S A x B = N.S

Table (6) Effect of some fungicides on total damaged percentage of different varieties corn grains stored under natural conditions

Treatment		Topsin M 70							Soni 8						
Period (month)	Variety	0	2	4	6	8	10	12	0	2	4	6	8	10	12
1	Balady behena	7	7 8	9.0	9 9	10.0	10.0	11.0	7.0	8.0	9 1	11.0	13.0	13.0	15.0
2	Balady Sharkia	0 0	0.0	0.0	3.0	3 1	3.9	4.5	0.0	0.0	2.0	2.3	3.0	4.0	5.5
3	Balady Monofi.	0.0	0.0	2.0	3.0	4.0	4.5	4.8	0.0	0.0	2.0	4.0	6.0	7.0	8.5
4	Balady Sohage	0.0	0.0	0.0	0.0	0.0	0.2	1.5	0.0	0 0	0.0	0.0	0.0	2.1	2.1
5	Balady Assiout	0.0	1 0	2.0	3.0	3.0	3.9	4.5	0.0	0.0	0.0	1.0	2.1	3.5	3.9
6	Balady Kena	0.0	0.0	2.0	2.3	3.1	3.0	3.9	0.0	0.0	0.0	1.0	1.5	1.8	1.9
7	Nab El gamal Ken.	0 0	1.0	1.0	2.8	3.9	3.9	4.9	0.0	0 0	0.0	1.0	1.3	1.5	1.5
8	Mean control	2 55	4.75	7.10	9.08	11.73	15.53	17.3	3.55	4.75	7.1	4.08	11.73	15.53	17.3
9	Taba Beheria	9.0	11.0	11.0	12.0	12.0	13.0	14.5	9.0	9.0	9.0	10.0	10.5	10.5	11.5
10	Mean control	9.0	13	16.0	15.3	16.9	19.0	23.3	9.0	13	16.0	15.3	16.9	19.0	23.3
11	Sc 10 Sharkia	1.0	1.0	1.5	2.5	2.5	4.0	4.0	1.0	1.0	1.0	1.2	1.4	1.9	3.0
12	Mean control	0.5	0.6	2.3	3.1	4.3	6.8	7.5	0.5	0.6	2.3	3.1	4.3	6.8	7.5
13	TWC 352 Sharkia	0.0	0 0	0.0	0.0	1.5	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
14	Mean control	0 0	0.0	0.0	0 6	1.6	2.0	3.0	0.0	0.0	0.0	0.6	1.6	2.0	3.0
15	Bashiaa ier Mono 13	0 0	0.0	0.0	0.0	0.0	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.5	1.0
16	Mean control	0 0	0.0	0.0	2.3	2.3	3.0	3.0	0 0	0.0	0.0	2.3	2.3	3.0	3.0
17	SC 10Sohage	0 0	1.0	1.0	2.0	3.0	3.5	4.0	0.0	0.0	0.0	1 0	2.0	2.3	2.5
18	Mean control	0.5	0.6	2.3	3.1	4.3	6.8	7 5	0.5	0.6	2.3	3 1	4.3	6.8	7.5
19	USA	2 0	2 0	2.3	2.5	3.0	3.9	4.0	2.0	2.0	2.0	3.0	3.0	3.1	3.5
20	Argentina	1 0	1 0	1.0	2.0	2.1	2.5	3.0	1.0	1.0	1.0	1.0	1.0	1.5	1.8
21	Hunggary	2 5	2 5	2.5	2.5	2.5	2.5	2.5	2 5	2.5	2.5	2.5	2.5	3.0	4.5
22	Mean control	2 86	3 86	8 86	10.83	13.4	14.4	14.6	2.86	3.86	8.86	10.83	13.4	14.4	14.6

L.S.D. at 0.05 for:
Cultivars(A) = 0.485 A x C = 0.899 A x B = 0.721 Treatments (B) = 0.343 B x C = 0.611 Periods (C) = 0.458 A x B x C = 1.524

2- Effect of some fungicides on damage percentage of grains during storage

With regard to the fungicides: (Topsin M70 and Somi 8) , results presented in Table (6) indicated that , the two fungicides have fully decreased percentage of corn grains damage (mold , sprout , insect and heat damage). Each fungicide at the tested rate significantly decreased grain invasion in comparison with the control. The use of either fungicides caused the least percentage of corn grain damage specially after a storage period of 12 months.

In general, any of the tested chemicals (preservatives or fungicides) exihibited significant reduction in percentage of corn grains damage under all storage periods compared with the control (untreated). There results are in harmony with those stated by Abdel Hamid (1991), Wicke *et al.* (1992), Mahdy (1994), Eisa *et al.* (1996) and Abdel- Reheem and Tewfic (1999).

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دراسات على تدهور حبوب الذرة الشامية تحت الظروف المصرية_ نسبة التالف وبعض الطرق المستخدمة للمقاومة

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****المعمل المركزى للأغذية والأعلاف – مركز البحوث الزراعية- الجيزة**

أجريت هذه الدراسة على حبوب الذرة الشامية التى تم جمعها من بعض محافظات الدلتا (البحيرة- الشرقية والمنوفية) ومحافظات الوجه القبلى (أسيوط-سوهاج وقنا) وكذالك حبوب الذرة الصفراء المستورده من الأرجنتين والولايات المتحدة الأمريكية والمجر وذلك لدراستها تحت ظروف التخزين المصرية. يعتبر كل من محتوى الحبوب من الرطوبة وكذلك نوع الصنف من أول العوامل التى تؤثر على تواجد قطريات المخزن على الحبوب وبالتالى تأثيرها على نسبة التلف لهذه الحبوب أو تدهورها مثل تلف الجنين والتلف الحشرى والتالف حراريا. وقد زادت نسبة التالف للحبوب أو تدهورها بزيادة مدة التخزين (صفر،٢، ٤، ٦، ٨، ١٠، ١٢ شهرا) لجميع العينات المختبرة تحت الدراسة سواء المحلية منها أوالمستوردة – فزيادة مدة التخزين من شهرين إلى ١٢ شهرا صحبها زياده تدريجية فى نسبة التالف مقارنة بالكونترول . وقد زاد محتوى الحبوب من الرطوبة فى جميع العينات حتى مده تخزين ثمانى أشهر بعدها بدأت تقل تدريجيا.

وقد لوحظ تأثير بعض المواد الحافظة مثل الثيوبوريا وحمض البروبيونيك (٢٠%) عند استخدامها على الحبوب المخزونة على نسبة التالف أو تدهور الحبوب بعد المعاملة حيث حدث انخفاض معنوى فى نسبة التالف للأصناف المعاملة عن غيرالمعاملة (كنترول). فى فترة التخزين ٦-١٢ شهرا أعطت الثيوبوريا أفضل النتائج فى انخفاض نسبة التالف بينما اثبت البروبيونيك كفاءة عالية فى خفض نسبة التالف بعد فترة تخزين ١٢ شهرا وفى نفس الإتجاه سجلت الحبوب المستوردة المعاملة أقل نسبة تالف عن غير المعاملة. كما أدى استخدام المبيدات الفطرية (توبسين إم ٧٠ وسومى ٨) إلى خفض النسبة المئوية لتلف أو تدهور الحبوب بنجاح وقد أدى استخدام أى من المبيدين بالتركيز المستعمل إلى خفض معنوى لغزو إصابة الحبوب. وقد تم الحصول على أقل نسبة تالف بعد مده تخزين ١٢ شهرا من المعاملة بكل من المبيدين.