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POTENTIAL IMPACTS OF ENVIRONMENTAL CONDITIONS, POLYPHENOLIC COMPOUNDS AND TRYPSIN INHIBITOR AGAINST EAR AND KERNEL ROTS DISEASES OF MAIZE

Farahat, G. A.*; S.M. El-Moghazy* and M. A. El-Bana**
*** Plant Pathol. Res. Inst., Agric. Res. Station, Sakha, Egypt**
**** Food Tech. Res.. Inst., Agic. Res. Centr., Giza**

ABSTRACT

Visible ear rot infection (VER), frequency of associated fungi percentages and disease severity rating (DSR) of 25 maize genotypes were affected significantly by the two years . Diseases criterion were higher in the season of 2008 than 2009. VER recorded 26.67 to 46.66% and 3.00 to 11.00% , DSR were (5) and (3-4) during the two seasons, respectively, with the most infected maize ones. VER caused significant reduction of yield weight (100 kernels/ g) with most of tested maize genotypes. *Fusarium verticillioids* (*F. moniliforme)* was the most frequently isolated phytopathogenic fungus from the seeds of all maize genotypes with higher values especially in season 2008 followed by *A. niger, A. flavus* and *Penicillium sp.* The last fungi group recorded high values in 2009 than 2008. High ear rot and fungi frequency values led to significant decrease in germination, especially in the first season. Consequently, ear rot disease was affected by climatic conditions during the period of disease development in August and September for the two tested seasons, here, climatic conditions were more suitable for the disease development and its equerries was determined as recorded high temperature degrees (max) and relative humidity, especially at (13:30 O'clock).The decrement in minimum temperature degrees were clear in season 2008, where the disease increased. That mean, minimum temperature and relative humidity at 13.30 O'clock were more suitable in 2008 than 2009 and played an active role in developing ear rot disease in maize. Quality of some maize genotypes susceptible and resistant to ears and kernels rot were investigated. Results showed that, resistant maize genotypes had the highest values of ether extract, ash, fiber and carbohydrates compared with susceptible ones. On Contrast, the susceptible maize genotypes contained the highest level of crude protein compared to resistant ones. Considerable increase of total, reducing and non-reducing sugars values were recorded with the susceptible maize genotypes than these of resistant ones. On the other hand, susceptible maize genotypes contained lower total phenolics and trypsin inhibitors than the resistant genotypes. SC10 maize genotypes (resistant) had the highest amount of total phenols and trypsin inhibitor compared with other resistant and susceptible ones. In this study corn flours cv.SC10 were separately added at different levels (10,15,20,25) to wheat flour (82٪) for processing balady bread impaling were investigated. The flour were subjected to quality properties examination bread were examined organolepticaly .

The obtained results showed that the farinograph and extensogesaph results indicated that , mixing time, arrival time , dough weakening and extensibility increased with increasing the level of adding corn flours add . While stability , resistance to extension and energy decreased when compared with wheat flours control. As for organoleptic properties it was found that the over all acceptabilities were good for all the tested bread .

INTRODUCTION

Maize (*Zea mays* L.) is a cereal crop grown throughout the world. Maize plays an important role in the diet of millions of African people due to its high yields per hectare (Asawalan, 2006). In Egypt, maize is the third important grain crop after wheat and rice for human consumption, as well as for animal feeding.

Fungi are important and rank second as the causal of deterioration and loss of maize grains (Ominski *et al.*, 1994). The major genera commonly encountered on maize in tropical regions are *Fusarium, Aspergillus* and *Penicillium* (Orsi *et al.*, 2000).

Fusarium verticillioids (formally *F. moniliforme),* teleomorph *Gibberella fujikuroi* and related species that infect maize and cause ear mold and stalk rot in field grown maize worldwide, especially in warmer climates where maize as grown (White, 1999). Bulleman (1996) ,Vigier *et al.* (1997) and Desjardins *et al*. (1998) showed that, *F. moniliforme* was the major causal agent of symptomless, better competition and predominantly responsible for ear rot of maize which fuminisns (FBS) toxin can be present and accurately toxic to certain livestock i.e. horses and swine and have carcinogenic properties in rates, animals and humans. In addition to, Wicklow (1988) and Essien (2000) showed that, *F. moniliforme* has been found to be most wide spread and most frequent in preharvest maize followed by *Aspergillus flavus, A. niger* and other molds (*Alternaria* and *Rhizopus*), these fungi can cause diseases in the field and known for production of toxic metabolites. Furthermore, Tolba and Soad El-Sayed (2002) showed that , colonization by these fungi led to reduction in germination and decrease of 100 kernels weight. Igawa *et al.* (2007) added that, maize was subjected to ear rot caused by toxigenic *Aspergillus* and *Fusarium* species, resulting in contamination with aflatoxins, fumonisins, trichothecens and zearalenone.

Environmental factors played a major and largely uncharacterized role in indefence of maize against FB production by *F. verticilliods* (Shelby *et al.*, 1994). Vigier *et al.* (1997) added that, both *F. gramenarum* and *F. subglutinos* required cooler temperature did not exceed 25^{o}C and a higher water activity, this could explain the lower disease severity symptoms with *F. verticillioids which* grows well at higher temperature and ear rot are associated with drought and insect stress, Miller (2001) . Murphy and Rice (1993) added that, *Fusarium* allowed heavy colonization in heat and high humidity.

Phenolics in grain had been implicated in resistance to ear rots and insects of maize (Classen *et al.*, 1990). The majority of grain phenolics are located in outer layers of the grain ie. percarp ,aleurone and germ (Sen *et al.*, 1994). Chen *et al.* (2007) founded that, antifungal trypsin inhibitor proteins was upregulated twofold or higher in resistant maize lines compared with susceptible ones. Many research groups have validated the role of plant trypsin inhibitors (TI) as mean of plant defense against fungal infection (Baker *et al.*, 2009). The work to be described here was performed to figure out :a- Maize genotypes reactions against ear and kernels rots causal organisms studied under natural infection . b- the role of poly phenolic compounds contents and trypsin inhibitor on disease resistance .c- to identify new sources of maize genotypes to disease resistance to used of different blends for production bread.

MATERIALS AND METHDOS

Material :

The present work was carried out at the experimental farm of Sakha Agric. Res. Station during 2008 and 2009 growing seasons. Grain of pure maize single crosses (SC) viz. SC10, 11, 12, 122, 123, 124, 125, 128, 129, 155,162, 166, three way crosses (TWC) viz, TWC310, 311, 314, 320, 321, 322, 323, 324, 327, 329, 351, 352 and open pollinated variety Giza 2 (G2). Randomized complete block design with three replicates was used. Each plot included two rows 6 m long at 75 cm distance and sown by 3-5 grains/hill, thinned to one plant/hill after three weeks. The experiment was carried out during two successive seasons 2008 and 2009 under natural infection. All cultural practices were applied at the proper time. Ear rot disease was recorded after harvesting directly/plot in the field as illustrated scale of (Raid *et al.* 1996) as follows:The severity of ear rot symptoms was evaluated using a 7 class rating scale were 1= 0%, 2=1-3%,3=4-10%, 4=11-25%, 5=26-50%, 6=31-75% and 7=>75% of kernels exhibited visible symptoms of infection such as rot and mycelial growth. Weight of 100 kernels (g) (healthy and infected) for each genotype were recorded.

Material :

a-Isolation of associated fungi of 25 maize genotypes kernels:

Randomized samples (3 ears) was collected for each maize genotypes, transported to the laboratory in a separate paper bags, air dried and stored at laboratory temperature. To isolate different fungal pathogens causing ears and kernels rot, standard blotter test method of **ISTA (1993)** was used to record percentage of germination and frequency of each isolated fungus for each maize genotype.

b- Effect of environmental conditions of ears and kernels rot development in the field:

To accurately determine the effect of temperature (max. and min.) degrees, relative humidity (RH% at 7.30 and 13.30 O'clock) and pan evaporation on ears and kernels rot severity development, meteorological data of these parameters throughout the season study from Rice Res. Training Center at Sakha Agric. Res. Station. The parameters were recorded during the period of July to October in the two years, where the infection were done from the silk appearance (flowering) until the maturation of kernels and ears as shown in Table (3).

c- Chemical composition of maize samples:

Grains samples of SC12, SC10 and SC162(resistant) and TWC321, TWC323 and Giza 2(susceptible) were taken at random from each metallic screen genotype and ground to fine powder to pass through 2 mm mesh for chemical analysis, i.e. … Moisture content, crude protein (N% x 5.95), fat, ash and fiber were determined according to the procedures of A.O.A.C. (1990) and expressed as a percentages of the dry weight of the sample.

d-Total carbohydrates (%):

Total carbohydrates content of maize was determined by James (1995) method.

e-Reducing, non-reducing and total sugars:

Reducing and total sugar content of maize were determined according to Sadasivam and Manickam (1992) method. Non-reducing sugar was calculated by subtracting the above mentioned two components.

f-Extraction of polyphenolic compounds:

Polyphenolic compounds were extracted by soxhlet method for 6 hours using 10 gm of each defatted maize samples and 200 ml methanol solvent. The crude solvent extracts were filtrated through filter paper (Whatman No. 1). Then dried using vacuum rotary evaporator at 45^{o}C. The dry residues were weighted to calculate the yield (Abd El-Sattar, 2006**).**

g-Total polyphenolic compounds: Total polyphenolic compounds were determined according to Gufinger method (1981).

h-Trypsin inhibitor activity (T1A): Trypsin inhibitor activity was determined using the method of Kakade *et al.* (1969) and expressed as the number of units inhibited per gram dry matter. One unit is arbitrarily defined as an increase of 0.01 absorbance unit at 280 min in 20 min per 10 ml of reaction mixture.

i-Rheological properties of dough and Organoleptic quality of balady bread :

One superior genotype cv, SC10 was chosen form the different samples to prepare wheat flour then study the rheological properties of dough and Organaleptic of balady bread .

The characteristics of dough prepared from corn flours at different levels (10,15,20,25%) were separately added to wheat flour (82%) and measured by mean of farinagraph and extensagraph according to the methods described by A.A.C.C (1995) . Traditional baking and modified methods were carried out according to Abd El –Rahim *et al.* (1999) .Organaleptic evaluation was carried out according to Abd El – Rahim (1992) by 10 panalest well trained panelists and the average score for each character was calculated . Wheat flour (82% extraction) , fresh bakery compressed yeast and salt (sodium chloride) were obtained from local market of Kafr El- sheikh Governorate , Egypt .

The laboratory investigations were carried out at the Plant Pathology and Food Technology Research. Institutes.

Statistical analysis:

Data were analyzed statistically using the analysis of variance and the means were further tested using the least significant difference test (LSD) as outlined by Steel and Torrie (1980)

RESULTS AND DISCUSSION

Data presented in Table (1) showed that, year effects were significant, so the data could not be pooled and were analyzed separately by year. Disease severity rating (DS) for 25 genotypes were generally higher in 2008 than 2009, especially for SC123, 124, 125, 129, 166, TWC311, 321, 323, 329 and G2. Its recorded DSR (5) and infection percentage 26.67 to 46.66%. The most resistant ones in SC12 and 166. In the reverse, the most susceptible ones i.e. G2 followed by TWC 321 and 323 in season 2008. DS rating in 2009 ranged from 2-4 and infection percentage from 1.07 to 11.00 (with TWC314). Ear rot disease caused significant effect of yield weight (100 kernels, g),most of tested maize genotypes recorded a positive effect in reducing % of 100-kernels weight. The most effective ones TWC 323 and G2 (32.55 and 30.27%) followed by SC122 and 123, while SC11, TWC322 and327 recorded the least reducing weight percentage. The remaining of other tested genotypes recorded reduction percentages ranged from 13.02 to 25.28. The results in the same line of White (1999), Tolba and Soad El-Sayed (2002). Kossoa and Aho (1993) reported that fungi could cause about 50-80 of damage on farmers maize if conditions are suitable for their development. Ominski *et al.* (1994) added that fungi are an important and rank second as the cause of deterioration and loss of maize.

Isolation of associated fungi of 25 maize genotypes:

Results in Table (2) showed that *Fusarium miniliforme, Fusarium sp., A. niger, A. flavus, Pencillium sp.* and other fungi (*Nigrospora oryzae, Alternaria sp., Helminthopsorium sp., Mucor sp., Rhizopus sp.* and *Aspergillus sp*.) were associated of most different maize genotypes seeds and isolated by planting seeds on PDA medium ,the most prevailing fungal genera were *F. moniliforme* followed by *A. flavus, A. niger* and *Penicillium sp*. during growing seasons 2008 and 2009. It is evident from the data that, *F. moniliforme* was the most frequently isolated phytopathogenic from the seeds of all maize genotypes used in this study, it was recorded frequency percentage 72.90% (mean) in 2008 and 47.50% (mean) in 2009. The infection counts of other most prevailing fungi were generally high in the second season than the first. These ranged from in mean 3.64% to 18.50% across the genotypes and years. As to germination percent, the data showed that, significant differences between the used genotypes. The highest percentage was recorded with SC123, 124 and 125 in 2009 and SC11 and TWC352 in 2008. The lowest percent was recorded with SC166 and TWC323 in 2008. High frequency of associated fungi, especially *F. moniliforme, A. niger, A. flavus* as well as visible ear rot percent led to significant decreasing in germination percentage, especially in season 2008 with most of tested maize genotype. The last two fungi recorded high frequency in 2009 than 2008. The results are in agreement with Bulleman (1996) and Tolba and Soad El-Sayed (2002) they showed that *F. moniliforme, Penicillium* sp., *A. flavus* and *A. niger* were colonist of maize ears led to a reduction in germination and played an active role in the deterioration of kernels and

Table (1): Visible ear rot percentage, disease rating and yield of 25 maize genotypes under natural infection during 2008 and 2009 growing seasons.

Genotypes	2008		2009		Weight of 100 kernels (g)		
	Inf. %	DSR.	Inf. %	DSR.	Infected	Healthy	Losses %
SC10	18.3 a-f	4	1.66 abc	2	30.45 c	39.55 d	23.01
SC11	21.66 b-g	4	3.33 abc	2	34.45 d	37.55 c	8.25
SC12	9.33 a	3	2.00 abc	2	35.05 e	40.55	13.56
SC122	25.33 d-i	4	1.07 a	2	29.55 a	40.05 e	26.22
SC123	27.33 f-i	5	3.00 ab	2	30.55 c	40.05 e	26.22
SC124	16.66 a-d	4	2.33 abc	2	30.05 b	40.05 e	24.96
SC125	30.00 ab	5	8.67 fgh	3	30.05 b	39.55 d	24.02
SC128	14.33 ab	4	2.66 abc	2	29.55 a	39.55 d	25.28
SC129	26.67 e-i	5	8.00 efg	3	30.05 b	35.05 b	14.26
SC155	17.66 a-e	4	4.00 cd	3	35.05 e	40.55 f	13.56
SC162	10.66 a	3	2.33 abc	2	30.05 b	40.05 e	24.96
SC166	31.00 hij	5	6.67 ef	3	30.05 b	34.55 a	13.02
TWC310	22.66 b-h	4	10.33 hi	3	34.45 d	45.05 h	23.53
TWC311	33.33ij	5	3.66 bc	2	34.55 d	40.05 e	13.73
TWC314	31.66 hij	5	11.00 i	4	34.55 d	45.10 h	23.39
TWC320	24.00 c-h	4	6.00 de	3	40.05 g	49.55 i	19.17
TWC321	37.33 j	5	6.0 de	3	30.05 g	40.05 e	24.96
TWC322	15.66 abc	4	9.00 ghi	3	40.05 g	45.10 h	11.19
TWC323	36.66 j	5	8.00 efg	3	30.05 b	44.55 g	32.55
TWC324	21.33 b-g	4	4.00 cd	3	35.05 e	45.10 h	22.28
TWC327	15.66 abc	4	2.76 abc	2	35.05 e	39.55 d	11.38
TWC329	33.33 ij	5	10.66 hi	3	39.35 f	49.55 i	20.48
TWC351	15.33 abc	4	1.37 ab	2	30.05 b	40.05 e	24.96
TWC352	16.66 a-d	4	2.17 abc	2	30.05 b	35.07 b	14.31
G2	46.66 k	5	8.00 fgh	3	34.55 d	49.55 i	30.27

Inf % = Infection

DSR . disease severity rating as scale adopted by Reid *et al.* (1996) the influence will extend to human and animal who depend on maize in their food and feed.

The max. temperature degree and relative humidity at 13.30 O'clock was higher during disease conspicuous period (August-September) as shown in Table (3). The reverse was true with pan evaporation during the season of 2009. The decrease in min. temperature degrees were clear in 2008 which the high ear rot and frequency of associated fungi were recorded. That means, min. temperature degrees and relative humidity at (13.30 O'clock) play an active role in causing of ear rot disease in maize.

Grand mean of min. temperature degrees during August and September were 16.3 and 15.3 (suitable) in 2008, 19.0 and 19.0 in 2009. Average min. temperature degrees were 14.5 (suitable for disease development) and 18.6, respectively, in the two seasons. The results were supported by the findings of White (1999) and Miller (2001), they showed that *F. moniliforme* grows well at higher temperature (warmer limits) and ears rot are associated with drought and insect stress. Moreover, Shelby *et al.* (1994) added that environmental factors play a major and largely uncharacterized role in indefence of maize against *F. verticilliods* infection. The results in the same time of Murphy and Rice (1993) and Reid *et al.* (2002).

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Chemical composition of some resistance and susceptible maize grain genotypes:

Chemical composition of the resistant and susceptible maize grain genotypes are presented in Table (4). Data indicated that susceptible maize genotypes Giza 2 contained the highest content of crude protein (12.8%) followed by the susceptible TWC321 (12.6%), while the lowest resistance was SC10 (11.5%). The increment of total protein in the count of infection could be attributed to the contribution of the causal agent. On the other hand, the increase in total protein may be due to the consumption of sugars and/or carbohydrates of the host by pathogen (Tolba and Soad, 2002).

Table (3): Grand mean temperature, relative humidity (RH) and pan evaporation (PE) during the growing season 2008-2009 from July to September at Sakha Agriculture Research Station.

Season	2008					2009				
Month	Temperature ^{o}C		RH%		PE	Temperature ^{o}C		RH%		PE
	Max.	Min.	7:30	13.30	(mm)	Max.	Min.	7:30	13.30	
Jul.	32.0	15.7	80.0	55.7	674	33.0	20.2	80.0	50.6	726
Aug.	33.0	16.3	83.2	56.0	653	32.4	19.0	81.5	51.0	681
Sept.	33.5	15.0	77.3	47.7	608	32.5	19.0	77.1	46.0	635
Oct.	28.0	11.0	70.0	50.0	410	30.3	16.2	75.5	48.0	425
Average	31.63	14.50	77.63	52.35	587.5	32.05	18.61	78.50	48.90	616.75

Max. = Maximum, Min. = Minimum, PE = Pan evaporation,
RH% = Relative humidity

Table(4): Chemical composition (%) of some resistant and susceptible maize grain genotypes.

Genotypes / Constituents	Resistant			Susceptible		
	SC10	SC12	SC162	TWC321	TWC323	Giza 2
Moisture	11.42 d	12.31 c	12.21 c	12.50 b	12.80	12.86 a
Protein	11.50 e	12.20 c	11.90 d	12.50 b	12.60 b	12.80 a
Ether extract	5.10 a	4.72 b	4.83 b	4.65 c	4.53 d	4.39 d
Ash	1.46 a	1.35 b	1.50 a	1.26 b	1.11 c	1.13c
Crude fiber	2.33 a	2.10 a	1.90 b	1.85 b	1.55 d	1.71 c
Total carbohydrates	79.11 a	78.86 b	78.62 c	78.45 d	78.31 d	78.19 e

In the same row, means followed by the same letter are not significantly different at P<0.05
Each value was an average of three determinations

The data in the same table revealed that, the resistant maize genotype SC10 had the highest ether extract (5.1%) compared with the other maize genotypes. The highest content of ash was recorded for the resistant maize genotype SC162 (1.50%), while the susceptible maize genotypes TWC323 had the lowest value (1.11%). Results also revealed that susceptible maize genotypes show decrease in their fiber content compared with resistant maize genotypes. These results are in accordance with those of Fahim *et al.* (1982) and Tolba and Soad (2002) who reported that the decrease in crude ash may be due to the colonization of some ear rot fungi especially *A. niger*, which led to increase of cellulytic activity. The highest carbohydrates content was found in resistant maize genotypes SC10 (79.11%) compared with the susceptible maize genotypes TWC323 which had the lowest content (78.31%). These results may be due to colonization of seed rot fungi which led to decrease carbohydrate content in most cases (Ghosh and Nadi, 1986 and Purushotham *et al.*, 1996).

Total, reducing and non-reducing sugars content:

Total reducing and non-reducing sugars content are presented in Table (5). From this table, it should be noted that, considerable increase of total, reducing and non-reducing sugars were recorded for all susceptible maize genotypes compared with resistant maize genotypes. Hence, susceptible maize genotypes Giza 2 contained the highest amount of total and reducing sugars (3.25 and 1.52%), respectively, among all of the tested maize, where, resistant genotype SC10 had the lowest values (2.3 and 0.9%), respectively.

These results are in harmony with those of Prasad *et al.* (1988) and Badr *et al.* (1997) who reported that *A. flavus* stimulated the hydrolysis of starch and protein producing extracellular amylase, protease and lipase enzymes.

Table (5):Total, reducing and non-reducing sugars (%) of different genotypes of maize.

Genotypes	Total sugars	Reducing sugars	Non-reducing sugars
Resistant			
SC10	2.30 e	0.90 d	1.40 c
SC12	2.83 c	1.21 c	1.62 b
SC162	2.56 d	1.10 c	1.55 c
Susceptible			
SC321	3.03 b	1.10 c	1.93 a
TWC323	3.17 a	1.32 b	1.85 a
G2	3.25 a	1.52 a	1.73 b

In the same column, means followed by the same letter are not significantly different at $P<0.05$. Each value was an average of three determinations .

Extracted yield, Total phenolic compounds and trypsin inhibitor content of maize genotypes:

Total phenolic compounds extracted from different maize genotypes using solvent methanol then the total phenolic extract yields were showed in Table (6). From this table, it was observed that resistant maize genotype SC12 had the highest yield among of total phenolic yields (10.8%), while the lowest yield from total phenolic compounds was (9.61%) from susceptible maize genotype SC321. Apparent also from the same table that, susceptible maize genotypes contained lower total phenolics than that of resistant maize genotypes. These results are in agreement with those reported by Badr *et al.* (1997) and Bily *et al.* (2003) who reported that significant negative correlation were found between disease severity and fenolic acid content. Also, Kostandi (1979) and Nazim *et al.* (1990) found that, susceptible maize lines and hybrids were characterized by lower level of total and free phenols than the resistant ones.

It is apparent also from the same table that, resistant maize genotypes show increase in their trypsin inhibitor content compared with susceptible maize genotypes. The resistant maize genotype SC10 had the highest amount of trypsin inhibitor (0.48 T.V/mg), while the lowest value was found in Giza 2 (susceptible) (0.32 T.V/mg)These results are in accordance with those of Koeppe *et al.* (1985), Habib and Fazili (2007) and Chen *et al.* (2007) who found that antifungal trypsin inhibitor proteins was upregulated twofold or higher in resistant maize lines compared with susceptible ones.. The results of this study have implication for maize breeding program.

Table (6):Yield ,total phenolic and trypsin inhibitor contents from some maize genotypes.

Genotypes	Extract yield (%)	Total phenols (mg/g)	Trypsin inhibitor (T.U/mg)
Resistant			
SC10	9.90 b	0.25 a	0.48 a
SC12	10.80 a	0.26 a	0.47 a
SC162	10.51 a	0.25 a	0.45 a
Susceptible			
SC321	9.61 b	0.17 b	0.33 b
TWC323	10.32 a	0.13 b	0.35 b
G2	10.00 a	0.15 a	0.32 b

In the same column, means followed by the same letter are not significantly different at P<0.05 . Each value was an average of three determinations.

Rhealogical properties of dough from different formulas were measured by farinograph and extensograph and the results are given in table (7).The results revealed that mixing corn with wheat flour caused a slight decreased in the water absorption of the dough . Furthermore , it was observed that dough development (mixing time) , arrival time , dough weakening and extensibility increased with increasing the addition amount of corn flours while stability our finding are coincided with those of (Asad, 2001 and Rizk, 2004), resistance to extension and energy decreased when compared with wheat flours (control). Dough stability had been attributed to protein poor in sulfhydryl groups, which normally caused a softening or degradation action of the dough (Abd El-Rahman and Abd El-Hady, 2008) .

The obtained Organoleptic qualities of the tested balady bread from mixtures of wheat flours and corn flour showed in table (8). Data showed that the overall acceptability is fancy for all the tested bread . Furthermore , the control sample which contain (100%wheat flour) recorded highest value (93) . While, the lowest overall a acceptability recorded for sample contain (75%wheat flour and 25% corn flour), these results are in agreement with those of Mohsen *et al*. (1997) and Rizk (2004) they found that , addition of corn flour at 10% level caused almost slightly effect on the produced bread.

Conclusion

From the obtained results it can be concluded that ,breeders of maize produced genotypes contain of high amounts of trypsin inhibitor and total phenols to safe control of maize ear and kernel rots diseases instead of using conventional synthetic fungicides which caused environmental pollution , hazards of general health of human and animals.

Table (7): Effect of addition of corn flour as partial substitute to wheat flour (82%extract) on farinograph and extensograph parameters

Parameters / Blends	Farinograph					Extensograph			
	Water absorption%	Arrival time (min)	Dough development (min)	Stability time (min)	Weake--ning dough (B.U)	Resistanceto extension (B.U)	Extensi–bility (mm)	Propor- tional number	Energy (cm^2)
100%wheat	57.6	2.0	1.0	5.5	65	310	125	2.5	82.5
90%wheat flour +10% corn flours	55.5	2.5	1.0	5.0	65	300	130	2.1	75.5
85% wheat flours +15% corn flours	54.5	3.0	1.5	4.5	70	290	135	2.05	75.5
80 % wheat flours +20% corn flours	54.0	3.5	2.2	4.0	80	280	140	1.8	66.5
75% wheat flours +25% corn flours	53.6	4.0	2.5	4.0	90	270	145	10.6	60.5

In the same column, means followed by the same letter are not significantly different at P<0.05

Each value was an average of three determinations

Table (8): Oraganoleptic qualities of the tested balady bread from mixtures of wheat flour (82% extract) and corn flour .

Properties	Loaf rising	Crust quality	Crust colour	Crumb uniformity	Crumb colour	Odor	Taste	Overall acceptability
Source	**10**	**10**	**10**	**10**	**25**	**10**	**25**	**100**
100% wheat flour	10	9	9	9	22	10	24	93
90% wheat flour +10% corn flour	9	9	9	8	22	9	23	89
85% wheat flour +15% corn flour	8	8	9	8	22	9	23	88
80% wheat flour 20% corn flour	8	7	8	8	21	9	22	86
75% wheat flour 25% corn flour	7	7	8	7	20	9	20	81

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التأثيرات المحتملة للظروف الجوية والمركبات الفينولية ومثبط التربسين ضد مرض أعفان الكيزان والحبوب فى الذرة الشامية

جمال البسيونى فرحات* ، سليمان محمد المغازى* ، محمد أحمد البنا**
*** معهد بحوث أمراض النبات - مركز البحوث الزراعية - سخا - مصر**
**** معهد بحوث تكنولوجيا الأغذية - مركز البحوث الزراعية - مصر**

أجريت هذة الدراسةبهدف1- التعرف على تأثير التراكيب الو راثية على الاستجابة لاعفان الحبوب والكيزان فى الذرة الشامية و دراستها تحت العدوى الطبيعية.2-دور المركبات الفينولية و مثبط التربسين فى مقاومة المرض.3- التعرف على تراكيب وراثية للذرة مقاومة للأمراض واستخدامها فى خلطات لأنتاج الخبز.

و أظهرت النتائج ما يلى:

يوجد اختلاف معنوي فى نسبة الإصابة بعفن الكيزان الظاهري وفى نسبة عدد الفطريات وفى الشدة المرضية فى 25 تركيب وراثى من الذرة الشامية متأثر بالسنوات لذا فالنتائج سوف تحلل كل عام على حده. مقاييس المرض كانت عالية فى موسم 2008 عن 2009. العفن الظاهرى تراوح من 26.67 إلى 44.66% والشدة المرضية 5 ، 3-10.66% فى حالة الشدة المرضية (3-4) لكلا الموسمين على التوالى مع أصناف الذرة الأكثر إصابة. تسبب العفن الظاهرى فى الكيزان فى خفض وزن المحصول معنويا (100 حبة بالجرام) مع معظم أصناف الذرة المختبرة.

فطر *Fusarium verticillioids* سجل اكبر عدد تم عزله من كل تراكيب حبوب الذرة الشامية وبقيم عالية خصوصا فى موسم 2008 متبوعا بفطريات *Pencillium* spp., *A. niger, Aspergillus flavus*. المجموعة الأخيرة من الفطريات سجلت نسب عالية فى موسم 2009 عن 2008. القيم العالية لعفن الكيزان والعدد الفطرى أدى إلى إنخفاض معنوى فى الإنبات خصوصا فى الموسم الأول.

تأثر مرض عفن الكيزان بالظروف الجوية خلال فترة تطور المرض فى شهرى أغسطس وسبتمبر فى الموسمين هذا يعنى أن الظروف الجوية كانت أكثر ملائمة لتطور المرض يظهر ذلك فى درجات الحرارة العظمى والرطوبة الجوية خصوصا عند الساعة 13.5. انخفاض درجات الحرارة الدنيا كان واضحا فى موسم 2008 حيث كان المرض مرتفعا. هذا يعنى أن درجة الحرارة الصغرى والرطوبة الجوية عند الساعة 13.5 كانت أكثر ملائمة فى موسم 2008 عن 2009 وتلعب دورا حيويا فى حدوث عفن الكيزان فى الذرة الشامية.

كما تمت دراسة الجودة لبعض التراكيب الوراثية للذرة الشامية الحساسة والمقاومة لمرض عفن الكيزان والحبوب وأوضحت النتائج ما يلى: الأصناف المقاومة للمرض أعطت قيم عالية فى المستخلص الإيثيرى والرماد والألياف وكذلك الكربوهيدرات مقارنة بالأصناف الحساسة للمرض. وعلى العكس كانت الأصناف الحساسة تحتوى على كمية عالية من البروتين مقارنة بالأصناف المقاومة.كذلك وجد زيادة للسكريات الكلية المختزلة والغير مختزلة للأصناف الحساسة عن الأصناف المقاومة.

إضافة لما سبق الأصناف الحساسة تحتوى على كمية قليلة من المركبات الفينولية ومثبط إنزيم التربسين مقارنة بالأصناف الحساسة. هجين فردى 10 وهو مقاوم يحتوى على كمية عالية من البولى فينول ومثبط إنزيم التربسين عند مقارنته مع التراكيب الأخرى الحساسة للمرض.

تم إجراء مقارنة بين أنواع الخبز البلدي الناتج عن إضافة دقيق الذرة الشامية لهجين فردى 10(مقاوم) إلى دقيق القمح البلدي بنسبة (25،20،15،10٪)وتمت دراسة الخلطات الناتجة على الصفات الطبيعية للدقيق الناتج على جهازي الفارينوجراف والاكستنسوجراف أن إضافة دقيق الذرة الشامية إلى دقيق القمح يؤدى إلى زيادة كلا من زمن الخلط وزمن الوصول وضعف العجينة والانسيابية بينما أدت لتناقص لثبات والمطاطية والطاقة كما أصبح من الاختبارات الحسية أن جميع أنواع الخبز الناتجة من الخلطات عالية الجودة .

من نتائج هذه الدراسة ينصح الأتي:أن يقوم مربى الذرة الشامية بإنتاج تراكيب وراثية تحتوى على كميات كبيرة من مثبط إنزيم التربسين و المركبات الفينولات وذلك للمقاومة الآمنة لمرض عفن الكيزان والحبوب بدلا من استخدام المبيدات التي تسبب تلوث للبيئة بجانب خطورتها على الصحة العامة للإنسان والحيوان0

قام بتحكيم البحث

أ.د / السيد عبد المجيد فيظ الله	**كلية الزراعة – جامعة المنصورة**
أ.د / عادل خميس غازى	**كلية الزراعة – جامعة كفر الشيخ**

Table (2): Isolation of associated fungi percentage of certain maize genotypes during seasons 2008 and 2009

Genotypes	Associated fungi percentage 2008							Associated fungi percentage 2009						
	F.m	F.sp	A.n	A.f	P.sp	Other	Ger.%	F.m	F.sp	A.n	A.f	P.sp	other	Ger%
SC10	51.2	4.7	11.6	25.6	18.6	0.0	87.05 f	66.0	4.3	0.0	19.1	6.4	4.3	90.10 i
SC11	63.4	2.6	8.1	7.2	14.3	4.5	96.05 o	55.7	8.2	9.8	4.9	14.8	6.6	93.10 g
SC12	49.5	1.9	16.2	14.3	15.2	2.9	90.10 i	68.4	5.3	5.3	13.2	5.3	2.6	94.10 h
SC122	71.6	6.8	4.5	4.5	10.2	2.3	93.10 l	47.4	5.3	1.3	25.0	21.1	0.0	88.10 b
SC123	67.5	1.2	8.8	1.8	18.8	2.5	87.20 f	54.0	4.0	6.0	22.0	4.0	10.0	97.05 k
SC124	60.0	0.0	1.1	25.6	5.6	7.7	89.50 h	49.2	1.6	6.6	29.5	9.8	3.3	96.85 k
SC125	74.4	1.3	0.0	0.0	21.8	2.5	88.10 g	38.0	8.5	15.5	14.1	11.3	12.7	97.10 k
SC128	84.8	1.5	1.5	4.5	4.5	3.0	92.10 k	17.1	2.4	48.8	25.6	3.7	2.4	93.10 g
SC129	72.9	5.6	2.8	1.9	14.1	2.8	90.10 i	38.1	3.6	16.7	35.7	2.4	3.6	90.03 c
SC155	48.4	1.2	5.5	9.9	34.1	1.4	90.10 i	45.9	2.1	14.3	21.4	12.2	4.1	94.10 e
SC162	86.8	1.2	1.2	1.4	0.0	8.8	87.10 f	38.8	5.9	8.2	25.9	8.2	12.9	96.10 j
SC166	66.3	10.2	1.1	1.1	13.3	8.2	80.10 a	37.4	2.2	16.5	22.0	16.5	5.5	96.15 j
TWC310	76.0	2.7	0.0	1.4	1.4	18.6	81.10 b	60.0	13.3	0.0	13.3	13.3	0.0	93.10 g
TWC311	83.9	.5	4.9	6.2	2.5	0.0	83.10 c	647	2.9	5.9	14.7	5.9	5.9	93.10 g
TWC314	64.2	7.5	0.9	1.9	22.6	2.8	94.10 m	65.1	2.3	0.0	25.6	2.3	4.7	93.10 g
TWC320	83.9	1.6	4.8	6.5	3.2	0.0	88.10 g	41.1	2.7	4.1	41.1	9.6	1.4	90.10 e
TWC321	90.2	2.8	0.0	1.4	2.8	2.8	85.10 d	27.7	3.2	31.9	26.6	0.0	6.4	91.10 e
TWC322	80.8	10.5	1.3	5.2	0.0	0.0	94.10 m	56.3	2.5	17.5	13.8	6.3	5.0	91.15 e
TWC323	82.5	3.2	3.2	1.6	1.6	7.9	80.10 g	38.8	2.4	35.3	5.9	8.2	9.4	90.10 c
TWC324	83.3	4.2	0.0	4.2	4.2	4.2	94.10 m	28.3	3.0	40.4	11.1	12.1	5.1	90.60 d
TWC327	80.8	7.7	6.4	2.6	2.6	0.0	86.10 e	46.7	8.0	17.3	4.0	6.7	16.0	95.01 i
TWC329	81.3	5.2	3.1	3.1	5.2	2.1	91.10 j	41.0	7.7	3.8	32.0	14.1	9.0	87.10 a
TWC351	6984	2.1	3.1	3.1	22.4	0.0	90.00 i	647	7.8	2.0	7.8	15.7	2.0	93.01 g
TWC352	75.5	3.9	1.0	7.8	3.9	7.8	98.10 p	52.0	6.5	0.0	5.2	31.2	5.2	92.10 f
G2	75.0	0.0	0.0	2.8	19.4	2.8	89.10 b	45.0	8.0	18.0	4.0	14.0	13.0	89.10 b
Mean	72.9	3.68	3.64	5.8	10.8	3.16		47.5	4.92	13.0	18.5	10.2	5.85	

F.m = *F. moniliforme*, F.sp: *Fusarium* sp., A.n: *A. niger*, A.f: *A. flavus*, Psp: *Penicillium* sp., ger: germination.