J. Plant Prot. and Path., Mansoura Univ., Vol. 6 (9): 1285 - 1295, 2015

GRAIN YIELD AND QUALITY OF SOME EGYPTIAN WHEAT VARIETIES AS INFLUENCED BY POWDERY MILDEW INFECTION

Hasan, M.A.[1] and Abeer Elhalwagi[2]

[1] Plant Pathology Research Institute, Agricultural Research Center, Giza, Egypt

[2] National Gene Bank, Agricultural Research Center, Giza, Egypt

ABSTRACT

Wheat powdery mildew caused by *Blumeria graminis* f. sp. *tritici* has recently assumed significance affecting wheat production under Egyptian conditions. Relationship between yield reduction and grain quality and the disease were studied during 2012/13 and 2013/14 growing seasons at Gemmeiza Agricultural Research Station on 9 wheat varieties i.e. Sakha 93, Giza 168, Gemmeiza 7, Gemmeiza 9, Gemmeiza 10, Gemmeiza 11, Misr 1, Misr 2 and Sids 12. Disease severity was 4.33 % to 41.66 % in 2012/13, 8.33 % to 51.66 % in 2013/14. Area under disease progress curve (AUDPC) was found to be correlated with powdery mildew severity during the two growing seasons. The highest loss in 1000 kernel weight was recorded on Sakha 93. On the other hand, Sids 12 showed the lowest loss during 2012/13 (1.13%), whereas Misr 2 showed the lowest loss in 2013/14 season (1.2%). Regarding the effect of the disease on grain quality, the highest increase in protein content was observed on Sakha 93(14.14% -15.85%) ,whereas Giza 168 showed the least increase in protein content .The most affected wheat cultivar in carbohydrate content was found in Gemmeiza 7 (6.64%). Increase % in wet gluten content varied from season to season, Gemmeiza 11 exhibit the highest value , whereas Giza 168and Sakha 93 revealed the least change.

Keywords: Wheat, *Blumeria graminis* f. sp. *tritici*, disease severity, AUDPC, crop losses.

INTRODUCTION

Wheat is an important cereal crop in Egypt and all over the world. It is a staple food crop and also known as “king” of the cereals (Laghari *et al*., 2010). Powdery mildew caused by *Blumeria graminis* (DC.) E.O. Speer f. sp. *tritici* Em. Marchal (*Bgt*), is one of the most devastating diseases of wheat worldwide especially under cool climates (Bennett, 1984). Disease severity depends on many factors including cultural practices, weather conditions and the degree of cultivar susceptibility (Fried *et al*., 1979). Powdery mildew infection reduces supply of photosynthesis and nitrogen re-translocation from leaves thus affecting yield components (Fried *et al*., 1979; Bowen *et al*., 1991).

Generally, the yield losses depend on the stage of plant growth when infection accurse (Griffey *et al.*, 1993).Development of resistant varieties is the most effective, economically and environmentally friendly approach for disease control (Alam *et al*., 2013). The most common breeding strategy has been the use of major genes conferring hypersensitive types of resistance,

but the effectiveness of this approach has commonly been ephemeral due to frequent changes in the pathogen population .

The main objective of this study was to determine the effect of powdery mildew on wheat grain yield and flour quality in the tested in nine Egyptian wheat varieties.

MATERIALS AND METHODS

The experiment was carried out at Gemmeiza Agricultural Research Station during 2012/13 and 2013/14 growing seasons under natural infection of powdery mildew. The experimental design was split plot design with three replicates. The main plots were devoted for fungicide treatment (with& without) while the split plots were devoted for tested varieties . The tested wheat varieties were Sakha 93, Giza 168, Gemmeiza 7, Gemmeiza 9, Gemmeiza 10, Gemmeiza 11, Misr 1, Misr 2 and Sids 12 (Table 1). The plot size was 6 × 7 m = 42 m^2, each plot contained 20 rows with 6 m long and 30 cm between rows. Protected plots were treated three times with Sumi-eight 5 EC (1H-1,2,4-Triazole-1-ethanol,.beta.-[(2,4-dichlorophenyl)methylene]-.alpha.-(1,1-dimethylethyl)-,(.beta.E) (35 cc /100 L water) served as healthy control.

Powdery mildew assessment:

Powdery mildew severity was determined using the modified Cobb's scale 0 to 100% (Peterson *et al*., 1948), as the percentage of leaf surface area covered by mycelia. Disease severity assessment was recorded four times at 10-day intervals during the season; the first assessment made at the late booting stage (Growth Stage 45), and the last score was taken around G.S. 75, when the check cultivar reached its maximum severity. These values were used to calculate the area under disease progress curve (AUDPC) as described by Pandey *et, al.* (1989). The AUDPC was calculated for each variety as follows:

$$\mathbf{AUDPC = D\ [1/2\ (Y_1 + Y_k) + (Y_2 + Y_3 + \text{- - - - - } + Y_{k-1})]}$$

Where: D = Days between two consecutive recording (time intervals)

$Y_1 + Y_k$ = Sum of the first and last scores.

$Y_2 + Y_3 + \text{- - - - - } + Y_{k-1}$ = Sum of all in between disease scores.

Determination of yield components:-

When the plants reached the maturity stage, spikes of all plots were hand harvested, threshed and one thousand kernel weight (g) and spike weight (g) were recorded. Randomly selected thousand grains from each genotype were weighed. Also, spike weight was determined for each variety. The percent reduction in each component was calculated according to the formula described by Colpauzos *et al.,*(1976) as follow:

$$\mathbf{Reduction\ (loss)\ \% = 1\text{-}Yd/Yh\ X\ 100}$$

Where: Yd = yield of diseased plants

Yh = yield of healthy plants

Determination of flour quality:-

Grain quality tests were done at laboratory of the National Gene Bank, ARC, Giza, Egypt as follow:

Determination of total carbohydrate:-

Total Carbohydrate was determined using the phenol sulphuric acid method according to Dubois *et al* (1956).

Determination of total protein

Protein percentage was determined using Kjeldahl apparatus as nitrogen percentage according to the Association of Official Agricultural Chemists(AOAC 1990) where, percentage of protein was obtained by multiplying nitrogen percentages by the factor 6.25 (Sadasivam and Manickam,1996).

Determination of wet gluten content:

Wet gluten yield were determined according to AOAC,(1990) by machine washing method (GB/5506-85, National Standard of China). Paste was made with 25.00 g flour (w) mixed with 12.5 ml of water, followed by washing for 10 minutes with water at a flow rate of 50-60ml /min on a special 88-um sieve using a Perten Glutamatic Gluten Index machine (Perten Instruments AB, S-14105 Huddeings, Sweden). Afterwards, the wet gluten piece was centrifuged at 6000 rpm for 1 min on a special 600-um metallic sieve using a Perten Centrifuge 2015 machine (Perten Instruments AB, S-14105 Huddeings, Sweden) and the wet gluten yield was obtained (WI). The wet gluten samples was cut into twelve pieces, placed in a tin and dried for 30 min at 155 C using a special Perten Glutork 2020 dryer. After cooling in a desiccator, weight of dry gluten (W2) was recorded. The gluten index of wet gluten content (WGC) (Eq.1), dry gluten content (DGC) (Eq. 2) and moisture content of wet gluten (MCWG) (Eq.3) was obtained. Testes was carried out in triplicates for each sample.

1- WGC = W1/Wx 100

2-DGC = W2/W x 100

3- MCWG = W1-W2/W2 x 100

Statistical analysis:

Least significant differences (L.S.D. at 5 % level of probability) were calculated to determine the significant differences between means (Snedecor 1957).

Table 1: List of the tested local wheat varieties, pedigree and year of release.

No.	Variety	Pedigree	Year of release
1	Sakha 93	Sakha 92/TR 810328 S 8871-1S-2S-1S-0S	1999
2	Giza 168	MIL/BUC//Seri CM93046-8M-0Y-0M-2Y-0B	1999
3	Gemmeiza 7	CMH74A.630/SX//SER182/3/AGENT. GM4611-2GM-3GM-1GM-0GM.	1999
4	Gemmeiza 9	ALD"S"/HUAC"S"//CMH74A.630/SX. GM4583-5GM-1GM-0GM.	1999
5	Gemmeiza 10	MAYA74"S"/0N//160-147/3/BB/GLL/4/CHAT"S"/5/CROW"S". GM5820-3GM-1GM-2GM-0GM.	2004
6	Gemmeiza 11	B0W"S"/KVZ"S"//7C/SERI82/3/GIZA168/SAKHA61. GM7892-2GM-1GM-2GM-1GM-0GM.	2011
7	Misr 1	OASIS/SKAUZ//4*BCN/3/2*PASTOR. CMSSOYO1881T-050M-030Y-O3OM-030WGY-33M-0Y-0S.	2011
8	Misr 2	SKAUZ/BAV92. CMSS96M0361S-1M-010SY-010M-010SY-8M-0Y-0S.	2011
9	Sids 12	BUC//7C/ALD/5/MAYA74/ON//1160-147/3/BB/GLL/4/CHAT"S"/6/MAYA/VUL//CMH74A.630/4*SX.SD7096-4SD-1SD-1SD-0SD.	2007

RESULTS

Evaluation of the tested wheat varieties for powdery mildew under field conditions:

The tested wheat varieties showed different disease severities % in the two growing seasons (2012/13 and 2013/14).

Data in Table (2) in 2012/13 indicated that wheat varieties Giza 168, Sids 12, Misr 1, and Misr 2 showed low levels of powdery mildew severity% *i.e.* 4.33 %, 4.33 %, 4.33 % and 8.33 %, respectively. Whereas, wheat cvs. Gemmiza 9 and Sakha 93 showed high levels of powdery mildew severity 41.66 % and 38.33% respectivily. Area under disease progress curve (AUDPC) ran in parallel line with disease severity. The lowest values of AUDPC were recorded on the wheat varieties Giza 168 (40), Sids 12 (40), Misr 1 (40) followed by Misr 2 (181.5) . While, wheat varieties Gemmiza 9 and Sakha 93 showed the highest values of AUDPC (840 and 825) during 2012/13 growing season. The other wheat varieties were in between these two limits.

Table 2: Powdery mildew severity (%) and area under disease progress curve (AUDPC) of 9 wheat varieties under field conditions during 2012/13 and 2013/14 growing seasons at Gemmiza Agric. Res. Station.

varieties	2012/13		2013/14	
	Disease severity (%)	AUDPC	Disease severity (%)	AUDPC
Sakha 93	38.33	825.0	51.66	915.00
Giza 168	4.33	40	8.33	185.5
Gemmeiza 7	18.33	240	31.66	565.0
Gemmeiza 9	41.66	840.0	41.66	840.0
Gemmeiza 10	28.33	560.0	38.33	825.0
Gemmeiza 11	21.66	240	21.66	240
Misr 1	4.33	40	8.33	181.5
Misr 2	8.33	181.5	21.66	240
Sids 12	4.33	40	8.33	185.5
L.S.D	9.78	26.5	10.82	25.3

AUDPC: area under disease progress curve

Data in Table (2) also revealed that the wheat varieties Giza 168, Misr 1 and Sids 12 each showed 8.33 % powdery mildew severity with low values of AUDPC (185.5-181.5 and 185.5) respectively in 2013/2014 season. Whereas, wheat varieties Sakha 93, Gemmiza 9 and Gemmiza 10 showed high levels of powdery mildew severity *i.e*. 51.66 %,41.66% and 38.33%, respectively. Whereas the other wheat varieties under study were in between. Regarding to the data shown in table 2 in 2013/2014 the highest values of AUDPC was recorded on the wheat variety Sakha 93 (915) whereas the least AUDPC value observed on Misr 1(181.5) .

Yield reduction:

Yield losses due to powdery mildew infection of the nine wheat varieties under study were estimated during 2012/13 and 2013/14 growing seasons. Data in Tables (3 and 4) revealed that the loss in yield components was correlated with disease severity during the two growing seasons.

Data in Tables (3 and 4) showed that the loss in 1000- kernel weight ranged from 1.13 % in Sids 12 to 12.09 %in Sakha 93 during 2012/13 growing season. Other varieties showed reduction between these two limits. In season 2013/2014 the loss in the 1000 kernel weight was higher than in the previous season on Sakha 93 showed 15.86% reduction, whereas Misr 2 showed the lowest value of loss (1.2%)

The loss in spike weight ranged from 2.2 % in Sids 12 to 26.36 % in Gemmeiza 10 during 2012/13 growing season. Other varieties showed loss in spike weight within these two extremes. Regarding the loss in spike weight in 2013/2014 Gemmeiza 7 and Gemmeiza 10 was the most affected variety by powdery mildew infection as they gave the highest values of loss (22.25%

and 22%). On the other hand Sids 12 was the least affected variety followed by Giza 168 (8.03% and 8.5% respectively) where they showed the least amounts of losspercentages.

Table 3: Effect of powdery mildew (*Blumeria graminis*) infection on 1000- kernel weight (gm) of 9 wheat varieties at Gemmiza Agric. Res. station during 2012/13 and 2013/14 growing seasons.

Variety	2012/13			2013/14		
	1000 kernel weight (gm)			1000 kernel weight (gm)		
	Infected	Protected	Loss (%)	Infected	Protected	Loss (%)
Sakha 93	35.26	40.11	12.09	35.00	41.51	15.68
Giza 168	38.11	39.8	4.26	39.41	40.3	2.2
Gemmeiza 7	43.31	45.6	5.02	42.1	46.32	9.11
Gemmeiza 9	36	38.11	5.53	37.8	39.33	3.89
Gemmeiza 10	40	42.7	6.32	40.31	44.6	9.61
Gemmeiza 11	43.65	45.8	4.69	40.2	45.22	11.1
Misr 1	38.9	39.5	1.51	38.21	39.5	3.26
Misr 2	39	40.2	2.98	39.6	40.1	1.2
Sids 12	43.61	44.11	1.13	40.11	43.62	8.04
L.S.D. at 5 %	0.22	0.14		1.23	0.064	

Grain quality assessment:

1-Protein content:

Grain quality is a complex character that can be affected by many factor, one of the most important is diseases severity. The impact of powdery mildew on percentages of protein content varied with cultivar and disease severity (Tables 5).

Table 4: Effect of powdery mildew infection on spike weight of 9 wheat varieties at Gemmiza Agric. Res. station during 2012/13 and 2013/14 growing seasons.

Variety	2012/13			2013/14		
	spike weight (gm)			spike weight (gm)		
	Infected	Protected	Loss (%)	Infected	Protected	Loss (%)
Sakha 93	2.33	3.00	22.33	2.59	3.21	19.31
Giza 168	3.14	3.51	10.5	2.88	3.15	8.5
Gemmeiza 7	3.00	3.82	21.46	3.11	4.00	22.25
Gemmeiza 9	2.41	3.11	22.5	2.61	3.25	19.69
Gemmeiza 10	2.00	2.91	26.36	2.41	3.09	22.00
Gemmeiza 11	3.01	3.42	11.98	3.11	3.65	14.79
Misr 1	2.81	2.93	4.09	2.6	3.2	18.75
Misr 2	2.93	3.11	5.78	2.9	3.4	14.7
Sids 12	3.11	3.18	2.20	3.32	3.61	8.03
L.S.D. at 5 %	0.25	0.083		0.0745	0.105	

The obtained data revealed that, highest values of increase % in protein content were observed with infected plants of Sakha 93 and Gemmeiza 9 (15.85 and 10.9) respectively in 2012/2013. On the other hand Giza 168 showed the least increase % (1.15). The other cultivars exhibited different values of protein content and different increase percentages.

The same trend was experienced in 2013/2014. Sakha 93 was the most affected cultivar with powdery mildew infection which revealed high increase % in protein content (14.14). These results correlated with powdery mildew severity.

Table 5: Effect of powdery mildew infection on protein content during 2012/13 and 2013/14 growing seasons.

Variety	2012/2013			2013/2014		
	Infected	Protected	Increase%	Infected	Protected	Decrease%
Sakha 93	13.31	11.2	15.85	13.43	11.53	14.14
Giza 168	13.88	13.72	1.15	13.81	13.77	0.28
Gemmeiza 7	14.9	13.8	7.38	15.14	13.82	8.71
Gemmeiza 9	14.42	12.84	10.9	14.33	12.64	11.79
Gemmeiza 10	15.02	14.8	1.46	15.00	14.5	3.33
Gemmeiza 11	13.9	12.93	6.97	13.94	12.91	7.38
Misr 1	14.8	13.65	7.77	14.79	13.6	8.04
Misr 2	13.85	12.77	7.79	13.8	12.75	7.6
Sids 12	14.83	13.32	10.1	14.61	13.3	8.96
L.S.D. at 5 %	0.0986	0.0913		0.064	0.0833	

Carbohydrate content:

The impact of disease on carbohydrate content varied among cultivars and between the two seasons (Table 6). Results revealed that Gemmeiza 7 showed the highest decrease % in carbohydrate content during 2012/13 season (6.64) followed by Misr 1 (4.72). Gemmeiza 9 exhibit the least decrease level (1.14%).

Table 6: Effect of powdery mildew infection on carbohydrate content during 2012/13 and 2013/14 growing seasons.

Variety	2012/2013			2013/2014		
	Infected	Protected	Increase%	Infected	Protected	Decrease%
Sakha 93	61.4	62.9	2.38	61.5	63	2.38
Giza 168	58	59.9	3.17	60.1	61.1	1.62
Gemmeiza 7	57.6	61.7	6.64	57.6	61.83	0.84
Gemmeiza 9	60.2	60.9	1.14	60.3	60.7	0.65
Gemmeiza 10	57.5	60.2	4.48	57.8	60.2	3.98
Gemmeiza 11	60	61.8	2.91	59.93	60.5	0.94
Misr 1	60.5	63.5	4.72	59.41	60.7	2.12
Misr 2	61	62.5	2.4	62.3	62.9	0.95
Sids 12	60	61.6	2.59	60.61	61.5	1.44
L.S.D.	0.174	0.370		0.129	0.139	

In 2013/14 a little decrease % in carbohydrate content i.e. ranged from 0.65 in Gemmeiza 9 to 3.98 in Gemmeiza 10. There was no significant effect of powdery mildew infection on carbohydrate content in some wheat cultivars, *i.e.* Gemmeiza 9 , Gemmeiza 7 and Gemmeiza 11.

Wet gluten content:

Results in table (7) showed that Giza 168 and Gemmeiza 7 exhibited the least increase (%) in wet gluten (3.2% and 3.5%), respectively. On the other hand Gemmeiza 11 followed by Gemmeiza 9 reveled the highest increase % during the two successive seasons (16.29% and 13.25%) and (18.62%- 11.3%) respectively. Sakha 93 showed the least increase(%) in wet gluten in 2013/14 growing season which reveled 3.79%.

Table 7: Effect of powdery mildew infection on Wet gluten content during 2012/13 and 2013/14 growing seasons.

Variety	2012/2013			2013/2014		
	Infected	Protected	Increase%	Infected	Protected	Decrease%
Sakha 93	31.11	30	3.56	31.6	30.4	3.79
Giza 168	31.2	30.2	3.2	30	28.6	4.66
Gemmeiza 7	34.2	33	3.5	29	26.43	8.86
Gemmeiza 9	33.2	28.8	13.25	33.6	29.8	11.3
Gemmeiza10	33.43	31.6	5.47	33.00	31.12	5.69
Gemmeiza11	35.6	29.8	16.29	34.63	28.18	18.62
Misr 1	29.6	27.31	7.73	29.8	28.3	5.11
Misr 2	32.9	30.6	6.07	31.92	29.6	7.26
Sids 12	34.6	31	10.4	30.16	28.94	4.04
L.S.D. at 5 %	0.182	0.705		0.511	0.123	

DISCUSSION

This study aimed to determine the effect of powdery mildew (*Blumeria graminis* f.sp. *tritici*) infection on spike grain yield and some bread-making quality using nine Egyptian wheat varieties conditions during the two successive seasons 2012/13 and 2013/14.

Powdery mildew severity% was recorded for each of the tested wheat genotypes. The three wheat varieties Giza 168, Misr 1 and Sids 12 showed an adequate level of resistance to powdery mildew infection showing low levels of disease severity (4.33 % and 8.33 %) during season 2012/13and 2013/14 respectively. On the other hand, Sakha 93 exhibited the highest disease severity (38.33% and 51.66%) during the two successive seasons. The variation in disease severity among different varieties and growing seasons were also represented by others (Vechet, 2006 and El-Shamy *et al*. 2012).

According to the obtained results and depending on the values of AUDPC, it could be stated that the wheat varieties Giza 168, Misr 1 and Sids 12 showed high and appropriate levels of adult plant resistance to powdery mildew infection under field conditions during the two seasons. These

varieties showed the lowest values of AUDPC less than 300 (El-Shamy *et al*., 2012).

Spike grain yield and yield components are complex characters and may be affected by the cumulative result of different physiologic processes, one of them powdery mildew infection. In this study, Sids 12, Misr 1 and Misr 2 showed the lowest losses in 1000-kerenl weight during the two seasons. The highest loss in 1000-kerenl weight was recorded on Sakha 93 which could be the reflective of powdery mildew susceptibility. Tomas and Solis (2000) concluded that the reduction in grain yield of the durum wheat cultivars in South of Spain was mainly caused by powdery mildew infection. El-Shamy *et al*. (2012) found that the highest reduction in yield components was detected in cv. Gemmeiza 10 i.e. the loss in kernel weight was (16.72 %) and in grain yield/m^2 was (17.73 %) in season 2009/10. In 2010/11 the loss in 1000 grain wheat ranged from 0.17 % to 0.47 %, while grain yield/m^2 ranged from 0.27 % to 1.28 %.

Regarding the grain quality, height disease pressure (Dereje, and Chemeda2007) reported that a reduction of starch biosynthesis of common bean (*Phaseolus vulgaris* L.) due to infection by common bacterial blight (caused by *Xanthomonas axonopodis* pv. phaseoli). He found that an interruption of normal starch synthesis due to disease may result in nitrogen increase at the loss of starch. When powdery mildew infection attacks wheat varieties at early stage it resulted in shriveled kernels and shriveling of kernels most often results in increased grain protein due to an increase in the ratio of protein to starch (Alam *et al*., 2013). Increase in disease pressure resulted in a significant increase in flour protein and loss of photosynthetic leaf area. Flour produced from grain grown under disease pressure would tend to have both higher protein content and higher water absorption (Everts *et al*., 2001).

REFERENCES

AOAC, 1990. Official Methods of Analysis of the Association of Official Analytical Chemists 15th ed. Washington DC 20044 USA.

Alam, M.A., M.S.N. Mandal, C. Wang and W. Ji., 2013. Chromosomal location and SSR markers of a powdery mildew resistance gene in common wheat line N0308. African J. of Microbiology Research, 7(6):477-482.

Bennett, F.G.A., 1984. Resistance to powdery mildew in wheat: A review of its use in agriculture and breeding programmes. Plant Pathol., 33:279-300.

Briceno-Felix, G., J. Huerta-Espino, L. Torres, J.A. Betbese and J.A. Martin Sanchez, 2004. Yield losses caused by powdery mildew on bread wheat cultivars under irrigated Mediterranean conditions in Spain. Options Mediterranean, Series A, No. 81:183-185.

Bowen, K.L., K.L. Everts and S. Leath, 1991. Reduction in yield of winter wheat in North Carolina due to powdery mildew and leaf rust. Phytopatholog, 81: 503-511.

Colpauzos J., A.P. Roelfs, M.E. Madson, F.B. Martin, R.D. Wilconxson, 1976. A new model to measure yield losses caused by stem rust in spring wheat. Agric. Exp. Sta. Univ.Minnesota, Tech. Bull., 307:1-23.

Dereje, H. and F. Chemeda, 2007. Relationship between stripe rust (*Puccinia striiformis*) and grain quality of bread wheat (*Triticum aestivum*) in the highlands of Bale, southeastern Ethiopia. J. Food, Agric. & Environment, Vol.5 (2): 24-30.

Dubois, M., K.A. Gilles, Hamilton J.K., Rebers, P.A. and F. Smith 1956. Colorimetric method for determination of sugars and related substances, Anal. Chem., 29. 350–356.

El-Shamy, M.M, Minas Sallam and H.M.F. Awad 2012. Powdery mildew infection on some Egyptian bread wheat cultivars in relation to environmental conditions. J. Plant Prot. and Path., Mansoura Univ., 3: 363-372.

Everts, K. L., S. Leath and P. L. Finney, 2001. Impact of powdery mildew and leaf rust on
milling and baking quality of soft red winter wheat. Plant Dis. 85:423-429.

Fried, P.M., D.R. MacKenzenzie and R.R. Nelson. 1979. Disease progress curves of *Erysiphe graminis f. sp. tritici* on Chancellor wheat and four multilines. Phytopathology Z., 95:151-166.

Griffey, C.A., M.K. Das and E.L. Stromberg. 1993. Effectiveness of adult-plant resistance in reducing grain yield loss to powdery mildew in winter wheat. Plant Dis., 77:618-622.

Laghari, K.A., M.A. Sial, M.A. Arain, A.A. Mirbahar, A.J. Pirzada, M.U. Dahot and S.M. Mangrio. 2010. Heritability studies of yield and yield associated traits in bread wheat. Pak. J. Bot., 42(1):111-115.

Pandey H.N., T.C.M.Menon and M.V. Rao, 1989. A simple formula for calculating area under disease progress curve. *Rachis* 8:38-39.

Peterson, R.F., A.B. Campbell and A.E. Hannah, 1948. A diagrammatic scale for estimating rust intensity on leaves and stems of cereals. Can. J. Res., 26:496-500

Sadasivam, S and Manickam, A. 1996. Biochemical Methods. New Age International (P) Limited, Second Edition, New Dewlhi 110002. India.

Snedecor, G.W. 1957. Statistical Methods, 5th eds.Iowa State College Press, Ames, Iowa.

Tomas, A. and I. Solis 2000. Effects of powdery mildew (*Blumeria graminis*) severity on durum wheat cultivars. Ciheam-Options Mediterraneeannes, Serie A. N. 40, 417-419.

Vechet, L. 2006. Reaction of winter wheat cultivars and breeding lines to *Blumeria graminis* f. sp. *tritici.* Plant Protection Science, 42: 15-20.

تاثير الاصابه بالبياض الدقيقى على محصول الحبوب والجودة لبعض اصناف القمح المصريه

محمد عبد القادر حسن[١] و عبير الحلوجي[٢]
[١] معهد بحوث أمراض النباتات -مركز البحوث الزراعية -الجيزة – مصر
[٢] البنك القومي للجينات -مركز البحوث الزراعية -الجيزة – مصر

يعتبر مرض البياض الدقيقى فى القمح المتسبب عن الفطر بلومريا جرامينس من اهم الامراض الحديثة الانتشار التى توثر فى انتاجية محصول القمح تحت الظروف المصرية. درست العلاقة بين النقص فى محصول الحبوب وجودة الحبوب خلال الموسيمين الزراعيين ٢٠١٢/٢٠١٣ و ٢٠١٣/٢٠١٤ بمحطة البحوث الزراعية بالجميزة على تسعة اصناف من القمح وهى سخا ٩٣, جيزة ١٦٨ ,جميزة٧, جميزة٩, جميزة ١٠, جميزة ١١, مصر ١, مصر ٢ وسدس ١٢. تراوحت شدة الاصابة بالبياض الدقيقي ما بين ٥- ٤٠% خلال موسم٢٠١٢/٢٠١٣ بينما فى موسم ٢٠١٣/٢٠١٤ تراوحت من ٥- ٥٠%. المساحة الواقعة تحت المنحنى المرضى كانت مرتبطة بشدة الاصابة خلال العامين. اعلى فقد في وزن الالف حبة لوحظ مع الصنف سخا ٩٣ خلال العامين (١٢.٠٩% و ١٥.٦٨%). على الجانب الاخر سدس ١٢ اعطى اقل فقد في وزن الالف حبة خلال ٢٠١٢/٢٠١٣ (١.١٣%) بينما مصري ٢ اعطى اقل فقد في وزن الالف حبة خلال ٢٠١٣/٢٠١٤ (١.٢%). بالنسبة لتاثير البياض الدقيقى فى القمح على جودة الحبوب. كانت اعلى نسبة زيادة فى البروتين مع الصنف سخا ٩٣ والذى اعطى ١٥.٨٥% و ١٤.١٤% خلال ٢٠١٢/٢٠١٣ و٢٠١٣/٢٠١٤ بينما اعطى الصنف جيزة ١٦٨ اقل زيادة في محتوى البروتين. جميزة ٧ كان أكثر الاصناف تأثرا في محتوى الكربوهيدرات والذي اعطى اقل نقص (٦.٦٤%). وكانت النسبة المئوية للزيادة في الجلوتين الرطب متغيرة من موسم لموسم. جميزة ١١ اعطت اعلى زيادة خلال الموسمين بينما جيزة ١٦٨ وسخا ٩٣ اظهرو اقل قيم للزياده فى الجلوتين الرطب.