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RESISTANCE TO STRIPE RUST IN SOME EGYPTIAN WHEAT GERMPLASM

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ABSTRACT

Stripe rust, caused by *Puccinia striiformis* f. sp. *Tritici* [*Pst*], is an important wheat disease that causes considerable yield losses in wheat growing areas worldwide. It is better to control the disease throughout the use of cultivars with durable resistance. This study to evaluate 20 Egyptian cultivars against stripe rust at both seedling and adult stages, at a rust hot spot location in Sakha Agriculture Research Station, Egypt, during the 2010/2011 and 2011/2012 growing seasons. Slow rusting resistance at adult plant stage was assessed through the determination of infection type (IT), disease severity (DS), relative area under disease progressive curve (rAUDPC), and coefficient of infection (CI). Results indicated that the among 20 cultivars tested, five cultivars showed resistance reaction *i.e.* Misr 1, Gemmeiza 10, Gemmeiza 11, Sids 13 and Sohag 3, while the remained tested cultivars showed susceptible reaction at seedling stage. On the other hand, at adult plant stage five Egyptian cultivars showed little or no infection, therefore it were selected as immune or resistant cultivars. *i.e.* Sakha 61, Gemmeiza 10, Benisweif 4, Benisweif 5, and Sohag 3, while the rest cultivars tested showed moderately resistance to moderately susceptible and susceptible reaction. The cultivars Giza 168, Sakha 94, and Gemmeiza 7 had the susceptible reaction at seedling stage and it were moderately resistant to moderately susceptible at adult stage. Consequently, these cultivars with low rAUDPC (7.14 to 14.28%) most probably could have slow rusting resistance. Results of mean comparison values of CI and rAUDPC indicated that Giza167, Gemmeiza 5, and Sids 1 exhibited the highest CI and rAUDPC. Correlation analysis of different parameters also showed highly strong relationship of CI with rAUDPC and disease severity (R^2 = 0.92 and 0.94, respectively). Meanwhile, the thousand kernel and test weight decreased due to high rust infection, high significant difference could be detected among cultivars. As for 1000 kernel weight the highest value was recorded with Beniswief 5 (53.90g and 50.20g) during 2010/2011 and 2011/2012, respectively. Regarding the test weight Misr 1 was the least affected cultivar by the disease that reduced by 1.52 %, at first season while Beniswief 1 recorded 1.57% in the second season.

Keywords*:* Wheat ,stripe rust, yellow rust, slow rusting, durable resistance, Egypt.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the first important and strategic cereal crop for the majority of world's populations and Egypt as well. Many diseases, particularly rusts, drastically reduce the yield and quality of wheat crop. Among the three rusts, (leaf, stem and yellow rust). Yellow (stripe) rust caused by [*Pst*] is the major foliar disease of wheat, resulting in yield loss all over the world Kolmer, (1966). In Egypt, stripe rust caused high loss in the production of most Egyptian wheat cultivars in the Nile delta area El-Daoudi *et al*., (1996). It was reported that the disease prevailed at higher altitudes,

cool and temperate regions wherever wheat is grown (Johnson, 1992; McIntosh *et al*., 1995 and Boyed, 2005). The causal agent [*Pst*] plasticity and adaptability to changing climatic conditions made it fit in most of the places around the world. Such characteristics include mutation, migration, somatic and sexual hybridization of wheat rusts (Stubbs, 1985; Kolmer, 2005; Jin *et al*., 2010). Use of resistant cultivars is the most economical and the preferred method of controlling the rusts Chen and Line, (2003). In several cereal rust pathosystems, the quantitative aspects of cultivar resistance were described by means of the disease severity at a certain moment or plant development stage as indicated by the Area Under Disease Progress Curve (AUDPC) or by means of the apparent infection rate (r) Broers *et al*., (1996). This type of resistance or slow rusting acts through polygenic genes (Zadoks 1972; Ohm and Shaner, 1976; Parlevliet and Zadoks, 1977; Shahin 2008; Mashaal, *et al.,* 2008).

The main objectives of the present investigation were to evaluate and determine the components of slow-rusting in 20 Egyptian wheat cultivars versus susceptible cultivar (Morocco) against certain virulent isolates of stripe rust fungus under greenhouse and field conditions to be exploited for evaluating the cultivars in the breeding program of wheat for rust resistance.

MATERIALS AND METHODS

Seedling test: Twenty Egyptian wheat cultivars with the susceptible check (Morocco) were obtained from Wheat Research Department, Sakha Agric. Res., Stn., Egypt. The tested cultivars were evaluated in a greenhouse by sowing seeds (10 seeds) of cultivars in pots which included mixture of soil, peat moss and sand in 7:5:5 proportions, respectively. Ten days old seedling were inoculated with a mixture of spores and talcum powder in (1:20) proportions as method adopted by Stubbs (1988). The pots were placed for 24h in a dark moist chamber at 10°C and then transferred to greenhouse at 15-18°C and 16h light ca 7300 lux. and 8 h. dark. after 14-17 days of inoculation, the plant reaction was recorded according to the method of McIntosh *et al*. (1995) using the scale 0-4, where 0 = no visible uredia, 1 = small uredia with necrosis, 2 = small to medium sized uredia with green islands and surrounded by necrosis or chlorosis, 3 = medium sized uredia with or without chlorosis and 4 = large uredia without chlorosis. Infection types (ITs) of 3+ were regarded as susceptible, whereas ITs of 3 or lower were regarded as resistant, this experiment was repeated twice.

Field experiment: An experiment was conducted at Sakha Agricultural Research Station during two successive seasons (2010-2012). Twenty wheat cultivars listed in Table (1). representing the Egyptian germplasm (*T. aestivum* L.) were candidate cultivars. Each cultivar was sown in two rows with 1.5 m. long and 30 cm. apart, 3g of seeds were adequate for each of two experiment and broadcasting method was applied. Split plot design with three replications was performed in the experiment, since the main plots were two methods of applications (a) severe artificial inoculation with [*Pst*]. (b) complete protection using systemic fungicide "Sumi-eight EC" at the rate of

0.35ml/l. The sub-treatments were represented by the 20 local wheat entries. Artificial inoculation was carried out by spraying all tested cultivars and spreader rows two times after the sun set with a mixture of spores and talcum powder in (1:20) proportions according to the method of Tervet and Cassel (1951). Percentage of severity was recorded four times, started when Morocco reached 30% severity according to the modified Cobb scale Peterson *et al*., (1948) and reaction based on Roelfs *et al*., (1992). Coefficient of infection (CI) were calculated by combinations of disease severity (DS) and infection type (IT), was used for estimating Area Under Disease Progress Curve (AUDPC). Constant values for infection types were used since (immune =0, R= 0.2, MR=0.4, MR-MS=0.6, MS=0.8, S=1; Stubbs *et al*., (1986). Estimation of AUDPC and rAUDPC was performed according to the following equation adopted by Milus and Line, (1986).

$$AUDPC = D [½ (Y_1 + Y_k) + Y_2 + Y_3 + …. + Y_{k-1}]$$

Where, D = Time interval (days between reading), (Y_1+Y_k) = Sum of first and last disease scores. $(Y_2+Y_3 + …+ Y_{k-1})$ = Sum of all in-between disease scores.

$$rAUDPC = \text{line AUDPC} / \text{susceptible AUDPC} \times 100$$

On the other hand, yield component parameters were taken into consideration *i.e.* 1000 kernel weight (g.) and test weight (g.) likewise the reduction % in certain yield components. Reduction (%) in grain yield was estimated according to the equation of Calpouzos *et al*., (1976), as follows:

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

Where, Yd = Yield disease, and Yh = Yield healthy. Then, they obtained data were statistically analyzed by MSTAT-C program and by using MS-Excel program as well for correlation analysis. Finally, resistance reaction at seedling and adult stages was compared for grouping them.

RESULTS

Seedling reaction: The results of estimated seedlings reaction in Table (1). showed variation between the tested entries either in seedling or in adult plant stages. Among 20 cultivars tested, only five cultivars exhibited resistance reaction *i.e.* Misr 1, Gemmeiza 10, Gemmeiza 11, Sids 13 and Sohag 3 while, fifteen entries had susceptible reaction at seedling stage, the cvs. *i.e.* Giza 168, Sakha 94 and Gemmeiza 7 had the susceptible reaction at seedling tests and moderately resistant to moderately susceptible reaction at adult plant stage.

CI Value: The data of disease severity and host reaction were combined to calculate coefficient of infection (CI). Cultivars with CI values of 0-20, 21-40 and 41-60 were regarded as possessing high, moderate and low levels of adult plant resistance, respectively. Table (1) clearly showed that disease pressure was considerably high as indicated by CI of susceptible check. Maximum CI value recorded among tested cultivars were 32-45% of the susceptible check for three entries *i.e*. Sakha 93, Gemmeiza 5 and Giza 167 while the remaining 17 cultivars ranged from 1%-23%.

rAUDPC value : Based on the rAUDPC values, cultivars were categorized into 2 distinct groups. The first group included genotypes exhibiting rAUDPC values up to 20% of check, while lines showing rAUDPC values up to 70% of check were placed in the second group. In these cultivars, rust initiated and sporulated but with final chlorotic and necrotic stripes (MR and/or Ms infection types). Subsequently, the progress of rust development remained slower and restricted. Cultivars of group 1 were marked as better slow rusting and that of group 2 were marked as moderately slow rusting since, they also developed epiphytotic of very low potential as infected by their rAUDPC values despite the ultimate expression of high infection type. These cultivars are expected to possess genes that confer partial resistance. Misr 2, Giza 168, Sakha 94, Gemmeiza 7, Shandaweel 1 and BeniSweif 6 exhibited rAUDPC value less than 20% of Morocco and were marked as better slow rusting. On the other hand, cultivars having rAUDPC values up to 70% of susceptible check were grouped as moderately slow rusting in group 2. These were Giza 167 and Gemmeiza 5 both, group 1 and 2 comprised cvs. with varying degrees of partial resistance which has been advocated to be more durable.

Table (1): Adult plant infection type , seedling reactions, and mean comparison for coefficient of infection, AUDPC and rAUDPC in 20 Egyptian wheat entries against stripe rust, at Sakha, Egypt (average of 2010/2011-2011/2012).

Cultivars	Mean comparison based on Duncan multiple testing*				
	Adult plant reaction	Mean of coefficient of infection	Mean of AUDPC	Mean of rAUDPC	Seedling reaction**
Misr 1	MR	1^{l}	30^{i}	4.46	2
Misr 2	R-MR	1.4^{k}	42^{i}	6.25	3
Giza 167	MS-S	45^{b}	460^{b}	68.54	4
Giza 168	MR-MS	10^{g}	72^{h}	10.71	3+
Sakha 61	R	1l	30^{i}	4.46	3
Sakha 93	MS	32^{d}	168^{e}	25	3
Sakha 94	MR-MS	7^{h}	78^{l}	7.14	3
Gemmeiza 5	MS-S	41.5^{c}	360^{c}	53.57	3
Gemmeiza 7	MR-MS	7^{h}	96^{f}	14.28	3
Gemmeiza 10	I-R	1^{l}	36^{i}	5.35	1+
Gemmeiza 11	MR-MS	1^{l}	32^{i}	4.76	1+
Sids 1	MS-S	23^{e}	360^{c}	53.57	4
Sids 12	MS-S	1.9^{j}	52^{i}	7.73	3+
Sids 13	MR-MS	1^{l}	34^{i}	5.05	1+
Shandaweel 1	MR	6.4^{h}	52^{i}	7.73	3
Beni Sweif 1	MS-S	22^{f}	228^{d}	33.92	4
Beni Sweif 4	I-R	1^{l}	42^{i}	6.25	3
Beni Sweif 5	I-R	1^{l}	36^{i}	5.35	3
Beni Sweif 6	MR	6^{i}	64^{l}	9.25	4
Sohag 3	I-R	1^{l}	36^{i}	5.35	2
Morocco	S	94.55^{a}	672^{a}	100	4

***Means followed by the same letters in each column are not statistically different at 1% level. **Infection type based on McIntosh *et al*. (1995); 0, 1, 2 are resistant and 3+ is susceptible; Minus and plus sign were used to indicate variation in IT's and letters C and N were used to indicate more than normal chlorosis and necrosis, respectively.**

1000 Kernel weight (g): Regarding the 1000 kernel weight, data in the Table (2) indicated that both of the tested protected and infected entries showed significant differences. The highest protected weight was recorded with BeniSweif 5 (53.9g), however the least weight was recorded with Sakha 61 (41.06g). On the other hand, the highest weight in the infected plot was recorded with BeniSweif 6 (50.50g), however the least infected one was recorded with Giza 168 (39.00g), the highest reduction % was recorded with Giza 167 (12.3%). However the least reduction was recorded with Sohag-3 (2.19%), this was the situation during 2010/2011. It seemed to be quite similar during 2011/2012, since both infected and protected 1000 kernel weight were significantly different from the susceptible check and each other. The highest reduction percentage was recorded with Giza 167 (12.5%), while the least reduction was recorded with BeniSweif 5 (2.59%) Table 3.

Table (2): Thousand grains weight, test weight and their reduction % of different wheat genotypes in the presence and absence of stripe rust during 2010/2011 at Sakha station, Kafrelsheikh.

Cultivars	Final rust severity	1000 Kernel weight (g.)				Test weight (g.)			
		P	I	Diff.	Reduction %	P	I	Diff.	Reduction %
Misr 1	R	48.80^{k}	45.60^{l}	3.20	6.55	679.40^{d}	669.08^{b}	10.32	1.52
Misr 2	1MR	43.75^{r}	40.10^{r}	3.65	8.34	678.54^{e}	656.18^{d}	22.36	3.30
Giza 167	20S	47.80^{n}	41.90^{o}	5.60	12.3	620.44^{q}	594.04^{p}	26.4	4.26
Giza 168	10MR	41.46^{s}	39.00^{s}	2.46	5.93	636.30^{m}	609.26^{l}	27.04	4.25
Sakha 61	5R	41.06^{t}	38.30t	2.76	6.72	641.56^{l}	600.71^{o}	40.85	6.37
Sakha 93	20MS-S	44.11^{q}	40.33^{q}	3.78	8.57	618.89^{r}	585.91^{s}	32.98	5.33
Sakha 94	5MS	47.43^{o}	45.58^{m}	1.85	3.90	654.45^{i}	628.18^{g}	26.27	4.01
Gemmeiza 5	20MS-S	48.32^{l}	44.51^{n}	3.81	7.88	633.64^{n}	607.98^{m}	25.66	4.05
Gemmeiza 7	5MR-MS	50.90^{i}	48.30^{h}	2.60	5.10	633.56^{o}	601.35^{n}	32.21	5.08
Gemmeiza 10	0	51.30^{h}	48.60^{g}	2.70	5.26	690.58^{c}	669.08^{b}	21.5	3.11
Gemmeiza 11	10MR-MS	51.58^{f}	49.30^{e}	2.28	4.42	699.61^{b}	660.05^{c}	39.56	5.65
Sids 1	10MS-S	49.85^{j}	45.85^{j}	4.00	8.02	664.40^{h}	615.28^{k}	49.12	7.39
Sids 12	TrS	48.20^{m}	45.80^{k}	2.40	4.79	646.30^{j}	624.36^{h}	21.94	3.39
Sids 13	Tr MR	51.79^{d}	47.68^{i}	4.11	7.94	644.14^{k}	623.07^{i}	21.07	3.27
Shandaweel 1	5MR	44.60^{p}	40.90^{p}	3.70	8.29	612.75^{s}	593.40^{q}	19.35	3.16
Beni Sweif 1	5MS-S	51.73^{e}	50.26^{b}	1.47	2.84	664.78^{g}	630.76^{f}	34.02	5.12
Beni Sweif 4	0	52.80^{b}	49.90^{d}	3.90	7.24	641.60^{l}	615.71^{j}	25.89	4.04
Beni Sweif 5	0	53.90^{a}	48.70^{f}	4.21	7.95	707.40^{a}	683.27^{a}	24.13	3.41
Beni Sweif 6	TRMR	52.60^{c}	50.50^{a}	2.10	3.99	677.68^{f}	644.14^{e}	33.54	4.95
Sohag 3	0	51.38^{g}	50.25^{c}	3.13	2.19	624.87^{p}	589.53^{r}	35.34	5.66

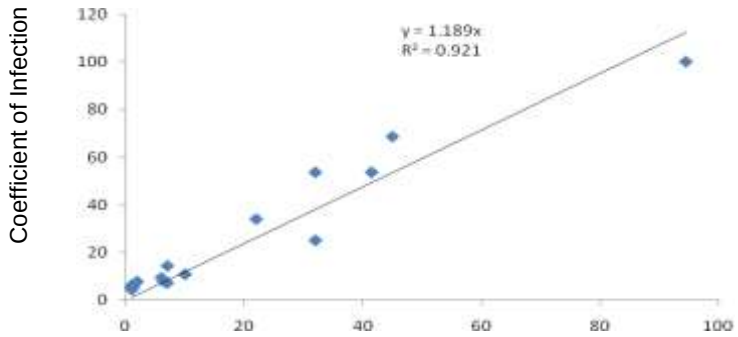
I= Infection , P=Protect, In a column, means followed by a common letter are not.

Test weight (**g.**): Concerning the test weight from the perspective of the above mentioned parameters, the presented data of the Table (2) BeniSweif 5 were significantly differentiated from the tested entries within the protected plots followed by Gemmeiza 11. The situation was quite different in case of infected plots, since BeniSweif 5 occupied the highest rank in this regard and significantly differentiated from the rest of entries. The presented data in Table (2), also revealed that the highest reduction % in test weight was observed in the wheat cultivar Sids 1 (7.39%). On the other hand, The least reduction was recorded with Misr1 (1.52%) during 2010/2011. Data in Table (3) also revealed that BeniSweif 5 occupied the first rank within the protected plots (746.05g.) while the reverse (least test weight (g) was recorded with

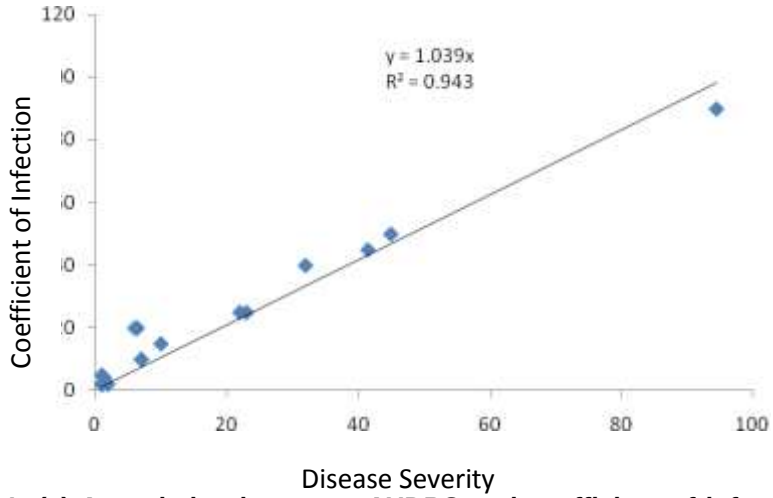
Sohag 3 (670.39g.). The least reduction % in test weight due to stripe rust infection the obtained results indicated that was recorded with BeniSweif 1 (1.57%) during 2011/2012.

Association between slow rusting parameters: Field assessment of slow rusting resistance was evaluated through FDS, rAUDPC and CI. CI is the mostly used parameter for the purpose. During in this study, an attempt was made to elucidate the relationship between these parameters. Positive relation of coefficient of infection was found with final disease severity and rAUDPC with a strong R^2 value that was 94% and 92 %, respectively Fig1.

(a)



(b) rAUDPC



Disease Severity

Fig. 1: (a) Association between rAUDPC and coefficient of infection for assessment of slow rusting and (b) association between final disease severity and coefficient of infection for slow rusting assessment.

Table (3): Thousand grains weight, test weight, and their reduction % of different wheat genotypes in the presence and absence of stripe rust during 2011/2012 at Sakha station, Kafrelsheikh.

Cultivars	Final rust severity	1000 Kernel weight (g.)				Test weight (g.)			
		P	I	Diff.	Reduction %	P	I	Diff.	Reduction%
Misr 1	0	45.20^{gh}	42.20^{g}	3.00	6.64	695.74^{p}	674.75^{k}	20.99	3.02
Misrp 2	R	42.80^{j}	38.80^{jk}	4.00	9.34	685.85^{q}	660.73^{n}	25.12	3.66
Giza 167	20S	44.78^{h}	39.20^{j}	5.58	12.5	704.34^{n}	690.19^{d}	14.15	2.01
Giza 168	10MR	40.48^{l}	37.88^{l}	2.60	6.42	717.97^{f}	685.97^{f}	32.00	4.46
Sakha 61	5R	49.42^{b}	45.90^{c}	3.52	7.12	711.90^{k}	685.11^{g}	26.79	3.76
Sakha 93	20MS-S	40.20^{l}	38.70^{k}	1.50	3.73	717.71^{g}	668.56^{i}	49.15	6.85
Sakha 94	5MS	43.96^{i}	40.86^{i}	3.10	7.05	733.92^{e}	721.41^{b}	12.51	1.70
Gemmeiza 5	20MS	45.70^{f}	41.50^{h}	4.21	9.21	710.48^{l}	683.05^{h}	27.43	3.86
Gemmeiza 7	5MR-MS	49.87^{ab}	44.33^{e}	5.54	11.10	708.94^{m}	695.61^{c}	13.33	1.88
Gemmeiza 10	R	45.30^{fg}	42.60^{fg}	2.70	5.96	739.17^{c}	690.15^{d}	49.02	6.63
Gemmeiza 11	10MR-MS	49.40^{b}	46.90^{b}	2.50	5.06	734.78^{d}	695.74^{c}	39.04	5.31
Sids 1	10MS	48.12^{c}	43.05^{f}	5.07	10.5	717.24^{i}	679.40^{i}	37.84	5.28
Sids 12	TrS	47.30^{d}	45.30^{d}	2.00	4.22	712.29^{j}	664.35^{m}	47.94	6.73
Sids 13	Tr MR	41.90^{k}	38.10^{l}	3.80	9.06	717.45^{h}	655.06^{o}	62.39	8.70
Shandaweel 1	5R	40.50^{l}	37.70^{l}	2.80	6.61	717.24^{i}	677.25^{j}	39.99	5.58
Beni Sweif 1	R	48.54^{d}	45.76^{cd}	1.78	5.72	674.97^{r}	664.40^{m}	10.57	1.57
Beni Sweif 4	0	49.44^{b}	45.77^{cd}	3.67	7.42	701.20^{o}	687.44^{e}	13.76	1.96
Beni Sweif 5	0	50.20^{a}	48.90^{a}	1.30	2.59	746.05^{a}	726.27^{a}	19.78	2.65
Beni Sweif 6	0	49.80^{ab}	47.20^{b}	2.60	5.22	743.04^{b}	721.54^{b}	21.50	2.89
Sohag 3	0	46.24^{e}	42.98^{f}	3.26	7.05	670.67^{s}	640.14^{p}	30.53	4.55

I= Infection , P=Protect, In a column, means followed by a common letter are not significantly different at the 5% level by DMRT.

DISCUSSION

Stripe (yellow) rust caused by *Puccinia striiformis* f. sp. *tritici* is considered to be an important wheat disease all over the world including Egypt. The disease attacks wheat through out the different growth stages.

The obtained results gave evidence to the presence of five entries out of twenty exhibited resistant response against the mixture of stripe rust races at seedling stage. On the other hand, nine entries out of twenty showed resistance at adult stage. The obtained results indicated that entries *i.e.* Misr 1, Gem. 10, Gem. 11, Sids 13 and Sohag-3 were resistant at both seedling and adult stages. On other hand, entries *i.e.* Sakha 61, BeniSweif 4, BeniSweif 5, and BeniSweif 6 showed susceptibility in seedling and resistance in adult stage.

The cultivars Giza 168, Sakha 94, and Gemmeiza 7 had the susceptible reaction at seedling stage and were moderately resistant to moderately susceptible at adult plant stage. These cvs. which had low rAUDPC (5.05-10.70%) at adult stage could have durable resistance. It could concluded that these entries may exhibit durable resistance, in which it could be kept for long time irrespective off the change in pathogen genotype. Because durable resistance, such as slow rusting, and High- Temperature Adult Plant resistance (HTAP), is controlled by more than one gene (at least 2-3), these findings are supported by Dehghani and Moghaddam, (2004). Workers must take into consideration this kind of resistance (durable)

because the rust pathogen can change its genotype by mutation migration and selection effect of resistant cvs. on the pathogen (Hovmoller, 2001, Ben Yehuda *et al*., 2004). Concerning the coefficient of infection values, the obtained results related to disease severity combined to coefficient of infection enabled us to group the CI values to 3 categories 0-20, 21-40 and 41-60 according the findings of Ali *et al.*, (2009).

The obtained results gave evidence that Giza 167, Sakha 93 and Gem. 5 exhibited higher CI value (32-45%) comparing with the value of the check. The remaining 17 possessed values ranged between (1-32). From this stand point, the pathotypes of stripe rust may be considered more virulent to the evaluated entries. Consequently entries as Misr 1, Sakha 61, Gem. 10, Gem. 11, Sids 12, Sids 13, BeniSweif 4, BeniSweif 5, and Sohag 3 may carry major genes or combinations of major genes that effectively performed against the virulent races of the causal agent of stripe rust in Sakha these results run in the lines with those of Johson (1988) and Ali *et al*., (2007). The obtained results gave evidence to the inclusion of the susceptible entries on race specific resistance and this behavior may explain the alteration of such entries from resistance to susceptibility after few years of release, similar results were supported by Chen *et al*., (1993). Generally, the entries proved to have slow rusting need more genetically studies or marker-assisted identification for the resistance of such entries. As regard to the relative area under disease progress curve (rAUDPC) as a tool for identifying slow rusting the obtained results indicated that the tested entries could be divided into two categories: the first exhibited less than 20% of the rAUDPC of susceptible check, the second exhibited (20%-70%) of the check. Consequently the first group (>20%) is considered better slow rusters *i.e*. Misr 2, Giza 168, Sakha 94, Gem. 7, Shandweel 1 and BeniSweif 6. So it is assumed to have partial resistance as reported by Parlevliet, (1988). On the other hand, entries having rAUDPC (>70%) of the susceptible check are grouped as moderate slow rust (second group) *i.e.* Giza 167, Gem. 5. Both, group 1 and 2 comprised cultivars with varying degrees of partial resistance which has been advocated to be more durable Singh *et al*., (2004). Regarding the 1000 kernel weight and test weight of the tested entries, the obtained results indicated the presence of significant differences between the tested entries within both protected or infected plots during the two season. Obtained results gave evidence that increase of precipitation and decrease in temperature during 2011/2012 was none than 2010/2011. such reason may explain the increase of DS and CI, AUDPC, rAUDPC and 1000 kernel weight. These results were supported by the findings of (King, 1976; Chen *et al*., 2002 and Shahin 2008).

Finally, the obtained results gave evidence to the presence of positive relation coefficient (92% and 94) during the two seasons between CI and the rest of the tested parameters *i.e.* least reading AUDPC, rAUDPC and the 1000kernel weight, similar results run in parallel lines with the present ones (Ali, *et al.*, 2008; Sandoval-Islas *et al.,* 2007 and Safavi, *et al.,* 2010). It could be concluded in the present study that the tested evaluated entries exhibited diversity requiring resistance reactions ranging from immunity-resistance-partial resistance and susceptibility. Most of the evaluated entries exhibited better performance under high disease pressure shown within the susceptible check. Degrees of resistance within the tested entries can be used for future manipulation in wheat improvement program in Egypt.

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مقاومة بعض أصناف من القمح المصرى ضد الصدأ الاصفر

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يعتبر الصدأ الاصفر المتسبب عن فطر بكسنيا استرافورمس من اهم الامراض التى تسبب خسارة فى المحصول فى اغلب المساحات التى تزرع بالقمح فى العالم وفى مصر . ويستحسن مقاومة هذا المحصول من خلال استخدام الاصناف التى ثبت انها تحتوى مقاومة مستديمه Durable resistance وقد تم دراسة السلوك المرضى لعشرين صنف محلى فى ظروف الحقل تحت وطاة العدوى الصناعيه – وتحت ظروف الصوبة الخاصة بالصدأ الاصفر فى سخا خلال موسمى 2012/2010 و 2012/2011 . وقد تم دراسة ابطاء الصدأ من خلال دراسة مقاييس معينه تتمثل فى معامل العدوى CI وقراءة الصدا النهائية بالحقل والمساحة الواقعه تحت منحنى المرض AUDPC والمساحة النسبية تحت منحنى المرض rAUDPC وقد دل حساب معامل الارتباط بين هذه المقاييس فى الاصناف المختبرة فى الموسمين كان هذا المعامل قوى بنسبه تصل الى 92% و 94%. كذلك تم دراسة وزن الالف حبه وحجم ثابت وحساب النسبة المئوية للخفض فى هذا الوزن وقد اوضحت الدراسة ان تأثير الاصابة بالصدأ الاصفر على الاصناف أن الصنف بنى سويف 5 قد سجل أعلى قيمه فى وزن 1000 حبة خلال موسمى الدراسة بقيمة 90, 53 جرام و 20, 50 جرام . بينما سجل الصنف مصر 1 اقل تأثراً بالمرض عند قياس الوزن الثابت بنسبة 52, 1 % وذلك خلال الموسم الاول وسجل الصنف بنى سويف 1 اقل نقص فى المحصول بالنسبة للوزن الثابت بنسبة 57 , 1% . كما دلت النتائج فى النهاية ان بعض من تلك الاصناف المختبرة تمتلك مقاومة مستديمة Durable resistance فى الاصناف جيزة 168 وصنف سخا 94 وصنف جميزة 7 وان زيادة الدراسات الوراثية لهذه الاصناف تفيد فى برنامج التربية لإنتاج اصناف مقاومة فى مصر.