EVALUATION OF CERTAIN WHEAT ENTRIES AGAINST LEAF AND STRIPE RUST DISEASES IN NORTH DELTA

By

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ABSTRACT

Data of the present work throw light on the evaluation of some Egyptian wheat entries at both seedling and adult stages against either leaf or stripe rust diseases. Among 36 entries, 10 and 6 entries were resistant against races No's 57 and 77 of leaf rust pathogen (*Puccinia recondita*), while, 9,13,13 entries proved to be resistant against tested isolates no. 1, 2 and 3 of stripe rust (*Puccinia striiformis*), respectively.

According to the data of two seasonal field experiments, under the stress of artificial inoculation by the two pathogens, Sakha 24 entry exhibited the highest level of resistance to stripe rust. Meanwhile, disease severity ranged between trS. and 80S. The least area under disease progress curve (AUDPC) was recorded with Sakha 24 entry, while the reverse was true with both Sids 7 and Sids 9 wheat entries. The yield components of the tested entries were significantly different as affected by the disease. The highest loss (%) due to stripe rust was recorded in Sids-5 and Sids-9 entries, however, the least affected was Sakha-10 entry.

As regard to leaf rust, the new promising lines i.e. 202, 204 and 206 proved to be distinctive, however, the rest of tested materials showed a response ranged between 5 and 80% susceptibility. Generally, the highest AUDPC was recorded with both Sids-1 and Giza-139 entries, however, the reverse was observed with Tosson wheat entry.

INTRODUCTION

Under Egyptian enviromental conditions, wheat (*Triticum aestivum* L.) crop is subjected to the attack of several rust diseases i.e. stem rust (*Pucciinia graminis tritici*), leaf rust (*P. recondita*) and stripe rust (*Puccinia striiformis*),. The wheat rusts are the most common diseases in Egypt. Many varieties were cancelled for their susceptibility to rust diseases (**Abd El-Hak et al. 1982**).

The significance of each disease, in particular, depends upon the prevalence of aggressive and/or virulent races of the parasite as well as their affinity or compatibility with the genetic constitutions of the host in a given environment. Therefore, the cultivated wheat varieties suffered from sudden epidemics during the last decades from the perspective of change in weather conditions in relation to the genetic makeup of both host and parasite (**El Daoudi et al., 1987)**.

The first leaf rust epidemic in Egypt was recorded on wheat var. Giza 139 during 1945 and the second was recorded during 1968 (**Abd El-Hak and Kamel 1972**). The estimated losses due to leaf rust disease, using different wheat entries, ranged between 12-28% loss in yield of resistant varieties in epidemic conditions **(Sambroski and Peturson 1960)**. Also, **Bajwa et al. (1986)** reported that the losses in kernel weight of wheat varieties due to leaf rust infection ranged between 2.0-41% according to the level of their resistance or susceptibility.

The stripe rust had destroyed most of the wheat area grown with Giza 144 cv. in Northern governorates particularly in Manzala district (**Abd El-Hake et al., 1972**). The last dramatic epidemic was that of 1995 in which stripe rust attacked most of the

commercial wheat varieties causing severe infection particularly in North and South Delta areas. The yield of wheat cvs. Gemmeiza -1, Giza-163, Sakha-69, Giza-157, Sakha-92, Giza-166 and Giza-164 was significantly affected by the disease attack (**El Daoudi et al., 1996**).

The main objectives of this work are (1) screen for new sources of resistance to leaf and stripe rusts, (2) study the behavior of certain wheat cvs. and/or high yielding lines under epidemic circumstances of stripe rust, (3) assess the grain yield loss as affected by leaf and stripe rusts on the tested cultivars and (4) estimation of certain disease parameters.

MATERIALS & METHODS

a- Evaluation of different wheat entries against infection with both stripe and leaf rusts at seedling stage under greenhouse conditions.

The included wheat entries were planted in 10 cm diameter pots. Seedlings at 7-days old were artificially inoculated with uredospores of individual physiologic races of leaf rust (*Puccinia recondita*) i.e. 57 and 77, the main aggressive dominant races of leaf rust under Egyptian conditions, (**Imbaby et al. 1995**). Inoculated seedlings were placed for 48 hours under humid conditions then transferred to the greenhouse (Cereal Dis. Res. Dept., Agric. Res. Center, Giza, at 20 °C ± 2. After 10-12 days from inoculation the rust reactions were recorded. The rust reactions 0, 0;, 1, and 2 were considered resistant (R) response, while X, 3, and 4 were considered susceptible (S) response (**Stakman et al. 1962**).

Seedling tests against stripe rust (*Puccinia striiformis*) were performed at Sakha Res. Greenhouse. Seedlings of different tested wheat entries (7 days-old) were inoculated with uredospores of each of the three stripe rust isolates namely 1, 2 and 3, which were dominated at Kafr El-Sheikh , Gharbia, and Doumiatt Governorates, respectively. After inoculation, seedlings were placed at 9-10 °C for 48 hr then transferred to durnal light regime i.e. 8 hrs darkness at 9-12 °C followed by artificial illumination of 7500 Lux at 15-18 °C for 16 hrs (**Zadoks, 1972**). Disease expression data were recorded as previously mentioned. Data about infection type for the two rust diseases were finally transformed to resistance (R) or susceptibility (S) reaction type.

b- Evaluation of adult plants of different wheat entries against infection with both stripe and leaf rust under field conditions.

These experiments were carried out under environmental field conditions at Sakha Agric. Res. St. for two successive seasons (i.e. 1997 and 1998). The included wheat entries were planted on 15 and 25 November in both 1997 and 1998 seasons respectively, in a split plot design with three replicates. The experimental unit (replicate) consisted of 3 rows with 3-meter long and 20 cm apart. Each row was cultivated with 5 g of a given tested wheat entry. The recommended agricultural practices were applied. To create epidemics of a given rust disease, mixture of fresh uredospores collected from wheat plants showing natural infection with either stripe rust or leaf rust and mixed with talcum powder at the rate of 1:25 (v/ v) was used for artificial inoculation according to the methods described by **Tarvit** and **Cassell** (**1951**). At late tillering and beginning of booting stage, plants of different tested wheat entries were uniformly dusted with the uredospore-talcum powder mixture (inoculated plots). The rust-free plots (protected

plots), were established by spraying with the systemic fungicide Sumi-eight EC "(E)-1-(2,4-Dichlorophenyl)-4,4-dimethyl-2-(1,2,4-triazol-1-yl)-1-penten-3-ol" (diniconazole) at the rate of 0.35 ml / l water and repeated 3 times at 10 days intervals to serve as control. Infection type was recorded 10 days after inoculation and repeated 3 times at 10 days intervals according to the scales of **Peterson et al. (1948)**.

The obtained data served in determination of area under disease progress curve (AUDPC), losses in weight of yield and test weight according to the following equations:

$$AUDPC = D\,[1/2\,(y_1 + y_k) + (y_2 + y_3 + \ldots y_{k-1})]$$ (**Pandy et al., 1989**)

Where: D = Time interval, (y_1+y_k) = sum. of first and last scores of disease scores and $(y_2 + y_3 + ...y_{k-1})$ = sum. of all inbetween disease scores.

$$\text{Loss in weight of yield \%} = \left(1 - \frac{yd}{yh}\right) 100$$ (**Calpouzos et al. 1976**).

Where: yd = Yield for diseased plants, and yh = Yield for healthy plants (from protected plots).

The test weight i.e. the weight of certain volume (100 ml) of wheat kernels (specific weight) and weight of 1000 kernels were also determined for each wheat entry.

RESULTS

Seedling Stage Test:

Data about the disease reaction of 36 wheat entries at seedling stage against the two physiologic races of leaf rust *Puccinia recondita* 57 and 77 clarified that 10 and 6 wheat entries were resistant to race 57 and race 77, respectively. However, the wheat entries Sakha-9, Sakha-12 and Sakha-93, in addition to lines 202, 204 and 206 were resistant at the seedling stage against the both races of leaf rust. The rest wheat entries were susceptible to leaf rust (Table 1).

Regarding reaction against isolates 1, 2, and 3 of stripe rust (*Puccinia striiformis*), the same data (Table 1) indicated that 9, 13, and 13 wheat entries, out of the tested 36 wheat entries proved to be resistant against these isolates, respectively. The wheat entries Giza-139, Giza-144, Giza-155, Sakha-10, Sakha-61, Line 202, Line 204, and Line 206 showed resistant reaction against the 3 tested isolates of stripe rust. However, the rest were susceptible to stripe rust isolates.

It is interesting to find that the three lines 202, 204, and 206 have exhibited resistant reaction against both leaf rust races and stripe rust isolates.

Adult Stage Test:

Data presented in Table (2) show the field evaluation of 36 wheat entries under stress of artificial inoculation with leaf and stripe rust uredospores during 1997 and 1998 seasons.

The obtained data indicate that leaf rust (P. recondita) severity was relatively higher during 1997 season than in 1998 one. It was ranged between less than 5% infection i.e. TrS and 80% infection i.e. 80S during the two seasons. Regarding behavior of the tested wheat entries during both seasons against leaf rust, the present results clearly indicated that wheat lines 202, 204 and 206 proved to have the least level of infection (trS) with leaf rust followed by wheat entries Sakha-10, 12, 24, and 93 which exhibited

5S, while. Sakha-9, 69, Sids-5, 6, 7, 8 and 9 which exhibited susceptibility ranging between 5-10S, meantime, Giza-162, 163 and 164, Sakha-66 and Sids-4 showed 10-20S during both growing seasons. On the other hand, the highest level of infection (60S-80S) was associated with the entries Sids-1 and Giza-139 followed by Sids-2, the most susceptible wheat entries with leaf rust disease, during both seasons.

Table (1): Evaluation of 36 wheat entries against two physiologic races of leaf rust (Puccinia recondita) and 3 isolates of stripe rust (P. striiformis) at seedling stage.

No.	Entry	Leaf rust races		Stripe rust isolates		
		57	77	1	2	3
1	Mabrouk	S	S	S	S	R
2	Tosson	S	S	S	**R**	S
3	Giza -139	S	S	**R**	**R**	**R**
4	Giza -144	S	S	**R**	**R**	**R**
5	Giza - 155	S	S	**R**	**R**	**R**
6	Giza -156	S	S	S	**R**	**R**
7	Giza -158	S	S	S	**R**	**R**
8	Giza -162	S	S	S	S	S
9	Giza -163	S	S	S	S	S
10	Giza -164	S	S	S	S	S
11	Giza -165	S	S	S	S	S
12	Sakha -8	**R**	S	S	S	S
13	Sakha -9	**R**	**R**	S	S	S
14	Sakha -10	**R**	S	**R**	**R**	**R**
15	Sakha -12	**R**	**R**	S	S	S
16	Sakha -24	S	S	S	S	S
17	Sakha -61	S	S	**R**	**R**	**R**
18	Sakha -66	S	S	S	S	S
19	Sakha -69	S	S	S	S	S
20	Sakha -92	S	S	S	S	S
21	Sakha -93	**R**	**R**	S	S	S
22	Gemmeiza-1	**R**	S	S	S	S
23	Gemmeiza-3	S	S	S	S	S
24	Gemmeiza-5	S	S	S	**R**	**R**
25	Sids-1	S	S	S	S	**R**
26	Sids-2	S	S	**R**	**R**	S
27	Sids-3	S	S	S	S	S
28	Sids-4	S	S	S	S	S
29	Sids-5	**R**	S	S	S	S
30	Sids-6	S	S	S	S	S
31	Sids-7	S	S	S	S	S
32	Sids-8	S	S	S	S	S
33	Sids-9	S	S	S	S	S
34	Line-202	**R**	**R**	**R**	**R**	**R**
35	Line-204	**R**	**R**	**R**	**R**	**R**
36	Line-206	**R**	**R**	**R**	**R**	**R**

The remainder wheat entries showed intermediate susceptibility ranging from 30S to 60S in both seasons. It is interesting to state that, the level of infection with leaf rust disease during 1997 was relatively higher at seedling stage on most tested wheat entries than in 1998 one, but this trend was reversed in few other wheat entries.

The results in Table (2) also show that, the tested wheat entries exhibited different reactions against infection with stripe rust (*P. striiformis*) disease. The levels of infection were ranged between 0 and 90S during both seasons of 1997 and 1998. In this respect, the wheat entries Giza-144,-155 and Sakha-61 only exhibited complete resistance i.e (0-reaction). Meanwhile, wheat Lines 202, 204 and 206 produced trS-reaction; Tosson, Giza-139, Sakha-93, and Sids-1 exhibited trS-5S and Giza-158 and Gemmeiza-5 showed susceptible reaction ranging between 5S–10S came the next in both growing seasons. On the other hand, the highest disease reaction (60S-90S) was recorded with Giza-139, -144, -163, and -164, Sakha-69, Gemmeiza-1, Sids-4,-5,-6,-7, and -8. The latter wheat entries seemed to be the most susceptible against stripe rust infection in both seasons. The other wheat entries showed intermediate reactions ranging between 20S-60S in both seasons.

From data in Table (2) it could be concluded that out of the 36 tested wheat entries, the lines 202, 204, 206 and Sakha-93 only seemed to be the least susceptible at adult stage against infection with both leaf and stripe rust diseases during both 1997 and 1998 seasons.

Leaf rust development:

Data in Table (3) show the leaf rust disease development on 13 wheat entries during two successive seasons in term of area under disease progress curves (AUDPC).

Concerning with AUDPC, data (Table 3) show that the highest figures were recorded with Sids-1 followed by Giza-139, and Gemmeza-5 in both seasons. The AUDPC values were 1400.0, 1265.0, and 1150.0 in 1997 and 1500.0, 1300.0, and 1200.0 in 1998 season for these three entries, respectively. In contrast, the lowest values were recorded with wheat entries Tosson and Giza-156. The AUDPC values were 429.5, 543.0 in 1997 and 525.0 and 475.0 in 1998 season for both entries, respectively. The rest of tested entries exhibited in between values.

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Table (**2**): Field evaluation of 36 wheat entry against leaf and stripe rusts, under the stress of artificial inoculation at adult stage during two seasons (1997-1998).

No.	**Entries**	**Leaf rust reaction**		**Stripe rust reaction**	
		1996/97	**1997/98**	**1996/97**	**1997/98**
1	Mabrouk	70 S	70 S	20 S	5 S
2	Tosson	50 S	40 S	0	5 S
3	Giza 139	70 S	70 S	5 S	5 S
4	Giza 144	60 S	70 S	0	0
5	Giza 155	50 S	60 S	0	0
6	Giza 156	60 S	40 S	20 S	5 S
7	Giza 158	50 S	40 S	10 S	10 S
8	Giza 162	20 S	20 S	40 S	20 S
9	Giza 163	20 S	10 S	80 S	80 S
10	Giza 164	20 S	10 S	60 S	80 S
11	Giza 165	10 S	5 S	70 S	90 S
12	Sakha 8	30 S	20 S	50 S	50 S
13	Sakha 9	10 S	10 S	70 S	60 S
14	Sakha 10	5 S	5 S	20 S	20 S
15	Sakha 12	5 S	5 S	30 S	30 S
16	Sakha 24	5 S	5 S	20 S	20 S
17	Sakha 61	40 S	50 S	0	0
18	Sakha 66	20 S	20 S	50 S	50 S
19	Sakha 69	10 S	10 S	80 S	70 S
20	Sakha 92	30 S	10 S	40 S	80 S
21	Sakha 93	5 S	5 S	TR S	5 S
22	Gemmeiza 1	30 S	30 S	70 S	60 S
23	Gemmeiza 3	40 S	40 S	50 S	50 S
24	Gemmeiza 5	60 S	70 S	5 S	10 S
25	Sids 1	80 S	80 S	5 S	5 S
26	Sids 2	60 S	70 S	20 S	10 S
27	Sids 3	50 S	40 S	30 S	40 S
28	Sids 4	10 S	20 S	80 S	60 S
29	Sids 5	5 S	10 S	80 S	80 S
30	Sids 6	10 S	5 S	70 S	80 S
31	Sids 7	10 S	5 S	80 S	90 S
32	Sids 8	10 S	5 S	80 S	90 S
33	Sids 9	10 S	5 S	80 S	90 S
34	Line 202	TrS	TrS	TrS	TrS
35	Line 204	TrS	TrS	TrS	TrS
36	Line 206	TrS	TrS	TrS	TrS
	Mean	28.2	26.5	36.5	37.5

Table (3): Leaf rust disease development @ on 13 wheat entries expressed in term of area under disease progress curves (AUDPC) at Sakha during 1997 and 1998 growing seasons.

Entries	Rust severity % at dates				
1997	Mar-10	Mar-20	Mar-30	Apr-10	AUDPC***
Mabrok	5.0	20.0	50.0	60.0	1025.0
Tosson	2.6	5.0	20.0	33.3	429.5
Giza 139	10.0	30.0	56.5	70.0	1265.0
Giza 144	13.3	26.6	50.0	70.0	1182.5
Giza 155	5.0	10.0	30.0	43.3	641.5
Giza 156	2.0	5.0	23.3	50.0	543.0
Giza 158	5.0	10.0	30.0	40.0	625.0
Sakha 61	0.0	16.6	30.0	40.0	666.0
Gemmeiza 3	5.0	20.0	30.0	40.0	725.0
Gemmeiza5	10.0	30.0	50.0	60.0	1150.0
Sids 1	20.0	30.0	60.0	80.0	1400.0
Sids 2	5.0	20.0	50.0	60.0	1025.0
Sids 3	5.0	10.0	30.0	40.0	625.0
1998	Mar-20	Mar-30	Apr-10	Apr-20	AUDPC***
Mabrok	10.0	20.0	50.0	70.0	1100.0
Tosson	5.0	10.0	20.0	40.0	525.0
Giza 139	10.0	30.0	60.0	70.0	1300.0
Giza 144	5.0	20.0	50.0	60.0	1025.0
Giza 155	5.0	10.0	30.0	50.0	675.0
Giza156	5.0	5.0	20.0	40.0	475.0
Giza158	5.0	20.0	30.0	40.0	725.0
Sakha61	5.0	10.0	20.0	40.0	525.0
Gemmeiza 3	10.0	20.0	40.0	40.0	850.0
Gemmeiza 5	10.0	30.0	50.0	70.0	1200.0
Sids 1	20.0	40.0	60.0	80.0	1500.0
Sids 2	5.0	20.0	40.0	60.0	925.0
Sids 3	5.0	10.0	40.0	40.0	725.0

Stripe rust development:

Data in Table (4) elucidate the stripe rust disease development in term of AUDPC for 21 wheat entries at Sakha station during 1997 and 1998 seasons.

In respect to the AUDPC, data indicated that the higest values were recorded with Sids-9 (1641.5), Sids-7 (1466.0), Giza-163 (1424,5) and Gemmeiza-1 (1418.0) In 1997, however, in 1998 the highest values were recorded with Sids-5 (2500.0) followed by Sids-7 (2250.0), and Giza-165 (2100.0). On the other hand, the lowest values of AUDPC were recorded with entry Sakha-24 (150.0), and Sakha-10 (183.0) in 1997 season and Sakha-24 (150.0), Giza-162 (195) in 1998 season.

Weight of 1000 kernels and test weight as affected with leaf rust infection:

Data in Table (5) show the evaluation of 13 wheat entries against leaf rust infection under field conditions in terms of weight of 1000-kernels and test weight at Sakha Station during 1997 and 1998 growing seasons.

The tested wheat entries showed significant differences in the kernel weight due to infection either in inoculated (not sprayed) or in protected plots (sprayed with fungicide) in both seasons. In this regard, the entry Sids-3 produced the highest kernel weight in both inoculated and protected plots, while the lowest kernel weight was produced by entries Giza-139 in inoculated plots and Giza-158 in protected plots during both seasons. Compared with protected plots, the obtained results showed significant losses in weight of 1000-kernel of the tested wheat entries as affected by leaf rust infection. Loss % ranged between 9.24% (Tosson) to 23.21% (Giza-159) in 1997 season and 9.07 (Sakha-61) to 25.25% (Giza-139) in 1998 season.

Concerning the test weight, trend of the obtained results and their significance might be differed than those of kernel weight Table (5). The wheat entries Sids-3, Sakha-61, Gemmeiza-5 and Gemmeiza-3 in both seasons in addition to Mabrouk, Giza-156, Giza-158 and Sids-2 in 1998 season only produced the highest test weight in inoculated plots without significant differences inbetween, while, Giza-159, -144 and -156 resulted in the lowest test weight in both seasons. For each entry, it was clear that the test weight in protected plots was significantly higher than in inoculated ones. The lowest loss % in test weight was associated with the entry Gemmeiza-3 in both seasons while Giza-139 in 1997 and Mabrouk and Giza-156 showed the highest losses in 1998 season.

Weight of 1000 kernels and test weight as affected with stripe rust infection:

Data in Table (6) show that both 1000-kernel weight and test weight of 21 wheat entries were significantly affected by stripe rust infection under field conditions during 1997 and 1998. Depending on wheat entry, the values of 1000-kernel weight ranged between 23.13-40.93 g and 23.86-43.60 g in inoculated plots (artificially inoculated), and 40.63-59.26 g and 41.03-56-33 g in protected plots (sprayed with fungicide) in 1997 and 1998, respectively. In inoculated plots, the highest and lowest values of 1000-kernel weights were produced by wheat entries Sakha-24 and Sids5 in 1997 season, respectively. However, the latter entry produced the highest value in protected plots. The present data show clearly that the wheat entries particularly those of Sids group produced the lowest values of 1000-kernel weight in inoculated plots but this was reversed in case of protected plots in both seasons. Losses percentages fluctuated between 10.73% (Sakha-24) to 60.63% (Sids-5) in 1997 season and 6.24% (Sakha-24) to 56.74% (Sids-7) in 1998 season.

As for test weight, similar trend was observed. The wheat entries Giza-163 and Sakha-24 produced the lowest and highest values, respectively either in inoculated or in protected plots during both seasons. Compared with test weight in protected plots, the loss percentage fluctuated between 10.82% (Sakha-10) to 53.40% (Gemmeiza-1) in 1997 season and between 5.24% (Sakha-24) to 55.94% (Gemmeiza-1) in 1998 season. The other tested wheat entries showed in between reactions.

Table (4): Stripe rust disease development on 21 wheat entries, expressed in terms of rate of increase (r–value) and area under disease progress curves (AUDPC) at Sakha during 1997 and 1998 growing seasons.

	Stripe Rust Severity % (during 1997 season)						Stripe Rust Severity % (during 1998 season)					
Entries	Mar 10	Mar 20	Mar 30	Apr 10	r-value	AUDPC *	Mar 20	Mar 30	Apr 10	Apr 20	r-value	AUDPC *
Giza 160	0.0	0.0	6.3	40.0	0.215bc	283.0	2.0	3.3	8.3	16.6	0.142d	195.0
Giza 163	8.3	30.0	63.3	90.0	0.251d	1424.5	5.0	50.0	80.0	80.0	0.214hi	1725.0
Giza 164	8.3	20.0	43.3	60.0	0.170a	633.0	8.3	56.6	80.0	80.0	0.168ef	683.0
Giza 165	5.0	20.0	50.0	70.0	0.213bc	1075.0	10.0	70.0	90.0	90.0	0.219hi	2100.0
Sakha 8	2.0	5.0	26.6	50.0	0.236cd	566.0	5.0	20.0	40.0	50.0	0.147de	875.0
Sakha 9	5.0	20.0	60.0	70.0	0.213bc	1175.0	5.0	20.0	50.0	60.0	0.194gh	1025.0
Sakha 10	0.0	0.0	8.3	20.0	0.159a	183.0	0.0	0.0	20.0	20.0	0.083a	300.0
Sakha 12	0.0	0.0	10.0	30.0	0.191ab	250.0	0.0	0.0	20.0	30.0	0.193fgh	350.0
Sakha 24	0.0	0.0	5.0	20.0	0.159a	150.0	0.0	0.0	5.0	20.0	0.083a	150.0
Sakha 66	0.0	5.0	30.0	50.0	0.236cd	600.0	0.0	0.0	10.0	50.0	0.236 I	350.0
Sakha 69	6.6	36.6	63.6	76.0	0.230cd	1415.0	5.0	40.0	70.0	70.0	0.213hi	1475.0
Sakha 92	2.0	10.0	26.0	40.0	0.215bc	560.0	0.0	5.0	30.0	80.0	0.213hi	750.0
Gemmeiza 1	6.6	30.0	63.3	90.0	0.251d	1418.0	5.0	20.0	40.0	60.0	0.194gh	925.0
Gemmeiza 3	5.0	10.0	30.0	50.0	0.174a	675.0	5.0	10.0	30.0	40.0	0.172fg	625.0
Sids 3	5.0	10.0	46.0	76.6	0.228cd	968.0	5.0	20.0	30.0	40.0	0.199h	725.0
Sids 4	6.6	20.0	50.0	86.0	0.251d	1163.0	5.0	50.0	60.0	60.0	0.133cd	1425.0
Sids 5	6.6	26.6	66.6	80.0	0.188ab	1365.0	50.0	90.0	90.0	90.0	0.092ab	2500.0
Sids 6	1.6	10.0	46.6	80.0	0.213bc	907.0	20.0	60.0	70.0	80.0	0.082a	1800.0
Sids 7	6.6	30.0	73.3	80.0	0.188ab	1466.0	40.0	70.0	90.0	90.0	0.113bc	2250.0
Sids 8	10	40.0	60.0	80.0	0.188ab	725.0	8.3	33.3	60.0	60.0	0.194gh	1274.5
Sids 9	5.0	40.0	80.0	83.3	0.235cd	1641.5	20.0	50.0	70.0	90.0	0.164efg	1750.0

* Rust severity % was recorded according to Peterson et al. (1948)

Table (5): The response of 13 wheat entries against leaf rust infection under field conditions expressed in terms of 1000 K.W, test weight and their loss % in either infected or protected plots, at Sakha during 1997 and 1998 growing seasons.

	1000 Kernel weight						Test weight					
	1997			1998			1997			1998		
Entries	**Infected**	**Protected**	**Loss %**	**Infected**	**Protected**	**Loss %**	**Infected**	**Protected**	**Loss %**	**Infected**	**Protected**	**Loss %**
Mabrouk	38.73 de	45.07 def	14.07	37.90 c	44.9 d	15.59	83.47 c	91.40 def	8.68	85.06 ab	94.73 abc	10.21
Tosson	40.27 c	44.37 ef	9.24	38.23 c	43.10 e	11.30	86.10 b	92.16 cd	6.58	84.53 b	91.30 bcd	7.42
Giza-139	35.50 h	46.23 cd	23.21	33.66 f	45.03 d	25.25	78.83 e	89.57 g	11.99	81.10 c	88.87 de	8.74
Giza-144	40.27 c	47.17 bc	14.63	42.36 a	48.40 a	12.48	81.47 d	89.83 fg	9.31	80.93 c	89.40 de	9.47
Giza-155	42.47 b	47.70 b	10.96	40.26 b	47.57 ab	15.37	78.33 e	85.36 h	8.17	79.43 c	88.27 e	10.01
Giza-156	38.83 de	44.03 f	11.81	40.36 b	45.70 cd	11.68	84.47 c	90.10 efg	6.25	84.96 ab	90.90 cde	6.53
Giza-158	34.80 h	40.43 g	13.93	33.76 f	42.67 e	20.88	86.63 b	92.57bcd	6.42	85.53 ab	92.57 abc	7.61
Sakha-61	41.47 bc	46.03 cd	9.91	43.10 a	47.40 ebc	9.07	87.73 ab	93.30 abc	5.97	87.83 a	94.23 a	6.79
Gemmeiza-3	40.10 cd	43.67 f	8.17	37.70 c	43.13 e	12.59	86.90 ab	91.67 cde	5.20	86.37 ab	92.37 abc	6.50
Gemmeiza-5	37.17 fg	46.47 bcd	20.01	35.56 de	47.23 abc	24.71	87.60 ab	94.63 a	7.43	87.17 ab	94.73 a	7.98
Sids-1	35.8 gh	45.67 de	21.61	35.06 ef	45.30 d	22.60	86.30 b	93.97 ab	8.16	84.35 b	93.90 ab	9.98
Sids-2	38.30 ef	47.17 bc	18.80	37.16 cd	45.87 bcd	18.99	86.33 b	91.70 cde	5.86	85.50 ab	92.30 abc	7.37
Sids-3	44.13 a	49.73 a	11.26	42.80 a	49.03 a	12.71	88.57 a	93.43 abc	5.20	86.10 ab	94.27 a	8.66
L.S.D at 0.05, for the two treatments (in infected and in protected) in each entry.												
1.33				1.42			1.53			2.85		

Table (6):The response of 21 wheat entries against stripe rust infection under field condition expressed in terms of 1000 K.W, test weight and their loss % in either infected or protected plots, at Sakha during 1997 and 1998 growing seasons.

	1000 Kernel weight						Test weight					
	1997			1998			1997			1998		
Entries	**Infected**	**Protected**	**Loss**	**Infected**	**Protected**	**loss**	**Infected**	**Protected**	**loss**	**Infected**	**Protected**	**loss**
Giza 162	34.00 de	40.90 1 i	16.89	34.20 cd	41.03 k	16.65	63.56 e	84.94 i	25.17	65.56 df	91.43 a	28.29
Giza 163	27.03 h	47.74 fg	43.38	24.76 Ij	48.46 efg	48.90	42.30 l	90.96 fg	53.49	41.40 k	93.53 be	55.73
Giza 164	31.70 f	47.76 fg	33.62	27.83 gh	47.63 fgh	41.57	71.00 bc	89.36 gh	20.54	62.93 de	93.26 be	32.52
Giza 165	33.43 ef	49.00 f	31.77	31.26 ef	49.83 def	37.73	60.10 fg	90.96 fg	33.92	51.83 ij	91.40 e	43.29
Sakha 8	35.86 c	46.43 a	23.41	35.00 cd	47.93 efg	26.98	66.53 d	88.00 h	24.39	71.06 c	93.83 be	24.26
Sakha 9	35.56 cd	44.40 h	19.90	35.53 cd	42.36 jk	16.13	57.36 hi	83.23 ij	31.08	53.06 ij	88.10 fg	39.77
Sakha 10	40.93 b	48.10 fg	14.90	42.66 a	47.86 efg	10.86	73.06 b	81.93 j	10.82	75.23 b	80.60 h	6.66
Sakha 12	40.36 b	46.86 a	13.87	40.16 b	45.16 hi	11.07	72.26 b	48.22 ij	14.20	69.56 c	79.63 h	12.64
Sakha 24	43.83 a	49.10 f	10.73	43.60 a	46.50 gh	6.24	81.73 a	92.53 cf	11.67	81.66 a	86.20 g	5.26
Sakha 66	33.90 de	40.66 i	16.62	36.30 cd	41.36 jk	12.25	72.90 b	93.90 be	22.36	71.13 c	92.50 de	23.10
Sakha 69	25.86 hi	40.63 i	36.35	24.23 ij	46.60 gh	48.00	51.23 j	91.10 efg	43.76	50.90 j	90.96 ef	44.04
Sakha 92	32.53 ef	51.10 e	36.34	30.10 fg	50.53 de	40.43	62.08 ef	92.10 dg	32.59	54.60 hi	93.10 cde	41.35
Gemmeiza 1	32.77 ef	51.11 e	35.88	31.20 ef	49.03 efg	36.37	45.13 k	96.86 a	53.40	42.16 k	95.70 ad	55.94
Gemmeiza 3	36.23 c	50.80 e	28.68	36.56 c	43.83 ij	16.58	58.60 gh	77.16 k	24.05	57.50 gh	75.26 I	23.59
Sids 3	29.43 g	56.53 b	47.93	26.86 hi	52.30 cd	48.63	68.73 cd	96.30 ab	28.62	65.16 de	93.46 be	30.28
Sids 4	34.10 de	52.46 de	34.99	30.93 f	53.70 bc	42.40	50.93 j	97.43 a	47.72	51.26 j	96.53 ab	46.89
Sids 5	23.33 j	59.26 a	60.63	24.23 ij	53.66 bc	54.85	55.40 i	95.20 abc	41.80	51.80 ij	96.56 ab	46.35
Sids 6	33.20 ef	56.33 b	41.06	27.46 h	57.10 a	51.90	67.83 d	94.80 ad	28.44	61.93 ef	93.43 be	33.71
Sids 7	26.13 hi	54.40 c	51.90	24.36 ij	56.33 ab	56.74	61.26 efg	93.77 bf	34.66	59.03 fg	93.26 be	36.70
Sids 8	29.90 g	53.33 cd	43.99	33.73 de	53.73 bc	37.22	68.66 cd	94.63 ad	27.44	62.30 e	96.36 abc	35.34
Sids 9	24.90 ij	53.40 cd	53.37	23.86 j	55.06 ab	56.66	67.16 d	95.20 abc	29.45	63.40 de	97.63 a	35.06
L.S.D at 0.05 For the two treatments (in infected and in protected) in each entry.												
	1.49			2.45			2.62			2.46		

DISCUSSION

The present work is dealing with the evaluation of certain wheat entries against either leaf or stripe rust, tasking into consideration certain disease parameters and yield components.

The obtained results showed that the wheat cultivars Sakha-9, Sakha-12 and Sakha-93 in addition to lines-202, -204 and -206 were resistant at the seedling stage against leaf rust (*P. recondita*) races 57 and 77. So far Sakha-93 and Lines-202, -204 and -206 proved to be good sources of resistance. Sakha 9, and 12 cvs. are known to be a part of the Egyptian wheat germplasm, but not known as commercials. Consequently this result may add a depth of their resistance to be exploited as good sources of resistance.

The obtained results indicated that entries i.e. Giza-139, -144, -155, Sakha-10, -61, and lines-202, -204 and -206 proved to be resistant against the 3 isolates of stripe rust (*P. striiformis*) predominant in the region during 1996/97 and 1997/98 seasons. It is known that Sakha 61, Giza 144, Giza 155 are considered to be good sources of resistance, according to the simultaneous testing against stripe rust **(El-Daoudi et al., 1996 ; Abu El–Naga et al., 1998).** The new released lines-202, -204 and -206, proved their efficacy against both leaf and stripe rust diseases, because they were released within the critical time of epidemics i.e. they received a lot of inocula representing variable genetic constitutions of the causal agent(s). These new lines are on the road to be commercially produced.

As regard to the evaluation against leaf rust at adult stage under field conditions, the obtained results indicated that the new promising lines-202, - 204 and -206 acted well against leaf rust. On the other hand Sids-1, Giza-139 and Gemmeiza-5 exhibited the highest area under the disease progress curve (AUDPC), however, Tosson, Sakha-61, Mabrouk, Giza-156, -155, -158 exhibited lowest AUDPC. Consequently, it could be concluded that these entries might have slow rusting. These results are in harmony with those of **Ragab et al. (1989)** who reported that at the adult stage, the slow-rusting cvs. Sakha 69, Sakha, 61, Sakha 92, Giza 162 and Baart had a lower rate of disease increase (r-value) as well as smaller area under disease progress curve (AUDPC), while the higher r-value and AUDPC were evident on cultivars Sakha 8 and Giza 157 with the two races comparing with the above mentioned cultivars.

Concerning the evaluation against stripe rust at adult stage, the obtained results indicated that entries such as Giza-144, Giza-155, and Sakha-61 exhibited no susceptibility (0-infection type) against the disease under the stress of epidemic conditions prevalent in the region. These materials are still serving as valuable source of resistance in breeding programs. Looking through the rest of the materials, the entries Sakha-10, -12–24 and 93 and the new lines i.e. -202, -204, and -206 proved to exhibit the lowest AUDPC. Sakha-. This would support the resistant materials in Egypt specially against stripe rust. The obtained results could be interpreted in light of publications of **Yang** & **Zeng, (1989), Chen** & **Line (1995)** and **Ma** & **Singh (1996).**

As for 1000-kernel weight and test weight as affected by leaf rust infection, the obtained results indicated that the entry Sids-3 produced the highest kernel weight, while the lowest was produced by the entries Giza-139 and Giza-158 during both seasons. Significant loss in weight of 1000-kernel was recorded among the tested wheat entries. The entries Tosson and Sakha-61 produced

the lowest loss in 1000-kernel weight, while, Giza-139, Gemmeiza-5, and Sids-1 showed the highest losses during both seasons. Loss % ranged between 9.24-23.21% in 1997 season and 9.07-25.25% in 1998 season. About test weight, the entries Sids-3, Sakha-61, Gemmeiza-5 and Gemmeiza-3 in both seasons produced the highest test weight in infected plots and this result may reflect the tolerance of these entries against stripe rust infection. The lowest loss % in test weight was associated with the entry Gemmeiza-3 in both seasons, while, Giza-139 in 1997 and Mabrouk and Giza-156 showed the highest losses in 1998 season. In this regard, **Sambroski and Peturson (1960)** using other wheat entries, reported 12-28% loss in yield of resistant varieties in epidemic conditions. Also, **Bajwa et al. (1986)** reported that the losses in kernel weight of wheat varieties due to leaf rust infection ranged between 2.0-41% according to the level of their resistance or susceptibility.

The obtained results also revealed that the highest loss % in 1000-kernel weight due to stripe rust infection was recorded on Sids-5, Sids-7 and Gemmeiza-1 (60.63 , 56.74 and 53.40 %, respectively). The reverse was observed on Sakha-24, being 10.73% and 6.24% during 1997 and 1998 seasons, respectively. The rest of tested entries ranged between the two edges. Similar results were reported by several authors (**Doling & Doodson, 1968 , King, 1976 , El-Naimi & Mamluk, 1994 , El-Torabi et al., 1995 , Fazel, 1996 , El-Daoudi et al., 1996** and **Abu El-Naga et al., 1997)**. It could be concluded from the present work that the entries such as Tosson, Giza-155 and Sakha-61 must receive intensive studies from the perspective of genetic control particularly against stripe rust. On the other hand, the new released vrs. and or lines exhibited good performance against the concerned diseases.

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تقييم بعض المدخلات الوراثية للقمح ضد مرضى صدأ الأوراق والصدأ الأصفر فى اقليم شمال الدلتا

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تم تقييم 36 مدخل وراثى من القمح ضد مرض صدأ الأوراق (السلالات 77 ، 57) ومرض الصدأ الأصفر عزلات (1 ،2 ،3) وقد أسفر التقييم عن وجود 10 مدخلات وراثية مقاومة للسلالة 57 و6 مدخلات مقاومة للسلالة 77 وكذلك وجود 9 ، 13 ، 13 مدخل وراثى مقاوم لعزلات الصدأ الأصفر 1 ،2 ، 3 على التوالى فى طور البادرة. وعلى مدى موسمين وتحت ظروف الحقل (تحت وطأة العدوى الصناعية بالصدأ الأصفر) أظهرت الأصناف سخا 61 ، جيزة 144 ، جيزة 155 ، طوسون وسخا 24 أعلى درجات المقاومة بينما انحصرت شدة الإصابة فى بقية الأصناف مابين آثار إصابة إلى 80% إصابة فى طور البلوغ . وقد سجلت أقل مساحة تحت منحنى المرض مع الصنف سخا 24 وسجل العكس على أصناف سدس 7 ، وسدس 9 ، كما تفارقت الأصناف فى معدل زيادة المرض وبعض مكونات المحصول مثل وزن 1000 حبة والوزن النوعى ، وسجل أعلى درجة من الخسارة على الصنفين سدس 5 ، وسدس 9 وكان أقلهما تأثرا من حيث الخسارة هو المدخل سخا 10 . وفيما يتعلق بتقييم الأصناف ضد الصدأ البرتقالى فقد بينت الدراسة تميز بعض السلالات المبشرة مثل 206 ، 204 ، 202 فى رد فعلها ضد المرض وتراوحت شدة الإصابة فى بعض المواد المختبرة مابين 5–80% (قابلية للإصابة). وقد تميز الصنف طوسون بأقل مساحة تحت منحنى المرض ولوحظ العكس مع الصنف سدس 1 وجيزة 139 ، كما أظهرت بعض الأصناف فروقا معنوية فى الوزن النوعى وإنخفض هذا الفرق فيما يتعلق بوزن الألف حبة .