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FREQUENCY OF VERULENCE AND VIRULENCE FORMULA OF WHEAT STRIPE RUST RACES IDENTIFIED IN EGYPT

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ABSTRACT: ***Wheat stripe rust is one of the major diseases on wheat in Egypt which appears annually in virulence of different frequencies. In this investigation, stripe rust samples were collected from different location of lower Egypt during two season (2005/06-2006/07). Three single pustules method of isolation was followed for each sample. Rust data were recorded as infection types and virulence frequencies were determined against 22 Yr genes, in monogenic lines and some Egyptian genotypes. Virulence frequencies were very high against YrCV, Yr (3), Yr SU, Yr (6), Yr (7), Yr 2, Yr 7, Yr 8, Yr 9, Yr 27, Yr 18, Yr 6 and Yr A, while the lowest frequencies were found against Yr1, Yr 5, Yr 10, Yr 15, Yr SD, Yr 3, Yr SP, Yr 17 and Yr 4. The cvs. Sakha 61, Sakha 94, Gemmeiza 9 and Giza 168 were the least frequencies. The physiologic races were identified according to their reaction on the 22 Yr's and virulence formula (virulence / avirulence) was recorded for each race. Thirteen physiologic races of Puccinia striiformis were found. Race 102E22 was most frequent (13.33 %) followed by races 238E0 and 238E182(10%). The least ones in the regard were races 198E144 and 2E128 (3.33%) .***

Key words: ***Virulence, Frequency, identified, stripe rust, Races, Monoginic.***

INTRODUCTION

Stripe rust (*Puccinia striiformis*) is a common disease on wheat in all growing areas in Egypt. Nevertheless, disease infection with stripe rust disease usually occurs only at the late growth stages starting from the flowering stage. No disease infection was recorded on seedling plants under field conditions. Therefore, breeding for adult plant resistance is the most important method to control this disease under the Egyptian conditions.

Stripe rust can be considered as a sporadic disease because it appears in some seasons but not in the others. It appeared in epidemic case in 1967, 1983, 1996, and 1997 (Abd El-Hak, *et al*, 1972, El-Daoudi, *et al*, 1996 and Abu El-Naga 1999- 2001), and disappeared in the other season. Moreover, all wheat genotypes produced in Egypt are susceptible in terms of infection types except Sakha 61 which shows moderately susceptible and response has a high level of partial resistance (Ashmawy 2005). Therefore, to protect

the local genotypes from infection by this disease, genes for resistance should be incorporated into the high yielding genotypes.

Disease resistance is controlled by major or minor genes or both together, however complementary effect between major genes may enhance the response of a variety and give higher levels of resistance (Simons *et al*., 1978).

Many of the major genes are effective through the whole life of the plant, whereas a few of them are only effective at the adult stage. Resistance during later period of plant growth is called adult plant resistance as defined by (Zadoks, 1961) as the resistance that is only effective in the advanced growth stages of the plant .

Expression of resistance depends on the host-parasite interaction, environmental conditions, plant growth stage and the interaction between resistance genes in the wheat genome (Kolmer, 1996).

Therefore, the leaf rust single investigation were to study the frequency of virulence against the stripe rust single genes for resistance and also against the local genotypes, to serve the national breeding program for resistance.

MATERIALS AND METHODS

Infected leaf specimens were collected from different wheat growing areas in Egypt during 2005/06-2006/07. Samples were obtained from the commercial fields as well as from wheat stripe rust trap nursery, from lines carrying known genes for stripe rust resistance (*Yr's).*

Each specimen was transferred onto 8-9 days – old seedling of the highly susceptible cv. Giza 160 under greenhouse conditions.

Three single pustules were tested per each sample, and each culture was increased on cv. Giza 160 seedling to generate sufficient inoculate (spores) to inoculate the set of differentials, following the method of Stakman *et al.*, (1962). The differential sets (Table,1) consisted of monogenic lines of wheat possessing 17 stripe rust resistance gene (Johnson *et al.,* 1972), in addition to another set of six lines added as supplementary set to serve the race identification.

Infection types were recorded according to scale of 0-9 grades (Mc Neal 1971) as shown in (Table, 2). Wheat seedlings of eight days were sprayed with tap water and the leaves were gently rubbed between moistened fingers and again sprayed with water by an atomizer in the inoculation chambers. Inoculation was carried out by shaking and brushing rust spores over the plant leaves and sprayed gently again with water in order to induce initial a thin film of water on the plant leaves. The light intensity was adjusted at 7600 lux while the temperature was 15°C and relative humidity of 95 % was supplied. The day / night rhythm was 8/16 (Stubbs , 1988).

Frequency of virulence was determined against two sets of varieties. The first set included local wheat genotypes, whereas the second set included 22 monogenic lines carrying adult-plant resistance genes. The frequency of

virulence was estimated as the percentage of virulent isolates to the total number of isolates for each genotype.

$$\text{Virulence (\%)} = \frac{\text{susceptible response} \times 100}{\text{Total number of isolates}}$$

According to the method adopted by Green (1965).

Table (1): Differential varieties assigned for identification of physiologic races of stripe rust incited by *Puccinia striiformis tritici* West according to Johnson *et al*., (1972).

Entries names	Yr's	Abbreviation	Entries names	Yr's	Abbreviation
Cheinese 166	1	Ch	Hybrid 46	4	H46
Lee	7	Lee	Reichersberg 42	(7)	R42
Heines Kolben	6	HK	Heines Peko	(6)	Pe
Vilmorin 23	3	V23	Nord Deprez	(3)	No
Moro	10	Mo	Compare	8	Com
Strubes Dickkopf	SD	Std	Carsten V	CV	CV
Suwon × Omar	SU	SU	Spalding Prolifi	SP	Spa
Clement	9	CL	Heines VII	2	HVII
Tirt-Spelt album	5	SP			

Table (2): Infection types and classes of stripe rust reaction adopted by Mc Neal *et al*. (1971).

Infection type	Infection class	Disease symptoms	Symbol
0	Immune	No visible infection	O
1	High Resistant	Necrotic/ chlorotic flecks, without sporulation	HR
2	Resistant	Necrotic/chlorotic stripes, without sporulation	R
3	Moderately Resistant	Trace sporulation, necrotic/chlorotic stripes	MR
4	Moderate Light	Light sporulation necrotic/chlorotic stripes	LM
5	Moderate	Inter mediate sporulation, necrotic/chlorotic stripes	M
6	Moderate High	Moderate sporulation, necrotic/chlorotic stripes	HM
7	Moderately Susceptible	Abundant sporulation, necrotic/chlorotic stripes	MS
8	Susceptible	Abundant sporulation, with chlorite	S
9	Very Susceptible	Abundant sporulation, without chlorotic	VS

RESULTS

Frequency of Virulence:

Frequency of virulence of the causal organism *Puccinia striiformis* of wheat stripe rust was studied using rust samples collected from lower Egypt during 2005/06- 2006/07. The obtained cultures were tested in the following seasons 2005/06-2006/07. Virulence was tested against 22 monogenic lines for leaf rust resistance (Table 1), and also against selected wheat local genotype varieties. Occurrence of virulence was estimated as virulent isolates to the total number of isolates to the total number of isolates for each wheat genotype.

1) Occurrence of virulence in 2005/06:

The results presented in Table (3), showed different frequencies of virulence to the tested lines. The lowest values were found against *Yr1, Yr 5, Yr 10, Yr 15, Yr SD, Yr 3, Yr SP, Yr 17* and *Yr 4* ranging from 0% to 15.72% in an ascending order. On the other hand, the highest occurrence of virulence was found against *YrCV, Yr (3), Yr SU, Yr (6), Yr (7), Yr 2, Yr 7, Yr 8, Yr 9, Yr 27, Yr 18, Yr 6* and *Yr A* ranging 24.86 to 78.57 in a descending order . whereas, the rest of lines showed moderate responses, as shown in Table (3).

2) Occurrence of virulence in 2006/07:

Results obtained revealed that exhibited the lowest frequencies of virulence being was 0% against *Yr 1, Yr 10, Yr 15* and *Yr 17*. On the other hand *Yr A, Yr 18 , Yr 27, Yr 8, Yr 6, Yr SU, Yr 7, Yr (6) ,Yr 2,* and *Yr(7)* arranged according to their virulence frequency 90.00, 83.33, 83.33, 83.33, 83.33, 78.33, 71.66, 70.00, 58.33 and 53.33respectively .

Frequency of virulence to local wheat varieties:

Occurrence of virulence was also estimated as percentage of virulent occurrence against the local wheat cultivars to the total number of the tested isolates.

1) Occurrence of virulence in 2005/06:

The presented in Table (4), showed different frequencies of virulence to the tested wheat varieties. The lowest values were found against Gemmeiza9, Giza168, Sakha 61, Sakha 94 and Gemmeiza 10 ranging from 42.85, % to 50.0% in an ascending order. On the other hand, the highest occurrence of virulence was found against Sakha 8, Giza 160, 163, Sids4, Sids8 and Sids9 100% in an descending order . whereas, the rest of wheat varieties showed moderate responses, as shown in Table (4)

2) Occurrence of virulence in 2006/07:

The presented in Table (4), showed different frequencies of virulence to the tested wheat varieties. The lowest values were found against Sakha 61, Giza168, Gemmeiza 9, Sakha 94 and Gemmeiza 10 ranging from 45.0.% to 58.33 % in an ascending order. On the other hand, the highest occurrence of

virulence was found against Giza 160, 163, Sakha 8, Sids4, Sids8 and Sids9 ranging from 83.33- 100% an descending order. whereas, the rest of wheat varieties showed moderate responses, as shown in Table (4)

Table (3): Frequency of virulence of *Puccinia striiformis tritici* against 22 monogenic lines for stripe rust resistance during 2005/06 and 2006/07seedling stage.

No.	*Yr*,s	Virulence / Season					
		2005/06			2006/07		
		No. of avirulent isolates	No.of virulent isolates	Virulence frequency%	No. of avirulent isolates	No.of virulent isolates	Virulence frequency%
1	*Yr*1	70	0	0.00	60	0	0.00
2	*Yr*2	36	34	48.58	25	35	58.33
3	*Yr*3	63	7	10.00	41	19	31.66
4	*Yr*4	68	2	2.86	55	5	8.33
5	*Yr*5	70	0	00.00	55	5	8.33
6	*Yr*6	21	49	70.0	10	50	83.33
7	*Yr*7	36	34	48.58	17	43	71.66
8	*Yr*8	33	37	52.86	10	50	83.33
9	*Yr*9	32	38	54.29	17	43	71.66
10	*Yr*10	70	0	0.00	60	0	0.00
11	*Yr*15	70	0	0.00	60	0	0.00
12	*Yr*17	65	5	7.14	60	0	0.00
13	*Yr*18	25	45	64.28	10	50	83.33
14	*Yr*27	30	40	57.14	10	50	83.33
15	*Yr*A	15	55	78.57	6	54	90.00
16	*Yr*CV	53	17	24.29	11	49	81.66
17	*Yr*SD	59	11	15.72	11	49	81.66
18	*Yr*SU	44	26	37.15	13	47	78.33
19	*Yr*SP	63	7	10.00	37	23	38.33
20	*Yr*(3)	47	23	32.86	45	15	25.00
21	*Yr*(6)	39	31	44.29	18	42	70.00
22	*Yr*(7)	39	31	44.29	28	32	53.33

Total number of isolates in 2005/06 = 70
Total number of isolates in 2006/07 = 60

Table (4): Frequency of virulence of *Puccinia striiformis tritici* against 21wheat genotypes (2005/06 and 2006/07), seedling stage .

No.	Wheat variety	Virulence / Season					
		2005/06			2006/07		
		No. of avirulent isolates	No.of virulent isolates	Virulence frequency %	No. of avirulent isolates	No.of virulent isolates	Virulence frequency %
1	Sakha 8	0	70	100.00	0	60	100.00
2	Sakha 61	39	31	44.28	33	27	45.00
3	Sakha 69	10	70	85.71	10	50	83.33
4	Sakha 93	25	45	64.28	20	40	66.66
5	Sakha 94	39	31	44.28	28	32	53.33
6	Sakha 95	20	50	71.42	15	45	75.00
7	Gemmeiza 1	10	60	85.71	8	52	86.66
8	Gemmeiza 3	20	50	71.42	10	50	83.33
9	Gemmeiza 5	25	45	64.28	15	45	75.00
10	Gemmeiza 7	27	43	61.42	6	54	90.00
11	Gemmeiza 9	40	30	42.85	25	35	58.33
12	Gemmeiza10	35	35	50.00	30	30	50.00
13	Giza 160	0	70	100.00	10	50	83.33
14	Giza 163	0	70	100.00	6	54	90.00
15	Giza 164	10	60	85.71	10	50	83.33
16	Giza168	40	30	42.85	33	27	45.00
17	Giza 170	22	48	68.57	21	39	65.00
18	Sids1	6	64	91.42	5	55	91.66
19	Sids4	0	70	100.00	0	60	100.00
20	Sids8	0	70	100.00	0	60	100.00
21	Sids9	0	70	100.00	0	60	100.00

Total number of isolates in 2005/06 = 70
Total number of isolates in 2006/07 = 60

Physiologic races and virulence formula:

a. The first season 2005/06:

The collected samples were purified and multiplied on the susceptible cv (Giza 160, Morocco and *Triticum spelta saharense*) and identified on the stripe rust on wheat differentials at seedling stage.

Data presented in Table (5) revealed the occurrence of 11 physiologic races of stripe rust (*Puccinia striiformis* f. sp *tritici* West.). These physiologic races were 0E0, 4E16, 6E0, 14E20, 70E134, 128E62, 198E154, 266E100, 230E150, 230E186 and 234E158 were determined on the basis of sum of high infection types for each of the World differentials and European ones.

The survey samples of the 2004/05 in Northern governorates of Egypt. These data revealed that race 0E0 was the most frequent one (17.14%) followed by race 4E16 and race 198E154 (11.42%) followed by races 6E0, 70E134 and race 128E62 (10.0%) followed by race 230E150 (8.57%), races 14E20 and 226E100 (7.14%), race 230E186 (4.28%), race 234E158(2.85%), respectively.

b. The second season 2006/07:

Data presented in Table (6) revealed the presence of 13 physiologic races in 2006/07. These races were 0E0, 2E128, 32E0, 102E22, 102E128, 142E20, 198E154, 228E148, 230E150, 230E191, 238E0, 238E182 and 494E158 .

The relative frequency of yellow rust races are shown in Table (6). Data revealed that race 102E22 was the most frequent one (13.33 %) followed by both races 238E0 and 238E182 (10.0%), followed by races 102E128, 142E20, 230E150, 230E191 and 494E158 (8.33%). Race 0E0 and race 32E0 (6.66%) while race 228E148 (5.0%) , race 2E128 and race 198E154 (3.33%).

Table (5): Physiologic races of wheat stripe rust that were identified in Egypt in 2005/06 – frequency and V / AV formula.

No.	No. of isolates succeed	Frequency	Races	Virulence / Avirulence
1	12	17,14	0E0	/1, 7, 6, 3, 10, SD, SU, 9, 5, 4, (7), (6), (3), 8, CV, SP, 2
2	8	11,42	4E16	6, 8 / 1, 7 , 3, 10, SD, SU, 9, 5, 4, (7), (6), (3), CV, SP, 2
3	7	10,00	6E0	6, 7 / 1, 3, 10, SD, SU, 9, 5, 4, (7), (6), (3), 8, CV, SP, 2
4	5	7,14	14E20	7, 6, 3, (6), 8/ 1,10, SD, SU, 9, 5, 4, (7), 8, (3), CV, SP, 2
5	7	10,00	70E134	7, 6, SU, (7), (6), 2 / 1 , 3, 10, SD , 9, 5, 4, (3), 8, CV, SP
6	7	10,00	128E62	9, (6), (3), 8 , CV / 1, 7, 6, 3, 10, SD, SU, (7), 5, 4, SP, 2
7	8	11,42	198E154	7, 6, SU, 9, (7), (3), 8, 2 / 1, 3, 10, SD, 5, 4, CV, (6), SP
8	5	7,14	266E100	7, SD, SU, 9, (6), CV, SP / 1, 6, 3,10, 5, 4, (7), (3), 8, 2
9	6	8,57	230E150	7, 6, SD, SU, 9, (7), (6), 8, 2 / 1, 3,10, 5, 4, (3), CV, SP
10	3	4,28	230E186	7, 6, SD, SU, 9, (7), (3), 8, CV, 2 /1, 3, 10, 5, 4, (6), SP
11	2	2,85	234E158	7, 3, SD, SU, 9, (7), (6), (3), 8, 2 / 1, 6,10,5, 4, CV, SP

Table (6): Physiologic races of wheat stripe rust that were identified in Egypt in 2006/07 – frequency and V / AV formula.

No.	No. of isolates succeed	Frequency	Races	Virulence / Avirulence
1	4	6.66	0E0	/1 , 7, 6, 3, 10, SD, SU, 9, 5, 4, (7), (6), (3), 8, CV, SP, 2
2	2	3.33	2E128	7, 2 / 1, 6, 3, 10, SD, SU, 9, 5, 4, (7), (6), (3), 8, CV, SP
3	4	6.66	32E 0	SD / 1, 7, 6, 3, 10, SU, 9, 5, 4, (7), (6), (3), 8, CV, SP, 2
4	8	13.33	102E22	7, 6, SD, SU, (7), (6), 8 / 1, 3,10, 9, 5, 4, (3), CV, SP, 2
5	5	8.33	102E128	7, 6, SD, SU, 2 / 1, 3, 10, 9, 5, 4, (7), (6), (3), 8, CV, SP
6	5	8.33	142E20	7, 6, 3, 9, (6), 8 / 1, 10, SD, SU, 5, 4, (7), (3), CV, SP, 2
7	2	3.33	198E154	7, 6, SU, 9, (7), (3), 8, 2 / 1, 3, 10, SD, 5, 4, (6), CV, SP
8	3	5.00	228E148	6, SD, SU, 9, (6), 8, 2 / 1, 7, 3, 10, 5, 4, (7), (3), CV, SP
9	5	8.33	230E150	7, 6, SD, SU, 9, (7), (6),(3), 8, 2 / 1, 3, 10, 5, 4, CV, SP
10	5	8.33	230E191	7, 6, SD, SU, 9, 4, (7), (6), (3), 8, CV, 2 / 1, 3, 10, 5, SP
11	6	10.00	238 E 0	7, 6, 3, SD, SU, 9 / 1, 10, 5, 4, (7), (6), (3), 8, CV, SP, 2
12	6	10.00	238E 182	7, 6, 3, SD, SU, 9, (7), (3), 8, CV, 2 / 1, 10, 5, 4, (6), SP
13	5	8,33	494E 158	7, 6, 3, SD, SU, 9, 5, (7), (6), (3), 8, 2 / 1, 10, 4, CV, SP

DISCUSSION

Stripe rust of wheat (*Triticum aestivum* L.) caused by *Puccinia striiformis tritici* is considered one of the most serious diseases in Egypt. The disease became a very dangerous on most of the currently used varieties because of their susceptibility to the disease (El-Daoudi *et al.*, 1996) . It usually occurs at higher level of severity on the late sowings than the early ones when the environmental conditions became suitable for rust incidence and development (Mundt *et al*., 1995).

Also the amount of loss in grain yield depends on the aggressiveness of the prevailing physiologic race(s) as well as the suitable environmental conditions (Park *et al.,* 1988 and Hong and Singh 1996). In this case, the loss in grain yield may reach higher levels.

In 1967 the disease appeared on leaves and heads and destroyed a very large area of wheat plants in lower Egypt (Abd el Hak *et al*., 1972). Also in 1985, 1996 and 1997 it appeared at a very high levels of incidence and caused a highly significant loss in grain yield (El- Daoudi *et al.*, 1996). Therefore, survey and identification of the prevailing physiologic races of stripe rust were the first part of this study. This part is a very important step in testing the genetic materials in breeding program for stripe rust resistance.

The annual survey of the diseases was conducted through out two growing seasons of wheat crop in some governorates of Egypt gave evidence to the presence of different virulences of the causal agent(*Puccinia*

striiformis tritici **West.). The results obtained were established on the comparisons of both visual symptoms as infection types of the uredial stage of the casual agent with those reported by Wiese (1977) and Agrios ((1979).**

Isolation and identification of the prevailing races of the disease are an essential step to satisfy this work(Chen *et al.,* 2002). In the course of this study, virulence survey was carried out by collecting stripe rust samples from different locations of the country for rust isolation and identification.

The obtained results in seedling stage gave evidence to the presence of 11 and 13 physiologic races of stripe rust during the two successive seasons i.e 2005/06 and 2006/07, respectively. In the first season (2005/06) races 0E0, 4E16, 6E0, 14E20, 70E134, 128E62, 198E154, 266E100, 230E150, 230E186 and 234E158 were identified. While races 0E0, 2E128, 32E0, 102E22, 102E128, 142E20, 198E154, 228E148, 230E150, 230E191, 238E0, 238E182 and 494E158 were found in 2006 / 07.

Races 0E0, 4E16, 230E150, 238E198, 230E190, 70E 134, 198E156 previously found by Youssef *et al* (2003), Eisa *et al* (2004), Ashmawy (2005), Youssef *et al* (2007), Shahin (2008).

Yahyaoui *et al* (2002) identified races 6E0, 230E150 from samples collected from Syria in 1999. These races were also found in Egypt in the seasons of the study which indicated that the source of inoculums may be similar or the same. He also found that many races i.e. 6E0, 230E150, 198E150 were found in Syria, Lebanon, Yemen and Iran. These races were found also in Egypt which indicated that the movement of wind has a role in race wide spread in the region. Farzad Afshari (2006) races 6E6 A^+,6E22A^+ that were recorded in Iran were different than the identified races in Egypt therefore, Iran and / or Egypt are not the source of inoculums to each other.

All identified races during both seasons showed different frequencies of occurrence depending on the wheat cultivars from which the infected samples were collected. (Chen *et al*., 1995).

In general rust causal organisms are air- borne pathogens which carried by wind from their source to the susceptible plants. Therefore, the inoculate play an important role in the occurrence and frequency of virulence.

The appearance of new virulence is due to the appearance of new mutation, hetrokaryosis and the hybridization of genetically different individuals (Stakman, 1962). Stripe rust, in particular, has unknown alternate host (Singh *et al.,*1990), however, the variation in this pathogen usually accurse (McIntosh, 1992) and new virulence are appeared.

Virulence occurrence against the different stripe rust genes was also of different values depending on the host - race compatibility (Chen, 2005).

In this study, no virulence was detected to *Yr 1, Yr 5, Yr 10* and *Yr 15* and detected against *Yr CV, Yr (3), Yr SU, Yr (6), Yr (7), Yr 2, Yr 7, Yr 8, Yr 9, Yr 27, Yr 18, Yr 6* and *Yr A* during 2005/06.

In 2006/07 virulence was found to *Yr 1, Yr 10, Yr 15* and *Yr 17* while virulence against *Yr SP, Yr (7), Yr 2, Yr (6), Yr 9, Yr 7, Yr SU, Yr CV, Yr SD, Yr 6, Yr 8, Yr 18, Yr 27* and *Yr A.*

These results are in agreement with these obtained in the northern countries. In Iran *Yr 1, Yr 5, Yr 10* were resistant Farzad Afshari, (2006). These genes were effective in this region. Hovmoller, (1993) reported no virulence to *Yr 5, Yr17, Yr 10* were not observed in Dinmark. Dnial, (1994) reported rare virulence against *Yr1, Yr 10* were found in Kinya during 1986 – 1989. Kirmani *et al* (1989) reported that no virulence was found against *Yr 5, Yr10* and *Yr 15* in Pakistan. Welling, (2007) Mentioned that European origin has been the emotional source of the inoculums of stripe rust to other regions.

Badebo *et al.,* (1995) showed that virulence's to *Yr 6, Yr 7, Yr 8, Yr 9, Yr 10, Yr SD* and *Yr SU* were detected while virulence to *Yr 4, Yr 5, Yr CV* and *Yr SP* were absent. Hakim and Mamluk (1998) the natural population of the yellow rust pathogen could over came *Yr 6, Yr 7, Yr 10, Yr 8, Yr 2, Yr 18* and *Yr A.* Robort *et al* (1999) reported that *Yr 17* which is present in many Europan wheat cultivars confer resistance to yellow rust at seedling stage.

Frequencies of virulence to the tested wheat varieties, in terms of infection types were determined. The least frequencies of virulence were found to the cvs. Sakha 61, Sakha 94, Gemmeiza 9 and Giza 168 which showed 44.28, 44.28, 42.85, 42.85%, respectively, while cvs. Gemmeiza 10 ,Sakha 93, Gemmeiza 7, Gemmeiza 5 and Giza 170 showed 50.00, 64.28, 61.28, 64.2, 68.57 %, respectively. On the other hand, virulence frequencies against cvs. Sakha 95, Gemmeiza 3, Sakha 69, Gemmeiza 1, Giza 164 and Sids 1 were 71.42, 71.42, 85.71, 85.71, 85.71, 91.42 %, respectively. Frequency of virulence against cvs. Sakha 8, Giza 160, Giza 163, Sids 4, Sids 8 and Sids 9 were 100.0 % during 2005/06, while The frequency of virulence cvs. Sakha 8, Sids 4, Sids 8 and Sids 9 showing (100.00%). On the other hand, frequency of virulence to cvs. Sids 1, Giza163, Gemmeiza 7, Gemmeiza 1, Sakha 69, Giza160, Giza164 Giza168, Sakha 61, Gemmeiza 10 and Sakha 94 were 91.66, 90.00, 90.00, 86.66, 83.33, 83.33, 83.33, 45.00, 45.00, 50.00, 53.00 %, respectively during 2006/07 . Ashmawy (2005), Youssef *et al* (2007a) and Shahin (2008) found that the cvs. Sakha 61, Sakha 94, Sakha 93, Gemmeiza 9 and Giza 168 in the lower frequencies of virulence, on other hand cvs. Sakha 8, Sakha 69, Giza 163, Giza 160 in the higher frequencies virulence.

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تكرار ظهور السلالات الممرضة ومعادلة القدرة المرضية لمرض الصدأ الأصفر علي القمح وتعريف السلالات الفسيولوجية للفطر في مصر

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الملخص العربي

يعتبر مرض الصدأ الأصفر علي القمح من الأمراض الرئيسية في مصر والذي يظهر سنويا بدرجات مختلفة من التكرارات للسلالات الممرضة – وجمعت عينات الأوراق المصابة بالمرض من جهات متفرقة خلال موسمي الدراسة ٢٠٠٥/٢٠٠٦ – ٢٠٠٦/٢٠٠٧. وقد تم عزل السلالات أخذت بيانات الصدأ بطريقة طرز الإصابة ضد ٢٢ سلالة قمح حاملة لجينات فردية للمقاومة وكذلك ٢١ صنف من الأقماح المصرية وقد تم تسجيل المعادلة الرياضية لكل سلالة مع تسجيل غياب وظهور السلالات الفسيولوجية والتغير في ظهور هذه السلالات ونسب عزلة. وقد سجلت اعلي نسبة للإصابة علي سلالات القمح الحاملة لجينات ***Yr 2, Yr 7, Yr 6, Yr 8, Yr CV, Yr SP , Yr (3), Yr SU,*** بينما كانت السلالات ***Yr 1, Yr 5, Yr 15, Yr 17, Yr SD*** مقاومة. والأصناف سخا ٦١ وجيزة ١٦٨، أقلها في الإصابة وتم تعريف ١٣ سلالة. وكانت السلالة **102E22** أكثر السلالات تكرارا وقدرة علي إصابة سلالات القمح والأصناف .