

Wheat Yellow Rust Status In Egypt; The emergence and changing of virulence races of *Puccinia striiformis* f. sp. *tritici*

Mohamed A. Gad, Wassef A. Youssef, Atef A. Shahin
Wheat Diseases Research Department, Plant Pathology Research Institute,
Agricultural Research Center, Egypt
Corresponding author: a.a.shahin@hotmail.com
mohamedabo2002@yahoo.com



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Introduction

Wheat (*Triticum aestivum* L.) is a major winter crop and an essential source of carbohydrates and multiple nutrients, serving as a dietary food in Egypt. The importance of stripe (yellow) rust, caused by *Puccinia striiformis* f. sp. *tritici* (*Pst*), has increased destructively worldwide during the last decades in wheat (*Triticum aestivum*). In addition, the detection of the new races indicated continual changes of virulence in the *Pst* pathotypes population in Egypt. Virulence to resistance genes *Yr5* and *Yr15* were not found in any of the growing seasons. Genes such as *Yr1*, *Yr6*, *Yr7*, *Yr8*, *Yr9*, *Yr17*, *Yr18*, *Yr25*, *Yr27*, *Yr28*, *Yr31*, *Yr32*, and *YrSp* showed different infection types ranging from moderately resistance to susceptible. In addition, a race very similar to the "Warrior" race with virulence to *Yr1*, *Yr2*, *Yr3*, *Yr4*, *Yr6*, *Yr7*, *Yr9*, *Yr17*, *Yr25*, *Yr32*, *YrSp* and *YrAmb* was also confirmed in the 2015/2016 growing season (Shahin 2020). The objective of this study was to characterize the virulence and races of the stripe rust pathogen in Egypt from 2001 to 2021. In addition, Egyptian cultivars were evaluated for resistance to selected *Pst* races at both seedling and adult-plant stages to provide useful information for breeding resistant cultivars and managing the disease.

Materials and Methods

The present investigation was performed under both greenhouse and field conditions of the Department of Wheat Disease Research, at the Sakha Agriculture Research Stations, Plant Pathology Research Institute (PPRI), Agricultural Research Center (ARC), Egypt. To identify races of *Pst* collections samples using the standard World/European group of wheat differential hosts adopted by Johnson *et al.*, (1972). Also, used a new modern concept of race identification and genetic group.

Results and Discussion

The wheat differential hosts at both seedling and adult-plant stages showed a wide range of rust responses during the 2001 to 2021 growing seasons are presented in Fig. 1 and Table 1.

Pathogenic variabilities: race analysis

- *Yr9* (1990).
- *Yr27* aggressive race since 2010.
- *Yr32* race 2014.
- Warrior race since 2015 (Shahin 2020).



Fig. 1. Responses of wheat genotypes carrying stripe rust resistance genes (*Yr*'s).

Table 1. The adult plant field response to stripe rust under field condition for the Egyptian bread wheat cultivars.

Cultivar	Rust Response			New aggressive Race
	Old race	Yr27	New race	
Misir1	R	R-MR	5MR	MSS
Misir2	R	R-MR	10S	20S
Misir3	0	0	0	TR
Giza167	R	MS	MRMS	5MS
Giza 168	R-MR	MRMS	20S	20S
Giza 171	R	MRMS	5MS	TS
Sakha 61	R	R-MR	MR	5S
Sakha93	MR	10MS	30S	40S
Sakha94	MR	MR	TMS	20MSS
Sakha95	R-MR	MRMS	TMS	30MSS
Gemmeiza9	MRMS	MR	10MS	10MS
Gemmeiza10	MR	MR-MS	MR-MS	5MS
Gemmeiza11	R-MR	MS	10S	30S
Gemmeiza12	R	R	MR	10MS
Sids1	MR	MR	MRMS	10S
Sids12	MR	10MSS	30S	50S
Sids13	R	MRMS	20S	20S
Sids14	R-MR	MRMS	30MSS	50MSS
Shandaweel 1	R	MR	MS	30MSS

Yellow rust- new aggressive race in Egypt

Genotypes	Resistance genes	Old Race	New Race	Old Race	New
		Scores 0-9 scale	Yr27 pt. Scores 0-9 scale	Scores	Aggressive Race
Chinese 166	<i>Yr1</i>	0	0	0	5S
Lee	<i>Yr7</i> , +	7	7	50S	30S
Heines Kolben	<i>Yr6</i> , (<i>Yr2</i>)	7	7	20S	10MS
Wilmoren 23	<i>Yr3</i> +	1	1	?	10MS
Moro	<i>Yr10</i>	1	1	10R	5S
Strubes Dickkopf	<i>Yr5</i> , <i>Yr25</i>	7	7	T-10MR	10MS
Suwon 92*Omar	<i>YrSU</i>	2	7	0	30S
Clement (W-Kishik)	<i>Yr9</i> +, <i>Cle</i>	3	3	5MR	5MR
Triticum spelta album	<i>Yr5</i>	0	0	0	0
Hybrid 46	<i>Yr4</i> +	1	1	0	R
Reichersberg 42	(<i>W</i> , <i>Yr2</i> ?)	6	6	0	10MS
Heines Pelco	<i>Yr6</i> , <i>Yr2</i> , <i>Yr25</i> , +	7	6	5R	20MR
Nord Desprez	<i>3N</i>	1	2	5MR	R
Compair	<i>Yr8</i> , +	7	7	0	R
Carstens V	<i>Yr32</i> , <i>Yr25</i> , +	0	1	0	5MS
Spaldings Prolific	<i>SP</i>	0	0	0	5S
Heines VII	<i>Yr2</i> , <i>Yr25</i> +	7	7	5R	5R
<i>Yr17</i> /6*Avocet S	<i>Yr17</i>	5	?	MRMS	10S
Ciano	<i>Yr27</i>	5	8	20MS	30S
Opata 85	<i>Yr27</i> , <i>Yr18</i>	5	7	10MR	10MSS
<i>Yr32</i> /6*Avocet S	<i>Yr32</i>	0	?	0	30S

Selected Reference

- Johnson R, Stubbs RW, Fuch E, Chamberlain NH. (1972). Nomenclature for physiologic races of *Puccinia striiformis* infecting wheat. *Tran Br Mycol. Soc.* 58(3):475-480.
- Shahin, A.A. (2020). Occurrence of new races and virulence changes of the wheat stripe rust pathogen (*Pst*) in Egypt, *Archives of Phytopathology and Plant Protection*, Vol. 53, No. 11-12, 552-569.