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Physiologic specialization of *Puccinia triticina* in Andalusia (Spain) in 2004 and 2005

A.I. del Olmo*, J.C. Sillero* and D. Rubiales**
*CIFA, Dpto. de Mejora y Agronomía, Apdo. 3092, E-14080 Córdoba, Spain
**CSIC, Instituto de Agricultura Sostenible, Apdo. 4084, E-14080 Córdoba, Spain

SUMMARY – Knowledge of the virulence spectrum of leaf rust is needed for a rational selection of resistance genes to be incorporated in commercial cultivars. In the present work we intend to determine the virulence of Andalusian isolates collected on durum wheats in years 2004 and 2005. Ten virulence phenotypes were found. All analysed isolates were virulent on *Lr10, 12, 14a, 14b, 18* and *23* and avirulent on *Lr1, 2a, 3, 3bg, 3ka, 9, 15, 17, 24* and *26.* The most common virulence phenotype was BBBPPM which was spread all over the surveyed area. A decrease on virulence on *Lr1, 3, 3bg, 15, 17, 26* and *28* were observed in 2004 and 2005 when compared to 2003.

Introduction

Leaf rust, caused by *Puccinia triticina* is the most widespread and regularly occurring rust on wheat (Kolmer, 2003). It is showing particularly severe on durum wheat, with little resistance available in commercial cultivars. The purpose of the present work was to determine the virulence of durum wheat isolates collected in 2004 and 2005 in Andalusia (Southern Spain) and to compare it with virulence previously observed in 2003.

Materials and methods

Wheat leaves with leaf rust infections were collected in durum wheats from different locations of Andalusia (Southern Spain) in early May and June of 2004 and 2005, coinciding with heading. Isolates from uredinia collected in the field were inoculated to 7-day-old seedlings of susceptible durum wheat cultivar 'Meridiano'. Single-uredinium isolates were made and re-inoculated to 'Meridiano' to increase the inoculum. A plastic box was placed over each pot to prevent cross-contamination. Fresh filtered air was supplied to the box for avoiding excessive humidity. Urideniospores from each single-pustule isolate were inoculated onto 24 Thatcher near isogenic lines, each with a single *Lr* gene for resistance (Dyck and Samborski, 1968).

Infection types (IT) were scored 12 days after inoculation following a 0-9 scale (McNeal *et al*., 1971). Infection types 0 to 6 were considered resistant, and IT 7 to 9 were considered susceptible. All plants were maintained in a growth chamber at 20ºC with 14-h photoperiod and 112 µmol/m^2/s of light intensity.

For the nomenclature of the isolates, an adaptation of the Long and Kolmer (1989) system was used, where different combination of virulence/avirulence on sets of four *Lr* genes are recorded as a letter obtaining a four-letter virulence phenotype (Table 1).

Results

The thirty-two single uredinial isolates could be grouped in ten virulence phenotypes (Table 2). The most common virulence phenotype was BBBPPM which was spread all over the surveyed area. The second most common virulence phenotype was BBBPPP. All analysed isolates were avirulent on *Lr1, 2a, 3, 3bg, 3ka, 9, 15, 17, 24* and *Lr26.* A decrease of virulence on *Lr1, 3, 3bg, 15, 17, 26* and *28* were observed in 2004 and 2005 when compared to 2003 (Table 3).

Table 1. Code for nomenclature of races of *P. triticina* in ordered sets of four

		Infection type on near isogenic lines Thatcher (genes *Lr*)			
	Set 1	*1*	*2[a]*	*2c*	*3*
	Set 2	*9*	*16*	*24*	*26*
	Set 3	*3ka*	*11*	*17*	*30*
	Set 4	*B(l)*	*3bg*	*10*	*14a*
	Set 5	*14b*	*15*	*18*	*20*
	Set 6	*23*	*28*	*2b*	*12*
Code[†]					
B		L	L	L	L
C		L	L	L	H
D		L	L	H	L
F		L	L	H	H
G		L	H	L	L
H		L	H	L	H
J		L	H	H	L
K		L	H	H	H
L		H	L	L	L
M		H	L	L	H
N		H	L	H	L
P		H	L	H	H
Q		H	H	L	L
R		H	H	L	H
S		H	H	H	L
T		H	H	H	H

[†]*P. triticina* code consists of the designation for set 1 followed by that for set 2, etc.

Table 2. Racial composition of *P. triticina* in Andalusia during 2004 and 2005

Race	Number of isolates	Location (year) [†]	Virulent on
BBBPPM	7	CAR(04), CAS(04), SL(04), ST(04), TP(04), PB(05), UT(05)	*Lr10, 12, 14a, 14b, 18,20,23, B(l)*
BBBPPP	6	AL(04), CO(04), CB(04), PB(04), TO(05), QS (05)	*Lr2b, 10,12, 14a, 14b, 18,20,23, B(l)*
BGHFPM	4	JE(04), CH(04), N9(04), QS(04)	*Lr10, 11, 12, 14a, 14b, 16,18, 20, 23, 30*
BGCPPM	4	NIV(04),JEPP(04), MAT(04), VL(04)	*Lr10, 12, 14a, 14b, 16,18, 20, 23, 30, B(l)*
DBGPPP	4	JE(05), A364(05), EC(05), A394(05)	*Lr2b, 2c, 10, 11, 12, 14a,14b, 18, 20, 23, B(l)*
BBCPPT	2	VR(04), NIV1(04)	*Lr2b, 10, 12, 14a, 14b, 18, 20, 23, 28, 30, B(l)*
BBHPPM	2	AR(04), CO(05)	*Lr10, 11, 12, 14a, 14b, 18, 20, 23, 30, B(l)*
BBCPPM	1	SE(04)	*Lr10, 12, 14a, 14b, 18, 20, 23, 30, B(l)*
BBCFPP	1	PG(04)	*Lr2b, 10, 12, 14a, 14b, 18, 20, 23, 30*
DGCPPP	1	LP(04)	*Lr2b, 2c, 10, 12, 14a, 14b 16, 18, 20, 23, 30, B(l)*

[†]Location (CAR: Carmona, Sevilla; CAS: Castilleja del Campo, Sevilla; SL: Sanlucar la Mayor, Sevilla,; ST: Santaella, Córdoba; Tp:Torreperogil, Jaén; PB: Peal de Becerro, Jaén; UT: Utrera, Sevilla; AL: Alamillos, Cádiz, CO: Córdoba; CB: Bollulos del Condado, Huelva; TO: Tocina, Sevilla; QS: Quesada, Jaen; JE: Jerez, Cádiz; CH: Chucena, Huelva; N9: Sevilla; NIV: Sevilla; A364: Cadiz; A394: Cadiz; MAT: Matarratones, Jaén, VL: Villamanrique, Huelva; EC: Écija, Sevilla; VR: Villarubia, Córdoba; AR: Almodovar del Rio, Córdoba; SE: Sevilla; PG: Puente Genil, Córdoba; LP: Los Propios, Jaén).

Table 3. Frequency (%) of virulence of Andalusian isolates of *P. triticina* in 2003 and 2004-2005

Genes	Andalusia 2003†	Andalusia 2004	Andalusia 2005
Lr1	26	0	0
Lr2a	17	0	0
Lr2b	82	30.4	66.7
Lr2c	47	4.3	44.4
Lr3	26	0	0
Lr3bg	26	0	0
Lr3ka	17.4	0	0
Lr9	0	0	0
Lr10	100	100	100
Lr11	82.6	21.7	55.6
Lr12	100	100	100
Lr14a	100	100	100
Lr14b	100	100	100
Lr15	21.7	0	0
Lr16	21.7	39.1	28.1
Lr17	21.7	0	0
Lr18	100	100	100
Lr20	100	100	62.5
Lr23	100	100	100
Lr24	0	0	0
Lr26	21.7	0	0
Lr28	43.5	8.7	0
Lr30	39.1	60.9	11.1
LrB (l)	100	78.3	100
Thatcher	100	100	100
No. isolates	23	23	9

†Frequency of virulence of *P. triticina* calculated by Del Olmo (2003) of isolates collected in Andalusia in 2003.

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