

Validation of differentials for new *Fusarium oxysporum* f. sp. *lactucae* race 4 (Fol: 4) - Lettuce

Perrot Sophie, Pons Marine, Ton Allersma, Agnes Ricard, Eelco Gilijamse, Bertrand Monsimier, Mireille Buisson, Jordi Boshoven, Noor breugelmans, Mathieu Pel, Giovanna Gilardi, Pieter van Poppel, Javier Pen Asin, Philip Brown, Cristina Moyano Cardaba, Michel de Lange and Grimault Valérie

Background

A new race of *Fusarium oxysporum* f. sp. *lactucae* race 4 (Fol: 4), was described, and several varieties were used to differentiate it from the previously identified races (Giraldi et al, 2016). Therefore, a new table for differentials has been proposed at the ISF Disease Resistance Terminology Working group (ISF DRT WG) for publication. An interlaboratory test was planned by ISF and coordinated by GEVES to validate the newly identified differentials and race for use in resistance claims



Figure 1: symptoms of Fol on susceptible (left) and resistant(right) varieties of lettuce

Materials and methods






A collection of 10 isolates from the four races (races 1, 2, 3 and 4) of Fol was established. The aggressivity of each isolate was tested by at least 3 participants on the ISF differentials plus the variety Romabella (table 1). Test was run according to UPOV (Table 2).

Differential host	Fol: 1	Fol: 2	Fol: 3	Fol: 4
Patriot,	S	S	S	S
Costa Rica No.4	R	S	S	S
Romabella	R	R	S	S
Banchu Red Fire	S	R	S	IR

S: susceptible; R: resistant; IR: intermediate resistant

Table 1: expected comportment of varieties tested with the different races of Fol

Figure 2: notation scale for inoculation by soaking root in suspension of spores

0= Plant without symptoms and healthy vessels.	1 = Plant with brown vessels only below the cotyledon without yellowing and wilting.
	
2= Plant with brown vessels above the cotyledon, without yellowing and wilting.	3= Plant yellowing and wilting, brown vessels.
	
	4= Dead plant
	

Results and discussion

Fol: 1	Expected	Isolate A			Isolate C			Isolate G	
		Lab1	Lab7	Lab9	Lab10	Lab2	Lab8	Lab10*	Lab5
Patriot	S	S	S	S	S	S	S	S	S
Costa Rica No. 4	R	R	IR	R	R	R	R	R	R
Romabella	R	R	R	R	R	R	R	R	R
Banchu Red Fire	S	S	S	S	S	IR	S	S	S

Fol: 2	Expected	Isolate D			Isolate J		
		Lab3*	Lab7	Lab9	Lab2	Lab3	Lab7*
Patriot	S	IR	IR	IR	S	S	S
Costa Rica No. 4	S	S	S	S	R	S	S
Romabella	R	S	R	S	R	R	R
Banchu Red Fire	R	IR	IR	R	R	IR	IR

Fol: 3	Expected	Isolate E		Isolate K		
		Lab1	Lab3*	Lab5	Lab6	Lab7*
Patriot	S	S	S	S	R	IR
Costa Rica No. 4	S	IR/S	S	S	S	S
Romabella	S	R	R	S	S	IR
Banchu Red Fire	S	R	R	S	HG	S

Fol: 4	Expected	Isolate F		Isolate I				Isolate L		
		Lab5	Lab8	Lab1	Lab6	Lab8	Lab9*	Lab 1	Lab10	Lab9*
Patriot	S	IR	S	R	S	S	S	R	R	IR
Costa Rica No. 4	S	S	S	R	S	S	S	R	R	S
Romabella	S	S	IR	R	S	IR	S	R	R	S
Banchu Red Fire	IR	S	S	R	R	S	IR	R	R	IR

S: susceptible; R: resistant; IR: intermediate resistant; * lab who provided the isolate

Table 2: results obtained on differentials for isolates of four races

The isolates for race 1 were in line with expected results. This race is used for the official tests for registration on Catalogue and protection of breeder rights.

Most of isolates for races 2, 3 and 4 did not show the expected comportment. Isolate E described as race 3 was in line with a Fol: 2 isolate.

Isolates giving results closer to the expected results have been selected for a second interlaboratory test (Table 3).

Race	Isolate
Fol: 1	A
Fol: 2	J and E
Fol: 3	K
Fol: 4	I

Table 3: selected isolates of Fol

Conclusion and future perspectives

Results were consistent among laboratories for race 1 but were very variable between isolates and laboratories for the other three races. Therefore, the WG decided to organize a new ring test. GEVES will coordinate this second interlaboratory test.

ISF DRT WG decided that the differentials table was not ready to publish, and more research was needed for describing Fol: 2, 3, 4 races for resistance claims.

Acknowledgements



Litterature

- Fujinaga, M., Ogiso, H., Tsuchiya, N. Saito, H. (2001). Physiological specialization of *Fusarium oxysporum* f.sp. *lactucae*, a causal organism of Fusarium root rot of crisp head lettuce in Japan. J.Gen.Plant Pathol. 67:205-206.
- Ogiso, H., Fujinaga, M., Saito, H., Takehara, T., Yamanaka, S. (2002). Physiological races and vegetative compatibility groups of *Fusarium oxysporum* f.sp. *lactucae* isolated from crisphead lettuce in Japan. J.Gen.Plant Pathol. 68:292-299.
- Fujinaga, M., Ogiso, H., Tsuchiya, N., Saito, H., Yamanaka, S., Nozue, M., Kojima M. (2003). Race 3, a new race of *Fusarium oxysporum* f.sp. *lactucae* determined by a differential system with commercial cultivars. J.Gen.Plant Pathol. 69:23-28.
- Fujinaga, M., Ogiso, H., Shimohara, H., Tsushima, S., Nishimura, N., Togawa, M., Saito, H., Nozue, M. (2005). Phylogenetic relationships between the lettuce root rot pathogen *Fusarium oxysporum* f.sp. *lactucae* races 1,2 and 3 based on the sequence of the intergenic spacer region of its ribosomal DNA. J.Gen.Plant Pathol. 71:402-407.
- Gilardi, G., Ortega, S.F., van Rijswick, P.C.J., Ortu, G., Gullino, M.L. and Garibaldi, A. (2016). A new race of *Fusarium oxysporum* f.sp. *lactucae* of lettuce. Plant Pathology. doi:10.1111/ppa.12616.