Pathogenicity of Venturia inaequalis strains form Malus floribunda 821 : comparison with race 6 on apple clones

Gilles Bénaouf, Luciana Parisi

IOBC/WPRS

Working Group"Integrated Plant Protection in Orchards

Subgroup"Integrated Control of Pome Fruit Diseases"

PROCEEDINGS OF 4TH WORKSHOP ON INTEGRATED CONTROL OF POME FRUIT DISEASES

Croydon, England

August 19 - 23 1996

Scientific Editors: A.M. Berrie, X.-M. Xu
D.C. Harris, A.L. Roberts
K. Evans, D.J. Barbara
C. Gessler

Technical Editor: X.-M. Xu

IOBC/WPRS Bulletin
Bulletin OILB/SROP Vol.20(9)1997

Pathogenicity of *Venturia inaequalis* strains from *Malus floribunda* 821: comparison with race 6 on apple clones

G. Bénaouf and L. Parisi
Station de Pathologie Végétale et Phytobactériologie, INRA, 42, rue Georges Morel, BP 57, 49071 Beaucouzé Cedex, France.

Abstract

In this study we compared the pathogenicity of two monoconidial strains (1060 and 1066) derived from Fl 1, an isolate able to overcome the *Malus floribunda* clone 821 resistance (Roberts and Crute, 1994), with reference strains of race 1 and 6 on a set of selected apple clones. The results showed that monoconidial strains of Fl 1 do not belong to race 1 or to race 6. While they express virulence on *M. floribunda* 821, they have lost their virulence on cv Golden Delicious. The other sources of major genes for resistance (Vr, Va, Vb, Vbj and resistance of cvs Generos and Jonsib) were not overcome by strain 1066. The segregation of the crosses Golden Delicious x Idared and Golden Delicious x *M. floribunda* 821 showed that a single resistance gene segregated in the two progenies inoculated with strains 1060 and 1066. The presence of this gene in some Vf resistant cultivars could explain why strains 1060 and 1066 overcome the resistance of only some of them; the cv Golden Delicious is present in the pedigree of many Vf resistant selections. We propose the name Vg for the single gene which codes for resistance to these strains in Golden Delicious.

Introduction

The resistance to *Venturia inaequalis* of the recently released apple selections (gene Vf) was overcome by a new race of the pathogen (race 6). Nevertheless, the resistance of the parental clone, *Malus floribunda* 821, seemed more complex and was not overcome by this race (Parisi *et al.*, 1993). Roberts and Crute (1994) described an isolate, Fl 1, which was able to overcome the resistance of *M. floribunda* 821. In this study we compared two monoconidial strains derived from Fl 1 with reference strains of race 1 and 6 on a set of selected apple clones.

Materials and methods

The 2 monoconidial strains 1060 and 1066 were isolated from lesions on *M. floribunda* 821 inoculated with Fl 1 in controlled conditions. The apple clones (grafted potted trees) and the progenies of the crosses Golden Delicious x Idared and Golden Delicious x *M. floribunda* 821 were inoculated in a growth chamber. On the apple clones, Incidence (I) and Severity (S) were observed according to the protocol described by Parisi *et al.* (1993). For the progenies of the crosses, the symptoms were assessed according to the scale described by Chevalier *et al.* (1991); seedlings of the classes 0, 1, 2, 3a were considered as resistant, seedlings of the classes 3b, 4 as susceptible.

Results

Only the results obtained with strain 1066 are shown; the results with strain 1060 were similar. The pathogenicity of strain 1066 was compared with that of strains 104 (race 1) and 305 (race 6) on the same apple clone range (Parisi and Lespinasse, 1996) (Table 1).

Table 1 Pathogenicity of four strains of *Venturia inaequalis* on apple clones

Apple clone	Reference strain[a]		Strain from Fl 1 isolate
	Race 1	Race 6	
	104	305	1066
	I / S[b]	I / S	I / S
Susceptible clones			
Gala	48 / 2	nt[c]	15 / 2
Golden Delicious	23 / 4	22 / 3	0 / 0
McIntosh	31 / 2	25 / 3	13 / 3
Granny Smith	0 / 0	nt	0 / 0
Differential hosts			
Race 2	0 / 0	0 / 0	0 / 0
Race 3	0 / 0	0 / 0	0 / 0
Race 4	0 / 0	0 / 0	0 / 0
Race 5 (Vm)	0 / 0	0 / 0	0 / 0
Resistant Vf clones			
Malus floribunda 821	0 / 0	0 / 0	8 / 3
Priscilla	0 / 0	nt	11 / 2
Florina	0 / 0	10 / 1	0 / 0
Prima	0 / 0	19 / 3	0 / 0
Liberty	0 / 0	nt	0 / 0
Other sources of resistance			
Progenitor of Vr gene	0 / 0	0 / 0	0 / 0
Nova Easygro	0 / 0	19 / 2	14 / 1
Progenitor of Va gene	0 / 0	0 / 0	0 / 0
Progenitor of Vb gene	0 / 0	0 / 0	0 / 0
Progenitor of Vbj gene	0 / 0	0 / 0	0 / 0
Evereste	0 / 0	0 / 0	7 / 2
Generos	0 / 0	0 / 0	0 / 0
Jonsib	0 / 0	17 / 2	0 / 0

a: Results from Parisi and Lespinasse (1996) except McIntosh and progenitor of Vb gene (Reference strains from I.N.R.A. Angers)

b: I / S : Incidence = % scabbed leaves / Severity = score between 0 to 7, grading scale from Parisi *et al.* (1993)

c: nt : no tested.

Table 2 Segregation of progenies resulting from crosses of Golden Delicious with Idared or *Malus floribunda* 821

Cross and Strain	Number of seedlings tested	Number of Resistant	Number of Susceptible	Ratio R : S[a]
Golden Delicious x Idared				
104	137	0	137	0 : 1
1060	70	31	39	1 : 1
1066	67	36	31	1 : 1
Golden Delicious x *Malus floribunda* 821				
104	105	86	19	3 : 1
1060	107	57	50	1 : 1
1066	153	71	82	1 : 1

a : R : S refers to ratio of resistant to susceptible. This ratio does not denote a significant difference from 0 : 1, 1 : 1 or 3 : 1 at the 0.05 level based on the Chi Square method of determining significance.

Results obtained with strains 1060 and 1066 were in agreement with those obtained by Roberts and Crute (1994) with isolate Fl 1, with the notable exception of the response of cv Golden Delicious, which was susceptible to Fl 1, but resistant to the monoconidial strains. Priscilla (Vf) and Nova Easygro (Vr) were susceptible, while Florina, Prima and Liberty (Vf) were resistant to strains 1060 and 1066. Furthermore, we observed that the differential host clones of the races 2, 3, 4, and 5 previously defined were resistant to these strains. The main difference between race 6 and strains 1060 and 1066 was their virulence on *M. floribunda* 821 and cv. Evereste. The other sources of major genes for resistance (Vr, Va, Vb, Vbj and resistance of cvs Generos and Jonsib) were not overcome by strain 1066 (Table 1).

The segregation of the crosses Golden Delicious x Idared and Golden Delicious x *M. floribunda* 821 showed that a single resistance gene segregated in the two progenies inoculated with strains 1060 and 1066 (Table 2).

Discussion

Monoconidial strains of Fl 1 do not belong to race 1 or to race 6. While they express virulence on *M. floribunda* 821, they have lost their virulence on cv Golden Delicious. We propose the name Vg for the single gene which codes for resistance to these strains in Golden Delicious. The presence of Vg in some Vf resistant cultivars could explain why the strains 1060 and 1066 overcome the resistance of only some of them; the cv Golden Delicious is present in the pedigree of many Vf resistant selections. The study of

the inheritance of the avirulence genes involved in the pathogenicity of these strains and the study of inheritance of *M. floribunda* 821 resistance will allow clarification of *Venturia inaequalis/Malus* interactions.

Acknowledgments

We thank Drs. Roberts and Crute for sending the Fl 1 isolate of *Venturia inaequalis*. Plant material was kindly provided by the Station d'Amélioration des Espèces fruitières et Ornementales, INRA Angers. This work was supported by the Région Pays de Loire.

References

CHEVALIER, M., LESPINASSE, Y. & RENAUDIN, S., 1991. A microscopic study of the different classes of symptoms coded by the Vf gene in apple for resistance to scab (*Venturia inaequalis*). *Plant. Pathology* **40**, 259-256.

PARISI, L., LESPINASSE, Y., GUILLAUMES, J. & KRUGER, J., 1993. A new race of *Venturia inaequalis* virulent to apples with resistance due to the Vf gene. *Phytopathology* **83,** 533-537.

PARISI, L. & LESPINASSE, Y. 1996. Pathogenicity of *Venturia inaequalis* strains of race 6 on apple clones (*Malus* sp.). *Plant Dis.* **80,**1179-1183.

ROBERTS, T. & CRUTE, I., 1994. Apple scab resistance from Malus floribunda 821 (Vf) is rendered ineffective by isolates of *Venturia inaequalis* from *Malus floribunda*. *Norwegian J. of Agric. Sci.* Supplement **17,** 403-406.