

## COMPARISON OF THE PATHOGENICITY OF *VERTICILLIUM DAHLIAE* ISOLATES FROM ARGENTINA AND THE USA

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### Abstract

Different isolates from Argentina and one from the USA were artificially inoculated on a set of lines in order to compare their host specificities. Two different patterns of specificity were detected for the Argentinean isolates (VArg1 and VArg2). Some sunflower lines which showed total resistance to group VArg1 (0% of diseased plants) were extremely susceptible when they were inoculated with VArg2 isolate (100% of diseased plants and 100% of foliar damaged tissue). The USA isolate was highly aggressive independent of the host genotype. A number of public lines were tested for resistance sources but none of them were resistant to the USA isolate. HA 89 line was highly susceptible to all isolates. A set of sunflower differential lines was sown at different locations and was evaluated under natural infection conditions, indicating the presence of pattern type VArg1 with the exception of the Energia location where the presence of the VArg2 pattern was observed. From the results of this work it is concluded that different races of *Verticillium dahliae* are present in the two countries, since the USA isolate is different from the race cited previously for this country.

### Introduction

Leaf mottle and premature death of sunflower caused by *Verticillium dahliae* Klebahn is considered to be one of the most important diseases in Argentina but it is also present in the United States and Canada, and has been reported in most production areas of the world (Gulya et al., 1997).

Nowadays an important proportion of commercial hybrids exhibit high levels of resistance to this pathogen but sporadically a few diseased plants could be observed in materials classified as totally resistant.

In the past, sunflower carrying monogenic resistance from the HA 89 line provided control against isolates from North America (Fick and Zimmer, 1974). In Argentina a new race that infects the HA 89 line was detected (Bertero and Vazquez, 1982).

Quiroz (2003) found variability in the aggressiveness of different Argentine isolates and in the virulence of isolates with similar levels of aggressiveness concluding that different pathogenicity pathotypes are present in Argentina. Interactions between sunflower genotypes and isolations showed the existence of races.

In this work a set of Advanta and public lines was employed to determine the pathogenicity pattern of different isolates from Argentina and the USA.

## Materials and Methods

*Verticillium dahliae* isolates were obtained from naturally infected plants from different locations: Balcarce, Energía, Orense, since 1991. The USA isolate was obtained from diseased tissue in 1997 (original material was kindly provided by F. Stoenescu). They were inoculated on a set of lines by the root immersion technique (Sackston, 1980).

In the first greenhouse trial: 6 inbred lines (Advanta Semillas S.A.I.C.) and 2 public lines HA 89 and HA 372 were included in the trial. A totally randomized block design was employed (three blocks, four pots per block/material).

In the second greenhouse trial six public lines and three Advanta lines were tested with a similar design as described.

In both cases plants were evaluated 40 days after inoculation by scoring the percentage of diseased plants and proportion of necrotic leaves (resistance level 9=without symptoms; resistance level 1=100% of leaves diseased).

This set of lines was also sown in the field (Balcarce, Venado Tuerto, Energía, Orense, Cristiano Muerto, June and 9 July) in order to monitor the pathogen over the environments and years. The field trial plants were evaluated 15 days after flowering.

## Results

Two different patterns of specificity were detected for the Argentinean isolates (VArg1 and VArg2). VArg2 was obtained from susceptible plants of hybrid previously cited as resistant.

**First Trial.** The public lines, HA 89 and HA 372 and ADV58, showed disease symptoms and a high percentage of diseased plants with the three isolates tested. All the plants of the remaining genotypes looked healthy when they were inoculated with the VArg1 isolate. Nevertheless these lines were susceptible with the VArg2 isolate and the USA one (Table 1).

**Second Trial.** The lines HA 89 and ADV29 were used as checks in this experiment due to their differential behavior to the VArg1 isolate in the first trial. The results obtained in this trial confirm the differences previously observed.

The sunflower lines HA 821, RHA 276, HA 335, HA 371 and RHA 856 were susceptible to all isolates. The level of damage was variable between genotypes and isolates.

The lines ADV53 and ADV67 were resistant to the VArg2 isolate. Only the second line (ADV67) presented resistance to the two Argentinean races. All the genotypes were susceptible to the USA pathogen (Table 2).

**Field Trials.** Currently, the behavior pattern of the differential lines to this disease (ADV29, ADV58, ADV53 and ADV67) showed presence of VArg1 in different locations: Balcarce, Venado Tuerto, Junín, and Orense. On the other hand, the Varg2 pattern was only detected in Energía and Cristiano Muerto locations.

Table1. First greenhouse trial.

LINE	VArg 1		VArg 2		VUSA	
	Resistance level	% diseased plants	Resistance level	% diseased plants	Resistance level	% diseased plants
HA372	2.9	100	2.5	100	3.5	100
HA89	3.9	100	4.6	100	5.7	91.6
ADV58	2.5	100	3.2	100	3.6	100
ADV29	9.0	0	2.2	100	4.5	100
ADV01	9.0	0	5.8	100	5.1	100
ADV63	9.0	0	6.4	83.3	6.4	75
ADV17	9.0	0	6.6	75	5.4	91.6
ADV07	9.0	0	3.2	100	3.8	100

Table 2. Second greenhouse trial.

LINE	VArg 1		VArg 2		VUSA	
	Resistance level	% diseased plants	Resistance level	% diseased plants	Resistance level	% diseased plants
HA89	2.1	100	4.1	100	5.7	62.5
ADV29	9.0	0	3.7	85.7	4.2	85.7
HA821	5.0	87.5	4.4	100	2.5	100
RHA276	4.6	75	5.1	77.8	6.7	50
HA335	2.7	100	5.3	70	5.5	77.7
HA371	3.5	100	4.5	88.8	2.8	100
RHA856	1.6	100	2.6	100	3.8	100
ADV53	3.5	100	9.0	0	3.3	100
ADV67	9.0	0	9.0	0	3.1	100

## Discussion

The knowledge of the presence of different races is very important to fungal disease management. According the field trials, VArg 1 is the more abundant *V. dahliae* race in Argentina. The introduction of resistance genes in the commercial hybrids allows avoidance of losses of about 30 % in the cases of severe attacks (Creus, 2003).

Nevertheless some plants of hybrids and lines considered as resistant presented a characteristic leaf mottle. Isolates from these plants exhibited a clearly different specificity pattern indicating the presence of a new race (VArg2).

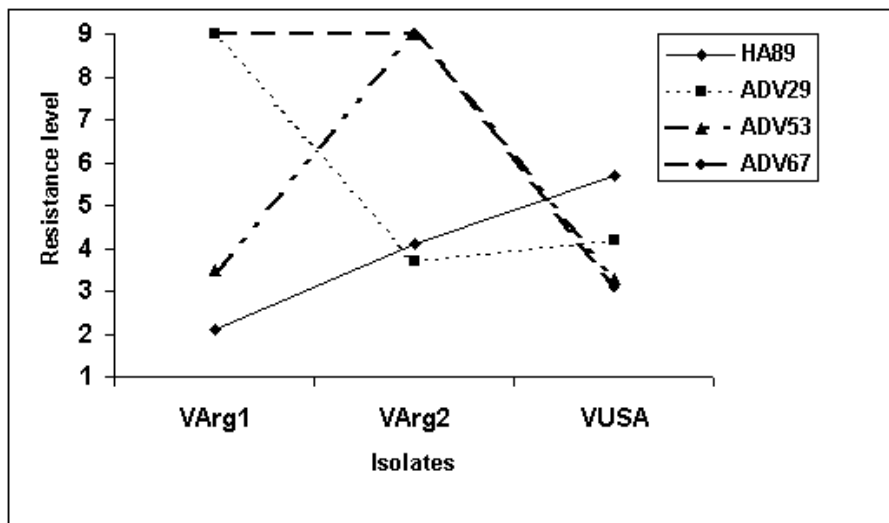
To date this race has not been an important concern because of its low proportion, but the increased use of VArg1 resistant hybrids could favor the growth of the minority race. The results of the present work about the presence of different races of *Verticillium dahliae* in

Argentina are clearly conclusive. The presence of a different race isolated from the USA and the absence of resistance sources constitute a potentially important problem for the future.

Gulya (1997) points out that HA 371 was resistant to the Argentinian race identified by Bertero and Vázquez (1982) and to the USA race present at that time. However the results obtained in our experiments were different; this line was susceptible to all isolates tested. This would indicate that Argentinean races tested are different to the one cited previously.

Figure 1 shows a synthesis of the differential interactions between pathotypes and genotypes when plants were artificially inoculated with the different races.

Figure 1. Effects of three isolates of *Verticillium dahliae* over differential lines.



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