

\*Research Institute of Crop Production, Prague, Czech Republic  
\*\*Mendel's University of Agriculture and Forestry, Brno, Czech Republic

## APRICOT CULTIVARS 'HARLAYNE' AND 'BETINKA' WERE PROVED TO BE HIGHLY RESISTANT TO THE SIX DIFFERENT STRAINS AND ISOLATES OF *PLUM POX VIRUS* (PPV)<sup>1</sup>

\*J. Polák, B. \*\*Krška, \*J. Pívalová and \*J. Svoboda

### Abstract

Results of three years evaluation of resistance of apricot cultivars 'Harlayne' and 'Betinka' to the six different isolates of *Plum pox virus* (PPV) are presented. No symptoms appeared in the leaves of apricot cultivar 'Harlayne' in course of three years after inoculation of different strains of PPV. No symptoms appeared on the leaves of apricot cultivar 'Betinka' after inoculation of PPV-D (original), PPV-D (*Prunus insititia*), PPV-M (apricot), PPV-M (peach) and PPV-recombinant (PPV-M × PPV-D) strains. ELISA did not prove the presence of PPV strains in leaves of both cultivars with polyclonal PPV antibodies. Mild diffuse rings and spots appeared occasionally in the leaves of one tree out of three tested trees of apricot cultivar 'Betinka' after inoculation of PPV-M (original) in the third year of evaluation (2004). The presence of PPV was confirmed by ELISA. Symptoms of PPV, diffuse spots and rings, appeared on leaves of control cvs 'Karola' and 'Velkopavlovická'. ELISA confirmed the presence of six different strains of PPV in control cultivars.

Apricot cultivars 'Harlayne' and 'Betinka' were shown to be immune or highly resistant to the six different strains and isolates of *Plum pox virus* within the three years after inoculation.

**Key words:** apricot, immunity, resistance, PPV strains

---

<sup>1</sup>The work was supported by the Ministry of Agriculture of the Czech Republic, Grant No. MZe 0002700603.

## Introduction

Trees of apricot cultivars naturally infected with *Plum pox virus* (PPV) were used in first studies on resistance (Syrgianidis 1979, Karayiannis 1988). Dosba et al. (1992) have tested many apricot cultivars and hybrids for resistance to PPV-D and PPV-M and proved cv. 'Harlayne' as immune to PPV. The immunity of apricot cultivar 'Harlayne' was confirmed by grafting into five years old trees of apricot, cv. 'Vegama' infected with PPV-M (Polák et al. 1997). One of 149 tested apricot hybrids, hybrid LE-3276 obtained in the Faculty of Horticulture, Lednice, Czech Republic, and later registered as cv. 'Betinka', was also proved to be immune to PPV-M. The immunity or resistance of apricots to PPV could be strain specific and could be broken by another PPV strain. Field trial was established to verify the immunity of cvs 'Harlayne' and 'Betinka' against different strains and isolates of PPV.

## Material and methods

### Plant material, inoculation with PPV strains

Virus free, two years old trees of apricot cultivars 'Harlayne' and 'Betinka', and as a control, PPV susceptible cultivars 'Karola' and 'Velkopavlovická' were inoculated by chip budding with six different strains and isolates of PPV in 2001:

- 1) PPV-M, original strain, obtained from the Mediterranean Agronomic Institute, Valenzano, Bari, Italy,
- 2) PPV-D, original strain, obtained from the Mediterranean Agronomic Institute, Valenzano, Bari, Italy,
- 3) PPV-M, isolated from apricot, cv. 'Vegama' in the Czech Republic (CR),
- 4) PPV-D, isolated from *Prunus insititia* L. in the CR,
- 5) PPV-M, isolated from peach, cv. 'Catherina' in the CR,
- 6) PPV-recombinant (PPV-M × PPV-D), isolated from *P. insititia* in the CR (Komínek et al. 1998, Glasa et al. 2004).

Buds from grafts of apricot, peach GF 305 and *P. insititia* infected with the different PPV isolates were used for inoculation of PPV. Three trees per cultivars were used for inoculation of each PPV strain or isolate. Every tree was inoculated with two buds. Growing of buds and developing of symptoms were checked and observed every month in course of three years in vegetation period.

### Visual and serological evaluation

Trees of apricot cultivars 'Harlayne', 'Betinka', 'Velkopavlovická' and 'Karola' were evaluated in the years 2002, 2003 and 2004 for the presence of PPV symptoms in leaves and tested by ELISA. PPV symptoms on fruits and stones were evaluated in 2004. Polyclonal PPV antibodies (Bioreba, Switzerland) were used for detection of PPV strains and isolates by DAS-ELISA (Clark and Adams 1977).

Samples for ELISA were prepared by grinding 0.2 g of leaves in phosphate buffered saline, pH 7.4 with 2% polyvinylpyrrolidone and 0.2% of egg albumin in the ratio 1:20. Microplates were read using a MR 5000 (Dynex) reader at 405 nm. The reading of  $A_{405}$  was performed after one hour incubation of the substrate at room temperature. Samples with  $A_{405} > 0.10$  were considered as positive, and samples with  $A_{405} < 0.03$  were rated as negative.

## Results

No symptoms appeared on the leaves of apricot cultivar 'Harlayne' after bud inoculation with PPV-D (original), PPV-D (*P. insititia*), PPV-M (original), PPV-M (apricot), PPV-M (peach), and PPV-recombinant (PPV-M × PPV-D) strains within three years (2002–2004). The presence of six PPV isolates could not be detected in leaves by ELISA. First fruits appeared in 2004. No symptoms appeared on fruits and stones of cv. 'Harlayne' after inoculation with six different PPV strains and isolates. Apricot cultivar 'Harlayne' was proved to be at least highly resistant, and candidate to be immune to the six different isolates of PPV in course of three years after inoculation.

No symptoms appeared on the leaves of apricot cultivar 'Betinka' after bud inoculation with PPV-D (original), PPV-D (*P. insititia*) PPV-M (apricot), PPV-M (peach), and PPV-recombinant (PPV-M × PPV-D) isolates during three years (2002–2004). The presence of five PPV strains was not shown in leaves by ELISA. First fruits appeared in 2004. No symptoms appeared on the fruits (Phot. 1) and stones of cv. 'Betinka' after inoculation with five different PPV isolates. Mild diffuse rings and spots (Phot. 2) appeared occasionally on the leaves of one tree from three tested trees of cv. 'Betinka' after inoculation with PPV-M (original) in the third year of evaluation (2004). ELISA confirmed the presence of PPV. Mild spots also appeared on the fruits (Phot. 3) and stones.

## Discussion

Although the apricot cultivar 'Betinka' was proved originally classified as highly resistant to the PPV, the original PPV-M strain breaks down the immunity of this cultivar (Polák et al. 1997). On the other hand our results confirmed previous results of Dosba et al. (1992) and Polák et al. (1997), who showed cv. 'Harlayne' resistant to PPV-M and PPV-D. The susceptibility of control cultivars 'Karola' and 'Velkopavlovická' to six PPV isolates was also checked.

PPV symptoms appeared on leaves of some inoculated trees of control cultivars 'Karola' and 'Velkopavlovická' in 2002, in most of trees in 2003, and in all trees in 2004. Identical or very similar symptoms, rings and diffuse spots appeared on leaves of trees infected with all the six PPV isolates. ELISA confirmed PPV in leaves of trees showing symptoms. Severe PPV symptoms, rings, spots appeared



Phot. 1. Fruits of apricot, cv. 'Betinka' harvested from the tree inoculated with PPV-M ('Catherina'). No PPV symptoms (photo by J. Polák)



Phot. 2. Rings and spots in leaf of apricot, cv. 'Betinka' infected with PPV-M (original) (photo by J. Polák)



Phot. 3. Mild diffuse rings and spots occasionally appeared in fruits of one apricot tree, cv. 'Betinka' inoculated with PPV-M (original)  
(photo by J. Polák)



Phot. 4. Malformations and spots in fruits of apricot, cv. 'Karola' infected with PPV  
(photo by J. Polák)

on fruits of cvs 'Karola' and 'Velkopavlovická' in 2004. Severe rings were also observed on the stones of fruits. Malformations were observed on fruits of cv. 'Karola' (Phot. 4). Apricot cultivars 'Karola' and 'Velkopavlovická' are susceptible to the all six PPV isolates.

The durability of resistance of cvs 'Harlayne' and 'Betinka' to the different PPV isolates will be observed still another two–three years. Symptoms on leaves and fruits will be evaluated. The presence of different PPV strains in leaves will be checked by RT-PCR.

## Acknowledgements

Authors are in debt to Mrs. Miloslava Ducháčová for manuscript preparation, to Dr. A. Myrta, Valenzano, Bari, Italy for support with PPV-M (original), PPV-D (original), and to Dr. P. Komínek, Prague–Ruzyně for PPV-D (*P. insititia*), PPV-M (apricot), PPV-M (peach), and PPV-recombinant strains.

## Literature

- Clark M.F., Adams A.N., 1977: Characteristic of the microplate method of enzyme-linked immunosorbent assay for the detection of plant virus. *J. Gen. Virol.* 34: 51–57.
- Dosba F., Orliac S., Dutrannoy F., Maison P., Masson G., Audergon J.M., 1992: Evaluation of resistance to *Plum pox virus* in apricot trees. *Acta Hortic. (The Hague)* 309: 211–220.
- Glasa M., Palkovics L., Komínek P., Labone G., Pittnerová S., Kúdela O., Candresse T., Šubr Z., 2004: Geographically and temporally distant natural recombinant isolates of *Plum pox virus* (PPV) are genetically very similar and from a unique PPV subgroup. *J. Gen. Virol.* 85: 2671–2681.
- Karayiannis I., 1988: Susceptibility of apricot cultivars to *Plum pox virus* in Greece. *Acta Hortic. (The Hague)* 235: 271–274.
- Komínek P., Hák R., Polák J., 1998: Characterisation of three *Plum pox virus* isolates in Czech Republic. In: 7th International Congress Plant Pathology, Edinburgh, 9–16 August 1998. Abstract – Vol. 2: 1.11.35
- Polák J., Oukropec I., Komínek P., Krška B., Bittóová M., 1997: Detection and evaluation of resistance of apricots and peaches to *Plum pox virus*. *J. Plant Dis. Prot.* 104: 466–473.
- Syrgianidis G., 1979: Research on the sensitivity of apricot varieties to Sharka (*Plum pox*) virus disease. *Agric. Res.* 3: 42–48.

Authors' addresses: Prof. dr Jaroslav Polák,  
Ms Jitka Pivalová,  
Dipl. Ing. Jiří Svoboda,  
Research Institute of Crop Production,  
Drnovská 507,  
16106 Praha 6,  
Czech Republic  
e-mail: polak@vurv.cz

Prof. dr Boris Krška,  
Mendel's University of Agriculture and Forestry,  
Faculty of Horticulture,  
Lednice – Mendeleum,  
691 44 Lednice,  
Brno,  
Czech Republic

*Accepted for publication: 16.05.2005*

