Genetics of Resistance to *Plum Pox Virus* in *A*pricot

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Abstract

Plum pox virus (PPV) causes serious damage in apricots grown in the Czech Republic and other countries where it is present. The virus spreads in orchards from infected trees by aphids to healthy trees of susceptible cultivars. Chemical control is ineffective from epidemiological point of view. For this reason growing of resistant apricot cultivars is the only way how to solve one of the most significant phytopathological problem. To study PPV resistance in apricot, three crosses between an apricot cultivars or a selection resistant to PPV and an apricot cultivars or a selection susceptible to PPV (LE-3218 × Stark Early Orange, LE-3241 × Vestar and LE-3246 × Vestar) were performed at Faculty of Horticulture of Mendel University of Agriculture and Forestry in Lednice na Moravě in 1999. The BC_1 seeds were stratified and the subsequent seedlings were grown in a greenhouse. The seedlings were repeatedly inoculated with PPV-Vegama isolate (PPV-M strain) by an infected chip. The resistance of the plants was evaluated by symptom observing and ELISA in three consecutive growth periods. The χ^2 test was used to analyse the data. It was found that two independent dominant complementary genes conditioned PPV resistance in apricot. The significance of these findings in relation to other reports is discussed. Knowledge of PPV resistance inheritance will help in planning apricot breeding programmes.

Keywords: *Plum pox virus*; *Prunus armeniaca* L.; resistance; inheritance

INTRODUCTION

Growing cultivars resistant to *Plum pox potyvirus* (PPV) is the most economical and optimal ecological way of minimizing the losses caused by this damaging pathogen. Experimental screening for PPV resistance was for the first time reported by Greek, French, Yugoslavian and Romanian colleagues, who had chosen Stark Early Orange as a donor of PPV resistance in 70s.

Later on, several other cultivars like Harlayne, Goldrich, Henderson and Stella were used in many breeding programmes.

Apricots are the least genetically characterized species of the genus *Prunus*. Currently Spanish, French, Romanian and Czech breeders and virologists are solving the problem with inheritance of PPV resistance including DNA mapping of genes controlling this trait.

In this paper we present results from the screening of apricot backcross progenies for PPV resistance.

MATERIALS AND METHODS

Apricot selections LE-3241 and LE-3246 both resistant to PPV (Vestar × Stark Early Orange) were

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crossed as a female parent to Vestar (susceptible to PPV) at Faculty of Horticulture in Lednice in 1999.

A selection LE-3218 (coming from the same progeny, susceptible to PPV) was crossed to Stark Early Orange (SEO) as a female parent. The BC_1 seeds were stratified before sowing for 3 months (5°C) and subsequent seedlings were grown in a greenhouse.

Each BC_1 seedling was inoculated with PPV-M strain (PONCAROVÁ & KOMÍNEK 1998) by chip-budding two times. The first inoculation was carried out 4 months after emergence, second one during second growth period (after dormancy rest). Symptoms of PPV infection were visually observed on apricot leaves.The presence of PPV was determined by ELISA at least two times.The observations were continued over three consecutive growth periods.

Simple χ^2 tests for good-of-fit based on an assumed genetic model were used to evaluate the experimental results.

RESULTS

Tables 1 and 2 show segregation ratios obtained from backcrosses between different parental combinations. At all progenies obtained ratios correspond 3: 1 (susceptible/resistant). The χ^2 ranged from 0.05 to 0.60 and the probability was from 25 to 90% at the other progenies.

The results show that two genes control PPV resistance in apricot. The resistance is a dominant trait and the resistant parents are heterozygous in both loci.

DISCUSSION

The results agree with our previous results (KRŠKA 1996) obtained from crosses between Vestar × SEO and Velkopavlovická (clone of Hungarian Best) × SEO in which a quarter of individuals was resistant to PPV. DOSBA *et al*. (1992) and MOUSTAFA *et al*. (2001) reached the same model of inheritance for this trait (two independent dominant genes). On the other hand DICENTA *et al*. (2000) found that a single gene controls PPV resistance in apricot. According to our experience three growth seasons are necessary for sufficient evaluation of the trait. MOUSTAFA *et al*. (2001) also describe differences in segregation ratios of resistance to PPV in apricot progenies after first and second chilling treatment GUILLET-BELLANGER and AUDERGON (2001) discovered at a self-pollinated progeny of SEO, that PPV resistance in apricot is under polygenic control involving at least 3 dominant heterozygous genes. But the number of individuals in the progeny was only 35 and the value of Chi-square test for 3 genes was not significant.

Table 1. Evaluation of apricot seedlings to PPV resistance

BC_1 progenies	Total	Resistant	Susceptible	Ratio S/R
LE-3241 × Vestar	75	17	58	3.41
LE-3246 × Vestar	80	17	63	3.71
LE-3218 × SEO	55	13	42	3.23

Table 2. Chi-square tests for BC_1 PPV resistance data and hypothetical genotype of resistant parents

BC_1 progenies	Theoretical ratio (R/S)	Chi-square	Probability (%)	Hypothetical genotype of resistant parent
LE-3241 × Vestar	1:3	0.22	50–75	AaBb
LE-3246 × Vestar	1:3	0.60	25–50	AaBb
LE-3218 × SEO	1:3	0.05	75–90	AaBb

Results obtained by segregation analysis will be confirmed by molecular mapping in progeny LE-3246 × Vestar.

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