

TESTING OF PLUM GERMPLASM FOR SENSITIVITY TO PLUM POX

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Summary. – A long-term orchard experiment with a broad assortment of plum cultivars aimed to screen their sensitivity to plum pox virus (PPV) was established in 1991. For this purpose, 207 cultivars to be artificially infected with PPV at a permanent site were chosen. The serotype M of PPV from a tree of cv. Domestic Prune, which had not been contaminated by other viruses, was used as a source of the infection. Three buds infected with PPV were budded on 1-year-old trees. In the course of the experiment the following results were obtained. The highest transmission of PPV was recorded in the first year after infection, when 69.5% of positive trees were detected by enzyme-linked immunosorbent assay (ELISA). After 4 years, the absence of PPV was still detected in 11.2% of the cultivars. These were reinfected with the same source of PPV in 1996. In 1998, there were 92.9% of trees contaminated by sharka. Seven years after infection with PPV, a dieback of 41 trees took place. In the most cases a presence of an ilarvirus in the plant was detected. The PPV infection was not transferred further on cvs Bila trnecka, Francia Naranes, Large Sugar Prune, Reine Claude Diaphane, Renkloda Jandacek, Scoldus, Tarnina x Kirke, Valasska trnecka and K-4. There were 75% of trees fruited in 1997. Only 28 cultivars had no symptoms of PPV on fruits. A statistically significant relationship between the incidence of PPV after the artificial infection and the presence of prunus necrotic ring spot virus (PNRSV). The presence of PNRSV reduced the transmission of PPV. Relationships between PPV and prune dwarf virus (PDV), and between PPV and (PDV + PNRSV) were not statistically significant.

Key words: plum pox virus; plum cultivars; germplasm; tolerance

Introduction

Plum-trees, mainly the cv. Domestic Prune, belong in the Czech Republic to very demanded fruit species, for the growth of which there exist desirable climatic and soil conditions and which have been very reliable in production of high and regular yields. Fruits of plums were very popular both in the domestic and foreign market. The recent deep decrease of plum growing has been caused by a wide-spread of the PPV disease. A renovation of plum orchards is largely dependent on the choice of cultivars tolerant of plum pox, however, their fruit quality and tree productivity have to be similar to those of cv. Domestic Prune.

The tolerance of a cultivar to PPV is dependent especially on the virus strain and ecological conditions of the site. This means that tolerant cultivars from a certain do not manifest the same character in other conditions (Minoiu, 1979).

The aim of the presented contribution is to summarize results obtained from a long-term experiment with a broad

assortment of plums regarding their tolerance of plum pox in the conditions of the Czech Republic.

Materials and Methods

The experimental planting comprising 207 cultivars of plums from a broad assortment was established during autumn 1990 in an area separated by space using two one-year-old trees on myrobalan rootstock per cultivar. The spacing of the trees was 6 x 4 m. The strips under tree-canopies were kept clean by herbicides, while mulching of sod was applied to the alley between rows. The planting was located at Holovousy at altitude of 320 m a.s.l. with average year temperature of 8.14°C and average rainfall of 654.7 mm. The cultivars from plum germplasm stock were chosen on the basis of negative tests for PPV by ELISA. The health status of trees on the permanent site was checked by ELISA tests for PPV, PDV and PNRSV. The trees were infected in August 1991 with virulent strain of PPV by budding of 3 buds taken from an infected tree of cv. Domestic Prune on the stem. This source of virus infection was chosen on the basis of results of ELISA test and visual symp-

toms of plum pox on leaves. According to ELISA, it contained neither PDR nor PNRSV. The incidence of PPV was evaluated in 1992 according to visual symptoms on leaves. In the cases when symptoms of PPV were found on leaves, control ELISA tests for PPV were made. These tests were repeated on all trees in 1993 and 1995, and on the trees, which were PPV-negative in the previous year, in 1994, 1996 and 1997. Those cultivars, which were not contaminated by PPV according to ELISA in 1995, were reinfected in 1996 using the same source of plum pox. Symptoms of plum pox on fruits were evaluated on fruiting trees for the first time in 1997. Trees with symptoms of bark cracking and dieback of branches were tested for the apple chlorotic leaf spot virus (APCLSV) by ELISA in 1997 and 1998.

Results and Discussion

Transmission of PPV after artificial infection in the course of 7 years is demonstrated in Table 1. The highest transmission of sharka took place in the first year after infection (69.5%). In the second year, the disease was disseminated to 7.6% of other trees. In the following three years, there were practically no newly contaminated trees. After the re-infection with PPV in 1996, the share of contaminated trees reached 87.4% in 1996 and 92.9% in 1997. After 7 years of the experiment, only 7.1% of the trees were without any contamination by sharka. A statistically significant dependence of the contamination by PPV after artificial infection on the presence of PNRSV was found by the chi square test. The presence of PNRSV reduced the transmission of PPV. Other relationships (between PPV and PDV, or between PPV and (PDV + PNRSV)) were not significant. These results support a possibility of mutual interactions of viruses in the plant which modify pathogenic effects of one virus by another virus (interference). Such interactions between viruses leading to protection response of the host have been described in the case of PPV in several reports, e.g. Rankovic and Paunovic (1989).

The cultivars of which the both trees showed some cracking of bark and later some dieback are listed in Table 2 which shows results of ELISA for PPV, PDV, PNRSV and ApCLSV. In 4 trees no other virus except PPV was found, while in the

Table 1. Percentage of diseased trees after artificial inoculation of PPV

Year	Diseased trees (%)
1992	69.5
1993	77.1
1994	81.8
1995	80.0
1996	80.7
1997	87.4
1998	92.9

Table 2. Health status of plum cultivars with dieback after 7 years from PPV infection

Cultivar	Virus detected by ELISA			
	PPV	PDV	PNRSV	ApCLSV
Bonne de Bry	+	—	—	—
Ebersweier	+	+	—	—
Green Gage	+	+	—	—
Chrudimcr	+	—	—	—
Italian Prune	+	+	—	—
Italian Prune IR-16-1	+	—	+	—
Italian Prune sel.	+	—	—	—
Italian Prune type Kouřim	+	+	—	—
Italian Prune type Mašek	+	+	—	—
Izjumnaja	+	+	—	—
K-4 hybrid	—	+	—	—
Tuleu Gras	+	+	—	—
Wegierka Dabrowicka	+	—	—	—

(—) = negative reaction; (+) = positive reaction

Table 3. Health status and presence of some viruses in PPV-free cultivars after the first artificial infection with PPV and after re-infection

Cultivars	Virus detected by ELISA			After re-infection with PPV
	PPV	PDV	PNRSV	
Bila trnečka	—	—	—	—
Francia Naranas	—	+	+	—
Large Sugar Prune	—	—	+	—
Reine Claude Diaphane	—	+	+	—
Renkloda Jandacck	—	+	+	—
Scoldus	—	+	+	—
Tarnina x Kirke	—	+	+	—
Valasska trnečka	—	+	—	—
K-4	—	+	+	—

(—) = negative reaction; (+) = positive reaction.

rest of the trees either PDV or PNRSV was present. In 4 trees the both ilarviruses were present. In the case of the hybrid K-4 no PPV but PDV was detected. Besides these cultivars, the abovementioned symptoms of tree dieback were observed on another 15 trees. The dieback of hybrid

K-4 was caused by a hypersensitive reaction to PPV as it was explained by Kegler *et al.* (1995). The dieback of other trees was probably also a consequence of their sensitivity to PPV in conjunction with the other ilarviruses tested.

Cultivars which were not contaminated by PPV on the both trees according to repeated testing are listed in Table 3. The PPV infection was not further transferred on cvs. Bila trnecka, Francia Naranes, Large Sugar Prune, Reine Claude Diaphane, Renkloda Jandacek, Scoldus, Tarnina x Kirke, Valasska trnecka and K-4. If our results regarding cv. Bila trnecka are confirmed also in the following years as completely resistant to PPV, this cultivar should be utilised in breeding programs as source of resistance to PPV. There were 75% of the trees fruited in 1997. Only 28 cultivars had no symptoms of plum pox on fruits.

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