

Reactions of Wild *Solanum* Species to Potato Virus X and Potato Virus Y¹

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Reactions of forty-four accessions from twenty-seven wild *Solanum* species to potato virus X (PVX) and potato virus Y (PVY) have been studied. Out of them *Solanum lesteri* P. I. 442694, *S. marinasense* P. I. 458380 and *S. tuberosum* ssp. *andigena* P. I. 243450 possess hypersensitive resistance; the other wild *Solanum* species examined are locally and systemically susceptible to PVX. As to PVY, certain species (*Solanum brevifolium* P. I. 218228, P. I. 245763, P. I. 245764, P. I. 273401; *S. fernandezianum* IS/C-1663; *S. hermanni* BIRM/S. 0210 and *S. trifidum* P. I. 255536) are immune.

The potato virus X (PVX, potexvirus group) and potato virus Y (PVY, potyvirus group) have spread all over the world in potatoes. In Hungary it is the most frequent virus after potato leaf roll virus (PLRV, luteovirus group), and in a great many cases it occurs in mixed form (Horváth, 1963, 1967). The fact that the course of inheritance and the occurrence of resistance genes in many wild *Solanum* species have been cleared for both viruses is of very great importance in producing virus resistant potato varieties (Ross, 1958, 1960, 1961, 1966, 1978; Horváth, 1968, 1984a; Cockerham, 1970; Munoz et al., 1975; Hooker, 1978; Oertel et al., 1980 etc.). Due to the investigations, there are today several virus resistant potato varieties known in the world. Characteristically of the variability of PVX and PVY strains with different properties have recently appeared of them (e.g. Klinkowski and Schmelzer, 1960; Rozendaal et al., 1971; De Bokx et al., 1975; Koenig and Bode, 1977; Moreira et al., 1978, 1980; Calvert et al., 1980; Jones, 1985), which at the same time have made the work of breeding more difficult. This fact explains the great attention paid for some years to studies of relationships between wild *Solanum* species in gene centres and viruses, and to descriptions of further *Solanum* species (Schmelzer and Spaar, 1975; Jones and Fribourg, 1978; van Soest, 1980, 1983; van Soest and Hondelmann, 1983; van Soest et al., 1980; Horváth, 1984b, 1987, 1988). Seeking out virus resistant wild *Solanum* species and detecting relationships between them and various viruses are equally important for breeding and from point of view of virus ecology and virus diagnosis.

¹ Dedicated to the late S. Barsy, given Kossuth-Prize for her potato breeding work, on the occasion of her 85th birthday.

Materials and Methods

Forty-four accessions of twenty-seven wild *Solanum* species were inoculated by carborundum-spatula technique with water diluted (1 : 1, v/v) tissue sap from *Nicotiana tabacum* cv. *Xanthi-nc* plants previously infected with PVX and PVY. The inoculated plants were symptomatologically checked for infection every 7 days, then at the end of the 3rd and 6th week serological examinations were performed for both viruses. To check the susceptibility to PVX and PVY of the wild *Solanum* species double sandwich ELISA method was applied using horse-radish peroxidase conjugate (see Clark and Adams, 1976). The PVX and PVY antiserum was conjugated with horse-radish peroxidase enzyme. The color reaction was measured at 492 nm wavelength on Dynatech ELISA reader. In latent host-virus relations back-inoculation was also carried out to removed leaves of indicator plants: *Gomphrena globosa* for PVX and *Solanum demissum* A6-hybrid for PVY (Köhler, 1953; Paul, 1964; Zschüttig and Horváth, 1968).

Results and Discussion

1. Experiments with potato virus X

In the course of experiments with PVX various host-virus relations were detected. As seen from Table 1 the host-virus relations were essentially characterized by the following symptoms: chlorotic and/or necrotic local lesions with leaf drop or without, and absence of systemic symptoms (A); chlorotic and/or necrotic local lesions with or without leaf drop, and systemic vein clearing, mosaic, in some cases necrotic symptoms (B); necrotic local lesions and necrotic systemic lesions (C); symptomless local susceptibility and symptomless systemic susceptibility (D); symptomless local susceptibility and systemic vein clearing and mosaic (E); necrotic local lesions with leaf drop (F). According to the diversity of the symptoms the individual wild *Solanum* species and their accessions showed local and systemic susceptibility (A-E), or with a mere local susceptibility hypersensitive resistance (F) to PVX (see Table 1). The P. I. 243390 and P. I. 243453 accessions of *Solanum tuberosum* ssp. *andigena* developed to necrosis too in response to infection by PVX. Particularly remarkable are certain latent host-virus relations (e.g. *Solanum abanqayense* P. I. 458404; *S. brevidens* P. I. 218228, P. I. 245763, P. I. 473401; *S. canasense* P. I. 265863; *S. fernandezianum* IS/C – 1663/1981). Out of the latter plants only *Solanum canasense* P. I. 265863 is mentioned for virus susceptibility by Hanneman and Bamberg (1986) as susceptible to PVX and PVY. These data have been confirmed in our own experiments. Resistance based on hypersensitivity was established for *Solanum lesteri* P. I. 442694; *S. marinasense* P. I. 458380; *S. tuberosum* ssp. *andigena* P. I. 243450.

Table 1

Origin of the investigated wild *Solanum* species and their reaction to potato virus X (PVX) and potato virus Y (PVY)

<i>Solanum</i> species	Accession number ¹	Type of reaction ²	
		PVX	PVY
<i>Solanum abancayense</i>	P. I. 458403, Peru	A	B
<i>S. abancayense</i>	P. I. 458404, Peru	D	B
<i>S. ambosinum</i>	P. I. 365316, Peru	NT	B
<i>S. ambosinum</i>	P. I. 365362, Peru	B	B
<i>S. brachistotrichum</i>	P. I. 283095, Mexico	NT	A
<i>S. brachistotrichum</i>	WRF 1271	B	A
<i>S. brevidens</i>	P. I. 218228	D	G
<i>S. brevidens</i>	P. I. 245763, Chile	D	G
<i>S. brevidens</i>	P. I. 245764, Chile	A	G
<i>S. brevidens</i>	P. I. 473401, Argentina	D	G
<i>S. canasense</i>	P. I. 265863, Peru	D	B
<i>S. fernandezianum</i>	IS/C-1662/1981	D	G
<i>S. hermanni</i>	BIRM/S.0210	E	G
<i>S. khasianum</i>	IS/C-673/1982	B	B
<i>S. lesteri</i>	P. I. 442694, Mexico	F	B
<i>S. marinasense</i>	P. I. 365333, Peru	A	B
<i>S. marinasense</i>	P. I. 458380, Peru	F	NT
<i>S. olgae</i>	IS/C-1013/1981	B	B
<i>S. oplocense</i>	P. I. 442682, Argentina	A	B
<i>S. oplocense</i>	P. I. 473192, Argentina	A	B
<i>S. ottonis</i>	IS/C-1672/1982	B	B
<i>S. pampasense</i>	P. I. 442697, Peru	B	B
<i>S. panduriforme</i>	BIRM/S.1398	B	NT
<i>S. papita</i>	P. I. 275227	B	B
<i>S. papita</i>	P. I. 275228, Mexico	B	B
<i>S. platense</i>	BIRM/S.0738	NT	B
<i>S. polytrichon</i>	P. I. 186545, Mexico	A	F
<i>S. polytrichon</i>	P. I. 25546, Mexico	A	B
<i>S. polytrichon</i>	P. I. 275241, Mexico	B	B
<i>S. quitoense</i>	IS/C-578/1981	B	B
<i>S. rigescens</i>	IS/C-1024/1981	B	F
<i>S. saponaceum</i>	IS/C-1026/1981	B	B
<i>S. scabrum</i>	BIRM/S. 0246	B	E
<i>S. sodomeum</i>	IS/C-1031/1981	B	B
<i>S. symonii</i>	BIRM/S.0797	B	B
<i>S. trifidum</i>	P. I. 255536, Mexico	B	G
<i>S. trifidum</i>	P. I. 255542, Mexico	B	NT

Table 1 (continued)

<i>Solanum</i> species	Accession number ¹	Type of reaction ²	
		PVX	PVY
<i>S. tuberosum</i> ssp. <i>andigena</i>	P. I. 243390, Colombia	B	E
<i>S. tuberosum</i> ssp. <i>andigena</i>	P. I. 243400, Colombia	NT	E
<i>S. tuberosum</i> ssp. <i>andigena</i>	P. I. 243436, Colombia	B	B
<i>S. tuberosum</i> ssp. <i>andigena</i>	P. I. 243450, Colombia	E	B
<i>S. tuberosum</i> ssp. <i>andigena</i>	P. I. 243453, Colombia	B	E
<i>S. tuberosum</i> ssp. <i>andigena</i>	WRF 1758 (279291 × 306302)	C	B
<i>S. weberbaueri</i>	P. I. 442703, Peru	A	B

¹ BIRM/S. — Birmingham *Solanaceae* Gene Bank, Birmingham, England; IS/C — Index Seminum of the Botanic Garden, Copenhagen, Denmark; P. I. and WRF — Potato Introduction Station, Sturgeon Bay, Wisconsin, USA.

² A, chlorotic and/or necrotic local lesions with leaf drop or without, and absence of systemic symptoms; B, chlorotic and/or necrotic local lesions with or without leaf drop, and systemic vein clearing, mosaic, in some cases necrotic symptoms; C, necrotic local lesions and necrotic systemic lesions; D, symptomless local susceptibility and symptomless systemic susceptibility; E, symptomless local susceptibility and systemic vein clearing and mosaic; F, necrotic local lesions with leaf drop (hypersensitive reaction); G, immunity; NT, not tested.

2. Experiments with potato virus Y

The types of host-virus relations between the *Solanum* species and accessions examined and the PVY partly agreed with those described for PVX (see A, B, E and F). It is remarkable that some *Solanum* species and accessions showed immunity of PVY (G), namely, neither the inoculated nor the non-inoculated leaves of *Solanum brevidens* P. I. 218228, P. I. 245763, P. I. 245764, P. I. 273401; *S. fernandezianum* IS/C—1662/1981; *S. hermanni* BIRM/S.0210; *S. trifidum* P. I. 255536 showed infection by PVY, and the virus could not even be detected in them by serological and biological tests (see Table 1). These latest experiment results are important because — to our best knowledge — literary data concerning the *Solanum* species and accessions mentioned are not available (Hanneman and Bamberg, 1986). The only exception is *Solanum brevidens* P. I. 245764, which according to the data of Hanneman and Bamberg (loc. cit.) is hypersensitive to PVY.

Some of the wild *Solanum* species discussed in present paper (e.g. *Solanum abancayense* P. I. 458404; *S. ambosinum* P. I. 365362; *S. canasense* P. I. 265863; *S. lesteri* P. I. 442694; *S. oplocense* P. I. 442682; *S. papita* P. I. 275227; *S. polytrichon* P. I. 255546; *S. weberbaueri* P. I. 442703) were also found to be susceptible to henbane mosaic virus (HeMV, potyvirus group); the pathogeneity of the latter virus for potato has recently been demonstrated (cf. Horváth et al., 1988).

Acknowledgements

The authors wish to express their thanks to Dr. Robert E. Hanneman, Jr., Potato Introduction Station, Sturgeon Bay, Wisconsin, USA, Dr. Richard N. Lester, University Botanic Gardens, Birmingham, England, and to the staff of the Botanic Garden, Copenhagen, Denmark, for his sending wild *Solanum* species. Thanks are due to Miss K. Molnár and Mrs. É. Bószé for their technical assistance.

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