Solanum stoloniferum AND S. *tarnii* AS RESISTANCE SOURCES OF THE NTN STRAIN OF POTATO Y POTYVIRUS (PVY^{NTN})

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ABSTRACT

Potato is one of our most important crop because of its rule supplying with food. Out of the cultivated plants potato has the most pathogens. Potato Y *potyvirus* (PVY) is the type member of *potyvirus* genus of Potyviridae family, which constitutes the largest known and economically most important family of plant viruses. A new strain of PVY, which produces severe necrotic ring symptoms on potato tubers was isolated at the first time by Beczner *et al.* (1982) in Hungary. This strain belongs to the tobacco veinal necrosis strain group. The new strain was named by Horváth (1992) which was accepted by the Virology Section of EAPR (European Association for Potato Research). The acronym of this new strain is: $PVY^{N(ew)\ T(uber)\ N(ecrosis)}=PVY^{NTN}$. The potato tuber necrotic ringspot disease (PTNRD) is identified by superficial bows and rings around the eyes, first protruding, later becoming sunken and necrotic. Furthermore PVY^{NTN} is suspected to overcome field resistance of numerous potato cultivars therefore, this is a resistance breaking strain of PVY. This virus strain became distributed throughout Europe and other parts of the world. The identification of resistance sources is of great importance, therefore experiments were carried out with wild *Solanum* species for determining their susceptibility or resistance to NTN strain of PVY. The objective of the study was to identify potential resistance sources among the wild *Solanum* species that could be used in the potato breeding program. We have studied more than 100 wild *Solanum* species and accessions to PVY^{NTN}. It was found some resistance species and accessions. Currently potato cultivars, resistant to PVY are derived from *S. stoloniferum* (e. g. 'Szignal'). Out of the resistance species some accessions of *Solanum stoloniferum* and *S. tarnii* could be used in the potato breeding. They were immune to the PVY^{NTN} infection.
Key words: potato, NTN strain of potato Y *potyvirus*, resistance sources

IZVLEČEK

Solanum stoloniferum IN S. tarnii KOT VIRI ODPORNOSTI ZA NTN SEV KROMPIRJEVEGA VIRUSA Y (PVY^{NTN})

Krompir je zaradi svoje prehrambene vrednosti ena izmed naših najpomembnejših kmetijskih rastlin. Med gojenimi rastlinami ima krompir največ bolezni in škodljivcev. Krompirjev virus Y (PVY) pripada rodu *Potyvirus* in družini Potyviroidae, ki tvori največjo znano in ekonomsko najpomembnejšo družino rastlinskih virusov. Nov sev PVY virusa, ki povzroča močno izražene nekrotične obročke na krompirjevih gomoljih, je na Madžarskem prvič izoliral Beczner s sod. (1982). Sev pripada

nekrotični skupini PVY. Sev je poimenoval Horváth (1992) in to ime je sprejela Virološka sekcija EAPR (Evropska zveza za raziskave krompirja). Akronim tega novega seva je $PVY^{N(ew)\ T(uber)\ N(ecrosis)}$, torej PVY virus z novo nekrozo na gomoljih. Bolezen obročkasta nekroza krompirjevih gomoljev (PTNRD) prepoznamo po površinskih lokih in obročkih okrog očes, ki so najprej izbočeni, nato pa udrti in nekrotični. Domnevajo, da lahko PVY^{NTN} premaga odpornost na polju pri številnih krompirjevih kultivarjih. Ta sev virusa se je razselil po vsej Evropi in drugod po svetu. Odkrivanje virusov odpornosti je zelo pomembno, zato smo preizkušali divje vrste iz rodu *Solanum* na njihovo občutljivost ali odpornost proti NTN sevu PVY virusa. Smoter te raziskave je bil ugotavljanje potencialnih virov odpornosti med divjimi vrstami iz rodu *Solanum*, ki bi jih lahko uporabili v žlahtnjiteljskih programih. Proučili smo več kot 100 divjih vrst in akcesij iz rodu *Solanum* in našli nekaj vrst in akcesij, odpornih proti PVY^{NTN}. Med odpornimi vrstami bi lahko za žlahtnjenje uporabili *Solanum stoloniferum* in *S. tarnii*. Ti dve vrsti sta bili imuni na okužbo z PVY^{NTN}. Trenutno vzgajamo odporne kultivarje s križanjem s *Solanum stoloniferum* in *S. tarnii* (t.j. 'Szignal').
Ključne besede: krompir, sevi NTN krompirjevega Y potivirusa, viri odpornosti

1. INTRODUCTION

Potato Y *potyvirus* (PVY) is one of the most important viruses of potato, causing severe yield losses. Virus was first described by Orton (1920). It has some strains, which were well characterized by Horváth (1966a,b; 1967a,b). The new, NTN strain was described at first time in Hungary by Beczner and his colleagues (Beczner *et al.* 1982, 1984). During the past eighteen years it became distributed throughout Europe and was also reported from America and recently from Japan and Peru (Table 1).

Table 1: Natural occurrence of PVY^{NTN}

Country	Reference
Hungary	Beczner *et al.*, 1982, 1984
Germany	Radtke 1984, Weidemann 1985
Czehoslovakia	Dedi *et al.*, 1988
Austria	Schiessendopler 1990
Yugoslavia	Buturovi and Ku 1989, 1990
Lebanon	Le Romancer and Kerlan 1991
France	Le Romancer and Kerlan 1991
Great Britain	Wright 1992
Denmark	Nielsen 1992
USA	McDonald and Singh 1993
Belgium	Le Romancer *et al.*, 1994
Rumania	Weidemann and Mass 1996
Israel	Weidemann and Mass 1996
Portugal	Serra and Weidemann 1997
Italy	Vicchi 1997, Vicchi *et al.*, 1997, Tomassoli *et al.*, 1998
Greece	Bem *et al.*, 1999
Japan	Ohsima *et al.*, 2000
Peru	Salazar *et al.*, 2000

Currently, it is a major problem of potato growers and breeders. This strain has resistance breaking characteristic and produces severe necrotic symptoms on potato tubers and also on berries. Due to the destructive nature of NTN strain of PVY (PVY^{NTN}), the identification of sources of resistance is very important. In our previous investigations we have studied the reaction of more than 100 *Solanum* species and accessions to NTN strain of PVY (Bosze *et al.*, 1996, Horváth *et al.*, 1997, Takács *et al.*, 1998, Horváth

et al., 1999, Takács *et al.*, 1999a, Takács 2000, Horváth *et al.*, 2001). The objective of this study was to identify further potential resistance sources among the wild *Solanum* species that could be used in the potato breeding program.

2. MATERIALS AND METHODS

Five accessions of *S. stoloniferum* (PI. 558472, 558473, 558475, 558476, 558477) and six accessions of *S. tarnii* (498046, 498048, 545742, 545808, 570641, 570642) originated from different states of Mexico were inoculated with the original Maradona isolate of PVY^{NTN}. The inoculated plant were symptomatologically checked for infection. Five weeks after inoculation the accessions were serologically tested using DAS ELISA method after Clark and Adams (1977). The presence of the viral antigene was monitored using polyclonal antibody and alkaline-phosphatase (AP)-conjugated antibody. Substrate absorbance was measured twenty minutes after adding the substrate at 405 nm wavelength. Test samples were considered positive if their absorbance values exceeded twice that of the healthy control samples. In latent host-virus relations back inoculation was also carried out to *Nicotiana tabacum* 'Xanthi', as indicator plant.

3. RESULTS AND DISCUSSION

Among the species and accessions examined two accessions of *S. stoloniferum* (PI 558472, 558476) and three ones of *S. tarnii* (PI 498048, 545742, 570642) were found to be resistant (immune) to PVY^{NTN}. Neither the inoculated nor the non-inoculated leaves showed symptoms and the virus could not be detected in them by serological and biological tests. These accessions therefore can be used as sources of resistance in potato breeding (Table 2).

Table 2: Reaction of *Solanum stoloniferum* and *S. tarnii* accessions to PVY^{NTN}

Species	Accession or PI number	Origin Country/state*	Symptoms (local/systemic)**	Absorbance	Biotest
S. stoloniferum	558472	Mex/Mex	-/-	0.173(-)	-
S. stoloniferum	558473	Mex/Oax	-/Led	3.396(+9)	+
S. stoloniferum	558475	Mex/Oax	-/Led, Vn	3.421(+)	+
S. stoloniferum	558476	Mex/Oax	-/-	0.151(-)	-
S. stoloniferum	558477	Mex/Milch	Led/-	3.592(+)	+
S. tarnii	498046	Mex/Hid	-/-	0.372(+)	+
S. tarnii	498048	Mex/Hid	-/-	0.237(-)	-
S. tarnii	545742	Mex/Ver	-/-	0.186(-)	-
S. tarnii	545808	Mex/Hid	Led/Mo, Nl	3.467(+)	+
S. tarnii	570641	Mex/Hid	-/Mo, Led	0.410(+)	+
S. tarnii	570642	Mex/Hid	-/-	0.193(-)	-
Positive control				4.000	
Negative control				0.112	

*Mex, Mexico; Oax, Oaxaca; Milch, Milchoacá; Hid, Hidalgo; Ver, Veracruz
**Led, leaf deformation; Vn, vein necrosis; Mo, mosaic; Nl, necrotic lesions; -, symptomless

No hypersensitive reaction was found. Systemic latent infection has been occurred in accession number of 558477 of *S. stoloniferum* and 498046 accession number of *S. tarnii*. Symptoms could not be observed on systemic leaves but serology and biotest proved the presence of virus in the systemic leaves of these two accessions. Remaining accessions were susceptible to PVY^{NTN} (Table 2). On the basis of our previous study the 545808 and 570641 accessions of *Solanum tarnii* were resistant to C strain of PVY (PVYC), while showed susceptibility to NTN strain. This result indicates that suscep-

tibility of the accessions to the different strains of the same virus can be varied. Opposite effect can also been observed; e. g. one accession of *S. arnezii* (PI 545880) proved to be resistant to both the C and NTN strain of PVY (Takács *et al.*, 1999b).

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