

## **SOLANUM STOLONIFERUM AND SOLANUM DEMISSUM ACCESSIONS AS NEW HOSTS AND RESISTANCE SOURCES TO THE NTN STRAIN OF POTATO Y POTYVIRUS**

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### **ABSTRACT**

Reaction of 34 accessions of *Solanum stoloniferum* and 15 accessions of *Solanum demissum* to the NTN strain of potato Y Potyvirus (PVY<sup>NTN</sup>) were investigated. Out of the wild *Solanum stoloniferum* examined 15 accessions showed hypersensitive resistance and 11 accessions showed extreme resistance to PVY<sup>NTN</sup>. The PI. 275247 accession displayed complex, extreme resistance to PVY<sup>NTN</sup>, alfalfa mosaic *Alfavirus*, cucumber mosaic *Cucumovirus* and henbane mosaic *Potyvirus*, therefore this accession is very important in potato breeding for virus resistance. Eight accessions of *Solanum stoloniferum* were systemically susceptible to PVY<sup>NTN</sup>. The investigated *Solanum demissum* accessions were equally susceptible to PVY<sup>NTN</sup>. Six accessions showed local (chlorotic, necrotic lesions on the inoculated leaves) and systemic symptoms (necrotic spots, veinal necrosis and mosaic on the non-inoculated leaves), too. Nine accessions reacted with systemic symptoms (necrotic spots, veinal necrosis and mosaic) to PVY<sup>NTN</sup>. Among the investigated accessions of *Solanum demissum* we have not found resistant (hypersensitive or extreme resistant) plants.

### **IZVLEČEK**

#### **AKCESIJE SOLANUM STOLONIFERUM IN SOLANUM DEMISSUM KOT NOVI GOSTITELJI IN VIRI REZISTENCE SEVA NTN KROMPIRJEVEGA Y POTYVIRUSA**

Raziskane so bile reakcije 34 akcesij *Solanum stoloniferum* in 15 akcesij *Solanum demissum* za sev NTN krompirjevega Y potivirusa (PVY<sup>NTN</sup>). Poleg samonikle (divje) vrste *Solanum stoloniferum* je 15 njenih testiranih akcesij kazalo znamenja skrajne hipersenzitivne rezistence, 11 akcesij pa je bilo skrajno rezistentnih za PVY<sup>NTN</sup>. Akcesija PI275247 je odražala kompleksno, skrajno rezistenco za PVY<sup>NTN</sup> za lucernin mozaik *Alfavirus*, kumarni mozaik *Cucumovirus* in mozaik črnega zobnika *Potyvirus*, zato je ta akcesija zelo pomembna za žlahtnjenje krompirja za odpornost proti virusom. Osem akcesij *Solanum stoloniferum* je bilo sistemsko občutljivih za PVY<sup>NTN</sup>. Testirane akcesije *Solanum demissum* so bile prav tako občutljive za PVY<sup>NTN</sup>. Šest akcesij je imelo lokalne (klorotične in nekrotične pege na inokuliranih listih) in sistemne simptome (nekrotične pege, žilne nekroze in mozaik na neinokuliranih listih). Devet akcesij je reagiralo s sistemskimi simptomi (nekrotične pege, žilne nekroze in mozaik) na PVY<sup>NTN</sup>. Med testiranimi akcesijami *Solanum demissum* niso ugotovljene rezistentne (hipersenzitivne ali skrajno rezistentne) rastline.

### **1 INTRODUCTION**

Potato Y Potyvirus (PVY) is one of the most important pathogens of potato. The appearance of a new strain of PVY, which produces severe necrotic rings on the tubers and berries has become highly important in most European countries (Beczner *et al.*, 1984; Radtke, 1984; Weidemann, 1985, 1993; Novák *et al.*, 1986; Dedić *et al.*, 1988; Steinbach and Hamann, 1989; Butorović and Kus, 1989, 1990; Kus 1990, 1995a, b;

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Schiessendoppler, 1990; Le Romancer and Kerlan, 1990, 1991; Nielsen, 1992; Wright, 1992; Le Romancer *et al.*, 1994). This new virus strain belongs to the tobacco vein necrosis strain group, named PVY<sup>NTN</sup>. Currently, PVY<sup>NTN</sup> is a major virological problem to potato growers and breeders, because it affects cultivars that are either immune or possess high levels of field resistance to PVY (Buturović and Kus, 1989; Weidemann, 1990; Le Romancer and Kerlan, 1992; Van den Heuvel *et al.*, 1994; Pepelnjak, 1995).

As the disease has already reached an epidemic state in some countries (Hungary; Slovenia), identification of sources of resistance gene(s) are of extreme importance. As far as we know, genes are described from *Solanum stoloniferum* (Nysto) and *Solanum demissum* (Nydem) and found that they gave hypersensitivity to all tested strains of PVY (Cockerham, 1970; Solomon, 1978; Ross, 1986).

Considering that some accessions of the above mentioned wild *Solanum* species as sources of resistance play a highly important role in breeding for virus resistance, we have studied the host-virus relations of some unknown accessions of tuber-bearing *Solanum stoloniferum* and *Solanum demissum* species to PVY<sup>NTN</sup>.

## 2 MATERIALS AND METHODS

Tuber-bearing *Solanum stoloniferum* and *Solanum demissum* accessions free from potato spindle tuber viroid (PSTVd) were mechanically inoculated at a stage of 8-10 leaves with a Hungarian strain of PVY<sup>NTN</sup> (see Beczner *et al.*, 1984). The inoculated plants were symptomatologically checked for infection weekly, then at the end of the 3<sup>rd</sup> and the 6<sup>th</sup> week serological examinations were performed. To check the susceptibility to PVY<sup>NTN</sup> of the accessions of two *Solanum* species double-antibody sandwich ELISA method (DAS-ELISA) was applied using horse-radish peroxidase conjugate (see Clark and Adams, 1977). The color reaction was measured at 492 nm wavelength on Dynatech ELISA reader. Out of the seven inoculated plants of each accession the highest absorbance value was recorded. Test samples were considered positive if their absorbance values exceeded twice that of the healthy control samples. In symptomless host-virus relations back-inoculation was also carried out to *Chenopodium amaranticolor* and *Nicotiana tabacum* cv. Xanthi-nc indicator plants.

## 3 RESULTS AND CONCLUSIONS

Thirty four accessions of *Solanum stoloniferum* were studied for their reactions to PVY<sup>NTN</sup> (Table 1). According to the results of examinations 15 accessions were found to be hypersensitive resistant (local chlorotic and/or necrotic lesions with leaf drop) to PVY<sup>NTN</sup>. Eleven accessions showed extreme resistance or immunity. Neither the inoculated nor the non-inoculated leaves showed symptoms and the virus could not be detected by serological and biological tests. Eight susceptible accessions of *Solanum stoloniferum* reacted with systemic vein clearing, vein necrosis, mosaic and in some cases with total necrosis to PVY<sup>NTN</sup>. It is interesting to mention that three accessions of *Solanum stoloniferum* showed complex, extreme resistance to alfalfa mosaic *Alfavirus*, AMV (PI. 255525, 275245, 275247), cucumber mosaic *Cucumovirus*, CMV (PI. 255548, 275247, 498005) and henbane mosaic *Potyvirus*, HeMV (PI. 275247, 498005, 498007). The PI. 275247 accession displayed complex, extreme resistance to PVY<sup>NTN</sup>, AMV, CMV and HeMV, therefore this accession is very

important in potato breeding for virus resistance (see Horváth and Wolf, 1992, 1995; Bősze *et al.*, 1996).

Table 1: Reaction of *Solanum stoloniferum* to NTN strain of potato Y *Potyvirus* (PVY<sup>NTN</sup>)

Accession or P. I. number	Symptoms <sup>1</sup>		Absorbance
	IL	NIL	
160 224	NI, Ld	-	0,007
160 225	-	-	0,005
161 160	Chl, NI	-	0,007
161 178	NI, Ld	-	0,008
161 252	Chl, NI	-	0,009
161 282	NI, Ld	-	0,009
230 557	NI, Ld	-	0,007
239 410	-	-	0,005
243 458	Chl	-	0,007
255 525	-	-	0,005
255 534	Chl, NI	-	0,005
255 548	-	-	0,005
275 244	Chl, NI	Vn, Tn	0,061
275 245	-	-	0,005
275 247	-	-	0,005
275 248	NI, Ld	-	0,006
275 252	NI, Ld	Mo	0,077
283 109	NI, Ld	-	0,006
338 621	NI, Ld	-	0,007
347 771	NI, Ld	Mo, Ton	0,080
365 401	NI, Ld	-	0,007
498 005	-	-	0,005
498 007	-	-	0,005
498 287	-	-	0,005
498 288	NI, Ld	-	0,005
545 737	NI, Ld	Vn, Tn	0,051
545 792	Chl	Vn	0,080
545 800	-	-	0,005
545 805	Chl, NI	-	0,005
547 740	-	Vc, Vn	0,077
558 453	Chl	-	0,005
558 465	-	-	0,005
558 466	Chl, NI	Vn	0,065
558 471	-	Ton, D	0,090
Negative control	-	-	0,005

<sup>1</sup> IL, inoculated leaves; NIL, non inoculated leaves; Chl, chlorotic lesions; D, death of the plants; Ld, leaf drop; Mo, mosaic; NI, necrotic lesions; Tn, top necrosis; Ton, total necrosis; -, no symptoms

The reaction of *Solanum demissum* accessions to PVY<sup>NTN</sup> are summarized in Table 2. Six accessions showed local (chlorotic and/or necrotic lesions) and systemic symptoms (necrotic spots, veinal necrosis, mosaic) too. Another nine accessions reacted with systemic symptoms. The investigated 15 accessions of *Solanum demissum* were equally susceptible to PVY<sup>NTN</sup>. Among the investigated accessions of *Solanum demissum* no resistant were found to PVY<sup>NTN</sup>.

Table 2: Reaction of *Solanum demissum* to NTN strain of potato Y Potyvirus (PVY<sup>NTN</sup>)

Accession or P. I. number	Symptoms <sup>1</sup>		Absorbance
	IL	NIL	
160 208	Chl, NI	Nsp	0,063
161 149	-	Nsp	0,066
161 366	-	Nsp	0,077
161 715	-	Nsp, Vn, Mo	0,085
205 514	-	Nsp, Mo	0,044
205 516	-	Nsp	0,037
275 211	-	Nsp	0,054
498 012	-	Nsp	0,066
558 052	Chl	Nsp	0,066
558 386	NI, Ld	Nsp, Mo	0,084
558 387	Chl, NI	Mo	0,095
558 389	-	Nsp	0,075
558 390	-	Nsp, Mo	0,067
558 391	Chl, NI	Nsp, Vn, Mo	0,089
558 463	Chl	Nsp	0,067
negative control	-	-	0,005

<sup>1</sup> IL, inoculated leaves; NIL, non inoculated leaves; Chl, chlorotic lesions; Ld, leaf drop; NI, necrotic lesions; Nsp, necrotic spots; Vn, vein necrosis; Mo, mosaic; -, no reaction

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