RESURGENCE OF *TOMATO SPOTTED WILT VIRUS* ON PEPPER (*CAPSICUM ANNUUM* L.) PLANTS IN SZENTES REGION

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Abstract

In Hungary *Tomato spotted wilt virus* was considered as an important pathogen since the mid-nineties. The introduction and spread of western flower thrips (*Frankliniella occidentalis*), an efficient TSWV vector, in that time certainly played an important role in TSWV emergence. Management of TSWV control was first directed against the thrips and weeds. Later on *Tsw* resistant gene was introduced into different types of pepper. In 2012 heavy crop losses were observed on TSWV resistant pepper varieties in Szentes region. Systemic virus symptoms on leaves and fruits and decline were observed in TSWV resistant cultivars, caused by resistance breaking strain of *Tomato spotted wilt virus.*

Key-words: *Tomato spotted wilt virus*, pepper, resistance, resistance breaking strain

Összefoglalás

Hazánkban a paradicsom foltos hervadás vírus (*Tomato spotted wilt virus*, TSWV) az 1990-es évek közepén vált jelentős kórokozóvá. Ebben döntő szerepet játszott a vírus hatékony vektorának, a nyugati virág tripsznek (Frankliniella occidentalis) a Magyarországra történő behurcolása. A betegség elleni védekezés eleinte a vektor ellen irányult, majd később a nemesítő intézetek TSWV rezisztens fajtákat állítottak elő szinte minden fajtatípusból, a Tsw rezisztenciagén sikeres beépítésével. 2012-ben Szentes környékén nagymértékű fertőzést figyeltünk meg a TSWV rezisztens paprikafajtákon. A jellegzetes levél és bogyó tünetek mellett nagyarányú növénypusztulást is észleltünk. A fertőzést a paradicsom foltos hervadás vírus rezisztencia áttörő törzse okozta.

Kulcsszavak: paradicsom foltos hervadás vírus, paprika, rezisztencia, rezisztencia áttörő törzs

Introduction

Tomato spotted wilt virus (TSWV) is the type member of the genus *Tospovirus* (family *Bunyaviridae*), causes an important disease of horticultural and agronomic crops. The virus distributed worldwide is having extremly broad host range and is now considered as one of

the ten most economically destructive plant viruses (Adkins 2000, Moyer 1999, Tomlinson 1987). TSWV is transmitted by thrips in a persistant manner, only the larvae can acquire the virus, which multiplicates in the vector and the adults can trasmit (Ullmann et al 1992). The virion varies in size from 80 to 120 nm and has spherical enveloped character (Prins and Goldbach 1998). The genome of TSWV consists of three ssRNA segments:

small (S) and medium (M) RNAs have ambisense coding strategies, whereas the large (L) RNA is of negative polarity (Fig. 1.).

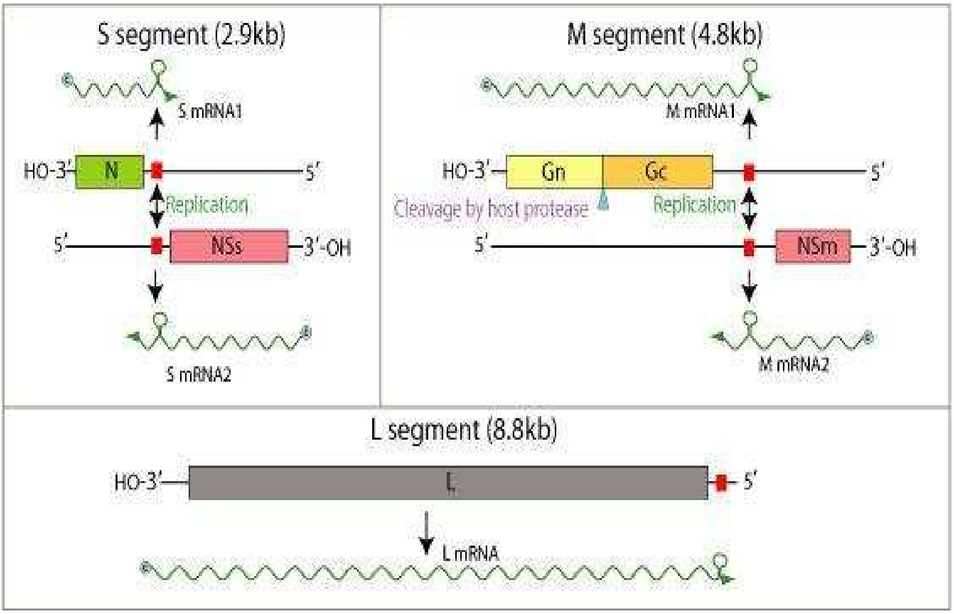

Figure 1. Tomato spotted wilt virus genome

In Hungary TSWV was described in 1972 (Ligeti and Nagy 1972), but the virus was not considered as an important pathogen. In 1995 very severe damage of TSWV infection was observed in tomato and pepper production in the Szentes vegetable growing region. The introduction and spread of western flower thrips (*Frankliniella occidentalis*), an efficient TSWV vector, in that time certainly played an important role in TSWV emergence (Csillléry et al 1995, Gáborjányi et al 1995, Jenser and Tusnádi 1989, Jenser 1995).

Management of TSWV control was first directed against the thrips using different insecticides or plastic traps, and against weeds as host plants of the virus and the thrips. Later on *Tsw* resistant gene from *Capsicum chinense* PI-

152225 és PI-159236 (Black et al 1996) was introduced into different types of pepper (conical white, long pale green hot and sweet, tomato shape, spice pepper and blocky types) (Csilléry unpublished). Pepper cultivars carrying *Tsw* resistance gene upon TSWV inoculation show necrotic local lesions on the leaves or other parts of the plant without systemic infection.

It was demonstated that TSWV can adapt very rapidly to plant resistance, and the *Tsw* resistance gene was broken down only a few years after its deployment in pepper crops (Roggero et al 2002, Thomas-Caroll and Jones 2003, Margaria et al 2004, Sharman and Persey 2006).

In 2010 and 2011 sporadically, but in 2012 and 2013 more frequently systemic virus symptoms were observed on resistant pepper cultivars in Szentes region (Bese et al. 2012, Csilléry et al 2012, Salamon et al 2010). The presence of new resistance breaking strain of TSWV was proved by virological (test-plant, serological and RT-PCR) methods.

Materials and Methods

Virus isolates. TSWV isolates originated from pepper cultivars susceptible and resistant

against TSWV from Szentes region. Fruit samples were collected from plants exhibiting typical symptoms of virus infection such as stunting, mosaic, chlorotic and/or necrotic spots, rings and distortion on the leaves and fruits (Fig. 2). The isolates were investigated on test plants, ELISA serological tests, RT-PCR and maintained by mechanical inoculation on *Nicotiana tabacum* cv. *Xanthi-nc* plants. The original samples were kept at – 70 C^{o}.

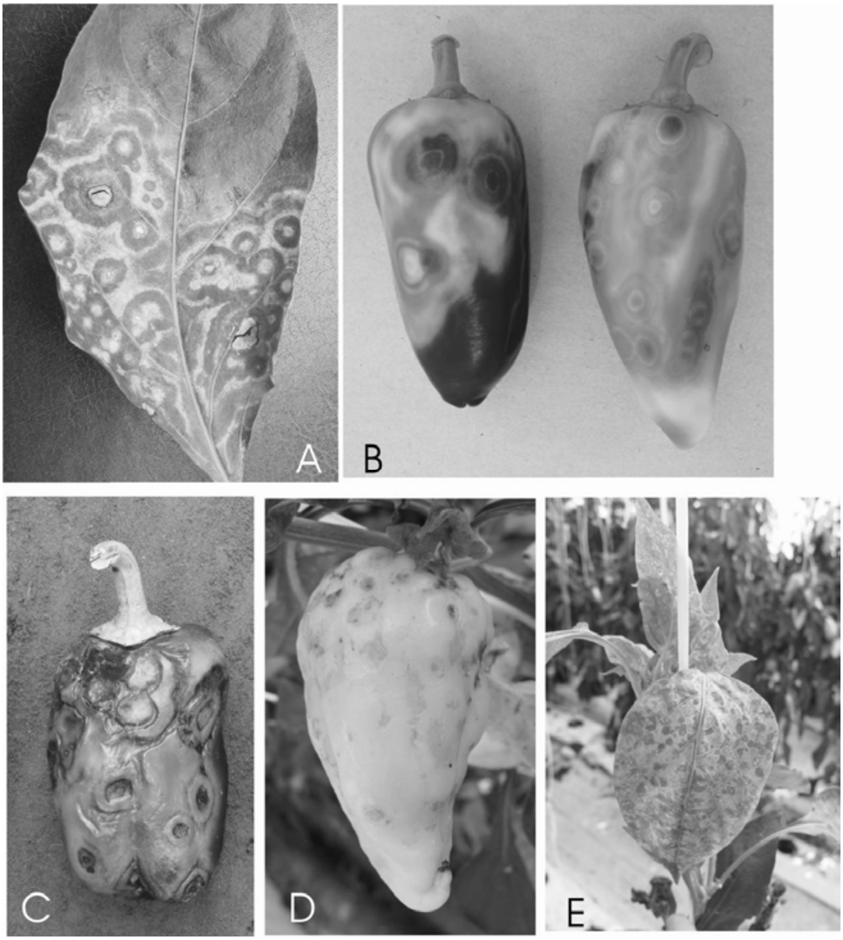

Figure 2. Symptoms of TSWV infection on leaves (A) and fruits (B) on susceptable cultivars, and on fruits of resistant cultivar (C). Systemic symptoms of resistance breaking TSWV isolate on resistant cultivars (D and E)

Results

The collected samples showed typical symptoms of *Tomato spotted wilt virus* infection. The virus was transmitted by mechanical inoculation onto test plants. On *Nicotiana tabacum* cv. *Xanthi*-nc plants chlorotic and necrotic spots and rings on inoculated leaves and systemic

mosaic or necrotic rings or necrosis were observed (Fig. 3). Slight differences on symptoms were observed among different isolates independently whether originated from TSWV susceptible or resistant pepper cultivars

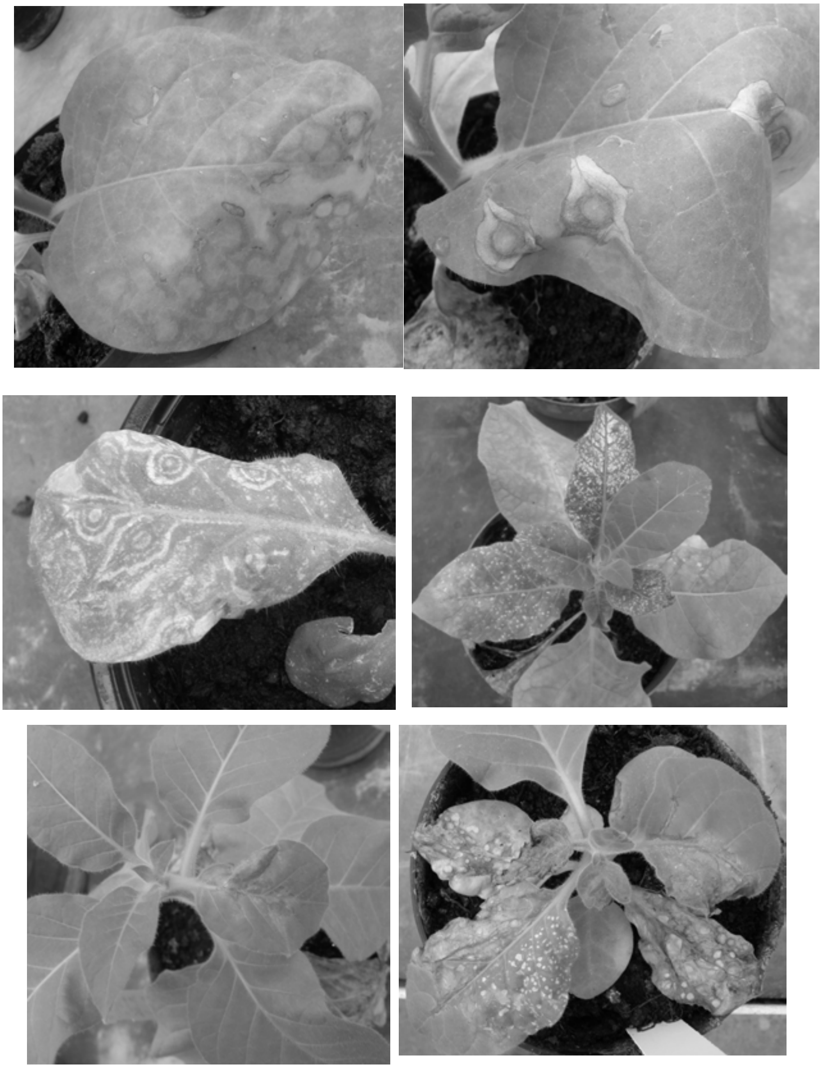

Figure 3. Different type of local and systemic symptoms on Nicotiana tabacum cv. Xanthi-nc plant caused by different TSWV isolates

Some TSWV isoltes were inoculated onto *Emilia sonchifolia* (this plants are systamically infected by TSWV and generally used to maintained the TSWV isolates) and only local necrotic symptoms were observed in contrast with other TSWV isolates (Fig. 4).

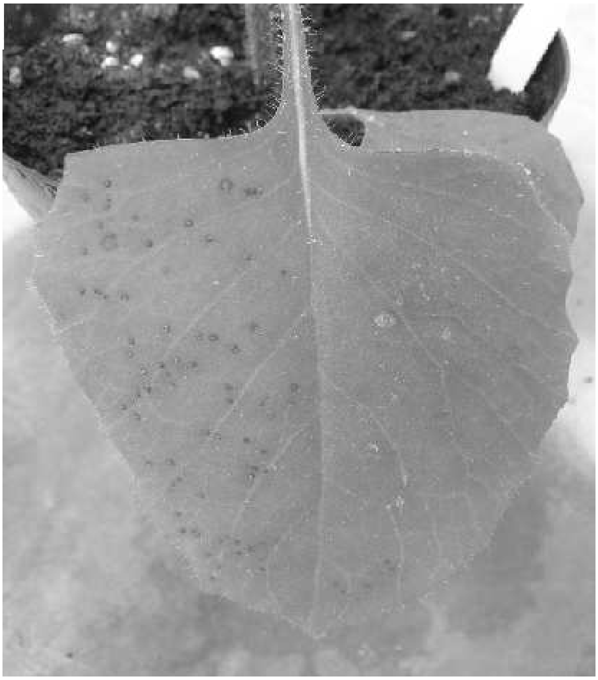

Figure 4. Local symptoms of Emilia sonchifolia after inoculation of Tomato spotted wilt virus isolated in Hungary.

TSWV specific PCR-product was amplifyed by RT-PCR method (Fig. 5). Our results confirmed the presence of *Tomato spotted wilt virus* both in TSWV susceptible and resistance cultivars in Hungary. Our results confirmed the presence of the resistance breaking isolate of *Tomato spotted wilt virus* in Hungary. Further investigations needed to characterize the resistance breaking TSWV isolates from Hungary.

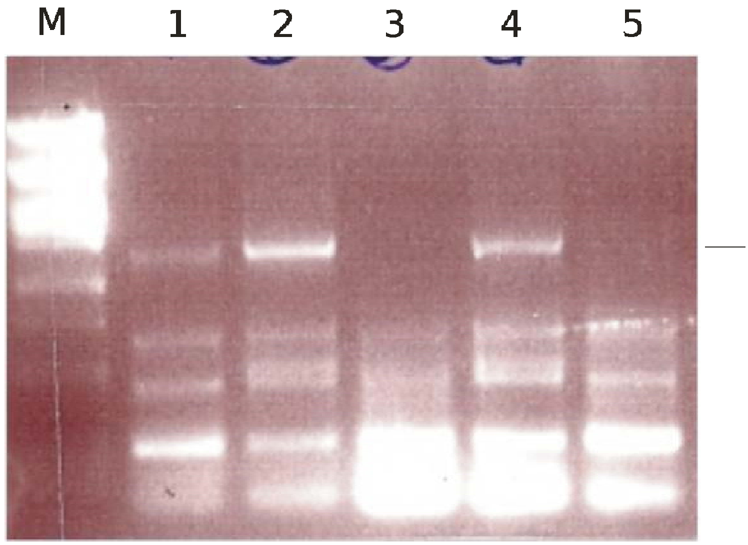

Figure 5. Separation of amplified RT-PCR products of TSWV infected pepper plants on 1 % agarose gel stained with ethidium bromide.
M– DNA lenght marker Pst I digested λDNA, Lane 1, 2 and 4 TSWV infected pepper, Lane 3 uninfected and Lane 5 healthy pepper plants.

Summarizing our investigations on TSWV resurgence in Hungary we can conclude that the first TSWV epidemic in mid 1990 years was connected with the introduction and spread of western flower thrips (*Frankliniella occidentalis*), an efficient TSWV vector, while the second emergence in 2010 and later was due to the appearence of resistance breaking isolates of TSWV.

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