PLANT INVADERS AS ARTIFICIAL AND NATURAL HOSTS OF ECONOMICALLY IMPORTANT VIRUSES

Gabriella KAZINCZI[1], József HORVÁTH[2], András TAKÁCS[3]

[1]Kaposvár University, Department of Botany and Plant Production, Kaposvar, Hungary
[2]University of Pannonia, Institute for Plant Protection, Keszthely, Hungary

ABSTRACT

We investigated the role of some invasive species (*Abutilon theophrasti, Ambrosia artemisiifolia, Asclepias syriaca, Cyperus esculentus, Phytolacca americana, Solidago gigantea*) in the epidemiology of plant viruses. Natural virus infestations have been monitored for more years. Mechanical inoculations and vector transmission studies were also carried out. Even in the last years, a lot of new weed-virus relations have been identified. At low percent (1-2 %) of the collected symptomless samples of *A. artemisiifolia, Cucumber mosaic virus* (CMV) and *Tomato spotted wilt virus* (TSWV) were detected. *A. syriaca* and *C. esculentus* as natural hosts of four viruses and *Brome streak mosaic virus* (BrSMV) became known, respectively. *Melandrium yellow fleck virus* (MYFV) and RS strain of CMV infested *P. americana* under glasshouse conditions during mechanical inoculations. Neither virological surveys under field conditions nor inoculations in the glasshouse showed *A. theophrasti* as host of plant viruses. Chlorotic ringspot symptoms on *S. gigantea* leaves suggested the presence of virus(es), which were not yet identified.

Key words: plant viruses, invasive weed species, host-virus relations

1 INTRODUCTION

Out of 2400 plant species of the Hungarian flora 71 ones are considered as invasive alien species (Mihály and Botta-Dukát, 2004). Most plant invaders are dangerous to ecological balance of biotic communities, nature conservation areas, to our rare and protected plant species and biological diversity. They can cause human health problems (e.g. pollen allergy of *Ambrosia artemisiifolia* and *Iva xanthiifolia*) and considerably reduce crop yields (Kazinczi *et al.*, 2008). Their indirect harmful effect as alternative hosts of plant pests and pathogens may also be also important Kazinczi, 2003). In this study we investigated the role of some invasive species (*Abutilon theophrasti, Ambrosia artemisiifolia, Asclepias syriaca, Cyperus esculentus, Phytolacca americana, Solidago gigantea*) in the epidemiology of plant viruses.

2 MATERIALS AND METODS

Under glasshouse conditions (free from virus vectors) *A. theophrasti, A. artemisiifolia, A. syriaca, P. americana* and *S. gigantea* plants at 4-6 leaf stages were mechanically inoculated with 11 viruses (C/U_1 strain of *Tobacco mosaic virus*, TMV-C/U_1; *Obuda pepper virus*, ObPV; NTN strain of *Potato virus Y*, PVY^{NTN}; RS-strain of *Cucumber mosaic virus*, CMV-RS; U/246 strain of CMV, CMV-U/246; *Melandrium yellow fleck virus*, MYFV; *Zucchini yellow mosaic virus*, ZYMV; *Sowbane mosaic virus*, SoMV; *Alfalfa mosaic virus*, AMV; *Tomato spotted wilt virus*, TSWV; *Pepino mosaic virus*, PepMV; *Turnip yellow mosaic virus*, TYMV). Previously viruses were maintained on their propagative hosts. The reaction of inoculated plants were checked symptomatologically, by DAS ELISA serological method and back inoculation.

[1] Ph.D., Kaposvár, Hungary; e-mail: kazinczi.gabriella@ke.hu
[2] Acad., Ph. D., Keszthely, Hungary
[3] Ph.D., ibid.

Between 2006 and 2008 symptomless plants and those ones sowing virus symptoms were collected from different parts of Hungary from waste lands and agro-ecosystems. Virus infection of the collected samples was checked by biotest (Horváth, 1983), DAS ELISA (Clark and Adams, 1977) and immunosorbent electronmicroscopical methods (Milne and Lesemann, 1984).
Thrips tabaci adults and larvae from TSWV infected *Nicotiana tabacum* were transferred to *A. artemisiifolia*. After two days feeding period *Ambrosia* plants were sprayed with deltametrin and kept in the vector free glasshouse until assessment. 30 days after spraying the plants were checked by DAS ELISA for TSWV infection.

3 RESULTS AND DISCUSSIONS

Mechanical inoculation of invasive plants was successful only in case of *P. americana*. CMV-RS gave only systemic symptoms on *P. americana* with strong leaf deformation and blistering on the young, upper leaves (Figure 1.). Both local and systemic symptoms were observed due to MYFV infection (Figure 2.). Other plant species studied showed no symptoms. Serological tests and back inoculations were also unsuccessful.

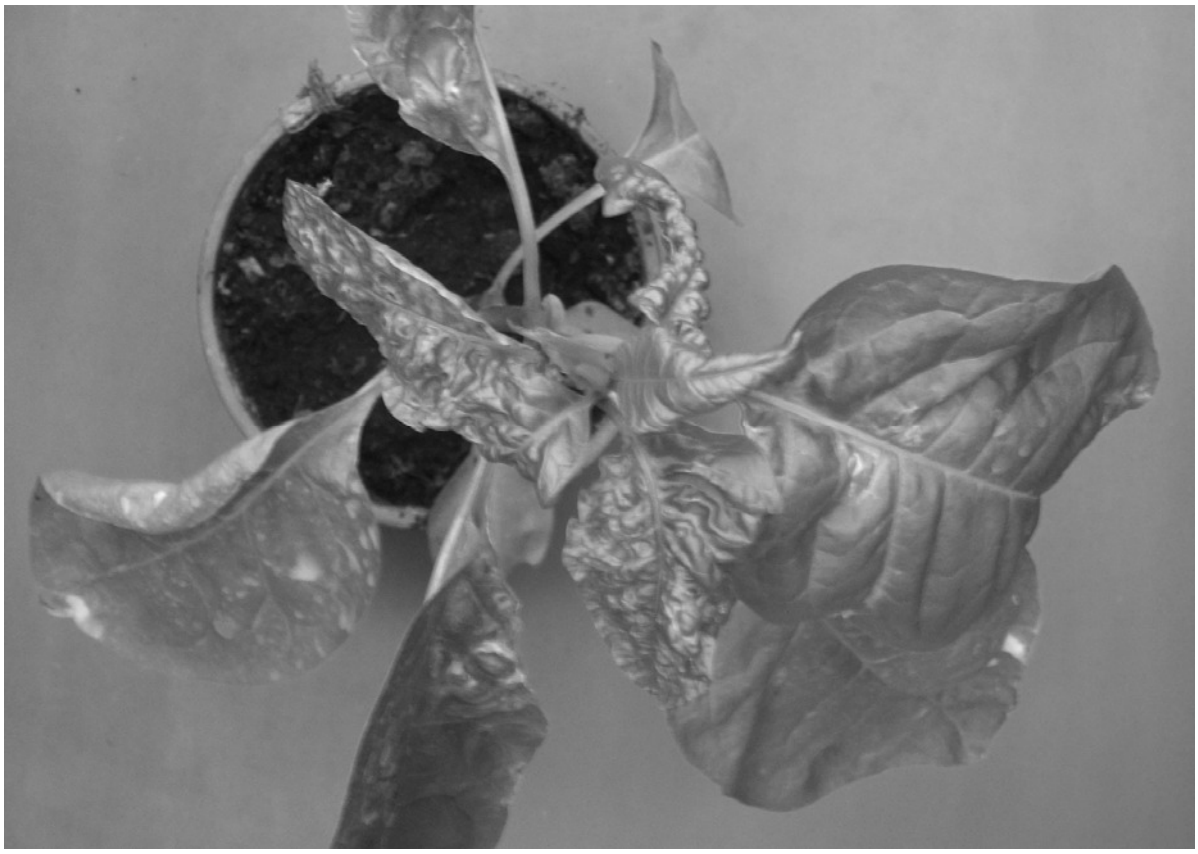

Figure 1: Systemic symptoms on *P. americana* due to CMV-RS infection

During field surveys, at low percent (1-2 %) of the collected symptomless samples of *A. artemisiifolia,* CMV and TSWV were detected. This was also confirmed by vector transmission studies. Our results confirmed that *A. syriaca* is natural host of TMV, TSWV, AMV and CMV (Kazinczi *et al*., 2002; 2004).
C. esculentus as natural hosts of BrSMV was detected at first time. Infested plants showed no virus symptoms but BrSMV was detected by DAS ELISA test. *C. esculentus* was detected for the first time in Hungary in maize fields in 1993 (Dancza, 1994). It causes damages mainly in

maize, beside this in vegetables and intensive apple orchards (Dancza, *et al.*, 2004). Formerly virus susceptibility of *C. esculentus* was not known in the literature, but other monocot weeds (e.g. *Elymus repens, Bromus* spp., *Sorghum* spp.) play important role in the epidemiology of cereal viruses.

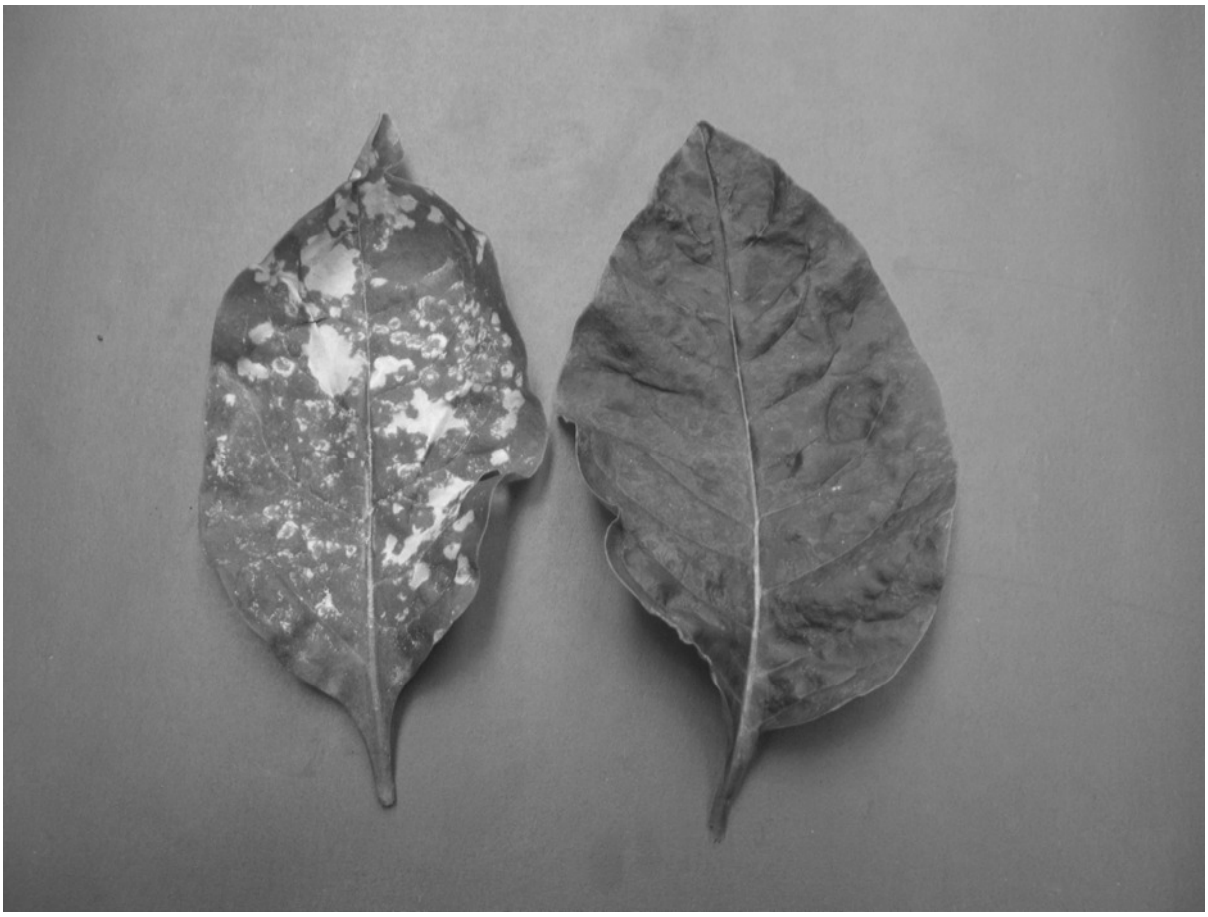

Figure 2. Local necrosis (left) and systemic mild systemic mosaic symptoms (right) on *P. americana* leaves due to MYFV infection

Neither virological surveys under field conditions nor inoculations in the glasshouse showed *A. theophrasti* as host of plant viruses. Chlorotic ringspot symptoms on *S. gigantea* leaves suggested the presence of virus(es), which were not yet identified.

4 CONCLUSIONS

More weed-host – virus relations were detected during field surveys as compared to those ones due to mechanical inoculations. It is possible that the high inhibitor content of the leaf tissues inhibits successful virus transmission, while it is not important during vector transmissions under field conditions. Subspecific taxa of both viruses and plants can also greatly modify the results of virus transmissions (Horváth, 1986).

In spite the fact that viruses did not cause considerable biological decline of invasive weeds, we can conclude that invasive plant species play important role as infection sources and reservoirs of economically important viruses. Nevertheless future examinations are necessary to study the role of invasive species in the epidemiology of plant viruses.

5 ACKNOWLEDGEMENTS

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