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New Data About the Virus Susceptibility of Some *Chenopodium* Species

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The aim of our study was to investigate the susceptibility of some *Chenopodium* species *(Chenopodium album, C. glaucum, C. berlandieri, C. ugandae)* to six viruses *(Alfalfa mosaic virus, Cucumber mosaic virus, Obuda pepper virus, Potato virus Y, Sowbane mosaic virus, Zucchini yellow mosaic virus).* Fourteen plants of each species were mechanically inoculated and virus susceptibility was evaluated on the basis of symptoms and back inoculation. A series of new host-virus relations were determined.

Keywords: Virus susceptibility, *Chenopodium* species.

The genus *Chenopodium* involves 200 species of great economical and virological importance. *Chenopodium quinoa* Willd. is an important food of certain ethnic groups, while *C. album* L. is one of the worst weeds of the world (Holm et al., 1977; Hegi, 1979). So far susceptibility of nearly 40 *Chenopodium* species is known to different viruses. The most known are in this respect *Chenopodium quinoa* Willd. and *C. amaranticolor* Coste et Reyn., which could be used in separation of viruses and for virus diagnosis as local assay and propagative hosts (Edwardson, 1974; Horváth, 1976, 1983; Schmelzer and Wolf, 1977). *Chenopodium album* is known as artificial and natural host of over 60 viruses (Schmelzer and Wolf, 1977; Horváth, 1986). *Chenopodium glaucum* L. has less virological importance with susceptibility to nine viruses [*Alfalfa mosaic virus* (AMV), *Bean yellow mosaic virus* (BYMV), *Beet yellows virus* (BYV), *Grapevine fanleaf virus* (GFLV), *Potato virus* M (PVM), *Robinia mosaic virus* (RMV), *Strawberry latent ringspot virus* (SLRSV), *Tobacco mosaic virus* (TMV), *Turnip mosaic virus* (TuMV)] (Schmelzer and Wolf, 1977; Horváth, 1983). So far the virological importance of *Chenopodium berlandieri* Moq. and *C. ugandae* Aellen was not known at all. Therefore the aim of our study was to investigate the reaction of *C. album, C. berlandieri, C. glaucum* and *C. ugandae* to different viruses.

Materials and Methods

Seeds of *Chenopodium album, C. berlandieri, C. glaucum* and *C. ugandae* were sown in sterile boxes in vector free glasshouse. The seedlings were planted in plastic pots (12 cm in diameter) containing a soil mixture of sand (pH: 6.96, humus %: 0.27): peat

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(pH: 6.78, humus %: 9.98) in a ratio of 1:3. Fourteen plants of each species were mechanically inoculated at 6–8 leaves stage with six viruses using Sörensen phosphate buffer (pH 7.2) in the ratio of 1:1 *(Table 1).*

Table 1

Viruses (strains and isolates) used for inoculation and their propagative hosts

Viruses	Strains or isolates	Acronyms	Propagative hosts
Cucumber mosaic virus	U/246	CMV-U/246	*Nicotiana tabacum* 'Xanthi-nc'
Alfalfa mosaic virus	*Asc*	AMV-*Asc*	*Chenopodium amaranticolor*
Sowbane mosaic virus	H	SoMV-H	*Chenopodium quinoa*
Zucchini yellow mosaic virus	10	ZYMV-10	*Cucumis sativus* 'Delicatesse'
Obuda pepper virus	pepper	ObPV-pepper	*Nicotiana tabacum* 'Samsun'
Potato virus Y	NTN	PVY^{NTN}	*Nicotiana tabacum* 'Xanthi-nc'

The inoculated plants were symptomatologically tested for infection. In order to confirm the results of symptomatology, back inoculations were also carried out to *N. tabacum* 'Xanthi-nc', *N. tabacum* 'Samsun', *C. amaranticolor, C. quinoa* and *C. sativus* 'Delicatesse' as indicator plants.

Results and Discussion

A lot of new host-virus relations were determined. *Chenepodium album,* as local and systemic experimentally host of SoMV-H and AMV-*Asc* was described *(Fig. 1).* Other viruses induced only local symptoms on *C. album (Table 2).*

In an earlier study Horváth (1983) experienced only local symptoms on *C. album* var. centrorubrum due to AMV infection. It shows that great differences may be in virus susceptibility of subspecific taxa. *Chenopodium album* belongs to the most serious and widespread weeds of the world (Holm et al., 1977). In Hungary, on the basis of the four

Table 2

Symptoms on *Chenopodium* species due to virus infections

	Chenopodium species			
	C. album	*C. berlandieri*	*C. glaucum*	*C. ugandae*
Viruses used for inoculation	Symptoms (local/systemic)*			
CMV-U/246	Chl/-	Chl, Nl/-	-/-	Ni
AMV-*Asc*	Chl/YeMo	Chl, Nl/YeMo, Led	-/-	-/-
SoMV-H	Chl/Led, Chl	Chl, Nl/Led, Mo	-/-, L	-/-, L
ZYMV-10	Chl/-	Chl/-	-/-	Ni
ObPV-pepper	Nl/-	Chl, Nl/Mo, Led	Chl, Nl/-	Chl/-
PVY^{NTN}	Chl, Nl/-	Chl, Nl/-	-/-	Ni

*- Symptomless; Chl: chlorotic lesions; Nl: necrotic lesions; YeMo: yellow mosaic; Led: leaf deformation; Mo: mosaic; L: latent infection; Ni: not investigated.

National Weed Surveys (1947–1997) it occupies the 3rd, 3rd, 2nd and 4th positions, respectively (Tóth and Spilák, 1998; Hunyadi et al., 2000). *Chenopodium album* is known as artificial and natural host of more than 60 viruses (Schmelzer and Wolf, 1977; Horváth, 1986). In Hungary, *C. album* samples collected from different agro- and water ecosystems were naturally infected only with three viruses [*Cucumber mosaic virus, Potato virus* S (PVS), *Potato leafroll virus* (PLRV)] (Kiss et al., 2002; Kazinczi, 2003). Its virological importance was satisfied on the evidence that it serves as food plant of *Frankliniella occidentalis,* which is the vector of *Tomato spotted wilt virus* (TSWV) (Cho et al., 1989).

As far as we know, so far no data was available about virological role of *C. berlandieri* and *C. ugandae.* In our experiments in case of *C. berlandieri* three local and three local and systemic host-virus relations were determined. Systematization of ObPV-pepper is very interesting, because earlier *Chenopodium* species as local hosts of the most *tobamoviruses* were described (Brunt et al., 1996) *(Table 2, Fig. 2). Chenopodium ugandae* and *C. glaucum* as local hosts of ObPV-pepper and systemic latent host of SoMV-H became known *(Table 2).* Neither local nor systemic symptoms could be seen due to SoMV-H infection, but back inoculation of systemic leaves to test plants (*C. amaranticolor* and *C. quinoa*) proved systemic latent host-virus relation. In spite the fact that AMV has been described from *C. glaucum* earlier (Schmelzer and Wolf, 1977; Horváth, 1983) our inoculation was unsuccessful. *Chenopodium glaucum* as local host of ObPV-pepper, non-host of CMV-U/246, PVY^{NTN} and ZYMV-10, and latent host of SoMV-H are decribed here for the first time.

All the studied four *Chenopodium* species have proved as hosts (local and systemic or systemic latent ones) of SoMV-H. Most *Chenopodium* species as artificial hosts of SoMV-H are known (Bennett and Costa, 1961; Kado, 1971). Natural occurrence of SoMV on *Chenopodium hybridum* L. and *Chenopodium murale* L. was described in Hungary (Horváth et al., 1993) and in the former Yugoslavia (Juretic, 1976). Our investigation confirmed the fact that *Chenopodium* species could be potential infection sources in potato agro-ecosystems, regarding the fact that SoMV is easily transmitted by seeds, pollen and mechanical way (Bos and Huijberts, 1996; Kazinczi and Horváth, 1998; Kazinczi et al., 2000), and it is also well known that 'Puebla' potato variety as natural host of SoMV is already known in Mexico (Salazar, 1996).

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