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WEEDS AS NATURAL HOSTS OF BEET POLEROVIRUSES

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Key words: beet poleroviruses, BMYV, BChV, TuYV, DAS-ELISA, RT-PCR

Three aphid-transmitted beet poleroviruses (family *Luteoviridae*) have been described as the agents of mild yellowing, causing serious economic damage through the world: *Beet chlorosis virus* (BChV), *Beet mild yellowing virus* (BMYV) and *Beet western yellows virus* (BWYV) (D'Arcy and Domier 2005, Stevens et al. 2005, Kozlowska-Makulska et al. 2007). Recently, the International Committee on the Taxonomy of Viruses (ICTV) has approved the reclassification of the non-beet-infecting strains of BWYV as a separate species in the genus *Polerovirus* with the name *Turnip yellows virus* (TuYV) (Mayo 2002). Both beet-infecting poleroviruses (BChV and BMYV) and one related non-beet-infecting polerovirus (TuYV) can not be distinguished using polyclonal antiserum (Smith et al. 1996). A number of weed species have the potential to play an important role in the epidemiology of mild yellowing diseases as reservoirs of inoculum for virus acquisition and spread by aphid vectors (Stevens et al. 1994). In the studies on the role of common weeds in spreading virus yellowing disease in Poland, carried out between 1968 and 1977 (Książek 1980), among 1574 weed plants tested belonging to 46 species, no single plant infected with poleroviruses has been found. On the contrary, analysis carried out by Paczuski and Blachowska (1992) using DAS-ELISA assay demonstrated 93 plants (out of 232) infected by BMYV. The percentage of infected weeds was more significant in the case of weeds collected from highly affected beet fields.

The aim of this study was to determine the significance of weeds in the epidemiology of mild yellowing disease of sugar beet. Moreover, we aimed to identify the polerovirus species harboring by these weed plants. Leaf samples were collected from weed and volunteer (self-sown) crop plants occurring among cultivated sugar beet plants or growing in the area adjacent to its fields. Weeds were collected irrespectively of the presence of symptoms, with most of them being symptomless (Table 1), and the sampling unit consisted mainly the youngest fully expanded leaves. The samples were collected between May and September in 2005–2007 at 13 localities, mainly from central Poland.

Beet and related poleroviruses (*Beet chlorosis virus*, *Beet mild yellowing virus* and *Turnip yellows virus*) were detected in 22 out of 119 samples by DAS-ELISA assay using polyclonal antiserum (Loewe Biochemica). To have confidence that there

Phytopathol. Pol. 46: 53–56
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ISSN 1230-0462

were no false positive reactions healthy plants of some weeds species like *Capsella bursa-pastoris*, *Chenopodium capitatum* or *Taraxacum officinale* were sown in greenhouse and then used as negative controls. Infected plants came from eight localities (Biała Góra, Dobrzelin, Kopytów, Michałów, Młochów, Radzików, Stare Kosiny, Warszawa-Ursynów) and they belonged to 12 species: *Anchusa arvensis*,

Table 1

List of weed species tested for the presence of beet and related poleroviruses

Weed species	Symptoms (reddening or yellowing	No. of tested plants	No. of infected plants
Agropyron repens	–	3	0
Amaranthus retroflexus	+	6	0
Anchusa arvensis	–	1	1
Artemisia vulgaris	–	5	0
Brassica napus	+	3	1
Chenopodium sp.	+	20	3
Centaurea cyanus	+	1	0
Chamomilla recutita	–	3	0
Cirsium arvense	+	5	1
Conyza canadensis	–	7	0
Erodium cicutarium	–	3	1
Eupatorium cannabium	+	1	1
Euphorbia helioscopia	+	1	1
Galinsoga sp.	+	9	4
Geranium pusillum	–	1	0
Malva neglecta	+	3	0
Matricaria perforata	–	1	0
Mentha arvensis	–	3	0
Papaver rhoeas	+	5	1
Polygonum sp.	+	2	0
Rumex obtusifolius	–	3	0
Senecio vulgaris	–	6	2
Silene latifolia	–	4	0
Sinapis arvensis	+	4	0
Solanum nigrum	–	2	0
Solidago canadensis	–	3	0
Taraxacum officinale	+	10	5
Sonchus sp.	+	2	1
Viola arvensis	–	2	0
Total		119	22

Presence (+) or lack (–) of symptoms.

Chenopodium spp., *Cirsium arvense*, *Erodium cicutarium*, *Eupatorium cannabinum*, *Euphorbia helioscopia*, *Galinsoga parviflora*, *G. ciliata*, *Papaver rhoeas*, *Senecio vulgaris*, *Sonchus* spp., *Taraxacum officinale* and one species of volunteer crop plant (*Brassica napus*). The weed species tested for the presence of beet and related poleroviruses are listed in Table 1. The most frequently infected species was *T. officinalis*. Moreover, four weed species: *Galinsoga* spp. (*G. parviflora, G. canadensis*), *Eupatorium cannabinum* and *Euphorbia helioscopia* were shown for the first time to be reservoirs of these viruses.

Only in the case of *Brassica napus,* after successful virus RNA extraction using single-tube RT-PCR multiplex protocol (Ready-To-Go RT-PCR Beads®, Amersham-GE Healthcare) and primers described by Hauser et al. (2000), we obtained a 350 pb product corresponding to TuYV. Unfortunately, our attempts to identify virus species in all weed plants for which we obtained positive results with DAS-ELISA test, using two different kits (Qiagen or Purescript) failed, probably due to low virus concentration or physiological age of these plants.

To summarize, our findings indicated that both weed hosts (12 species) and volunteer plants (one species) have the potential to play a considerable role in the epidemiology of mild yellowing disease as reservoirs of inoculum for virus acquisition and spread by aphid vectors. Over 18% of the tested weed plants contained at least one of the beet or related poleroviruses. Four new weed species were identified as hosts of these viruses but further studies have to be done to identify polerovirus species involved in weeds infection.

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Accepted for publication: 19.10.2007