Warsaw University of Life Sciences, Warsaw, Poland

DETECTION AND IDENTIFICATION OF *BEET MILD YELLOWING VIRUS* AMONG BEET POLEROVIRUSES INFECTING RED BEET PLANTS

K. Mroczkowska, A. Kozłowska-Makulska and M.S. Szyndel

Key words: red beet, beet poleroviruses, BMYV, DAS-ELISA, bioassay, RT-PCR

Beet poleroviruses (family *Luteoviridae*) that cause mild yellowing diseases of sugar beet, are an important factor contributing to sugar beet yield losses up to 30% (Stevens et al. 2005 a, b, Golnik and Kozłowska-Makulska 2007). These so-called beet poleroviruses are the following: *Beet mild yellowing virus* (BMYV), *Beet western yellows virus* (BWYV) and *Beet chlorosis virus* (BChV; D'Arcy and Domier 2005, Stevens et al. 2005 b). Poleroviruses are transmitted from plant to plant only by their natural aphid vectors (Hoffmann et al. 2001). Although beet poleroviruses have different host range (Stevens et al. 2005 a), each of them can infect species of the family *Chenopodiaceae*, which include *inter alia* sugar beet and red beet, both from the species *Beta vulgaris*. So far in Poland, there have been no reports about the occurrence of mild yellowing diseases in red beet crops though red beet area (20–23 thous. ha) constitutes 10% of the one under vegetable production (Polowa... 2000).

The goal of this study was to verify the sugar beet poleroviruses occurrence in fields of red beet in Poland as well as identify these viruses and to determine the biological properties of some polerovirus isolates obtained from red beet plants.

Leaf samples were collected from red beets growing at 15 fields placed at 11 localities mainly in central Poland (Table 1). Beet plants were cultivated in big commercial plantations as well as in small fields, home and allotment gardens. Only some of these fields were situated close to sugar beet plantations. Samples were collected from August to October 2005 and 2006.

Beet poleroviruses were detected in 14 out of 158 samples by DAS-ELISA using polyclonal antiserum from Loewe Biochemica. Infected plants were found in eight fields in seven localities (Kopytów, Biała Góra, Młochów, Siekierki, Sokół, Dawidy, Jeziorki). These were three big plantations, three small fields, one home garden and one allotment garden. Three of these red beet fields were situated close to sugar beet plantations.

Furthermore, the sample originating from Kopytów was used in RT-PCR to identify the virus species and then in the bioassay as a source of virus.

The product of 450 pb corresponding to *Beet mild yellowing virus* – BMYV was obtained after the RNA extraction using single-tube RT-PCR multiplex protocol

Phytopathol. Pol. 46: 63–65
© The Polish Phytopathological Society, Poznań 2007
ISSN 1230-0462

Table 1

Origin of beet poleroviruses

Year	Locality	Type of red beet fields	Vicinity of sugar beets	Number of samples	
				collected	infected
2005	Kopytów	Small field	+	14	1
	Biała Góra	Home garden	–	30	4
	Total			44	5
2006	Młochów 1st field	Small field	+	1	1
	Młochów 2nd field	Small field	+	1	1
	Radzików 1st field	Allotment garden	–	1	0
	Radzików 2nd field	Allotment garden	+	1	0
	Słupia Wielka	Big plantation	–	2	0
	Siekierki	Allotment garden	–	16	1
	Sokół	Small field	–	15	4
	Sułkowice	Home garden	–	14	0
	Dawidy	Big plantation	–	17	1
	Jeziorki 1st field	Big plantation	–	6	0
	Jeziorki 2nd field	Big plantation	–	11	1
	Nowa Iwiczna 1st field	Big plantation	–	12	0
	Nowa Iwiczna 2nd field	Big plantation	–	14	0
	Total			114	9
Total				158	14

(Ready-To-Go RT-PCR Beads®, Amersham-GE Healthcare) and primers described by Hauser et al. (2000). This is the first report on the occurrence of this virus on red beet crops.

Bioassay tests were carried out in 2005 and 2006. In the bioassay 10 test plants of each species: *Beta vulgaris* var. *conditiva, Sinapis alba, Tetragonia tetragonioides, B. vulgaris* subsp. *vulgaris* convar. *crassa* var. *altissima, Capsella bursa-pastoris, Claytonia perfoliata, Chenopodium capitatum* were inoculated with BMYV isolate from Kopytów. Inoculation (transmission) was done by *Myzus persicae* aphids. Acquisition feeding on red beet plant lasted 96 h and inoculation feeding on the test plants three or four days. In every case 10 apterous adult aphids were placed on individual plant. Plants exposed to non-viruliferous aphids were used as a control. *Beet mild yellowing virus* was detected by DAS-ELISA in *B. vulgaris* var. *conditiva, S. alba, B. vulgaris* subsp. *vulgaris* convar. *crassa* var. *altissima, C. bursa-pastoris* and *C. perfoliata*. Some leaf redding occurred on inoculated plants of *S. alba* and *C. perfoliata*, whereas on *B. vulgaris* subsp. *vulgaris* convar. *crassa* var. *altissima* yellowing leaves with necrosis were observed. On *C. bursa-pastoris* plants stunting and leaf rolling was observed.

To summarize, it was demonstrated, that poleroviruses occurred on red beets in Poland. Moreover, their occurrence was independent of a type of crop (big com-

mercial production, small field, home garden, allotment garden) as well as of vicinity of sugar beet plantation. However, the poleroviruses were also detected in some samples collected from the crops which were situated rather far away from sugar beet plantations. BMYV isolate identified on red beet plants infected *B. vulgaris* var. *conditiva*, *B. vulgaris* subsp. *vulgaris* convar. *crassa* var. *altissima*, *S. alba, C. bursa-pastoris* and *C. perfoliata*.

Literature

D'Arcy C.J., Domier L.L., 2005: Family *Luteoviridae*. In: Virus taxonomy. Eighth report of the International Committee on the Taxonomy of Viruses. Eds. C.M. Fauquet, M.A.Mayo, J. Maniloff, U. Desselberger, L.A. Ball. Elsevier, San Diego: 891–900.

Golnik K., Kozłowska-Makulska A., 2007: Polerowirusy i ich szkodliwość. Post. Nauk Roln. 2: 3–18.

Hauser S., Weber C., Vetter G., Stevens M., Beuve M., Lemaire O., 2000: Improved detection and differentiation of beet polerovirus species by restriction fragment length polymorphism (RFLP), single strand conformation polymorphism (SSCP) and multiplex RT-PCR. J. Virol. Methods 89: 11–21.

Hoffmann K., Verbeek M., Romano A., Dullemans A.M., van den Heuvel J.F.J.M., van den Wilk F., 2001: Mechanical transmission of poleroviruses. J. Virol. Methods 91: 197–201.

Kozlowska-Makulska A., Szyndel M.S., Syller J., Bouzoubaa S., Beuve M., Lemaire O., Herrbach E., 2007: First report on the natural occurrence of *Beet chlorosis virus* in Poland. Plant Dis. 91: 326.

Polowa uprawa warzyw. 2000. Ed. M. Orłowski. Brasika, Szczecin.

Stevens M., Freeman B., Liu H.-Y., Herrbach E., Lemaire O., 2005 a: Beet poleroviruses: close friend or distant relatives? Mol. Plant Pathol. 6, 1: 1–9.

Stevens M., Patron N.J., Dolby C.A., Weekes R., Hallsworth P.B., Lemaire O., Smith H.G., 2005 b: Distribution and properties of geographically distinct isolates of sugar beet yellowing viruses. Plant Pathol. 54: 100–107.

Authors' address:
Karolina Mroczkowska M.Sc., Anna Kozłowska-Makulska M.Sc., Dr. hab. Marek S. Szyndel, Warsaw University of Life Sciences, Department of Plant Pathology, ul. Nowoursynowska 159, 02-776 Warsaw, Poland,
e-mail: marek_szyndel@sggw.pl

Accepted for publication: 20.12.2007