

PRESENCE OF WHEAT DWARF VIRUS, CEREAL YELLOW DWARF VIRUS-RPV AND BARLEY YELLOW DWARF VIRUSES IN CEREAL SPECIES IN MARTONVÁSÁR

Dalma PRIBÉK¹ - Emil POCSAI² - Gyula VIDA¹ - Otto VEISZ¹

¹Agricultural Research Institute of the Hungarian Academy of Sciences, Martonvásár, Hungary

²Fejér County Plant Protection and Soil Conservation Service, Velence, Hungary

Introduction

Cereals are a major source of food and animal feed. One precondition for the production of a reliable quantity of high quality cereals is resistance to diseases, including those caused by viruses. One way of reducing viral damage is the use of satisfactory agronomical measures, but the most economical and most effective solution would be the cultivation of resistant or tolerant varieties. Among the viruses capable of infecting cereals, wheat dwarf virus (WDV), cereal yellow dwarf virus-RPV (CYDV-RPV) and the barley yellow dwarf virus group (BYDV) are currently the most widespread in the central part of Hungary (Szunics *et al.* 2003).

Szirmai (1967) was the first to identify a virus pathogenic to cereals (BYDV) in Hungary. The identification of different strains of this virus was not begun until later (Pocsai *et al.* 1995). The first incidence of WDV in Hungary was reported by Gáborjányi *et al.* (1988). Vectors (aphids, leafhoppers) are required for the transmission of both pathogens. Transmission takes place in a persistent manner.

The damage caused by cereal viruses, including WDV, CYDV-RPV and BYDVs, and the incidence rate of the viruses varies with the year, the location and the crop. At national level considerable fluctuations in virus incidence are observed each year, so a clear picture of the spread of the pathogens can only be obtained by surveys carried out over several years. The present paper compares the results of the 2005 virological survey on cereals grown in Martonvásár with data for the past four years.

Materials and Methods

Observations were carried out in Martonvásár between 2001 and 2005 to test the infection of various cereals with the WDV, CYDV-RPV and BYDV viruses. Leaves of winter wheat (*Triticum aestivum*), winter barley (*Hordeum vulgare*), durum wheat (*Triticum durum*), oats (*Avena sativa*) and triticale (*Triticosecale X*), sown at normal plant density at the optimum date and exhibiting yellowing and/or dwarfing symptoms, were collected in spring, when the symptoms were clearly visible, in the institute nursery. Each year 50 samples were taken from each species, with the exception of 2003, when no oat samples were available. The viruses present on the leaves were detected in the institute laboratory using Agdia sera and the ELISA (enzyme-linked immunosorbent assay) serological test (Clark and Adams 1977). The data were evaluated using two-factor analysis of variance.

Results and Discussion

During the period of the survey (2001–2005) leaves were collected in Martonvásár from diseased plants exhibiting symptoms in order to determine pathogen distribution. In 2004 the number of virus-infected plants was extremely low, so these data were omitted from the evaluation. The relative dominance of the viruses identified from the diseased plants can be seen in Table 1. In the majority of cases mixed infection was observed.

Table 1. Incidence of cereal viruses as a percentage of virus-infected plants

	Winter wheat				Winter barley			
Viruses	2001 (%)	2002 (%)	2003 (%)	2005 (%)	2001 (%)	2002 (%)	2003 (%)	2005 (%)
WDV	100	95.5	98	100	100	100	88	100
CYDV-RPV	6	8.8	0	0	4	0	4.7	0
BYDV-MAV	20	15.5	0	2	34	22	0	0
BYDV-PAV	2	0	62	2	4	8	11.9	2
BYDV-SGV	6	2.2	0	0	34	0	7	0
BYDV-RMV	8	0	38	2	46	0	28.5	10.6

	Durum wheat				Oats			Triticale			
Viruses	2001 (%)	2002 (%)	2003 (%)	2005 (%)	2001 (%)	2002 (%)	2005 (%)	2001 (%)	2002 (%)	2003 (%)	2005 (%)
WDV	100	100	71.7	100	80	100	12.2	100	100	100	100
CYDV-RPV	2	4.2	0	0	0	0	2	0	2	0	0
BYDV-MAV	34.6	0	0	0	63	0	4	4	0	0	0
BYDV-PAV	0	0	45.6	0	0	0	22.4	0	8	0	2
BYDV-SGV	2	0	6.5	0	5	0	0	2	0	0	0
BYDV-RMV	4	8.5	15.2	2	7.5	0	100	0	0	0	0

The only significant difference revealed by two-factor analysis of variance was between the incidence ratios of the viruses. This could be attributed to the extremely high rates for WDV. These data confirm the results of earlier surveys suggesting that WDV infection was far more serious than BYDV infection in the central part of Hungary (Szűcs *et al.* 2000). No year effects were detected between 2001 and 2005 (Table 2.), which was not surprising as samples were only taken from plants exhibiting disease symptoms. The effect of the viruses was also independent of the plant species (Table 3.).

Table 2. Effect of viruses and years, as revealed by analysis of variance (2001–2005)

<i>Host plant</i>	<i>Virus</i>	<i>Year</i>
Winter wheat	***	n.s.
Winter barley	***	n.s.
Durum wheat	***	n.s.
Oats	***	n.s.
Triticale	***	n.s.

***= Significant at the P=0.1% level

n.s.= Non-significant

Table 3. Effect of viruses and host plants, as revealed by analysis of variance (2001-2005)

<i>Factors</i>	<i>df</i>	<i>MSQ</i>	<i>F</i>	
Total	95			
Replications	3			
Treatments	23	1125.5	31.8	***
Virus	5	5076.1	143.6	***
Host plant	3	65.2	1.8	
Virus×Host plant	15	20.7	0.6	
Error	69	35.3		

***= Significant at the P=0.1% level

In the following analysis the results for plant species with confirmed infection (ELISA positive) were combined and the years were taken as replications (Sváb 1981). The data gave a good reflection of the dominant position of the WDV virus between 2001 and 2005. No significant differences were found within the CYDV-RPV and BYDV virus groups (Fig. 1).

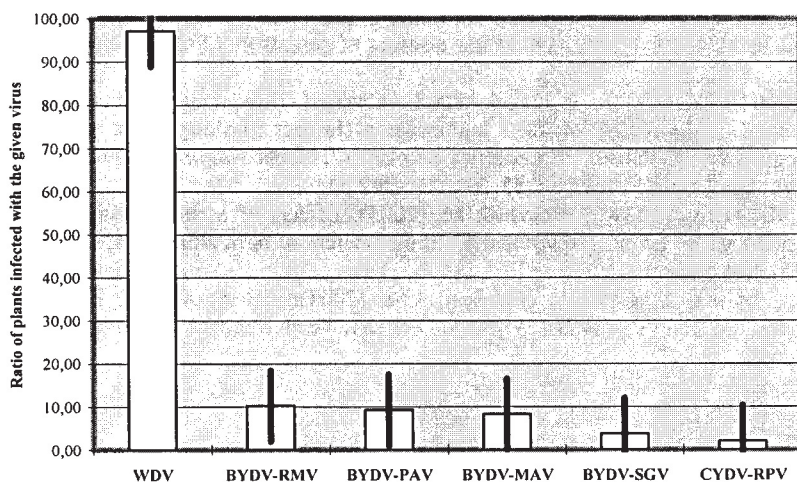


Fig. 1. Percentage distribution of the varieties between 2001 and 2005, averaged over all the plants

Conclusions

Climatic conditions affect both plants and vectors, thus influencing the spread of viruses. Winter came late in 2003, so the vectors were still active in early December. The spring was very wet and cold, so the vectors emerged late, but the cereals exhibited intensive growth. This probably explains the extremely low level of virus infection in 2004.

The data for 2001, 2002, 2003 and 2005 exhibited a clear pattern. In all four years WDV, which is transmitted by leafhoppers (*Psammotettix alienus*), was present in the highest ratio on all the plant species. In many cases several viruses infected the same host plant simultaneously. The aphids that transmit the CYDV-RPV and BYDV viruses were far less active.

References

- Clark, M.F. and Adams, A.N. (1977): Characteristics of microplate method of enzymelinked immunosorbent assay for detection of plant viruses. *J. Gen. Virol.* 34: 475-483.
- Gáborjányi, R., Bisztrai, G. and Vacke, J. (1988): Búza törpülés vírus: új gabonapatogén Magyarországon. (Wheat dwarf virus: new cereal pathogene in Hungary.) *Növénytermelés* 37: 495-500.
- Pocsai, E., Kovács, G., Murányi I., Orosz Á., Papp M. and Szunics L. (1995): Az árpa sárga törpesség vírus hazánkban előforduló törzseinek megállapítása árpa-, búza-, triticale- és kukoricakultúrákban. (Results of study on barley yellow dwarf virus in Hungary.) *Növényvédelem* 31: 547-554.
- Sváb, J. (1981): *Biometriai módszerek a kutatásban.* (Biometrical Methods in Research.) Mezőgazdasági Kiadó, Budapest. 557 pp.
- Szirmai, J. (1967): Új vírusbetegség gabonaföldjeinken. (New virus disease in Hungarian cereals.) *Magyar Mezőgazdaság* 22: 19.
- Szunics, L., Pocsai, E., Szunics, Lu. and Vida, G. (2000): Viral diseases on cereals in central Hungary. *Acta Agr. Hung.* 48: 237-250.
- Szunics, L., Pocsai, E., Vida, G., Veisz, O., Láng, L. and Bedő, Z. (2003): Kalászos gabonák vírusok okozta betegségei 2002-ben. (Viral diseases of cereals in 2002.) *Növénytermelés* 52: 33-39.
- Kádár, I. (2004): Szennyvíziszap-adagok hatása a növény (*Triticum vulgare* L.)-talaj rendszer néhány mikrobiológiai és biokémiai tulajdonságára (Impact of sludge treatments on some microbiological and biochemical properties of plant (*Triticum vulgare* L.)-soil system. – in *Hungarian*). *Agrokémia és Talajtan.* 53. 3-4. 331-342 pp
- Svetková, K.; Henselová, M.; Morvová, M. (2005): Effects of a carbonization product as additive on the germination, growth and yield parameters of agricultural crops. *Acta Agron. Hun.* 53. (3). 241-250 pp
- Tanács, L., Matuz, J., Gerő, L., Petróczi, I.M. (2005): Effect of NPK Fertilizers and Fungicides on the Quality of Bread Wheat in Different Years. *Cereal Res. Commun.* 33 (2-3): 627-634 pp