

THE OCCURRENCE OF BARLEY YELLOW DWARF VIRUS IN 2002 IN CROATIA

¹Bogdan CVJETKOVIĆ¹, Edyta HALUPECKI²

^{1,2}Department of Plant Pathology, Faculty of Agriculture, University of Zagreb, Croatia

ABSTRACT

In the spring of 2002 increased reduced growth of barley was observed at many locations in Croatia (Belje, Daruvar, Đakovo, Kutjevo, Nova Gradiška, Tovarnik, Valpovo and Zagreb). Based on the symptoms we concluded this was due to a virus infection. The barley leaves were golden yellow and lagged in growth. The change in leaf color began from the tip and edges of the leaf and spread to the lower parts. Watery spots could be observed on the yellowed leaves. The leaves of infected plants stood upright (bristled) and were thicker than those on the healthy plants. The symptoms on barley appeared on a group of several plants in a circle and included greater or smaller areas. Regarding dwarfing there were great differences. Some plants remained short – only 10-15 cm high and the ears were smaller and often empty. The symptoms on wheat were similar to those on barley and on some varieties the yellow color on the leaves turned to a reddish color. There was no marked underdevelopment on wheat. With increased temperatures in May and June the leaves gradually lost their yellow color. Samples of plants with symptoms were collected from the fields and the ELISA-test was performed for the presence of the PAV strain of the BYD virus. The virus was determined at the following locations: Brestovac (barley Lord; wheat Barbara and Superžitarka), Kneževo (barley Zlatko) and Kutjevo (barley Gaelic), Zagreb (wheat Dukat, Rennan, Banica, Marija, Kuna, Soisson, Superžitarka, Žitarka and Patria). In the region of Belje experts from the Department for Agricultural Zoology of the Faculty of Agriculture in Zagreb determined aphids that are known vectors of BYDV-PAV. Similar symptoms had been described in Croatia previously and they led to the presumption that this was Barley yellow dwarf virus (Panjan, 1964; Šarić, 1986). This is first definite determination of Barley yellow dwarf virus in Croatia on barley and on wheat.

Key words: barley, Barley yellow dwarf virus, Croatia, ELISA, wheat

IZVLEČEK

POJAV VIRUSA, KI POVZROČA RUMENO PRITLIKAVOST JEČMENA (Barley yellow dwarf virus, BYDV) NA HRVAŠKEM V LETU 2002

Spomladi 2002 smo na več lokacijah na Hrvaškem opazili slabšo rast ječmena (Belje, Daruvar, Đakovo, Kutjevo, Nova Gradiška, Tovarnik, Valpovo in Zagreb). Na osnovi simptomov smo določili, da gre za virusno okužbo. Ječmenovi listi so bili zlato rumeni in so zaostajali v rasti. Sprememba barve listov se je širila od konice in robov lista proti listni bazi. Na porumenelih listih so bile vidne vodene pege. Listi na okuženih rastlinah so bili pokončni in debelejši od zdravih listov. Okužene rastline so bile vidne v obliki večjih ali manjših otokov na polju. Glede zaostalosti v rasti so bile velike razlike. Nekatere rastline so ostale majhne, le 10 – 15 cm visoke, klasi so bili manjši in pogosto prazni. Simptomi na pšenici so bili podobni kot na ječmenu in pri nekaterih sortah se je rumena barva listov spremenila v rdečkasto. Pri pšenici nismo opazili zaostajanja v razvoju. Z naraščanjem temperatur v maju in juniju so listi postopoma izgubili rumeno barvo. Zbrali smo vzorce okuženih rastlin in z metodo ELISA smo ugotavljali raso PAV virusa rumene pritlikavosti ječmena (BYDV). Virus je bil določen na naslednjih lokacijah: Brestovac (ječmen Lord, pšenica Barbara in Super žitarka), Kneževo (ječmen Zlatko) in Kutjevo (ječmen Gaelic), Zagreb (pšenica Dukat, Rennan, Banica, Marija, Kuna, Soisson, Super žitarka, Žitarka, Patria). Na lokaciji Belje so strokovnjaki Oddelka za kmetijsko zoologijo Agronomske fakultete v Zagrebu, določili

¹ Prof. dr. sc., Svetošimunska 25, 10 000 Zagreb, Croatia

² M. Sc., ibid.

varietete listnih uši, ki so znane prenašalke virusa rumene pritlikavosti ječmena (BYDV-PAV). Simptomi so bili na Hrvaškem opisani v preteklosti, kar vodi k domnevi, da je šlo za BYDV (Panjan 1964 in Šarić 1986). To je prva zanesljiva determinacija virusa BYDV na ječmenu in pšenici na Hrvaškem.

Ključne besede: ječmen, barley yellow dwarf virus, Hrvaška, ELISA, pšenica

1 INTRODUCTION

Barley yellow dwarf virus was first described in 1951 in California (Oswald and Houston 1951). Today it has spread to many cereal-growing areas, including the surroundings states of Croatia. In Croatia the symptoms had been described earlier leading to the presumption that this was BYDV (Panjan 1964; Šarić 1986) but BYDV was not experimentally proven. In the spring of 2002 marked stagnation in height of barley and yellowing leaves were observed in eastern Croatia (Darda, Brestovac, Belje). The same symptoms were observed on barley at other locations in Croatia (Kutjevo, Nova Gradiška, Daruvar, Tovarnik, Čađavica, Valpovo, Zagreb and Đakovo) and on winter wheat in Zagreb and Belje (Fig. 1). Based on the symptoms we presumed this was due to a virus infection. In infected areas the barley yield fell by about 30 %.



Fig. 1: Distribution map of the symptoms of BYDV in Croatia in 2002.

2 MATERIAL AND METHODS

2.1 Symptoms of viral infection on barley

In the field one could observe barley plants with various levels of underdevelopment. In oases there were plants that had remained in the stage of tillering, while healthy ones were in the flowering stage. Some infected plants did not form ears at all. The leaves stood upright and were a golden yellow color. The yellow color first appeared on the edge of the leaves and then spread towards the base. The blade of the leaf alongside the main vein remained green somewhat longer but in the end the whole leaf turned yellow (Fig. 2).



Fig. 2: Symptoms of BYDV on barley.

2.2 Symptoms of viral infection on wheat

Underdevelopment was also observed on wheat but it wasn't as drastic as on barley. The leaves turned yellow and the yellow color turned to reddish at the top of the blade of the leaves (Fig. 3). On plants on which the only symptom was leaf yellowing an increase of temperature lead to the gradual decrease of yellowing.

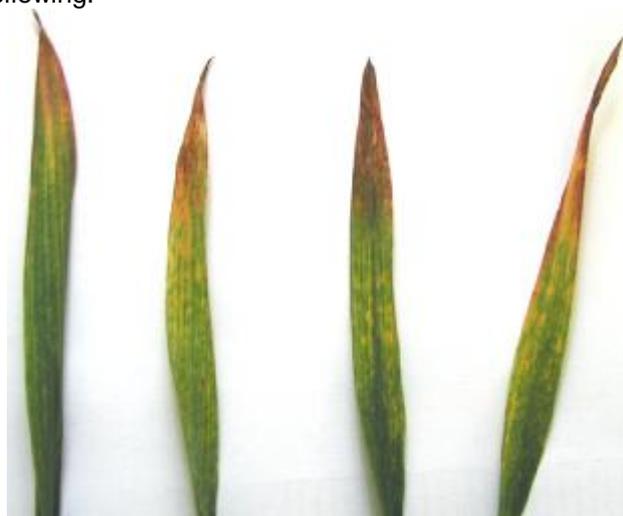


Fig. 3 Symptoms of BYDV on wheat.

2.3 Collected plant material

The following samples were gathered: a) barely plants from location Belje (Lord, Rex, Zlatko), b) wheat plants from location Belje (Superžitarka), c) barley plants from location Kutjevo: (Gaelic), d) wheat plants from location Maksimir (Banica, Dukat, Kuna, Marija, Patria, Rennan, Soisson, Superžitarka, Žitarka), e) barley seeds from location Belje. Collected plant material was submitted to the ELISA-test in order to determine the presence of the PAV serotype of the Barley yellow dwarf virus according to Eweida and Ryden (1984).

3 RESULTS AND DISCUSSION

The results in Table 1 show that BYD virus has been determined on barley varieties Lord,

Zlatko, and Gaelic. In Lord the greatest concentration of the virus was in the leaf and far less in the root and stem. Therefore it is to be recommended that the leaves should be used for the determination of the virus because the concentration in them is highest.

Table 1: Results of the ELISA-test for BYDV on barley.

Location	Cultivar	Organ	Result
Brestovac	Lord	leaf	+
“	Lord	stem	-
“	Lord	stem	-
“	Lord	root	-
“	Rex	leaf	-
“	Rex	root	-
Kneževo	Rex	leaf	-
“	Zlatko	leaf	+
Kutjevo 1	Gaelic	leaf	+
Kutjevo 2	Gaelic	leaf	+
Kutjevo 3	Gaelic	leaf	+

Key: + considered positive, - considered negative.

The symptoms on wheat were less noticeable so fewer samples were analyzed. However, we determined BYD virus on wheat varieties Banica, Barbara, Dukat, Kuna, Marija, Patria, Rennan, Soisson, Superžitarka and Žitarka (Table 2).

Table 2: Results of the analysis of wheat.

Location	Cultivar	Results
Brestovac	Srpanjka	-
“	Barbara	+
“	Superžitarka	-
“	Superžitarka	+
Maksimir	Banica	+
“	Dukat	+
“	Kuna	+
“	Marija	+
“	Patria	+
“	Rennan	+
“	Soisson	+
“	Superžitarka	+
“	Žitarka	+

Key: + considered positive, - considered negative.

Although the *Lolium* sp. showed symptoms of leaf yellowing and redness along the edges we did not manage to determine the virus in it. By applying the ELISA test we determined that the virus is present on seeds of barley Rex, Lord, Zlatko and on wheat (Superžitarka) (Table 3).

This is by no means evidence that the virus is seed borne. It is common opinion that the virus is not seed borne (Richardson 1979). However, there are experiments that prove the opposite (Szirmai 1979). Anyway, virus is transmitted in a persistent manner. According to D'Arcy (1997) there are two subgroups of BYDV based on serological connections.

Table 3: Results of the analysis of seeds.

Location	Crop/Cultivar	Symptoms in field	Leaf	Seed
Brestovac	Barley - Lord	+	+	+
“	Barley – Rex	+	0	+
“	Barley - Rex	+	-	-
“	Barley - Zlatko	+	0	+
Kneževo	Barley - Rex	+	-	+
“	Barley - Zlatko	+	+	+
Belje	Wheat -	+	+	+

Key: + considered positive, - considered negative, 0 non-tested.

There are virus isolates within each subgroup, namely:

1st subgroup

a) BYDV-PAV is transmitted usually by aphids *Rhopalosiphum padi* and *M. (S.) avenae*, erratically by *Schizaphis graminum*, but rarely by *R. maidis*.

b) BYDV-MAV is transmitted usually by *Macrosiphum (Sitobion) avenae*, but rarely by *Rhopalosiphum padi*, *R. maidis* and *Schizaphis graminum*.

c) BYDV-SGV is transmitted regularly by *Schizaphis graminum*, but rarely if at all by *M. (S.) avenae*, *R. padi* or *R. maidis*.

2nd subgroup

a) BYDV-RPV is transmitted regularly by *Rhopalosiphum padi*, erratically by *Sch. graminum*, but rarely by *R. maidis* and *M. (S.) avenae*

b) BYDV-RMV is regularly transmitted by *Rhopalosiphum maidis*, but infrequently by *R. padi*, *M. (S.) avenae* and *Sch. graminum*.

In the region of Belje the dominant species is *Rhopalosiphum padi* (Igrc Barčić and Gotlin 2002) so the appearance of BYDV (PAV) was to be expected. For the first time this paper experimentally proves the presence of BYDV serotype PAV on plants and seeds of wheat and barley in Croatia.

4 CONCLUSIONS

1) The presence of BYDV on wheat and barley was proven experimentally in Croatia for the first time.

2) It was experimentally proven that the virus could be found in the seeds although this is not evidence that it is seed-borne.

5 REFERENCES

- D'Arcy, C. 1997. Compendium of Barley Diseases. APS Press, St. Paul, Minnesota, USA.
- Eweida, M., Ryden, K. 1984. Detection of barley yellow dwarf virus (BYDV) in cereals and grasses by enzyme linked immunosorbent assay (ELISA) in Sweden. Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz, 91, 2:131-137.
- Igrc Barčić, J., Gotlin Čuljak, T. 2003. Važnost lisnih ušiju u prenošenju BYDV na pšenici i ječmu. Glasilo biljne zaštite, 1 (Sažeci sa 47. seminara biljne zaštite, Opatija, 11.-14.2.2003.,

- Hrvatsko društvo biljne zaštite, 2003: 20-21.
- Oswald, J. W., Houston, B. R. 1951. A new virus disease of cereals transmissible by aphids. *Plant Dis. Reprt.*, 35, 11: 471-475.
- Panjan, M. 1964. Crvenilo lista zobi. *Agr. glas.* 10: 718-719.
- Richardson, M. J. 1979. An annotated list of seed-borne diseases. *Phytopathological Papers*, No. 23 108-118, CAB, London.
- Szirmai, J. 1979. Magátviteli kísérletek az árpa sárga törpeség (barley yellow dwarf) vírussal. *Növénytermelés*, 28, 2: 147-153.
- Šarić, A. 1986. Žuta patuljavost ječma, opasna viroza žitarica. *Glasnik zaštite bilja*, 6: 217-219.