The natural viral infections of the weedy *Panicum miliaceum* (L.)

György PÁSZTOR - Rita SZABÓ - András TAKÁCS - Ágnes HENÉZI - Erzsébet NÁDASY

University of Pannonia, Georgikon Faculty, 8360 Keszthely, Deák Ferenc u. 17., pasztor018@freemail.hu

Abstract: Common millet is a dangerous weed in Hungary, not only on a maize field, but also in other crops like potato, sunflower, wheat and other cereals. It can widely spread because of the lack of seed dormancy. This weed is a close relative to wheat, so we wanted to investigate, which wheat viruses can infect of the common millet (*Panicum miliaceum*).

Forty-five millet leaf samples were collected from the fields in 2014 and 2015 near Keszthely and Lesencefalu, from Hungarian Transdanubia. After the collection, we immediately froze the samples, and stored at -20 °Celsius. We used the DAS ELISA serological method to determine wheat viruses from the leaves.

Nineteen of 45 collected leaf samplesgave positive results. Simple virus infection were realised in 15 samples, but complex infections were also detected in 4 samples.The samples were infected with Wheat streak mosaic virus in 22%, with Wheat dwarf virus and Barley stripe mosaic virus in 13%, with Barley yellow dwarf virus in 4% and with Barley stripe mosaic virus in 2%. Brome mosaic virus (BMV) was not detected from the collected samples. Complex infections of WDV and WSMV as well as WDV, WSMV and BYDV were also detected in three and one samples, respectively.

After the first investigation we collected another samples too, to continue our examination. Our results indicate, that millet as weed can play a major role in the distribution of different cereal virus species.

Keywords: millet, maize, virus, cereal

Introduction

Field crops play a key role in both food and animal feed worldwide. It is therefore worrying that the damages caused by the viral diseases show growing trend in the recent years. Prevention is the only effective protection against viruses. The millet is not just a weed, it has a really strong competitive harm, and also plays a role in spreading cereal viruses. Several viruses have been identified amongst the wild and cultivated millet species in several cases. Firstly Wheat streak mosaic virus has been identified from the millet species *P. capillare* in Australia and the United States (Christian and Willis 1993, Coutts 2008). In the work of Lapierre and Signoret (2004) it is mentioned, that the Barley yellow mosaic virus is a pathogen of the millet species. This fact carries several problems: while a lot of alien millet species have recently been identified, there is a high risk of carrying wheat viruses, as well. Therefore, the goal of our study was to examine the dominant millet species, *Panicum miliaceum* (L.) and its viral infection with the most dangerous wheat viruses in Hungary. The millet causes a major problem in maize, but in the recent years, we found it in other cultures too, like wheat stubble and potato (Pásztor and Nádasy 2016). That's the first signal of the mild climate change in Hungary, the millet, being a hot-consuming species, is spreading into other cultures. Because of that, the wheat is highly compromised, because of the wheat viruses. So, our goal was to examine this threat, especially its viral infection.

Materials and methods

45 millet (*Panicum miliaceum* L.) leaf samples were collected during the investigation in September of 2014 and 2015. We collected 35 samples from the grain-field stubble near Lesencefalu, and 10 samples from Keszthely. The collected samples showed signs of a viral infection. The laboratory test requires, that all the samples need to be packed individually in polyethylene bags and stored at -20 °Celsius.

The most commonly used serological test was used, the double antibody sandwich DAS ELISA test. We used reagents from the LOEWE Biochemica (Brome mosaic virus, Brome dwarf mosaic virus, Brome treak mosaic virus, Barley stripe mosaic virus, Barley yellow dwarf virus, Wheat dwarf mosaic virus and Wheat dwarf virus).

The colour of the samples was evaluated with Multiscan RC Elisa Reader at 405 nm. The samples, which extinction value was three times higher than the negative control, were considered positive.

Results and discussion

From the 45 leaf samples in 19 cases have been proven viral infection. The most serious infection has been diagnosed in the case of Wheat streak mosaic virus; we diagnosed 10 samples with this virus. In six-six samples the Wheat dwarf virus and barley stripe mosaic virus were also identified, among these two Barley yellow dwarf virus and one Brome streak mosaic virus infection were find. But, we can't identify the Brome mosaic virus (Fig.1, Fig. 2). We found complex infection also. Three samples with two viruses (WDV, WSMV), and one sample with three viruses (WDV, WSMV, BYDV) were infected.

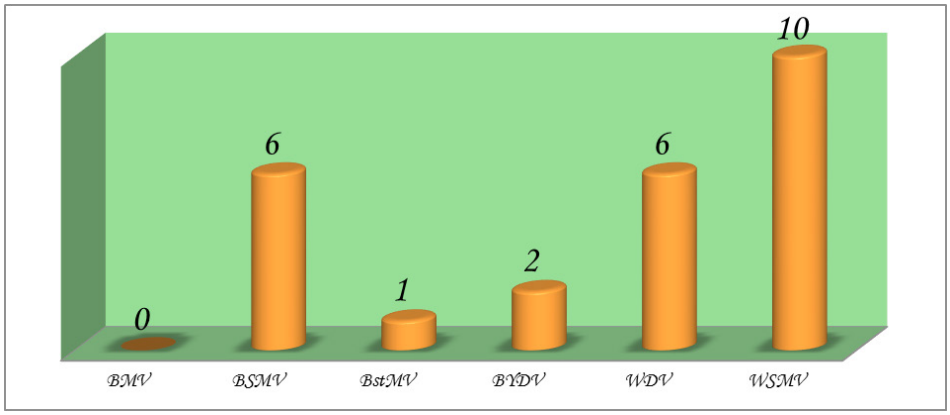

Figure 1. The number of different virus infected samples.

 DOI: 10.18380/SZIE.COLUM.2017.4.1.suppl

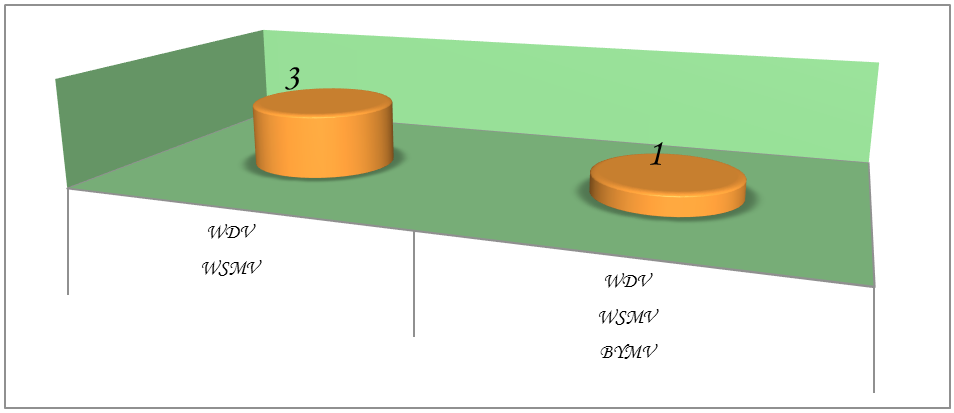

Figure 2. The complex virus infections

Conclusions

The results show, that the weedy subspecies of the broomcorn millet can play a significant role in spreading cereal viruses into the cereals. This study is unique, because so many viral diseases in such complexity was never been identified by the *Panicum miliaceum* species. Our main priority is the successful weed control, and prevention the spreading of new alien millet species.

The reduced agricultural technology promotes the spread of the pests, like new weed species and also the virus vectors and viruses. But if we stubble the fields and carry out the cultivation works in time, the spreading of the pests can be reduced. If it possible, it is advisable to choose resistant varieties in crop production.

To the good production of virus resistant varieties important the optimal plant nutrition, because of this help the genetically determined natural defence mechanism of plant. The forecast plays a key role in protection against vectors. The massive proliferation of pests can be significantly reduced by prevention, therefore the transmission of the virus. It is strongly recommended the further investigation of the millet species, because we can find them in other cultures too, and there are a lot more viruses, that can infect the millet and therefore the cultivated plant too.

For example, in Hungary the millet species causes a major problem in maize fields, but it can easy happen, that the two maize viruses (the Maize mosaic virus and the Sugarcane mosaic virus) can also infect those species. We need to extend our examination on the alien millet species too.

References

Christian, M.L., Willis, W.G. (1993): Survival of wheat streak mosaic-virus in grass hosts in Kansas from wheat harvest to fall wheat emergence. Plant Diseases, 77:239-242.DOI: http://dx.doi.org/10.1094/pd-77-0239

Coutts, B.A. (2008): The epidemiology of wheat streak mosaic virus in Australia: case histories, gradients, mite vectors, and alternative hosts. Australian Journal of Agricultural Research., 59:844-853.DOI: http://dx.doi.org/10.1071/ar07475

Lapierre, H., Signoret, P.A. (eds.) (2004): Viruses and Virus diseases of *Poaceae (Gramineae)*. INRA Paris.DOI: http://dx.doi.org/10.1002/9780470015902.a0003689.pub2

Pásztor, GY., Nádasyné Iházi, E. (2016): A köles fajok (*Panicum* spp.) hazai elterjedése, biológiája és a védekezés lehetőségei. Magyar Gyomkutatás és Technológia. 17: 3-14.DOI: http://dx.doi.org/10.1556/agrokem.58.2009.1.7

 DOI: 10.18380/SZIE.COLUM.2017.4.1.suppl