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Reaction of selected BYDV-tolerant wheat genotypes to czech PAV isolate

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Introduction

Barley Yellow Dwarf Virus (BYDV) is transmitted by several species of aphids and causes the probably the most important virus disease of cereals, which is spread worldwide on wheat, barley and other cereals. Management of the disease is mainly achieved trough control of vectors, the cereal aphids, by insecticide application. The most effective and sustainable control method is the use of genetic resistance/tolerance to the virus complex.

Materials and methods

In RICP Prague-Ruzyně the materials obtained from CIMMYT and ICARDA programmes (ALME2YDRES), Chile, Canada, USA, Hungary and Poland, together with advanced breeding lines and registered spring and winter wheat cultivars have been tested for resistance to BYDV. Field infection trials performed in 2002-2006 period contained infection and uninfected (control) variants. The plants were grown on two-row plots 1-m long with two replicates (plant spacing: 6x22 cm). Infection with PAV strain of BYDV was carried out at the beginning of the tillering stage. Bird cherry-oat aphids (*Rophalosiphum padi*) obtained from greenhouse rearing were used for virus transmission.

The intensity of the symptomatic response (VSS – visual symptom score) was classified according to a 1-9 scale (1- without symptoms) developed by Schaller and Qualset (1980), at the phase of full flowering. The effect of virus infection on yield components was assessed after plant harvesting, when the susceptibility index (SI) was also determined using formula devised by Comeau and St-Pierre (1982), as modified by Šíp *et al*. (1997).

Natural occurrence of viral yellowing diseases was monitored using control points of State Phytosanitary Administration in Czech Republic. BYDV-PAV, CYDV-RPV and WDV were detected by imunosorbent assay (ELISA).

Results and discussion

Natural occurrence of cereal viruses in 2005 was similar as in seasons 2003 and 2004. Cereal viruses were positively tested in 19 control points of 380 (5%). There was detected Wheat Dwarf Virus (WDV) and BYDV-PAV in warm regions of Czech Republic, with WDV being slightly dominant (WDV – 2.4%; BYDV – 2.1%; WDV+BYDV – 0.5% of tested samples). There was no sample positively tested to CYDV-RPV.

Previous studies (Šíp *et al*., 1995; Vacke *et al*., 1996) showed moderate tolerance in winter wheat varieties 'Sparta', 'Torysa', 'Sofia', 'Danubia' and 'Samara' and breeding line SG-U767. The advanced breeding lines of spring wheat SG-U7035, ST-135, ST-271-92, UH –126 and UH-7005 were classified as moderately tolerant (Vacke *et al*., 1996). The Brazilian variety 'Maringá' and its near isogenic Rht lines showed moderate to high tolerance to BYDV. Among the tested CIMMYT materials, a very high tolerance was detected in VEE"S"/TRAP1 (Vacke *et al*., 1996). However, it comes also from the latest results of tests that no winter and spring wheat variety registered in the Czech Republic could be reckoned as highly tolerant to BYDV.

Spring wheat: In comparison with susceptible control 'Jara' we approved tolerance of WKL91-138, 'Máringa 1' and 'Anza'. Two spring wheat lines SG-S26-98 and SG-S604-96 and registered variety Leguan were found tolerant. In two year period (2005, 2006) we tested eighteen lines from CIMMYT (ALME2YDRES) carrying *Bdv2* gene derived from *Thinopyrum intermedium.* None of these lines and the lines TC 14290E, TC 14290J, TC5, TC7 and TC9, that also carry this resistance gene, was found tolerant to BYDV. Average symptom score was 6.4 (min. = 4.8; max. = 8), indicating medium to susceptible response. However, more promising appeared to be some other materials obtained from Canada, Poland and Chile. Breeding lines Kivu-85, QG2.1, QG4.37 (Canada), the line SOA217/02 (Poland) and varieties 'Quino-Baes' and 'Bárbaro-B' from Chile were found tolerant or medium tolerant with VSS better than four (1 = tolerant).

Winter wheat: As reported by Bartoš *et al*. (2002), high level of resistance has not been detected in winter wheat and crossing with tolerant spring wheat materials was recommended as perspective strategy. Relatively higher, moderate tolerance was detected in winter wheat varieties 'Niagara', 'Meritto', 'Rexia', 'Athlet', 'Svitava' and 'Ebi' (tests 2002-2006), however, it is necessary to mention that variation range in symptom scores was lower than in spring wheat (4.44-6.55). Breeding line SG-S17-03 were evaluated with low symptoms (VSS = 3.9, 1 = tolerant) and reduction of yield parameters (SI = 5.7, average of the file 6.5, 1 = tolerant). Two years results (2005-2006) showed high tolerance of cultivars 'McCormic', 'Roane' and 'Tribute' (USA). Advanced breeding lines SG-U3097, SG-S25-03 and SG-S50-04, originated in the Czech breeding company SELGEN a.s., were found moderately tolerant. The most tolerant genotype was a "perennial wheat" PSR3628. This Agropyron/wheat hybrid had the lowest symptom score (2.3) and minimum yield reduction. However, it is a wild type, late and low yielding, susceptible to stripe rust and WDV.

Conclusions

In comparison with previous studies the obtained results document progress reached in wheat breeding for resistance to BYDV. New sources of resistance were detected also in winter wheat. However, a wider choice of resistant genotypes still offer spring types. There were detected some highly resistant spring wheat materials with still unknown resistance genes (e.g. WKL-91-138, Kivu-85, QG2.1 and QG4.37). It was also found that either Bdv1 or Bdv2 need not guarantee obtaining desirable resistance level. Progress can be reached by combining these resistance genes (using MAS). Owing to high differences in response of Bdv1 and Bdv2 gene carriers to BYDV, it is evidently necessary to identify and exploit also the other BYDV resistance genes.

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