# Occurrence and Virulence of Wheat Yellow Rust in Hungary during 1999–2001

*K. MANNINGER*

*Plant Protection Institute, Hungarian Academy of Sciences, 1525 Budapest, Hungary*

*E-mail: sman@nki.hu*

**Abstract**

The occurrence and virulence of wheat yellow rust in Hungary was studied in the period of 1999–2001. Yellow rust in Hungary occurred only in traces in 1999, strongly spread and reached epidemic level in Röjtökmuzsaj (West Hungary) in 2000, and the epidemic explosion was in the whole country in 2001. Surveys of yellow rust showed the importance of pathotypes, whose virulence spectra (virulent for *Yr2, Yr3, Yr6, Yr7, Yr8, Yr9, Yr17, YrA+, YrCV, YrSD*) were able to math the unknown resistance genes. Among 78 Hungarian and foreign cultivars 29 were strongly infected by yellow rust.

**Keywords**: wheat; cultivar; yellow rust; *Puccinia striiformis*; virulence; avirulence; susceptible; resistance gene

## INTRODUCTION

Yellow rust of wheat caused by the fungus *Puccinia striiformis* Westend. f.sp. *tritici* is occurring worldwide, in north-west Europe with high risk of epidemics (ZADOKS & BOUWMAN 1985). The frequency of epidemics and yield loss in wheat caused by yellow rust is different in each country (C DE VALLAVIEILLE-POPE *et al*. 1990). Yellow rust in Hungary is not common, although during recent years it has occurred annually (MANNINGER 2001).

## MATERIALS AND METHODS

***Collection of samples***. Samples of yellow rusted wheat leaf were collected in May during 1999–2001. Infected leaves were obtained at different regions in wheat nurseries and fields.

***Survey procedures***. Samples which contained sufficient inoculum were stored at 5°C until differential sets at the first leaf stage were available. Isolates were tested on differentials with *Yr1, Yr2, Yr3, Yr4, Yr6, Yr7, Yr8, Yr9, Yr10, Yr15, Yr17, YrA+, YrCV*, *YrSD, YrSPA* and *YrSU* resistance genes. Infected seedlings were set in dew chamber at 100% relative humidity on about 10°C for 20 to 24 h. After the incubation the infected plants were transferred to climate chamber with 15°C in which daylight was provided 1000 Watt with 16 and 8 h in light and dark photo periodic, respectively. Infection types on the differentials sets were recorded approximately 14–17 days after inoculation using the infection type nomenclature of STAKMAN *et al*. (1962). Virulence of yellow rust isolates were characterized with infection type 3 to 4, while avirulence of isolates 0 to 2+ at seedling stage.

***Field test***. 78 wheat cultivars were tested in the field (nursery) in Röjtökmuzsaj in 2001. The level of yellow rust infection was assessed two times. The percentage of affected flag leaf area was estimated using the modified Cobb scale (PETERSON *et al*. 1948).

## RESULTS

The occurrence of wheat yellow rust in Hungary was observed and its virulence was studied in the period of 1999–2001. Yellow rust occurred only in traces in 1999, it is strongly spread and reached an epidemic level in Röjtökmuzsaj (West Hungary) in 2000, and the epidemic explosion was in the whole country in 2001.

Supported by OTKA (No. T 029120).

Table 1. Virulence of wheat yellow rust in Hungary 1999–2001

| Differential cultivar | R gene/ factor | 1999 | 2000 | 2001 |
|---|---|---|---|---|
| Kalyansona | *Yr2* | V | V | V |
| Vilmorin 23 | *Yr3+* | | V | V |
| Nord Deprez | *Yr3+* | | V | V |
| Heines Peko | *Yr6, Yr2* | V | V | V |
| Heines Kolben | *Yr6, Yr2* | V | V | V |
| Lee | *Yr7* | V | V | V |
| Compair | *Yr8* | V | V | V |
| Kavkaz × Federation | *Yr9* | V | V | V |
| VPM1 | *Yr17* | | V | V |
| Avocet R | *YrA+* | V | V | V |
| Carstens V | *YrCV* | | V | V |
| Strubes Dickkopf | *YrSD* | | V | V |

During three years virulent isolates were found for *Yr2, Yr3, Yr6, Yr7, Yr8, Yr9, Yr17, YrA+, YrCV* and *YrSD* (Table 1), no virulent isolates were found for *Yr1, Yr4, Yr10, Yr15, YrSPA* and *YrSU*.

Lots of Hungarian cultivars were strongly infected by yellow rust (Table 2), some of them were moderately sensitive, although some cultivars remained uninfected in 2001.

## DISCUSSION AND CONCLUSION

Surveys of yellow rust showed the importance of pathotypes whose virulence spectra were able to match the unknown effective resistance genes. Two pathotypes were mostly responsible for the 2001 epidemic. They were virulent for *Yr2, Yr3, Yr6, Yr7, Yr8, Yr9, Yr17, YrA+ YrCV* and *YrSD*. The resistance genes: *Yr2, Yr9, Yr17* and *YrSD* are ineffective everywhere in the European countries. Virulence for *Yr1, Yr4, Yr10, Yr15, YrSPA* and *YrSU* has not been found during 1999–2001. These effective genes can be recommended as resistance sources for incorporation in

Table 2. Susceptible wheat cultivars against yellow rust Röjtökmuzsaj 2001

| Reaction type | | | |
|---|---|---|---|
| Susceptible (10-60S) | moderately susceptible (5-50MR-MS) | susceptible (10-60S) | moderately susceptible (5-50MR-MS) |
| **Hungarian cultivar** | | **Foreign cultivar** | |
| Alföld | Abony | Furore (AT) | Fatima-2 (HU-RO) |
| GK Bagoly | GK Verecke | Niagara (CZ) | Jarebica (YU) |
| GK Csörnöc | Mv Kucsma | Ukrainka (UA) | Renesansa (YU) |
| GK Dávid | Mv Martina | | Zlatka (YU) |
| GK Élet | Mv Pálma | | |
| GK Jászság | Mv Optima | | |
| GK Kalász | | | |
| GK Pinka | | | |
| GK Sas | | | |
| GK Tenger | | | |
| Mv Emma | | | |
| Mv Mariska | | | |
| Mv Prizma | | | |
| Mv Tamara | | | |
| Mv Vilma | | | |
| Róna | | | |

breeding programs in Hungary, although infection on lines with *Yr1, Yr4* and *YrSU* genes was observed in other European countries.

Among the susceptible cultivars GK Élet and GK Kalász in earlier years with unknown effective resistance genes, were moderately sensitive in 2000, and susceptible in 2001. The yellow rust epidemic in these cultivars probably developed because these cultivars were grown on large areas in Hungary in these years. However up to the present we could not find out which *Yr* genes are broken down.

## References

C DE VALLAVIEILLE-POPE, PICARD-FORMERY H., RADULOVIC S., JOHNSON R. (1990): Specific resistance factors to yellow rust in seedlings of some French wheat varieties and races of *Puccinia striiformis* Westend in France. Agronomie, **2**: 103–113.

MANNINGER K. (2001): Yellow rust of wheat in Hungary. Sustainable Systems of Cereal Crop Protection against Fungal Diseases as the Way of Reduction of Toxin Occurrence in Food Webs. In: Proc. Agricultural Research Institute Kroměříž, Ltd.: 204–206.

PETERSON R.F., CAMPBELL A.B., HANNAH A.E. (1948): A diagrammatic scale for estimating rust intensity of leaves and stem of cereals. Can. J. Res. Sect., **26**: 496–500.

STAKMAN E.C., STEWART D.M., LOEGERING W.Q. (1962): Identification of physiologic races of *Puccinia graminis* var. *tritici*. U.S. Dept. Agric., Res. Serv. E-**617** (rev.): 1–53.

ZADOKS J.C. (1971): System analysis and the dynamics of epidemics. Phytopathology, **61**: 600–661.

ZADOKS J.C., BOUWMAN J.J. (1985): Epidemiology in Europe. In: ROELFS A.P., BUSHNELL W.R. (eds): The Cereal Rusts, Vol. II. London: 329–369.