ACTA AGROBOTANICA
Vol. 58, z. 1 2005
s. 11 16

Occurrence of necrotrophic leaf pathogens in wheat and their relation to symptom development in Hungary (2000-2002)

MARIA CSOSZ

Cereal Research Non profit Company, Szeged, P.O.Box 391. Hungary, H 6701
E mail: laszlone.csosz@gk szeged.hu

(Received: 15.03.2005)

Summary

1879-2720 leaf samples from 8-13 stations of Hungary were collected in March, April, May and June 2000-2002. *Drechslera tritici-repentis*, *Septoria tritici*, *Stagonospora nodorum* and *Bipolaris sorokiniana* were found in the leaf samples. The occurrence of necrotrophic pathogens was highest (10,79%) in 2001 and lowest (2,63%) in 2002. The occurrence and rate of the necrotrophic pathogens changed significantly among years and locations. The resistance of cultivars based on natural infection could not be properly evaluated, as the level of the epidemic was mostly low and contradictory among locations.

Additionally forty four cultivars were tested in Szeged after winter wheat in protected and unprotected environment. Among the necrotrophic pathogens, the dominant pathogens were *D. tritici-repentis* (2001 and 2002) and *S. nodorum* (2001). The differences in variety resistance were significant. The biotrophic (leaf rust, yellow rust and powdery mildew) as well as the mentioned necrotrophic pathogens caused significant yield decrease in both years. According to values of correlation coefficients, the influence of biotrophic pathogens was greater on the yield.

Key words: winter wheat, *Drechslera tritici repentis*, *Septoria tritici*, *Stagonospora nodorum*, *Bipolaris sorokiniana*, resistance, yield response

INTRODUCTION

The infections by *D. tritici-repentis*, *S. tritici*, *S. nodorum* and *B. sorokiniana* significantly increased due to the poor economic situation, increasing monocultural and minimum tillage practices in Hungary at the late 90s. Medium epidemic caused by *S. tritici* what was observed in 1996 and 1999 in the Szeged nurseries. In 1996, Pál Békési recorded in Kecskemét a medium level of epidemic. The two data series often showed significant differences for the same cultivars.

D. tritici-repentis was described first in Hungary by Aponyi et al. (1988). The data basis is poor; mostly data of monocultural production were reported (Balogh et al., 1991; Rátai and Pecze 1997). Severe epidemics occurred only under these conditions, in the nurseries where the previous crop was canola or peas, only sporadic symptoms occurred that not allowed differentiation in resistance. Under these conditions only 1-2 cultivars showed significant infection like GK Mura (Röjtökmuzsaj and Táplánszentkereszt 1999). A consequent resistance testing and breeding work has not been made until now (Farkas 2000).

For these diseases, especially for *D. tritici-repentis* the identification of the disease by leaf symptoms is often problematic as another saprophytic pathogens like *B. sorokiniana*, *Fusarium* leaf spot, *Alternaria*, etc. may cause similar symptoms. Among them the identification of *S. tritici* is the less problematic.

To clarify the identification problems, describe the symptoms more precisely and characterize the resistance of cultivars we started a new project:

The aims of this work:

to receive data about the change of occurrence of the necrotrophic pathogens,

studying resistance of the winter wheat cultivars at natural infection,

studying resistance and yield reaction of the winter wheat cultivars after previous winter wheat.

MATERIALS AND METHODS

1.) Identification of necrotrophic leaf pathogens

1879-2720 leaf samples (3-5 leaves/sample) from 8-13 stations were collected for analysis in March, April, May and June 2000-2002. The previous crop was different at each field (canola, winter canola, peas, mustard, red pepper, sunflower peas black soil, onion, sugar beet, winter wheat (only 1 place). The samples were incubated in Petri dishes on wet filter-paper at 20°C for 48-72 hours, and then the microscopic identification of the necrotrophic fungi (*Bipolaris sorokiniana* (syn. *Helminthosporium sativum*), *Drechslera tritici-repentis*, *Septoria tritici*, *Stagonospora nodorum* was performed.

2.) Testing of winter wheat cultivars resistance against necrotrophic pathogens after winter wheat

44 registered cultivars were tested in the both years. The plot size was 4 m^2, in four replicates, under untreated and treated environments (randomized block design). The previous crop was winter wheat. Applied fungicides: 2001: 125 g/l tebuconazole + 100g/l triadimefon (1 l/ha, tillering), 187,5 g/l trifloxystrobin + 80 g/l ciproconazole (1 l/ha, flowering), 2002: 125 g/l epoxiconazole + 125 g/l kresoxim-metil (1 l/ha) (at flowering, early spraying was left as only sporadic symptoms were observed).

We scored the leaf spots, powdery mildew (*Blumeria graminis),* leaf rust *(Puccinia triticina)* and yellow rust (*Puccinia striiformis)*. Leaf samples were collected from each cultivar and identified by microscope for *D. tritici-repentis, S. tritici, S. nodorum* and *B. sorokiniana,* other pathogens were not found. After harvesting we measured the yield and the results were evaluated by two-way ANOVA.

RESULTS AND DISCUSSION

1.) Change of occurrence of necrotrophic pathogens:

Epidemiologically the four diseases have different patterns. The *D. tritici-repentis* and the *S. nodorum* was the highest in June and the *S. tritici* in March and April and *B. sorokiniana* was similar in each month, but the measure of the occurrence was not higher than 20 % as an average of three years (Table 1). These data are supported also by the yearly occurrence data. Presence of necrotrophic pathogens was lowest in 2002. We observed significant differences in composition and occurrence of pathogens among the locations and years.

Table 1. Change of occurrence of necrotrophic pathogens in Hungary

Months	Occurrence (%)			
	Years			Average of
	2000	2001	2002	three years
	N=1879	N=2262	N=2720	
	Drechslera tritici-repentis			
March	–	8,01	1,18	**4,59**
April	0,21	14,53	3,24	**5,99**
May	7,04	8,05	6,03	**7,04**
June	24,67	18,72	6,47	**16,62**
	Septoria tritici			
March	–	28,85	1,18	**15,01**
April	22,01	19,80	1,76	**14,53**
May	6,11	11,72	3,38	**7,07**
June	5,98	2,31	2,79	**3,69**
	Stagonospora nodorum			
March	–	11,54	1,03	**6,28**
April	2,73	9,40	1,32	**4,49**
May	5,07	5,13	6,62	**5,61**
June	20,37	31,79	6,47	**19,55**
	Bipolaris sorokiniana			
March	–	0,48	0,15	**0,31**
April	4,40	1,00	0,15	**1,85**
May	7,15	1,10	0,00	**2,75**
June	4,30	0,26	0,29	**1,62**

Natural leaf spot infection of 39 cultivars was observed on each location. Disease differences could evaluate only in some places, but the severity was mostly low to evaluate cultivar differences and even differences in cultivar behavior were observed among locations. For these reasons, we believe that artificial inoculation methods should be applied to evaluate resistance deviations.

2.) Testing of winter wheat cultivars resistance against necrotrophic pathogens after winter wheat as fore crop

2a.) Level of epidemic severity of different diseases:

Leaf rust epidemic was heavy; the powdery mildew epidemic was medium in both years. We observed a medium yellow rust epidemic in 2001. Level of leaf spots epidemic was different in both years (Table 2).

Table 2. Level of epidemic of the observed diseases

Observed diseases	2001	2002
Leaf spots (%)	15,44	38,91
Powdery mildew (ACI)*	18,96	12,63
Leaf rust (ACI)	37,81	55,68
Yellow rust (ACI)	21,23	0,00

* average coefficient of infection (CIMMYT, 1976)

Leaf samples from 32 cultivars were collected and identified for the following necrotrophic pathogens in the leaf samples (Table 3).

Table 3. Identified necrotrophic pathogens (%)

Years Necrotrophic pathogens	2001	2002
D. tritici-repentis	15,91	85,00
S. tritici	2,27	23,00
S. nodorum	13,64	2,00
B. sorokiniana	2,27	17,00

The occurrence of necrotrophic pathogens changed significantly even in the same location between years.

2b.) Evaluation of yield reactions

The above diseases caused significant yield decrease related to the protected control in both years (Figure 1).

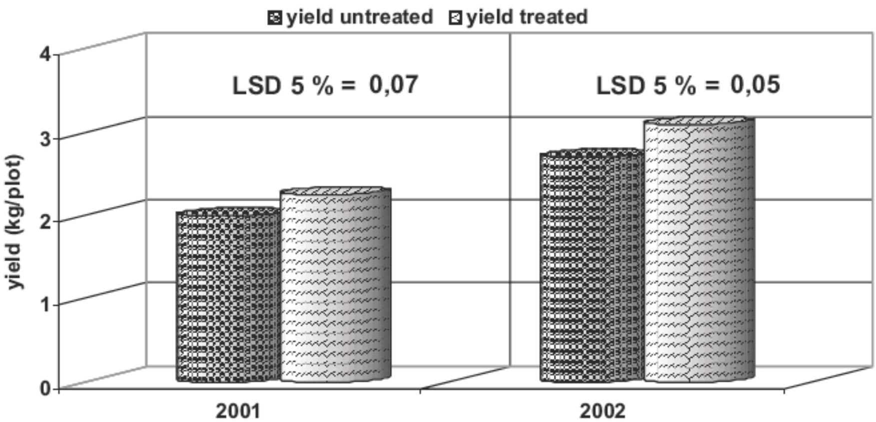

Fig. 1. Effect of leaf spots, powdery mildew, leaf rust and yellow rust on the yield (kg/plot) in 2001 and 2002 (Szeged, Hungary).

According to correlation coefficients the biotrophic pathogens influenced significant the yield response of the cultivars (Table 4).

Table 4. Values of correlation coefficients (n=44, 47)

Diseases	Years	Yield of untreated plots
Leaf spots	2001	– 0,1315
	2002	– 0,0175
Blumeria graminis	2001	– 0,4830**
	2002	0,0010
Puccinia triticina	2001	– 0,4336**
	2002	– 0,3608**
Puccinia striiformis	2001	– 0,3116*

Acknowledgements:

The author is indebted for the help of Dr. Pál Békési and Dr. Ákos Mesterházy and for financial support to the Agricultural Ministry research project (FVM 70-a1/2000. and FVM 57-a1/2002, D-22/01 TeT project.).

REFERENCES

Anonymus. 1976. CIMMYT Report on Wheat Improvement. Mexico, p. 115.

Aponyi G. I., Békési P., Matók I. 1988. Újabb betegség veszélyezteti a gabonát (A new disease in the cereal fields, DTR). Magyar Mezőgazdaság 40:9.

Balogh S., Aponyi G. I., Rátai V. R., Schweigert A., Füzi I. 1991. A kalászosok helmintospóriumos levélszáradása (Helminthosporium leaf blight of small grains). KSZE Agrofórum, 2:30 33.

Békési P. 1996. Az őszi búzafajták rezisztencia vizsgálatának 1996. évi eredményei (Resi stance tests results of the commercial winter wheat cultivars, 1996). Gyakorlati Agrofó rum, 7(10) 12 14.

Farkas B. 2000. Még egyszer a búza pirenofórás levélszáradásáról (Once more about the DTR in wheat). Gyakorlati Agrofórum, 11:(5) 20 21.

Rátai Vida R., Pecze R. 1997. Ismerkedjünk az őszi búza levélszáradásával! (How the DTR looks like?) Gyakorlati Agrofórum, 8(6) 41 43.

Występowanie nekrotroficznych patogenów na liściach pszenicy na Węgrzech i ich związek z rozwojem objawów chorobowych (2000-2003)

W latach 2000-2003 w okresie od marca do czerwca zebrano od 1879 do 2720 prób liści różnych odmian pszenicy. Próby pobierane były w 8-13 stacjach na terenie całych Węgier. Na zebranych liściach zidentyfikowano grzyby: *Drechslera tritici-repentis*, *Septoria tritici*, *Stagonospora nodorum* oraz *Bipolaris sorokiniana*. Najpowszechniejsze występowanie nekrotroficznych patogenów notowano w roku 2001 (10.79%), a najniższe w 2002 (2.63%). Zarejestrowano bardzo dużą zmienność w występowaniu nekrotrofów w zależności od lat i lokalizacji miejsc pobierania prób. Ocena odporności badanych odmian w wyniku samoistnych inokulacji nie była w pełni wiarygodna, gdyż poziom infekcji był niski i bardzo zróżnicowany w poszczególnych stacjach.

W Szeged, w warunkach kontrolowanych i niekontrolowanych, przetestowano 44 odmiany pszenicy ozimej. Wśród populacji nekrotrofów dominowały grzyby *D. tritici-repentis* (2001-2002) oraz *S. nodorum* (2001). Występowały znaczne różnice w poziomie odporności testowanych odmian pszenicy. Zarówno biotrofy (rdza brunatna, rdza żółta i mączniak prawdziwy) jak i w/w nekrotrofy powodowały znaczne i coroczne straty plonu. Statystycznie wykazano, iż współczynnik korelacji straty plonu i obecności patogenów był najwyższy dla patogenów biotroficznych.