Tan spot epiphytosis in winter wheat and triticale crop – comparative studies

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S u m m a r y

Development of tan spot epiphytosis in wheat and triticale has been investigated during three years of cropping seasons 1998-2001. The infection level of plants was scored in four stages of cereals development at the end of tillering (GS 29), shooting (GS 35-37), heading (GS 55-59) and milk maturity (GS 73-77). The monitoring performed on population of 327 wheat and 352 triticale genotypes indicated that the both cereals can be heavily infected by *P. tritici-repentis*, although the reaction of these hosts differed significantly. On triticale developed small, minute black spots usually without typical for wheat yellow halo. Moreover, the progress of tan spot of triticale over time was less rapid and disease intensity lower in the all plant growth stages during three years of studies.

Key words: *Pyrenophora tritici-repentis*, wheat, triticale

INTRODUCTION

Tan spot beside *Septoria* complex is one of the most important, common and widespread leaf spot disease of cereals. The causing factor *Pyrenophora tritici-repentis* (Died.) Drechsler [anamorph *Drechslera tritici-repentis* (Died.) Shoemaker] was described on over 25 species from *Gramineae* family including wheat and triticale which are principal hosts among cereals (Krupinsky, 1992). However for several years heavy outbreaks of tan spot has been reported mostly in USA, Brazil and Australia (Murray and Brown, 1987, Schilder, 1989), during the last decade the disease became more and more common also in several countries of Europe (Cook and Yarham, 1989, Gindrat et al., 1988, Verreet, 1991). The rapid increase of tan spot in Poland since late 80ies (Pokacka, 1990, 1991) was strong impulse to intense detail studies focused on occurrence, epidemiology and reaction of hosts to infection by *P. tritici-repentis*.

In the paper results of comparative analysis of tan spot epiphytosis in wheat and triticale are presented.

MATERIAL AND METHODS

- Monitoring of tan spot development

Monitoring of tan spot development was performed during three cropping seasons 1998/99, 1999/00 and 2000/01. The infection level of plants was scored in four stages of cereals development i.e. at the end of tillering (GS 29), shooting (GS 35-37), heading (GS 55-59) and milk maturity (GS 73-77) according to Tottman system of plant growth classification (Tottman, 1987). The progress of disease was characterized on the ground of two parameters:

distribution of infection degree of particular steam leaves

mean infection degree of tested plant population (wheat and triticales)

- The scoring system

Infection degree of leaves were estimated using six degree scale detailed described elsewhere (Wakuliński et al., 2000). According to that scoring system 0 represents absence of the disease and 5 very strong infection with spots covering over 70% of the blade. The all leaves at least of five stems per genotype were evaluated.

- The plant material

Totally, population of 327 wheat and 352 triticales genotypes was tested during three years of studies.

- The source of pathogen

The source of pathogen inoculum was wheat and triticales straws with pseudothecia which arising during saprophytic phase of fungus development. The straws was spread over soil just after seed sowing in approximately quantity of 250 g per square meter.

RESULTS AND DISCUSSION

Tan spot is typically polycyclic disease which develop during the whole period of plant growth since seedling stage till maturity. In our studies the first disease symptoms on wheat and triticales were observed at tillering stage already in the fall. However the disease intensity was initially equivalent in the both crop and less than 0,01% of plants were infected, the type of symptoms observed on wheat and triticales differed significantly. Wheat genotypes reacted as a rule in uniform way and produced brown flacks surrounded with yellow margin. In case of triticales on leaves developed at the beginning very small minute black spots distinctly separated from healthy tissue. On wheat, progress of the disease resulted in large necrotic lesion which coalescence and leaves rapidly die. The necrotisation of triticales leaves underwent much more slowly but due to rapid chlorophyll decomposition majority part of blade become chlorotic. On the surface of dying tissues of the both hosts developed abundantly conidia which subsequently served as a source of secondary infection.

Besides of symptomatological differences, the course of tan spot differ also in the „speed” of epiphytosis development. The more violent disease development was observed on wheat. It was accompanied by more serious infection of particular leaves (tab. 1) as well as mean infection degree of the whole plants (tab. 2).

Table 1.

Infection degree of particular wheat and triticale leaf of the stem at three plant growth stages

Cropping season	Plant growth stage	Host	Leaves of the stem (F– flag leaf, F-x – leaves below flag leaf)					
			F	F-1	F-2	F-3	F-4	F-5
1998/1999	GS 35-37	Wheat	0,00	0,05	0,61*	2,26*	4,31	4,96
		Triticale	0,00	0,00	0,21*	1,15*	4,13	5,00
	GS 55-59	Wheat	0,62*	1,25*	3,14*	4,66*	4,98	5,00
		Triticale	0,00*	0,03*	0,32*	2,10*	5,00	5,00
	GS 73-77	Wheat	2,28*	4,15*	4,99*	5,00	5,00	5,00
		Triticale	1,47*	2,58*	4,16*	5,00	5,00	5,00
1999/2000	GS 35-37	Wheat	0,00	0,00	0,15*	2,12*	4,55*	5,00
		Triticale	0,00	0,00	0,01*	1,09*	4,22*	4,97
	GS 55-59	Wheat	0,00	0,00	0,45*	2,32*	5,00	5,00
		Triticale	0,00	0,00	0,22*	1,41*	4,92	5,00
	GS 73-77	Wheat	0,09	2,04*	3,84*	4,89*	5,00	5,00
		Triticale	0,00	1,21*	2,91*	4,81*	5,00	5,00
2000/2001	GS 35-37	Wheat	0,00	0,02	0,31*	2,50*	4,25	5,00
		Triticale	0,00	0,00	0,11*	1,20*	3,92	5,00
	GS 55-59	Wheat	0,00	1,01*	2,90*	4,80*	5,00	5,00
		Triticale	0,00	0,00*	0,28*	1,87*	4,94	5,00
	GS 73-77	Wheat	2,73*	3,35*	4,43*	5,00	5,00	5,00
		Triticale	1,02*	1,84*	3,16*	4,70	5,00	5,00

* denote significance difference in leaf infection degree of wheat and triticale for particular plant growth stage

Table 2.

The average infection degree of wheat and triticale by *P.tritici repentis* at three plant growth stages

Plant growth stage	1998/1999		1999/2000		2000/2001	
	Wheat	Triticale	Wheat	Triticale	Wheat	Triticale
GS: 35-37	2,03 ^a	1,77 ^b	2,02 ^a	1,75 ^b	2,40 ^a	2,00 ^b
GS: 55-59	3,27 ^a	2,09 ^b	2,13 ^a	1,92 ^b	3,40 ^a	2,05 ^b
GS: 73-77	4,40 ^a	3,86 ^b	3,49 ^a	3,20 ^b	4,25 ^a	3,45 ^b

Values followed by the same letter are not significant different according to Tukey HSD test

The distribution of infection degree of particular leaves on wheat and triticale stem was very close and in the both cases fit the conditions of sigmoidal distribution. It has been stayed stable regarding to type over the time of analyzed plant growth stages, although absolute values of leaf infection changed.

Comparative analysis of mean disease intensities among the both cereal species clear indicate that the differences were mainly consequence of fever infection of the top and middle leaves of triticale. Significant differences in infection degree of wheat and triticale leaves were stated at tillering stage (GS 35-37) for the leaves: F-2, F-3, at heading stage (GS 55-59) for the leaves F, F-1, F-2, F-3 and at milk maturity for the leaves F, F-1, F-2.

Performed studies indicate that wheat and triticale, as well, can be heavy infected by *P.tritici-repentis*, although the fungus is significantly more important on wheat. The development of tan spot epiphytosis on wheat was much more faster and the leaves were infected stronger. This confirm previous commonly expressed opinion that triticale is generally less susceptible to pathogens than its parent plants i.e. wheat and ray (Zamorski et al., 1994).

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Epifitoza brunatnej plamistości liści w uprawie pszenicy i pszenżyta – badania porównawcze

Badano rozwój epifitozy brunatnej plamistości liści w uprawie pszenicy i pszenżyta w okresie trzech sezonów wegetacyjnych obejmujących okres 1998-2001. Stopień porażenia roślin oceniano stosując pięciostopniową skalę i przeprowadzano w fazach: krzewienia, strzelania w źdźbło, kłoszenia i dojrzałości młecznej zbóż. Wykonany monitoring obejmujący populację 327 genotypów pszenicy i 352 pszenżyta wskazał, że obydwa gatunki mogą ulegać silnemu porażeniu. Stwierdzono, że porażenie pszenżyta we wszystkich fazach rozwojowych trzech kolejnych sezonów wegetacyjnych było istotnie niższe niż pszenicy a przebieg epifitozy mniej gwałtowny. Poza istotnymi różnicami o charakterze ilościowym na pszenżycie w początkowych fazach rozwoju choroby reagowało tworząc bardzo drobne nekrozy bez typowego dla pszenicy halo.

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