

Variability of Resistance to Common Bunt of Wheat*

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Abstract

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During 1997–1998, the reaction of the collections of winter and spring wheat varieties to *Tilletia caries* was determined. In both years the most diseased winter varieties were Simona and Sparta, the least diseased were Samara and Ilona. High variability in the level of infection was observed in some varieties (Vlada, Estica, Regina, Vega). No winter wheat variety was completely resistant. The most diseased spring wheat variety was Alexandria in both years, while Grandur showed no infection. High variability in the level of infection was observed in the special trials with cv. Ina and Contra. In trials of the efficacy of seed dressing against *T. caries* and *T. laevis* there was variability only in the controls, but not in dressed variants.

Key words: *Tilletia caries*; *Tilletia laevis*; spring wheat; winter wheat; seed dressings

At present, seed treatment is the measure most commonly used against common bunt of wheat in the Czech Republic. Preferably, however, such treatment should be applied only if necessary, using principles of integrated plant protection. A method to evaluate the health status of multiplication stands with regard to seed dressing has been proposed (BENADA 1993). Use of these measures is still limited, with the result that most seed approved by the State Seed Inspection Service is dressed, even in cases without any teliospores on the seed. Therefore, common bunt appears in the fields of large farms only exceptionally. On the other hand, dwarf bunt (*Tilletia contraversa* Kühn) spreads in fields of some farms (BENADA 1997) because the health status inspection of all seed is not carried out regularly, and the seed dressings generally used are effective only against common bunt.

In this decade, several authors (BLAŽKOVÁ & BARTOŠ 1995; PAULECH & PAULECH 1993) have investigated the reaction of Czech or Slovak wheat varieties to common bunt, and the efficacy of seed dressings (HUSZÁR 1992). In our own studies, we also included the variability of the level of infection in field trials. The results presented here complement the field trials of 1993–1994 (BENADA *et al.* 1995) conducted with *Tilletia caries* (DC) Tul. in which wheats were inoculated with two rates of spores (20 and 200 mg spores per kg seed). In 1994, the trials were sown at three dates, and bunt incidence was lowest at the first and third sowing dates and with the higher rate of inoculum. Nevertheless, the differences in the

average incidence were low. It was concluded that the level of infection is influenced mainly by the conditions prevailing in a given year. In 1993, the highest infected variety was Sofia (47%), in 1994 it was Asta (up to 30% in some variants). Furthermore, the level of infection was not proportional to the amount of spores at the inoculum rates of 20 or 200 mg spores per kg seed.

In the trials of 1995–1998, several new winter wheat varieties and a collection of spring wheat varieties were included. More attention was paid to the question of variability of infection. The results from 1995 and 1996 were presented in the paper by POLIŠENSKÁ *et al.* (1998). The inoculation rate used in both years was 200 mg spores per kg seed. It was found that infection by *T. caries* in winter wheat was higher when the soil temperature following one week after sowing was lower (below 10 °C). In 1995, the varieties with the highest incidence were Ina (45%) and Regina (42%); in 1996 they were Simona (20%), Ritmo and Ina (both 15%).

The results of the field trials of 1997 and 1998 are presented below.

MATERIAL AND METHODS

Varietal trials

Seed of wheat was inoculated at a rate of 1 g spores of *T. caries* in 20 ml water per kg seed by shaking in a plastic bottle and sown in plots of 2.5 m² at a rate of 200 kg of seed per ha. The sowing dates for winter wheat were 1 Octo-

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ber 1996 and 13 October 1997. The spring wheat trials were sown on 14 March 1997 and 17 April 1998. At the end of vegetation of winter wheat, the central area of each plot was harvested by hand to obtain about 200 ears which were scored for infection. Since the bunt occurrence in spring wheat trials was low, infected spikes were counted in the whole plot.

Variability in the level of infection

The variability of infection levels was tested in the varieties Contra and Ina inoculated by dusting with *T. laevis* and *T. caries*, respectively, at the rate of 1 g spores/kg seed, and sown on 1 October 1996 in long, 1 m wide strips which were then divided into 2 m² large plots, and replicated nine times for each variety.

The variability of infection level was also tested in two seed dressing tests. Seed of the winter wheat variety Contra, heavily contaminated by *T. laevis* during harvest in 1995, and that of variety Ina inoculated by dusting at a rate of 2 g spores of *T. caries* per kg seed were used for the trials. The plot size was the same as in the variety trials. The used seed dressings are shown in Table 1.

The disease assessment was the same as in the above trials.

RESULTS

Varietal trials

The bunt incidence in winter wheat is shown in Table 2. There was a higher average incidence of bunt (late sowing) in 1998 than in 1997 (earlier sowing). The vari-

eties with the highest infection were Simona and Sparta, the lowest were Ilna and Samara. There was a high variability in disease level in some varieties. For instance, the variety Vlada was highly infected in 1997, while in 1998 it belonged to the group with the lowest incidence. The average bunt incidence in 1998 was high (24.1%) and low (7.5%) in 1997.

In the spring varieties the disease level was low, the most infected variety being Alexandria (Table 3), similar to the results from earlier years. There was no infection on the variety Grandur.

Variability in the level of infection

This variability is shown in Table 4. There was high variability in the level of infection; it ranged from 4 to 14.6 % in the variety Ina, and from 11.6 to 31.9% in Contra. All plants grown from dressed seed were free of the disease. The control plots of the variety Contra, grown from naturally infested seed without chemical treatment, were diseased at 46, 20 and 14.2%. The control plots of the variety Ina, grown from seed inoculated with *T. caries* showed 3.5, 8.8 and 9.0 % infection.

DISCUSSION

The trials in 1997–1998 showed that in winter wheat the average bunt incidence was higher at later sowing. This is in accordance with previous results. In contrast, the bunt incidence in some wheat varieties was very variable. There are also differences between the present results and previous data (POLIŠENSKÁ *et al.* 1998). The

Table 1. Seed dressings used in trials

Seed dressing	Rate [t ⁻¹]	Active ingredient	Content	Producer
Vitavax 200 FF	3 l	Carboxin	37.5%	UNIROYAL CHEMICAL Ltd.
		Thiram	37.5%	
		Imazalil	2%	
Derosal	1.33 l	Carbendazim	50%	Hoechst Schering AgrEvo GmbH
Derosal 45 ST	1.66 l	Carbendazim	45%	Hoechst Schering AgrEvo GmbH
Maxim Star	1.5 l	new compound		Rhone-Poulenc Agrochimie S.A
Maxim 025 FS	1.5 l	new compound		Rhone-Poulenc Agrochimie S.A
Maxim 025 FS	2 l	new compound		Rhone-Poulenc Agrochimie S.A
Panoctine 35 LS	2 l	Guazatine	350 g/l	Rhone-Poulenc Agrochimie S.A
Raxil 515 FS	2 l	Tebuconazole	15 g/l	Bayer AG
		Thiram	500 g/l	
Sibutol WS 39,8	2 l	Bitertanol	37.5	Bayer AG
		Fuberidazole	2.3	
Vincit F	3 l	Flutriafol	25 g/l	Zeneca Agrochemicals Ltd.
		Thiabendazole	25 g/l	
Dividend 030 FS	1.5 l	Difenoconazole	30 %	Ciba-Geigy AG Ltd.
Dividend 030 FS	2 l	Difenoconazole	30 %	Ciba-Geigy AG Ltd.
Dividend 030 FS	4 l	Difenoconazole	30 %	Ciba-Geigy AG Ltd.

Table 2. Rank of winter wheat varieties by level of infection with common bunt, *Tilletia caries*, in 1997 and 1998 and their average infection

Variety	Infection rank in year		Average infection [%]
	1997	1998	
Simona	1	1	37.3
Sparta	2	2	36.6
Siria	8	3	23.5
Trane	6	4	22.4
Regina	14	5	19.9
Estica	3	18	18.5
Asta	4	8	17.7
Athlet	16	6	16.3
Ina	7	9	16.2
Hana	11	11	15.2
Torysa	10	12	15.2
Bruta	9	14	14.2
Zdar	15	10	14.2
Vega	21	7	13.1
Alka	18	13	12.5
Astella	17	17	12.0
Vlada	5	23	10.9
Samanta	13	19	10.8
Bruneta	24	15	10.1
Brea	23	16	10.0
Ritmo	12	24	9.2
Boka	19	21	8.3
Iona	22	20	8.1
Samara	20	22	7.5
Average infection	7.5	24.1	15.8

Table 3. Incidence of common bunt, *Tilletia caries*, in spring wheat at two sowing dates: 14 March 1997 and 17 April 1998

Variety	Incidence [%]		
	1997	1998	Mean value
Alexandria	4.5	6.9	5.7
Grandur	0.0	0.0	0.0
Linda	3.1	0.8	2.0
Maja	2.8	4.4	3.6
Munk	0.0	1.2	0.6
Sandra	0.9	6.1	3.5
Saxana	3.6	1.5	2.5
Average	2.1	3.0	2.6

Table 4. Variability in level of infection by bunt in winter wheat varieties Contra (*Tilletia laevis*) and Ina (*T. caries*) sown on 1 October 1996

Replication	Incidence [%]	
	Contra	Ina
1.	24.8	14.6
2.	22.7	5.2
3.	27.7	11.0
4.	31.1	6.5
5.	20.0	4.0
6.	28.9	6.3
7.	11.6	7.7
8.	18.6	5.3
9.	31.9	8.5

reason for this variability lies probably in the influence of environmental conditions on the resistance, although soil conditions in particular plots may contribute to it as well. No winter wheat variety was completely resistant. The level of infection in spring varieties was markedly lower, which may be caused by less suitable environmental conditions for infection during spring. The variety Grandur, belonging to *Triticum durum*, was not diseased in any trial. All other wheat varieties belong to *T. aestivum*.

The reason for no variability in trials in which dressed seed was used is evidently the sufficiently high recommended rates of chemicals.

Only some authors state the variability of bunt incidence in field trials. Papers dealing with this problem have been reviewed by POLIŠENSKÁ *et al.* (1998). We have also shown in another contribution that the presence of some antagonistic micro-organisms such as *Pythium polygandrum*, *Trichoderma harzianum* and *Bacillus subtilis* can reduce teliospore germination in

common bunt and thus infection (BENADA & POSPÍŠIL 1999). Furthermore, it was found in "in vitro experiments" that bunt spores are very sensitive to anaerobic conditions and a higher water content in the medium or water drops on it can decrease the germination. The variability of the infection level has to be considered mainly in variety trials.

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Souhrn

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V letech 1997–1998 bylo zjišťováno napadení souboru ozimých odrůd po inokulaci sporami *Tilletia caries*. V obou ročnících byly nejvíce napadány odrůdy Simona a Sparta, nejodolnějšími odrůdami byly Samara a Ilona. U některých odrůd (Vlada, Estica, Regina a Vega) napadení silně kolísalo. Žádná odrůda pšenice ozimé nebyla zcela rezistentní. Ze sortimentu pšenic jarních v obou ročnících byla nejnapadnější odrůdou Alexandria, zcela bez napadení byla odrůda Grandur. Problémem při testování odolnosti odrůd a účinnosti mořidel je značná variabilita v napadení v rámci jednoho pokusu.

Klíčová slova: *Tilletia caries*; *Tilletia laevis*; pšenice jarní; pšenice ozimá; mořidla

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