

Distribution and characteristic of the fungus *Tilletia controversa* Kühn in the stands of winter wheat in eastern Slovakia

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Tilletia controversa is strongly distributed in the stands of winter wheat (*Triticum aestivum* L.) in the eastern Slovakia. During the years 1957-1992 the fungus was found in 307 localities (communes, cadastral territories) in 12 districts. Its occurrence was mostly abundant in the following districts: Bardejov, Humenné and Prešov. Lower occurrence was detected in districts: Svidník and Vranov nad Topľou, too. It occurs also in the districts Rožňava, Košice, Trebišov, Poprad, Spišská Nová Ves, Stará Lubovňa, and Michalovce in some degree. The contribution contains the list of localities, years and intensity of its occurrence, morphological and ecophysiological characteristics of the chlamydospores of the fungus. The knowledge of *T. controversa* occurrence will contribute to increase efficiency of the protection of wheat against the cited pathogen.

Key words: *Tilletia controversa* Kühn, distribution, Slovakia, characteristics, winter wheat

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Mazľavka trpasličia je v porostoch ozimnej pšenice (*Triticum aestivum* L.) na východnom Slovensku silne rozšírená. V priebehu rokov 1957-1992 sme zaevidovali jej výskyt na 307 lokalitách (katastrálnych úzamiach) v 12 okresoch. Najrozšírenejšia je v okresoch Bardejov, Humenné a Prešov. Vyskytuje sa tu v rôznom stupni každoročne. O niečo slabší výskyt sme zaevidovali v okresoch Svidník a Vranov nad Topľou. Ojedinele až slabo je huba rozšírená i v okresoch Rožňava, Košice, Trebišov, Poprad, Spišská Nová Ves, Stará Lubovňa a Michalovce. V práci uvádzame menný zoznam lokalít, roky a intenzitu zistených výskytov, morfológickú a ekofyziológickú charakteristiku chlamydospór huby. Poznatky o rozšírení umožnia organizovať cielavedomejšie a efektívnejšie ochranu pšenice voči uvedenému patogénu.

Occurrence of the fungus *T. controversa* in winter wheat stands in the eastern Slovakia was first described by Paulech in the year 1957. Great attention was put on finding out its distribution in this region since this time. Results of field investigation showed that its distribution and intensity of occurrence in winter wheat stands were much higher, than it was supposed (Paulech, 1964; Rácz, 1972; Moravčík et Zácha, 1985). Further spreading out of the fungus in our territory has not been stopped by relatively extensive precautions and precise instructions made for wheat protection against the mentioned pathogen. It is evident that for increasing of their efficiency we are in need of knowing the whole area of its distribution and wheat protection have to be organized on the base of this knowledges. This is the reason why our

paper was aimed on study of distribution of the fungus *T. controversa* in the area of eastern Slovakia. Results of our work are documented in this contribution.

MATERIALS AND METHODS

The area of our investigation of the fungus *Tilletia controversa* distribution can be limited up to the eastern Slovakia frontiers. We were looking for occurrence of smutty spikes infected by mentioned fungus and classifying intensity of its occurrence in winter wheat stands (*Triticum aestivum* L.) from the time of milk ripeness till the harvest. The number of smutty spikes was investigated in every stand from 4 to more plots in the area per 100 m², chosen from different parts of the field. One to four stands were classified in every locality by this way and the degree of local infection was classified according to the highest infection degree of its stands.

Intensity of infection was classified according to 5 points scale:

a = stand free of infection;

b = sporadic occurrence (less than 1 smutty spike per 100 m²);

c = weak occurrence (up to 3 smutty spikes per 100 m²);

d = medium occurrence (3–15 smutty spikes per 100 m²);

e = strong occurrence (more than 15 smutty spikes per 100 m²).

Percentage of smutty spikes in the strongest infected stands was obtained by counting healthy and infected spikes per 1 m², in 5 repetitions, chosen at different parts of the field.

As a locality cadastral territories (village, community) are identified. Obtained localities of occurrence are divided, according to our results into districts, in the district they are divided in groups according to the highest obtained degree of infection intensity of its stands in alphabetical order. We noted: Years of occurrence (only the last couple of numbers) and in brackets other degree of occurrence with years in which stands were infected on a lower degree than in their classification group.

Fungus identification was done by using visual symptoms of plants, light microscopy of chlamydospores and by measurement of their hyaline sheath, as well as by study of their shape in dried propanol (Trione et Krygier, 1977). Determination of samples obtained after year 1981 was done on the base of ecophysiology of spore germination (Paulech, 1991). Chlamydospores diameter, thickness of hyaline sheath, number of meshes of reticulation per spore diameter, as well as percentage of hyaline (smooth) spores obtained from 300 spores.

Cardinal temperatures for chlamydospores germination were obtained on evaluated clayey soil (Paulech, 1991) in climatized chambers (KTLK, ILKA, Germany),

at 12 hours daily light period, 12 000 lux intensity of illumination and at $65 \pm 5\%$ relative air humidity.

Photography of chlamydospores was made by scanning electron microscope Tesla BS 301.

RESULTS

Occurrence of the fungus *T. controversa* was found in 307 localities (cadastral territories) from 12 districts in the eastern Slovakia up to now. The strongest occurrence was found in districts Bardejov, Humenné and Prešov. It occurred there in different degrees every year. Lower occurrence was detected in districts Svidník, and Vranov nad Topľou. Sporadic and weak dwarf bunt occurrence was detected in following districts: Rožňava, Košice, Trebišov, Poprad, Spišská Nová Ves, Stará Lubovňa and Michalovce. Summary of the number of obtained localities in different districts and the intensity of fungus are shown in Tab. 1.

Name list of localities of the *T. controversa*, years of their occurrence and degree of infection intensity are introduced in the following review.

Review of obtained localities

District Bardejov

e (strong occurrence): Bardejov 1986 (c: 82, 83); Brezov 71 (c: 86; b: 80, 83); Dubinné 84, 86, 90 (c: 92; b: 80); Kuková (c: 86; b: 80, 84); Lascov 83 (c: 82); Lopuchov 86 (c: 82); Lučka 82 (d: 81; c: 84, 86); Marhaň 82 (c: 84, 89, 92); Mičákovce 83 (c: 86); Rokytov 86; Roveň 89; Stufany 82; Vyšné Rastislavice 83, 84, 86 (c: 90); Želmanovce 86 (b: 82).

d (medium occurrence): Bardejovská Nová Ves 82 (c: 86, 92); Brezovka 86; Giraltovce 85 (c: 84, 86, 92; b: 83); Kračunovce 86 (c: 92; b: 84); Nižné Raslavice 82, 85 (c: 92); Richvald 83,84.

c (weak occurrence): Abrahamovce 92; Gaboltov 92 (b: 82); Hankovce 80, 81, 86; Hažlín 92; Chmeľová 92; Jankovce 92; Jedlinka 92; Kľušov 86 (b: 82); Kobilnice 86; Koprivnica 82, 86, 92 (b: 84); Lužany pri Topli 81, 86; Malcov 82; Mihaľov 86; Mokroluh 86; Ortuťová 92; Poliakovce 86; Smilno 82, 92; Vaniškovce 86; Zborov 92 (b: 82); Železník 86 (b: 84).

b (sporadic occurrence): Bucfovany 82; Gerlachov 82; Kurima 84; Tarnov 82.

District Humenné

e: Černina 84 (c: 89, 90); Čukalovce 90; Hažin nad Cirochou 90; Chlmec 85 (c: 86, 89; b: 84); Koškovce 85; Nižné Čabiny 90 (d: 92); Ohradzany 85 (c: 83; b: 84); Olka 91 (b: 90); Pichné 90 (d: 89, 92; c: 91); Ptičie 83 (c: 86, 89, 90, 92; b: 84); Repejov 91 (d: 90); Svetlice 90 (d: 89); Zubné 91 (d: 92; c: 89, 90).

d: Dlhé nad Cirochou 91 (b: 89, 90); Hankovce 89, 90; Nižné Ladičkovce 91; Papín 89 (c: 90); Pčolinné 90; Vyšný Hrušov 86 (c: 84, 90).

c: Dedačov 90; Habura 90; Humenné 89; Jankovce 89; Kamenica nad Cirochou 84 (b: 89); Karná 92; Krásny Brod 90; Lubiša 90, 91; Lukáčovce 90; Osadné 90; Radvaň nad Laborcom 90; Rokytov 89; Slovenská Volova 91 (b: 89); Veľkopolie 89; Výrava 89; Udavské 92.

b: Brekov 89; Brestov 89; Hrabovec 89.

District Košice

e: Čečejevce 59 (c: 88); Haniska 82 (c: 85); Rozhanovce 84; Slanec 80 (d: 83, 84, 85; c: 87).

d: Hraničná pri Hornáde 84.

c: Klatov 88; Kysak 88.

District Michalovce

d: Strážské 84.

c: Budkovce 61; Lesné 89; Nancina Ves 80; Tibava 89.

b: Trhovište 71; Voľa 80; Závadka 89; Zemplínska Široká 71.

District Poprad

b: Jánovce 83; Mlynčeky 83; Svit 83; Vrbov 83.

District Prešov

e: Chmeľov 86 (b: 82); Jarovnice 85, 86 (d: 91; b: 82); Medzany 86 (b: 82, 91); Nemcovce 83, 86 (c: 90); Šarišská Poruba 86; Tulčík 83, 86 (d: 83, 85; c: 84, 91, 92); Uzovce 86 (d: 81, 82; c: 82, 83, 90, 91).

d: Bretejovce 86 (c: 92; b: 84); Daletice 86 (b: 82); Jakubovany 89, 92 (c: 87; b: 89); Kapušany 85 (c: 90); Kojatice 86 (c: 82; b: 83); Lada 86; Lemešany 85, 86 (c: 82, 87); Lesiček 92; Malý Šariš 83 (c: 81, 82, 86); Prešov 85 (b: 82); Rokycany 86; Svinia 84, 86 (c: 91; b: 81, 82); Šarišské Michaľany 84, 85, 86, 92 (c: 82, 88, 92); (c: 82, 88, 91); Šarišské Sokolovce 91 (c: 82, 87, 92); Široké 86, Terňa 86, 92 (b: 81, 82); Veľký Slivník 92 (c: 82); Veľký Šariš 86 (c: 83).

c: Demjata 83 (b: 81, 82); Drieňov 86 (b: 83); Hubošovce 87; Fulianka 86; Klenov 91; Malý Slivník 86 (b: 82); Ostrovany 86 (b: 82); Ražňany 86, 88, 89; Rožkovany 88; Solivar 90; Šarišské Dravce 92 (b: 82); Župčany 82, 86 (b: 83).

b: Bodovce 83; Červenica 82; Krivany 89; Lipany 82; Orkucany 82; Pečovská Nová Ves 82; Radatice 91; Rybník 89; Sabinov 82; Suchá Dolina 91; Šarišské Bohdanovce 82; Žipov 81.

District Rožňava

d: Gemerská Hôrka 84; Jelšava 85.

c: Brzotín 88.

b: Čoltovo 63; Rožňava 83.

District Spišská Nová Ves

d: Smižany 83; Studenec 83.

b: Spišské Podhradie 78; Spišský Štvrtok 82.

District Stará Lubovňa

c: Jarabina 88, 92; Kamienka 88 (b: 83); Plavnica 88 (b: 82); Stará Lubovňa 90 (b: 82);

b: Orlov 82; Plaveč 83.

District Svidník

e: Vyšný Mirošov 82 (d: 90; c: 88).

d: Breznica 82; Havaj 90.

c: Bukovce 90; Kružľová 90 (b: 89); Ladomírová 90 (b: 82); Nižná Jedľová 90; Nižná Pisaná 90; Nižný Orlík 88; Sitník 90; Stropkov 90; Šandal 90; Vyšná Jedľová 90.

b: Fijaš 82; Nižný Mirošov 82; Radoma 90; Ruský Kručov 82; Stročín 82; Svidník 82.

District Trebišov

d: Bôľ 84; Streda nad Bodrogom 84; Trebišov 84; Zemplínska Teplica 84.

c: Čelovce 80.

District Vranov nad Topľou

e: Ďurďoš 83 (d: 92); Soľ 85, 86.

d: Kvakovce 85, 86; Skrabské 91; Petkovce 91.

c: Čičava 91; Babie 91; Dlhé Klčovce 90; Hanušovce nad Topľou 90, 86; Hancovce 90; Košarovce 80; Nižný Hrabovec 86 (b: 81); Poša 86 (b: 82); Radvanovce 87, 88; Remeniny 91; Sečianska Polianka 82, 89; Slovenská Kajňa 91; Štefanovce 89, 90; Továrne 91; Továrňanská Polianka 89; Vyšný Žipov 89 (b: 91); Závada 89.

b: Bystré 91.

This review shows the distribution of fungus *T. controversa* mainly in the northern and higher situated regions of wheat cultivation. We detected its occurrence every year from 1979 in the eastern Slovakia. The strongest infected stand was detected at Vyšný Mirošov, district Svidník in the year 1982. Mean percentage of smutty spikes of this stand was 26.96 % (Tab. 2).

Beside knowledges about the distribution of the fungus *T. controversa* may be of importance the morphological and ecophysiological characteristics of chlamydospores of its population spread in the eastern Slovakia. Knowledges we have obtained in this fields are documented in Tab. 3 and Fig. 1.

DISCUSSION

Large distribution of the fungus *T. controversa* in winter wheat stands could be observed in the eastern Slovakia. Number of obtained localities, intensity of stands infection seemed to be something lower when compared with our data obtained in the central Slovakia (Paulech et al., 1993). From our investigation results, we could

find area of wheat cultivation free of dwarf bunt, or sporadic occurrence only in the eastern part of our territory. Especially flatland regions of Východoslovenská nížina are to be mentioned. Morphological and ecophysiological characteristic of the fungus *T. controversa* population spread out in the eastern Slovakia may be of essential similarity to the populations characteristic from other localities of our territory (Paulech, 1992, Paulech et al., 1993). Some difference could be supposed mainly in the intraspecies structure of the pathogen population in the field of distribution and representation of fungus physiological races. It seems to be no informations about population spread out in the eastern Slovakia. We have obtained only a few data from the other parts of our territory (Paulech et Paulech, 1991, Paulech, 1992).

According to our observations fungus *T. controversa* parasites besides on winter wheat also on species of the genus *Elytrigia* in the eastern Slovakia (Paulech et Maglocký, 1988). Experiments with transferring of dwarf bunt from these host plants on wheat were unsuccessful. In all probability two specialized forms of the fungus *T. controversa* might exist (Paulech et Paulech, 1991). The problematic of physiological races of the fungus *T. controversa* have been worked out as best in USA, till now (Hoffmann, 1982).

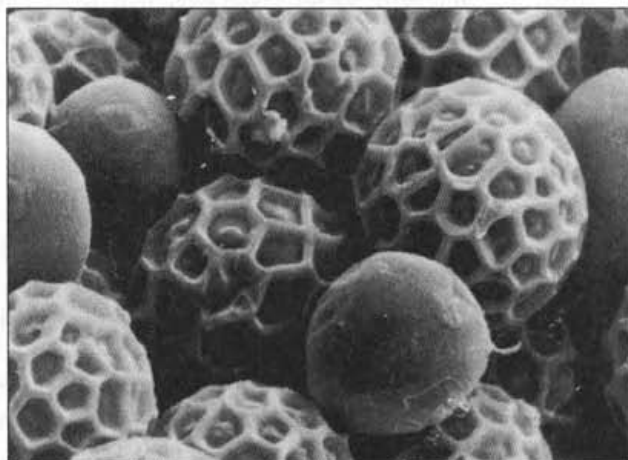


Fig. 1. Reticulated and smooth (hyaline) chlamydospores of the fungus *T. controversa*. Magnific. 3000 \times , SEM

District	Degree of occurrence/number of localities				Total
	sporadic	week	medium	strong	
Bardejov	14	35	7	14	70
Humenné	8	26	11	13	58
Košice	0	5	2	4	11
Michalovce	4	4	1	0	9
Poprad	4	0	0	0	4
Prešov	26	26	21	7	80
Rožňava	2	1	2	0	5
Spišská Nová Ves	2	0	2	0	4
Stará Lubovňa	6	4	0	0	10
Svidník	8	11	3	1	23
Trebišov	0	1	4	0	5
Vranov nad Topľou	4	17	5	2	28
Total	78	128	58	41	307

Table 1. Number of localities and degree of occurrence of the fungus *Tilletia controversa* in districts of eastern Slovakia.

Repetition	Number of spikes			Percentage	
	healthy	smutty	total	healthy	smutty
1	309	164	473	65.320	34.680
2	372	105	477	77.990	22.010
3	480	149	629	76.310	23.690
4	413	91	504	81.940	18.060
5	397	208	605	65.610	34.390
Total	1171	717	2688	—	—
Mean	234.20	143.40	537.60	73.44	26.56

Table 2. Number and percentage of healthy and infected (by the fungus *T. controversa*) spikes of wheat/m²

Locality: Vyšný Mirošov, distr. Svidník, year 1982

Characteristics	Values
Spore diameter	17.7–21.2 μm
Thickness of the hyaline sheath	1.4–2.1 μm
Number of meshes per spore diameter	3–8
Percentage of hyaline spores	2–4
Temperature required for germination	min. 1° C, opt. 5–8° C, max. 12° C
Dormancy period	28–30 days
Special condition for germination	light
Spore wall	reticulated
Odour	after trimethylamin
Color of spore mass	brown to blackishbrown
Percentage of aspherical spores	0–8

Table 3. Some characteristics of the fungus *T. controversa* distributed in eastern Slovakia

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