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INFLUENCE OF AGRO-ENVIRONMENTAL FACTORS ON *FUSARIUM* INFESTATION AND POPULATION STRUCTURE IN WHEAT KERNELS

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Roháčik T, Hudec K: Influence of agro-environmental factors on fusarium infestation and population structure in wheat kernels. *Ann Agric Environ Med* 2005, **12**, 39–45.

Abstract: The influence of location, year and cultivar on occurrence, level of infestation and *Fusarium* species spectrum in winter wheat seeds were evaluated. The wheat seeds from different cultivars and localities of the Slovak Republic were used for *Fusarium* species evaluation during years 1999, 2000, 2002 and 2003. The significant influence of the locality on total *Fusarium* kernel infestation was confirmed. The total sample infestation was significantly higher in the colder and moister localities, lower infestation was in warmer and dryer ones. Cultivar “Astella” was significantly the most susceptible. The widest *Fusarium* species spectrum was recorded in the locations with a high level of total kernel infestation. In localities with lower infestation, the species spectrum was less numerous. *F. poae* was the dominant species in all locations. The species *F. culmorum*, *F. avenaceum* and *Microdochium nivale* were subdominant and relatively frequent in the locations with higher altitude. The frequency and density of other isolated species (*F. graminearum*, *F. sporotrichioides*, *F. tricinctum*, *F. semitectum*, *F. acuminatum*, *F. heterosporum*, *F. sambucinum*, *F. solani*, *F. compactum* and *F. oxysporum*) was trivial in all localities. The kernel infestation and *Fusarium* population structure in wheat grains mostly depends on microclimatic condition of the locality. Rising of rainfall rate and altitude led to an increase in the species spectrum. The wide *Fusarium* species spectrum is connected with the high frequency of coincident species. The species with low and medium frequency achieved low or trivial density in population structure.

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INTRODUCTION

Fusarium head blight (FHB), *Fusarium* foot rot and *Fusarium* seedling blight are the most destructive diseases of small-grain cereals in humid and semi-humid areas. The diseases are commonly caused by *Fusarium culmorum*, *F. graminearum*, *F. avenaceum*, *F. poae* and *Microdochium nivale* [2, 7, 34]. In recent years, FHB has been the centre of attention for farmers and researches because of the economical important yield reduction as a result of the low number of grains per spike and reduced grain weight [3]. In the grains, *Fusarium* species effectively invade the lemma, glume, palea and ovary by penetration pegs. During the intercellular and intracellular spreading of the fungus, marked alterations in the host tissues were observed, including degeneration of cytoplasm, cell organelles and plasmalema. Enzyme and mycotoxin production is usually involved in the process

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Table 1. Characterisation of evaluated localities.

Locality	Altitude (m)	Part of Slovakia	Average year rainfall rate (mm)	Average year temperature (ºC)
Sládkovičovo	122	South	497,2	10.46
Bučany	165	South-West	570	9.4
Malý Šariš	295	East	599,3	7.86
Vígľaš-Pstruša	375	Central	640	7.9

[24]. The *Fusarium* grain infection decreased germination [9] and quality of kernels, in connection with mycotoxins contamination [42]. The *Fusarium* mycotoxins are dangerous for human [27] and animal health if the *Fusarium* species are associated with feed mixtures made from cereals [26]. The most important fusariotoxins are deoxynivalenol (DON), diacetoxyscirpenol (DAS), 3-acetyldeoxynivalenol (3-ADON), 15-acetyldeoxynivalenol (15-ADON), T-2 toxin, HT-2 toxin, nivalenol and others [8, 37].

Environmental factors (mostly temperature, rainfall rate and humidity) have a significant influence on the *Fusarium* species occurrence and disease severity [41]. The temperature and rainfall affect the production and dispersal of inoculum and the infection of wheat spikes and stem bases; this determines the occurrence and severity of diseases – FHB and grain infection [35]. Many field experiments were realised for controlling head blight and subsequent grain infection [28, 31], and great differences among fungicides efficacy were observed in the field [29, 40]. The problems in head blight control are based on wide species spectrum of causal agents. The prevalence of *Fusarium* species is different in each plant tissue and agroclimatic condition [13].

In the world, the *Fusarium* species distribution is studied permanently on many hosts and localities in different conditions, on cereals especially [10, 11, 34]. The occurrence of *Fusarium* species is most frequently analysed in FHB and infected - symptomatic kernels, or grains from infected spikes [11]. The kernels are of low quality with damaged starch granules and storage proteins [4]. The grains from healthy ears and grains without symptoms are evaluated rather sporadically for *Fusarium* infection. The aim of this work was to evaluate the influence of locality, year and cultivar on the structure of *Fusarium* population in asymptomatic wheat kernels as seeds for sowing.

MATERIALS AND METHODS

Sample collecting. The samples of winter wheat kernels were collected from different climatic locations of Slovakia in the years 1999, 2000, 2002 and 2003. The seeds of different cultivars (“Astella”, “Brea”, “Ilona”, “Viginta”) were collected from each locality (Bučany, Sládkovičovo, Vígľaš-Pstruša and Malý Šariš) after standard harvest (300 seeds per sample). The seeds for sowing, larger than 2.5 mm and without disease symptoms were used for the survey. The cultivars “Astella” and “Viginta” are the most wide-spread cultivars in Slovakia and cultivars “Brea” and “Ilona” are regarded as a standard for the baking quality of wheat cultivars. Evaluated locations are shown in Table 1. The evaluated locations are the State experimental stations, representing different climatic conditions of the Slovak Republic.

Isolation and identification of fungi. The subsamples of wheat grains were surface sterilised by shaking for 2 minutes in 1% NaOCl solution. Next were rinsed in redestiled water. The surface sterilised grains were placed on Petri dishes with Potato-dextrose agar (PDA) and incubated at 23ºC under 12/12 photoperiods (4000 lux, non-UV light). The overgrown *Fusarium* colonies were isolated, purified and identified according to the manuals [6, 17, 33], by visual and microscopic observation of single spore cultures. The percentage of infection and occurrence of *Fusarium* species were evaluated for each location and cultivar. The achieved results were tested by Analysis of variance, Tukey test, p = 0.05. There was

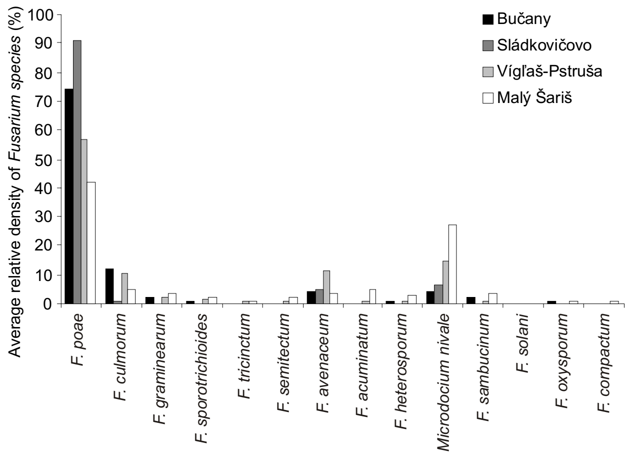

Figure 1. ARD - Average relative density (%) of *Fusarium* species in evaluated localities.

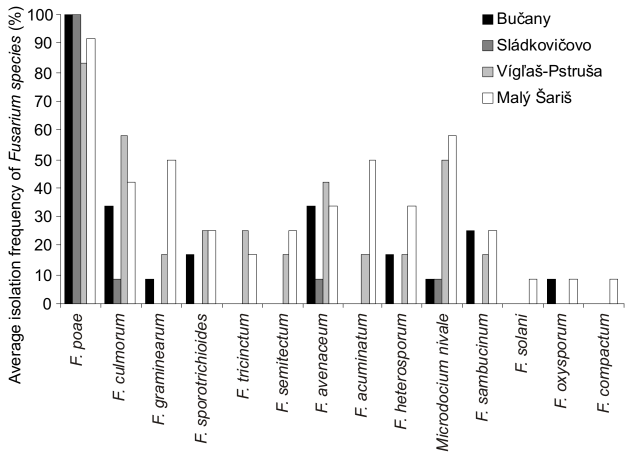

Figure 2. AIF - Average isolation frequency (%) of *Fusarium* species in evaluated localities.

following indicators calculated: total (TFKI) and average percentage of *Fusarium* spp. in samples and localities, isolation frequency of species (IF), average isolation frequency of species (AIF), relative fungal density of species (RD) and average relative density of species (ARD); according to following patterns [19]:

IF (%) = (number of samples with occurrence of species/total number of samples) × 100
AIF (%) = arithmetic average of IF of all years
RD (%) = (number of species isolates/total number of genus isolates) × 100
ARD (%) = arithmetic average of RD of all years

RESULTS

The average and total *Fusarium* kernel infestation in samples is presented in Table 2. Relative density and isolation frequency of *Fusarium* species is shown in Tables 3-6. The described results show significantly higher total sample infestation in colder and moister localities (Malý Šariš and Vígľaš-Pstruša). Significantly lower infestation was recorded in warmer and dryer localities. The significant influence of locality on total *Fusarium* kernel infestation (TFKI) was confirmed by the results.

The significant differences of TFKI among cultivars were achieved in locations Vígľaš-Pstruša and Malý Šariš only. "Astella" was the most susceptible cultivar, other cultivars were significantly less susceptible, without significant differences among the others. The differences of TFKI values among cultivars in warmer and dryer localities were not significant.

The widest *Fusarium* species spectrum was recorded in locations with high levels of TFKI. The dominant species was *F. poae* (Fig. 1, 2). *F. culmorum*, *F. avenaceum* and *F. nivale* (reclassified by Gams [16] as *Microdochium nivale*) were subdominant and relative frequent species; their relative fungal density was low. The frequency and density of the other species was very low and formed only the coincident part of isolated population. The species preference of concrete cultivar was not statistically confirmed.

In localities with lower TFKI levels, the species spectrum was less numerous. The dominant species was *F. poae*, in higher frequency and density than in localities with higher levels of TFKI. The frequency and density of other species was low and trivial. The *F. poae* frequency corresponds with its density, especially in warmer locations. In colder and moister locations, the *F. poae* frequency is high, but its density is lower than in warmer localities.

M. nivale has trivial meaning in warmer localities. In locations with higher altitude, it is the subdominant species in term of frequency and density. Presented results refer the *F. graminearum* to the less frequent group of species in grains above 2.5 mm. The *F. graminearum* (all isolated strains identified as a *F. graminearum* Group 2 [36]) density is low, the cultivar preference was not confirmed. According to the results, *F. culmorum* is a frequent species in wheat kernels, but in relatively low density.

Table 2. *Fusarium* infestation of evaluated samples of wheat kernels in Slovakia.

Localities	Year	Cultivar	Cultivar* TFKI (%)	Year TFKI (%)	Locality TFKI (%)
Bučany	1999	Astella	0.9 a**	1.07 a	1.92 a
		Brea	1.1 a		
		Ilona	1.2 a		
	2000	Astella	2.2 a	2.37 b	
		Brea	1.3 a		
		Ilona	3.6 a		
	2002	Astella	1.33 a	0.89 a	
		Viginta	0.67 a		
		Ilona	0.67 a		
	2003	Astella	3.67 a	3.33 b	
		Viginta	3.33 a		
		Ilona	3.0 a		
Sládkovičovo	1999	Astella	1.3 a	2.4 b	1.73 a
		Brea	3.5 a		
		Ilona	2.4 a		
	2000	Astella	2.1 a	2.73 b	
		Brea	1.9 a		
		Ilona	4.2 a		
	2002	Astella	1.0 a	0.99 a	
		Viginta	0.66 a		
		Ilona	1.33 a		
	2003	Astella	0.67 a	0.78 a	
		Viginta	0.33 a		
		Ilona	1.33 a		
Vígľaš - Pstruša	1999	Astella	6.7 b	4.43 a	6.85 b
		Brea	3.4 a		
		Ilona	3.2 a		
	2000	Astella	4.2 b	3.4 a	
		Brea	3.6 ab		
		Ilona	2.4 a		
	2002	Astella	11.33 a	13.44 c	
		Viginta	14.33 b		
		Ilona	14.67 b		
	2003	Astella	12.0 c	6.11 b	
		Viginta	1.0 a		
		Ilona	5.33 b		
Malý Šariš	1999	Astella	8.2 a	9.8 b	9.87 b
		Brea	11.9 b		
		Ilona	9.3 ab		
	2000	Astella	19.1 b	15.8 c	
		Brea	15.8 ab		
		Ilona	12.5 a		
	2002	Astella	6.0 b	4.89 a	
		Viginta	5.67 b		
		Ilona	3.0 a		
	2003	Astella	17.33 c	9 a	
		Brea	0.67 a		
		Ilona	9.0 b		

* - TFKI - total *Fusarium* kernel infestation of sample (%); ** - differences between values designated by the same letter are not significant (Analysis of variance, Tukey test, p = 0.05).

Table 3. *Fusarium* species occurrence in wheat kernels (Bučany).

Cultivar	1999		2000		2002		2003	
	RD	IF	RD	IF	RD	IF	RD	IF
				F. poae				
Astella	100	100	90.90	100	75	100	72.73	100
Brea	72.73		100		-		-	
Ilona	100		80.56		50		55.56	
Viginta	-		-		50		40	
				F. culmorum				
Astella	0	0	0	33.33	0	33.33	0	66.67
Brea	0		0		-		-	
Ilona	0		80.56		50		11.11	
Viginta	-		-		0		10	
				F. graminearum				
Astella	0	0	0	0	25	33.33	0	0
Brea	0		0		-		-	
Ilona	0		0		0		0	
Viginta	-		-		0		0	
				F. sporotrichioides				
Astella	0	0	0	0	0	0	9.09	66.67
Brea	0		0		-		-	
Ilona	0		0		0		0	
Viginta	-		-		0		1	
				F. avenaceum				
Astella	0	33.33	0	0	0	0	9.09	100
Brea	27.27		0		-		-	
Ilona	0		0		0		11.11	
Viginta	-		-		0		1	
				F. heterosporum				
Astella	0	0	0	0	0	0	0	66.67
Brea	0		0		-		-	
Ilona	0		0		0		11.11	
Viginta	-		-		0		1	
				M. nivale				
Astella	0	0	0	0	0	33.33	0	0
Brea	0		0		-		-	
Ilona	0		0		0		0	
Viginta	-		-		50		0	
				F. sambucinum				
Astella	0	0	0	0	0	0	9.09	100
Brea	0		0		-		-	
Ilona	0		0		0		11.11	
Viginta	-		-		0		1	
				F. oxysporum				
Astella	0	0	9.09	33.33	0	0	0	0
Brea	0		0		-		-	
Ilona	0		0		0		0	
Viginta	-		-		0		0	

Legend to Tables 3-6: RD- relative fungal density of species (%), IF - isolation frequency of species (%).

Table 4. *Fusarium* species occurrence in wheat kernels (Sládkovičovo).

Cultivar	1999		2000		2002		2003	
	RD	IF	RD	IF	RD	IF	RD	IF
				F. poae				
Astella	100	100	100	100	100	100	100	100
Brea	88.57		100		-		-	
Ilona	79.17		100		100		75	
Viginta	-		-		100		100	
				F. culmorum				
Astella	0	33.33	0	0	0	0	0	0
Brea	11.43		0		-		-	
Ilona	0		0		0		0	
Viginta	-		-		0		0	
				F. avenaceum				
Astella	0	33.33	0	0	0	0	0	0
Brea	0		0		-		-	
Ilona	20.83		0		0		0	
Viginta	-		-		0		0	
				M. nivale				
Astella	0	0	0	0	0	0	0	33.33
Brea	0		0		-		-	
Ilona	0		0		0		25	
Viginta	-		-		0		0	

DISCUSSION

Evaluation of locality, year and cultivar influence on total *Fusarium* species infestation of kernels (TFKI) is an important indicator for general recommendations for agricultural practice. The significantly higher TFKI in colder and moister localities and statistically significant influence of locality on TFKI is a useful result for practical plant protection measurements. The achieved levels of TFKI correspond with the results of Yli-Mattila [44], who discovered 4-20% wheat grain infestation. The presumption of increasing incidence of fungal pathogens (including *Fusarium* species in grains above 2,5 mm) in moist locations [15] is confirmed by the presented results. This kernel fraction is used as seeds for sowing in agriculture. The infestation of these asymptomatic kernels is in progress during the formation of grains, a long time after classical *Fusarium* head blight infection (during flowering and spikes forming). The saprophytic mycoflora on the surface of the kernels was eliminated by sterilisation before cultivation [12], thus the overgrown *Fusarium* species were localised underneath the surface tissues of evaluated grains. According to these results, the qualitative seeds for sowing from some locations may be a great source of *Fusarium* infection. These seed sources of inoculum are important for further infections and epidemiology in the field [18, 43], therefore, the myco-analysis carried out before sowing provides important information on fungi present in seeds [23]. The results suggest that wet localities are also favourable for *Fusarium* infestation of kernels fraction above 2.5 mm. In the year 2002, a high incidence of FHB was observed in Slovakia (in all localities mentioned in this work) because of favourable wet conditions during wheat flowering (unpublished information). Even though the TFKI was high in one locality only (Vígľaš-Pstruša) in 2002 (Tab. 2), this suggests that in a year of high FHB epidemic is not automatically the high incidence of *Fusarium* species in kernels.

The differences of TFKI among evaluated cultivars and localities have important practical meaning. The same year was not a year of the highest average TFKI in all

Table 5. *Fusarium* species occurrence in wheat kernels (Vígľaš-Pstruša).

Cultivar	1999		2000		2002		2003	
	RD	IF	RD	IF	RD	IF	RD	IF
F. poae								
Astella	0	33.33	100	100	85.29	100	83.33	100
Brea	0		52.78		-		-	
Ilona	43.75		45.83		40.91		100	
Viginta	-		-		65.12		66.67	
F. culmorum								
Astella	10.45	66.67	0	33.33	0	66.67	8.33	66.67
Brea	38.24		0		-		-	
Ilona	0		25.00		6.82		0	
Viginta	-		-		6.98		33.33	
F. graminearum								
Astella	0	0	0	0	0	66.67	0	0
Brea	0		0		-		-	
Ilona	0		0		13.64		0	
Viginta	-		-		9.30		0	
F. sporotrichioides								
Astella	0	0	0	0	5.88	100	0	0
Brea	0		0		-		-	
Ilona	0		0		4.55		0	
Viginta	-		-		6.98		0	
F. tricinctum								
Astella	0	0	0	0	0	66.67	2.78	33.33
Brea	0		0		-		-	
Ilona	0		0		6.82		0	
Viginta	-		-		2.33		0	
F. semitectum								
Astella	0	0	0	0	0	66.67	0	0
Brea	0		0		-		-	
Ilona	0		0		2.27		0	
Viginta	-		-		2.33		0	
F. avenaceum								
Astella	41.79	100	0	0	0	66.67	0	0
Brea	61.76		0		-		-	
Ilona	15.63		0		9.09		0	
Viginta	-		-		4.65		0	
F. acuminatum								
Astella	0	0	0	0	2.94	66.67	0	0
Brea	0		0		-		-	
Ilona	0		0		2.27		0	
Viginta	-		-		0		0	
F. heterosporum								
Astella	0	0	0	0	2.94	66.67	0	0
Brea	0		0		-		-	
Ilona	0		0		6.82		0	
Viginta	-		-		0		0	
M. nivale								
Astella	47.76	66.67	0	66.67	0	33.33	5.56	33.33
Brea	0		47.22		-		-	
Ilona	40.63		29.17		6.82		0	
Viginta	-		-		0		0	
F. sambucinum								
Astella	0	0	0	0	2.94	66.67	0	0
Brea	0		0		-		-	
Ilona	0		0		0		0	
Viginta	-		-		2.33		0	

localities. This confirms that the microclimate of the locality is more important for TFKI than general agroclimatic characterisation of the evaluated year.

The influence of used cultivar (depending on locality) is another important indicator for practical recommendations. Significant differences of TFKI among cultivars were achieved in higher and wet locations (Vígľaš-Pstruša and Malý Šariš) only. The most susceptible cultivar was "Astella". The results suggest that the seeds for sowing of some susceptible cultivars are better produced in dry and

Table 6. *Fusarium* species occurrence in wheat kernels (Malý Šariš).

Cultivar	1999		2000		2002		2003	
	RD	IF	RD	IF	RD	IF	RD	IF
F. poae								
Astella	23.17	66.67	49.74	100	61.11	100	30.77	100
Brea	0		24.68		-		100	
Ilona	24.73		12.8		66.67		48.15	
Viginta	-		-		64.71		-	
F. culmorum								
Astella	15.85	66.67	0	0	5.56	66.67	21.15	33.33
Brea	0		0		-		0	
Ilona	3.23		0		11.11		0	
Viginta	-		-		0		-	
F. graminearum								
Astella	0	33.33	2.09	66.67	0	33.33	13.46	66.67
Brea	1.68		0		-		0	
Ilona	0		7.2		11.11		7.41	
Viginta	-		-		0		-	
F. sporotrichioides								
Astella	0	33.33	0	0	5.56	66.67	0	0
Brea	3.36		0		-		0	
Ilona	0		0		0		0	
Viginta	-		-		17.65		-	
F. tricinctum								
Astella	0	0	0	33.33	5.56	33.33	0	0
Brea	0		5.06		-		0	
Ilona	0		0		0		0	
Viginta	-		-		0		-	
F. semitectum								
Astella	0	0	6.81	33.33	0	0	15.38	66.67
Brea	0		0		-		0	
Ilona	0		0		0		3.70	
Viginta	-		-		0		-	
F. avenaceum								
Astella	0	33.33	3.14	33.33	0	0	9.62	66.67
Brea	2.52		0		-		0	
Ilona	0		0		0		25.93	
Viginta	-		-		0		-	
F. acuminatum								
Astella	9.76	100	12.04	33.33	0	0	5.77	66.67
Brea	13.45		0		-		0	
Ilona	17.20		0		0		3.70	
Viginta	-		-		0		-	
F. heterosporum								
Astella	0	0	0	0	5.56	100	3.85	33.33
Brea	0		0		-		0	
Ilona	0		0		11.11		0	
Viginta	-		-		11.76		-	
M. nivale								
Astella	51.22	100	14.66	100	11.11	33.33	0	0
Brea	60.50		62.03		-		0	
Ilona	54.84		71.20		0		0	
Viginta	-		-		0		-	
F. sambucinum								
Astella	0	33.33	18.49	66.67	0	0	0	0
Brea	15.97		8.23		-		0	
Ilona	0		0		0		0	
Viginta	-		-		0		-	
F. solani								
Astella	0	0	0	0	0	0	0	33.33
Brea	0		0		-		0	
Ilona	0		0		0		3.70	
Viginta	-		-		0		-	
F. oxysporum								
Astella	0	0	0	0	0	0	0	33.33
Brea	0		0		-		0	
Ilona	0		0		0		7.41	
Viginta	-		-		0		-	
F. compactum								
Astella	0	0	0	33.33	0	0	0	0
Brea	0		0		-		0	
Ilona	0		8.8		0		0	
Viginta	-		-		0		-	

warm localities, on the grounds of inoculum presence in the kernels.

The AIF and ARD indicators seem to be good for *Fusarium* population development evaluation (Fig. 1, 2). *F. poae* was confirmed as a dominant species in all evaluated localities by four-years-observation. The highest frequency of *F. poae* corresponds with its density in warm locations especially. In colder and moister locations, *F. poae* frequency is high, but its density is lower in comparison with warmer localities. Some authors [2, 34] mentioned the *F. poae* as a frequent causal agent in wheat kernels, but others [14, 44] found this species in wheat kernels and FHB complex in relative low frequency. From phytopathological point of view, *F. poae* is not a dangerous pathogen for germinating wheat kernels [21], but under optimal conditions is able to decrease kernels germination and koleoptyle forming [9]. On the other hand, *F. poae* is dangerous mycotoxins (NIV, ZEA, DAS, FUS, ENS, HT-2 tox., T-2 tox.) producer [33], occurred more in Northern and Central Europe [8]. Moreover, Kosiak *et al.* [25] consider *F. poae* as the most abundant potential producer of HT-2 toxin and T-2 toxin in cereals in some years. Some authors proved a direct correlation between toxigenic *Fusarium* species occurrence and mycotoxins production [38], but usually no clear correlation is found between species composition and mycotoxins in grains [44].

Other phytopathological important species (*F. graminearum*, *F. culmorum*, *M. nivale* etc.) occurred in less density in evaluated *Fusarium* kernel population (Tab. 3-6). The structure of evaluated wheat kernel *Fusarium* population presents rather a potential risk of mycotoxin accumulation than as a dangerous phytopathological inoculum source. However, the mycotoxigenic profile of a contaminated crop is due not only to the predominant pathogenic *Fusarium* species, but also to the opportunistic species making up the complex [8]. Fungicide spraying of spikes is one of the methods to prevent mycotoxin contamination in kernels, but some authors are of the opinion that some fungicides inhibiting growth of the mycotoxin producers stimulate production of some mycotoxins [1, 32].

F. graminearum is considered as a major species in *Fusarium* species spectrum causing the FHB [8, 13] and one of the most frequent species in kernels [25]. The species is the most common in continental climates, such as Central and South-Eastern Europe [8]. According to our results, the *F. graminearum* is referred to less frequent group of species in asymptomatic wheat kernels.

M. nivale achieved low frequency and density in warmer localities. The species is mainly rather typical for mountains, wet and cold regions - in spring as a snow mould. It is known as an incidental pathogen of FHB, foot rot and head blight [13]. The FHB spikes infected by *M. nivale* are occasionally a source of inoculum for kernels infection. In wheat kernels, the *M. nivale* is not an important mycotoxin producer because no typical *Fusarium* toxins were found in naturally *M. nivale* – infected ears, even by high occurrence [22].

F. culmorum belongs to the most frequent *Fusarium* species on cereals worldwide, including Slovakia [30] [39]. Even though the *F. culmorum* density is relatively low according to this results, oscillating around 10%. This suggests that *F. culmorum* is more frequent and more specialised on root rot, foot rot and FHB [13], than occurred on asymptomatic wheat kernels. The low frequency of *F. culmorum* in grains results from host and pathogen specialisation, or from less favourable agro-climatic condition during grain ripening probably. However, some factors of variability, including a drastic change in climatic conditions at regional as well as at continental level can, along with close crop rotation between maize and small-grain cereals, lead to changes in the spread of *Fusarium* species [8].

The following species are the most common in FHB of wheat spikes world-wide: *F. graminearum*, *F. culmorum*, *F. avenaceum* [34]. The species spectrum in kernels above 2.5 mm was different, with *F. poae* dominance and less frequency of the most important species for FHB mentioned above. This suggests that *F. poae* is a more adaptable species for agroenvironmental conditions during grains forming than frequently mentioned species such as *F. graminearum* and *F. culmorum*. Another distinction is the form of sporulation - the “classical” FHB pathogens produce macroconidia and *F. poae* mostly microconidia. It is possible that *F. poae* microconidia are more adaptable for germinating on senescencing ears tissues, and to be more competitive with natural grain and spikes surface microflora. It seems that the dominance of *Sporotrichiella* section is caused by microconidia forming [5], which are easier spread. But Hőrberg [20] maintains, that the morphology of the spores does not influence the splash dispersal patterns. The mentioned facts suggest that the source of inoculum for grain infection is not the FHB infected spikes only, because of high incidence of *F. poae* in years without FHB epidemic.

CONCLUSIONS

The presented results suggest that *Fusarium* population structure in wheat grains depends mostly on micro-climatic conditions. The species spectrum is increased by raising rainfall rate and altitude. Increasing of *Fusarium* species spectrum in wheat kernels resulted in increasing of frequency of coincident species. Frequency and density of the prevalent species is decreasing consequently, but their dominance is sustained. The species with low and medium frequency achieved low or trivial density in population structure only.

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