

APPLICATION OF SOME BIOPREPARATIONS AGAINST FUNGI OF GENUS *FUSARIUM* PRODUCING MYCOTOXINS IN THE SYSTEM OF SPRING BARLEY GROWING

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Introduction

The biopreparations are biological agents (fungi, bacteria, yeasts, protozoa and others), having antagonistic effect against susceptible harmful pathogenic and semi-pathogenic microorganisms (genus *Fusarium*, *Drechslera* and others), they are used like plant protection material. We used in our field and laboratory experiments the biopreparations of Czech provenience - Supresivit (*Trichoderma harzianum*), Polyversum (*Pythium oligandrum*) and Ibefungin (*Bacillus subtilis*). These named fungi were used also in other experiments in which e.g. *Trichoderma harzianum* depressed some fungi of the genus *Fusarium* (Neethling and Nevalainen, 1996) and antagonistic fungus *Pythium oligandrum* and antagonistic bacteria *Bacillus subtilis* too (Vesely, 2001). Many of phytopathogenic fungi are transferred by the soil (*Gaeumannomyces graminis*, *Septoria* spp. and others) which are suppressed by applied antagonistic microorganisms. Main producers of trichothecene mycotoxins are the fungi of the genus *Fusarium*. These mycotoxins like deoxynivalenol (DON, vomitoxin), nivalenol (NIV), T-2 toxin, HT-2 toxin and FUS-X toxin were produced namely by the species of *Fusarium culmorum* and *Fusarium graminearum* which we intercepted from spring barley in our previous experiments. We assumed that the application of biopreparations leads to the decreasing of the populations of *Fusarium* and also to the reduction of mentioned mycotoxins levels.

Methods

Variants of field experiments with spring barley were following:

1. Control variant + ammonium sulphate
2. Vitavax + ammonium sulphate
3. Vitavax + (ammonium sulphate + Polyversum 3 g.kg⁻¹ fertilizer)
4. Vitavax + (ammonium sulphate + Ibefungin 10 ml.kg⁻¹ fertilizer)
5. Vitavax + (ammonium sulphate + Supresivit 1 g.kg⁻¹ fertilizer)
6. (Vitavax + Polyversum 3 g.kg⁻¹ of the seeds) + ammonium sulphate
7. (Vitavax + Ibefungin 10 ml.kg⁻¹ of the seeds) + ammonium sulphate
8. (Vitavax + Supresivit 1 g.kg⁻¹ of the seeds) + ammonium sulphate

We took away soil samples and we evaluated soil mycoflora including pathogenic fungi of spring barley by the method of soil extraction. In our previous experiments we studied the influence of different pre-crops (maize, sugar-beet, rape and cereals) on the level mycotoxins (deoxynivalenol, nivalenol, T-2 toxin, HT-2 toxin, FUS-X toxin) which were analysed by the method of gas chromatography.

We studied also the influence of meteorological factors on artificial infection with *Fusarium culmorum* and the effectivity of the use of chemical fungicides. Artificial infection was done by the spray of conidial suspension of *Fusarium culmorum* on spring barley (the concentration 10⁶ conidia per 1 ml) in the state of flowering.

Results and discussion

In our experiments we evaluated the width of soil spectrum micromycetes before/after the growing of spring barley. In the beginning of the cultivation there were in the soil following microfungi: *Penicillium* spp., *Aspergillus* spp., *Hemicola* sp., *Fusarium* spp. (*F. graminearum*, *F. sambucinum*, *F. poae*, *F. tricinctum*, *F. culmorum* etc.). After the treatment with the biopreparations (namely with Supresivit and Ibefungin) and the sowing of barley the number of the genus *Fusarium* decreased in the comparison with the control. This decreasing could be significant for lower plant's infestation with the genus *Fusarium* during beginning of the cultivation. The width of the spectrum after 1 month and after 2 month is visible from the Table 1.

Tab. 1. 1 month after sowing the spectrum in single variants was as follows:

<i>Vitavax</i>	<i>Supresivit</i>	<i>Ibefungin</i>	<i>Polyversum</i>
<i>Fusarium graminearum</i> (12 %)	<i>Fusarium</i> sp. (25 %)	<i>Fusarium graminearum</i> (6%)	<i>Fusarium graminearum</i> (3%)
<i>Fusarium culmorum</i> (16%)	<i>Fusarium oxysporum</i> (8%)	<i>Fusarium oxysporum</i> (8%)	<i>Fusarium oxysporum</i> (34%)
<i>Fusarium poae</i> (4%)	<i>Fusarium chlamydosporum</i> (6%)	<i>Fusarium</i> sp. (15%)	<i>Fusarium</i> sp. (5%)
<i>Fusarium tricinctum</i> (2%)			
<i>Fusarium</i> sp. (4%)			
<i>Paecilomyces</i> sp.			

2 month after sowing the spectrum of single variants was as follows:

<i>Vitavax</i>	<i>Supresivit</i>	<i>Ibefungin</i>	<i>Polyversum</i>
<i>Fusarium graminearum</i> (25%)	<i>Fusarium oxysporum</i> (9%)	<i>Fusarium</i> sp. (0%)	<i>Fusarium oxysporum</i> (18%)
<i>Fusarium tricinctum</i> (9%)	<i>Acremonium</i> sp. (9%)	<i>Acremonium</i> sp. (27 %)	<i>Acremonium</i> sp. (18%)

The populations of soil microorganisms could be divided on antagonistic microorganisms and non-antagonistic microorganisms. The most soil micromycetes which we isolated were non-antagonistic microorganisms.

After artificial infection with mycotoxigenic strain of *Fusarium culmorum* we found out that there were great differences after different pre-crops.

Bar chart showing the percentage of infestation by various *Fusarium* species on different crops (cereal, sugar beet, maize) across six regions (Akcent, sugar, Kompakt, Nordus, Amulet, Forum) from 2000 to 2003. The Y-axis represents the percentage of infestation (0% to 180%). The X-axis lists the crops and regions. The legend identifies the species: *F. culmorum* (white), *F. avenaceum* (light gray), *F. graminearum* (dark gray), *F. oxysporum* (black), *F. poae* (white with dots), *F. tricinctum* (white with horizontal lines), and Fusarium (white with vertical lines).

Region	Crop	Year	<i>F. culmorum</i>	<i>F. avenaceum</i>	<i>F. graminearum</i>	<i>F. oxysporum</i>	<i>F. poae</i>	<i>F. tricinctum</i>	Fusarium
Akcent	cereal	2000	85	65	15	10	0	0	0
		2001	115	65	15	10	0	0	0
		2003	175	65	15	10	0	0	0
	sugar beet	2000	125	35	35	10	0	0	0
		2001	65	35	35	10	0	0	0
		2002	45	35	35	10	0	0	0
maize	2000	65	55	15	10	0	0	0	
	2001	65	15	15	10	0	0	0	
	2002	65	15	15	10	0	0	0	
Kompakt	cereal	2000	95	75	15	10	0	0	0
		2001	155	75	15	10	0	0	0
		2002	105	75	15	10	0	0	0
	sugar beet	2000	105	75	15	10	0	0	0
		2001	105	75	15	10	0	0	0
		2002	105	75	15	10	0	0	0
maize	2000	40	40	15	10	0	0	0	
	2001	40	40	15	10	0	0	0	
	2002	40	40	15	10	0	0	0	
Nordus	cereal	2000	90	40	15	10	0	0	0
		2001	135	40	15	10	0	0	0
		2002	135	40	15	10	0	0	0
	sugar beet	2000	115	60	15	10	0	0	0
		2001	60	60	15	10	0	0	0
		2002	60	60	15	10	0	0	0
maize	2000	75	30	15	10	0	0	0	
	2001	75	30	15	10	0	0	0	
	2002	75	30	15	10	0	0	0	
Amulet	cereal	2000	95	95	15	10	0	0	0
		2001	135	95	15	10	0	0	0
		2002	95	95	15	10	0	0	0
	sugar beet	2000	110	40	15	10	0	0	0
		2001	110	40	15	10	0	0	0
		2002	110	40	15	10	0	0	0
maize	2000	45	45	15	10	0	0	0	
	2001	45	45	15	10	0	0	0	
	2002	45	45	15	10	0	0	0	
Forum	cereal	2000	90	90	15	10	0	0	0
		2001	150	90	15	10	0	0	0
		2002	130	90	15	10	0	0	0
	sugar beet	2000	95	30	15	10	0	0	0
		2001	95	30	15	10	0	0	0
		2002	95	30	15	10	0	0	0
maize	2000	30	30	15	10	0	0	0	
	2001	30	30	15	10	0	0	0	
	2002	30	30	15	10	0	0	0	

Conclusions

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that the decreasing of amount of these fungi would have also the effect on the decreasing of trichothecene mycotoxins in living environment. When it was lower amount of the fungi of the genus *Fusarium*, the concentration of mycotoxins will be also lower.

Acknowledgement

This contribution was prepared under financial support of scientific task MZe 0002700603 a MZe 0002700601.

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