

THE EXPLOITATION POSSIBILITY OF DOMESTIC WHEAT CULTIVARS

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ABSTRACT

The infection of wheat by the field fungus influences its yields, the total quality and the hygienic accuracy. At the mill, the cleaning process is not sufficiently effective, so the well developed, but infected kernels are present in the mass in front of the first grinder.

The results from the investigations have shown that the fungus of the species *Fusarium* are the most present contaminants, and the most present among them was *F. oxysporum*. Besides the fuzariums the fungus of the genus *Altenaria* were also present. At the most contaminated kernels their matabolits were isolated. The influence of the of the micotoxins *Zearalenon* and *Ohratoxin A* on the wheat quality was determined by the changes of the technological quality and the hygienic accuracy.

INTRODUCTION

Cereals, especially the wheat as the basic bread cereal, represent important strategic row material from the aspect of the importance for the nutrition of the nation. All its pproducts which are using in the human nutrition, can be contaminated by molds at the all phases of the production cycle. Many of those molds are toxigen and are potential producers of various mycotoxins. The contaminated wheat batchs are accepted at the all acceptance points of the processing industry, without any sanitary control.

The aim of the investigation in this study was to investigate the presence of molds in the wheat kernel and flour with identification of the species from the isolated micropopulations, first of all of the toxigenic

species, as well as to be determined their influence on the usability and the hygienic accuracy of the wheat kernel.

MATERIAL AND METHODS

In this study the results of the investigation on wheat varieties are presented, at which the attack of *Fuzarium spp.* and *Alternarie* was recorded. The kernel fractionation was performed on the basis of the sensorial evaluation, as well as of mycological and toxicological check. The contaminated kernels are divided into three fractions:

Darkgerm kernels at which was registered the colour change of the outer layers, mostly in the germ area and the crease of the potbellied part (1).

Little fuzarious kernels are weakly wrinkled kernels with less expressed white and pink coating.

Strong fuzarious kernels are expressively wrinkled white and pale red and light kernels (2,3).

At the reception acceptance very often comes wheat mixture which contains all the tree contaminated fractions and the sound kernels, which are used as a control sample. It is unknown which ratio of the tree kernels fractions is processed into the type flour at the mill, and continues into the final products which are consumed by the man. But, at the integral milling all of the kernel mass is milled and processed into bread and other bakinf products. All kernel categories are analysed by the official mycological, mycotoxycological, biological, physical-chemical, biochemical and rheological methods (4,5).

RESULTS AND DISCUSSION

Mycopopulation of wheat kernels: The results of investigation of the number of molds per wheat kernel, performed in the frame of this study, are present in the Table 1. The most infected were the strong fuzarious fractions (Table 1).

Mycotoxicological contamination of wheat: In the Table 2 are presented the results of investigation of AB1, AG1, OA and ZEA in the wheat kernels. CA was present in slightly and strong fuzarious fractions,

and ZEA which was found even in the 87% of the patterns its concentrations were too high.

Table 1. Average content of mold number per kernel of wheat fraction pattern

Fraction name	1	2	3
Sound	0,92	0,73	0,83
Dark-germ	2,00	2,97	2,94
Slightly fuzarious	2,87	3,12	3,21
Strong fuzarious	3,21	3,25	3,25

Table 2. Contamination of wheat kernels by mycotoxins

Fraction name	Variety	Mycotoxin ($\eta\text{g} \cdot \text{kg}^{-1}$)			
		Alfatoxins		Ohratoxin A	Zearalenon
		B ₁ +	G ₁		
Sound	1	0	0	0	500
Dark-germ	1	0	0	0	0
Slightly fuzarious	1	0	0	0	260
Strong fuzarious	1	0	0	0	1400
Sound	2	0	0	0	250
Dark-germ	2	0	0	0	180
Slightly fuzarious	2	0	0	0	270
Strong fuzarious	2	0	0	48	350
Sound	3	0	0	0	0
Dark-germ	3	0	0	0	180
Slightly fuzarious	3	0	0	32	200
Strong fuzarious	3	0	0	48	280

The regulation issues the maximal allowed concentration for the CA till 10 (g/kg) and for the ZEA till 1 (g/kg). Mycotoxins are included in the expressively termostable compounds, because they do not loose their toxicity during the termal processing.

Biological quality of wheat: The energy of sprouting and sprouting of the sound and darkgerm fractions had normal values, as can be seen on the Table 3. These values significantly decrease at the fuzarious fractions, the high fungus contamination influences badly on the

biological reproduction. The consequence of that is the increased share of the abnormal number of sprouts and sick kernels.

Table 3. Survey of biological properties of wheat varieties

Kernel fractions	Sprouting energy (%)	Sprouting (%)	Types of sprouts			
			normal	abnormal	sick kernels	fresh kernels
Average sample	44	44	40	4	56	0
Sound fraction	96	100	80	20	0	0
Dark-germ	88	96	90	6	4	0
Slightly fuzarious	64	64	60	4	32	4
Strong fuzarious	0	0	0	0	100	0

The greatest yield was obtained at the sound fractions, while the smallest at the strong fuzarious (Table 4), what is back proportional with ash content (Table 5). At the strong fuzarious fractions was registered the smallest flour yield and the highest ash content, what is an undesirable property from the aspect of milling processing.

Table 4. Level of flour yield of the investigated wheat fractions

Variety	Flour yield of fractions (%)			
	Sound	Dark-germ	Slightly fuzarious	Strong fuzarious
1	65	60		50
2	55	53	52	50
3	50	49	48	45

Table 5. Content of mineral substanses in wheat fractions

Variety	Ash content (% / s.m.)			
	Sound	Dark-germ	Slightly fuzarious	Strong fuzarious
1	0,88	0,89	0,90	0,97
2	0,90	0,93	0,96	0,96
3	0,94	0,95	0,98	0,98

Chemical methods clear point out to the disturbances which happen in the wheat conglomerate of gluten and starch provoked by the contamination of molds (protein content, wet gluten content and other).

Table 6. Protein content in wheat fractions

Variety	Protein content (% / s.m.)			
	Sound	Dark-germ	Slightly fuzarious	Strong fuzarious
1	13,3	13,7	13,8	13,9
2	13,6	14,0	14,5	14,9
3	14,0	14,6	14,8	15,0

The all investigated wheat varieties had relatively high protein content at the level of the I technological group at the all fractions, and the highest concentrations were registered at the strong fuzarious fractions (Table 6).

The wet gluten content of the all analysed varieties has shown considerable variations in the analysed fractions. The darkgerm fractions at the all varieties had the highest values of this rheological indicator, and the strong fuzarious fractions the smallest (Table 7). It is probably a consequence of a high mold contamination which have caused changes in the gluten stucture destroying one of the important gluten components-the glutenin fraction which gives to dough the elasticity.

Table 7. Wet gluten content in the wheat fractions

Variety	Wet gluten content (%)			
	Sound	Dark-germ	Slightly fuzarious	Strong fuzarious
1	32	33	30	26
2	33	35	31	27
3	34	36	32	30

Besides the differences in the wet gluten quantity, in the analysed fractions can be also emphasized the difference in regard to its quality. Gluten of the sound fractions show good flexibility, small stickiness and plasticity, as well as light yellow colour. Gluten quality of darkgerm and slight fuzarious fractions has decreased, while at the strong fuzarious kernels has shown the weakest rheological characteristics (sticky, brittle and incoherent gluten with dark gray colour).

CONCLUSIONS

On the basis of the results obtained during these investigations, the following can be concluded:

- Molds are frequent contaminants of wheat kernel and bread, which sometimes have the ability for production of mycotoxins;
- The attack of the field molds, especially fuzarious and representatives of the genus *Alternaria*, decrease the total quality of the wheat kernel, what less-more depends on the share of the contaminated kernels and the degree of their infection;
- The field molds with their philaments decompose the wheat kernel and with this they decrease or lead to unusage of the biological and proccsing quality and the hygienic accuarance.
- The molds and their methabolits-mycotoxins in the kernel, flour as well as in the bread and baked goods, can not be seen and felt, but they settle with years in the human organizm and in a corresponding moment (immunity decrease) can influence on the appearance of difficult diseases.

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