

## **EVALUATION OF MICROBIOLOGICAL PARAMETERS OF CEREALS EN ROUTE OF PRESERVATION PROCESS**

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### **Abstract**

*In this paper have made the microbiological exam to several lots from different types of cereals taken from Timis, Arad and Caras-Severin districts, immediately after cropping and have pursued the evaluation of those parameters, according to the storage conditions in barns, in closed storerooms, in metal containers at a low temperature of approximately 4°C. As the value of the obtained results was very close for all the samples exposed to the same environmental conditions, the data from the tables represent the average of the obtained values.*

**Key words:** *mold, grain, wheat, corn, Aspergillus, Penicillium, Fusarium*

### **Introduction**

The cereals contain a large number of microorganisms, bacteria and molds, which influence in a negative way their quality, stopping the normal process of panification and therefore they determine some economical loss (Coman, 1985; Popescu, 1993; Eliade, 1990). The number of microorganism varies on different types of cereals and it is influenced by the cropping and storage conditions. It has been noticed that high humidity and temperature determine the growth of the mycological charge and the quality changes of the obtained products from this cereals (Park, 1996; Tortora, 1998).

### **Experimental**

The analyses made for the determination of the mycological charge of the different types of cereals and their identification technique

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pursued the standard method for the microbiological exam of the cereals established by the "American Association Of Cereal Chemists" which is applied in Romania too (FDA recommendation, 1999; Scott, 1997).

### **Results and Discussions**

The obtained results following the working technique for the determination of the microbiological charge regarding those for types of cereals: wheat, maize, barley, oat, will be presented in the tables below, according to the storage conditions. A major importance for the cereals is represented by the fungal potential mycotoxicological charge. Following the working technique, the obtained results are presented in the tables 1 – 7.

**Table 1.** The cereals mycoflora in cropping season presented for the cereals samples in the moment of cropping in the three districts

Types of cereals	Timiș	Arad	Caraș
Wheat	62000	65000	70000
Maize	48000	43000	44000
Barley	38000	36000	40000
Oat	25000	28000	31000

**Table 2.** The cereals mycoflora, in February 2003, presented for the cereals samples kept in barns, in average in the three districts

Types of cereals	Timiș	Arad	Caraș
Wheat	41000	52000	58000
Maize	36000	36000	38000
Barley	29000	28000	31000
Oat	19000	21000	25000

**Table 3.** The cereals mycoflora in February 2003, presented for the cereals samples kept in closed storerooms, in average in the three districts

Types of cereals	Timiș	Arad	Caraș
Wheat	53000	62000	64000
Maize	42000	40000	42000
Barley	33000	32000	36000
Oat	20000	25000	28000

**Table 4.** The cereals mycoflora, in February 2003, presented for the cereals samples kept in refrigerators, in average, in the three districts

Types of cereals	Timiș	Arad	Caraș
Wheat	33000	36000	42000
Maize	28000	30000	29000
Barley	19000	21000	29000
Oat	15000	16000	19000

**Table 5.** The cereals mycoflora, in February 2003, presented for the cereals samples kept in barns, in average, in the three districts

Types of cereals	Timiș	Arad	Caraș
Wheat	58000	64000	70000
Maize	43000	41000	42000
Barley	32000	34000	39000
Oat	25000	27000	30000

**Table 6.** The cereals mycoflora, in May 2003, presented for the cereals samples kept in closed storerooms, in average, in the three districts

Types of cereals	Timiș	Arad	Caraș
Wheat	66000	66000	74000
Maize	52000	44000	45000
Barley	38000	38000	41000
Oat	26000	30000	33000

**Table 7.** The cereals mycoflora, in May 2003, presented for the cereals samples kept in refrigerators, in average, in the three districts:

Types of cereals	Timiș	Arad	Caraș
Wheat	33000	36000	42000
Maize	28000	30000	29000
Barley	19000	21000	29000
Oat	15000	16000	19000

Analyzing the tables' data, it is noticed that the total number of mushrooms varies from one species of cereals to another. Kept in the same conditions, according to the chemical composition of the cereals and especially according to the nutritive exigencies of the fungal for the support, which they are developing. It is also noticed that the less installations of aeration are in the storage places the more mushrooms exist on the cereals. So, the existence of the mushrooms depends directly on the initial humidity of the cereals before storage.

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Before of the synthesized metabolites the mold that contaminates different lots of cereals represent a danger for the costumers. That's why it is important to identify the possible existence of some fungal with great potential of toxinogen belonging to the following types: Penicillium, Asprgillius, and Fusarium in the some lots of cereals crop in the south – east of Romania.

In the table 8 is presented the frequency of the contamination with Penicillium and Aspergillius in some lots of cereals from Timis, Arad and Caras Severin districts.

**Table 8.** The incidence of contamination with Penicillium and Aspergillius of some lots of cereals in those three districts

District	Samples number	wheat	maize	barley	oat
Timiș	14	64.29	71.43	57.14	42.86
Arad	12	58.33	75.00	50.00	41.66
Caras Severin	10	80.00	90.00	70.00	70.00

All in all it is noticed from the analyzed tables that the degree of contamination with potential toxinogen fungal belonging to the Penicillium and Aspergillius species of the cereals from the vest side of Romania is high. For example at wheat the percentage degree is between 58.33 – 80%, at maize 50 – 70%, at barley between 50 – 70% and at oat is between 41.66 – 70%.

The contamination with some of the fungal species is made in the field and with the others during cropping, carriage and storage. The contamination degree of the cereals varies according to the substratum's nature – plant species – the resistance of the sort, the productivity degree of the toxinogen stems (some stems of fungal produce more mycotoxins than other do). A very large number of the stems from the Ochratoxins producing species do not produce these substances although, morphologically speaking, they cannot be separated from the producing ones.

The most frequent species of Fusarium involved in the contamination of the cereals are: Fusarium roseum var. graminearum, F. Moniliforme, F. oxysporum, F. tricinctum, F. sporotrichoides. When the humidity of the substratum is high, sometimes 22-30% and the temperature is 24-27°C. The Fusariums develop in 3-6 weeks and they

elaborate mycotoxins. Lower temperatures of 10-14°C favorise the elaborations of the toxin. The Fusarium developed on cereals partial ripened or on cereals with high humidity. The climatic conditions from our country, especially in autumn, when there are warm days and cold nights, assure a better development of the Fusarium. The incidence of contamination with Fusarium of some lots of cereals in those three districts is presented in table 9.

The presence of Fusarium in food and in fodders followed by the fact that people and animals consume them provokes disease named fusariotoxicoza. Fusariotoxicoza is a complex of chemical symptoms and anatomopathological lesions caused by different mycotoxins elaborated by the Fusarium species.

**Table 9.** The incidence of contamination with Fusarium of some lots of cereals in those three districts

District	Samples number	wheat	maize	barley	oat
Timiș	14	28.57	35.71	21.43	7.14
Arad	12	25.00	25.00	8.33	8.33
Caraș Severin	10	30.00	40.00	20.00	20.00

From the above tables it is noticed that the fusarium's incidence in the case of wheat is between 25-30%, in the case of maize is between 25-40%, at samples barley is between 8.33-21.43% and at the samples of oat is between 7.14-20%, so, there is a high contamination. By comparing the incidence of Fusarium at wheat and maize and that of fusarium at barley and oat it is noticed a great frequency in case of the first two cereals.

## Conclusions

By comparing the three possibilities of cereals storage it is concluded that the less efficient one, in keeping the physico-chemical and microbiological qualities of the cereals, is represented by the storage in closed stores, inadequate ventilated. The most efficient way of storage is storage in a controlled temperature and humidity in installation especially made for this purpose.

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In May, the verified microbiological parameters had superior values to the one's obtained in February regarding the cereals kept in barns and in closed storage rooms. At the cereals kept in refrigerators the values were almost the same. The results of those studies are relevant and they correspond to the studied literature data. That is the cause why we believe the investigations in this domain are important because of the great economical losses and of the diseases caused by the consumption of some cereals infected with fungal and mycotoxins.

The presence of molds in a large number in the analyzed cereals, which represent the main source of food for human beings and for animals, involves taking some severe measures in order to respect the agro technical conditions during the agricultural works and the necessary measures during their storage.

### **References**

- Coman, I., Popescu, O. (1985) *Micotoxine și micotxicoze*, Ed. Ceres, București
- Eliade E. (1990). *Fitopatologie*, Ed. II, Tipografia Universității București
- FDA. (1999). *Assessment of estimated risk resulting from aflatoxins in consumer peanut products and other food commodities*. Washington, D.C., 19 January, Bureau of foods, US Food and Drug administration.
- Park J.J., Smalley E.B. and Chu F.S. (1996). Natural occurrence of Fusarium mycotoxins in field samples from the 1992 Wisconsin corn crop. *Appl. Environ. Microbiol.*, 62, 1642-1648.
- Popescu, Gh. (1993). *Fitopatologie*, Ed. Tehnică, București
- Scott, P.M. (1997). Multi-year monitoring of Canadian grains and grainbased foods for trichotecenes and zearalenone. *Food. Addit. Contam.*, 14, 333-339.
- Tortora, J.G., Funke, R.B., Case, L.C. (1998). *Microbiology, an introduction*, sixth edition, Addison Wesley Longman, Inc.