MYCOLOGICAL AND MYCOTOXICOLOGICAL ANALYSIS OF SAGE USED IN THE MEAT INDUSTRY

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Introduction

The production of spices and constantly growing dependance of the food industry as a major consumer of spices, especially the meat industry, is affected by problems related to the presence of microorganisms. Spices are never completely sterile. They contain predominantly sporogenous bacteria and moulds. Control of raw materials and finished products for the presence of moulds and their toxic metabolites – mycotoxins – is exceptionally important in the drive to manufacture products which are safe and good for the human health. Major groups of toxins include: aflatoxins (produced by Aspergillus species; the most important is aflatoxin B_1(AB_1) which is classified in Group 1 of human carcinogens) (Scimeca, 1995), ochratoxins (toxic products of storage moulds of the genera Aspergillus and Penicillium; ochratoxins appear in several forms, the most widespread and also most toxic being ochratoxin A(OA), which is responsible for the Balkan endemic nephropathy) (Mašić *et al.*, 2000) and zearalenon (ZEA) (produced by Fusarium species, primarily by F. graminearum) (Bočarov,1996).

Materials and Methods

Mycological and mycotoxicological research

The mycological research encompassed the determination of the total number of moulds in 1 g of the tested sage (five different samples) and their identification according to the standard laboratory procedure (Škrinjar, 2000), (Raper and Fenel, 1965), (Samson and van Reenen-Hoekstra, 1988), (Ainsworth *et al.*, 1973), (Gerlach and Nirenberg, 1982). Two types of selective culture media were used: Sabouraud-maltose agar (SMA) and maltose yeast extract agar with 50% glucose. The presence of Aflatoxin B_1, ochratoxin A and zearalenon were determined by the ELISA testing method.

Results and Discussion

Table 1: Total viable count of moulds per 1g.

sample	total no. of moulds / g	
	SMA	MY 50 G
1	$4.1 \cdot 10^2$	$7.7 \cdot 10^2$
2	$4.9 \cdot 10^3$	$1.2 \cdot 10^2$
3	$1.5 \cdot 10^2$	$5.4 \cdot 10^2$
4	$3.0 \cdot 10^2$	$2.5 \cdot 10^2$
5	$4.0 \cdot 10^2$	$2.4 \cdot 10^2$

Table 2: Types of moulds isolated in the samples.

genus	species	percentage of total (%)
Aspergillus	*A. flavus*	66.60
	A. niger	
	A. rubrum	
	A. fumigatus	
Fusarium	*F. moniliforme*	16.60
Rhizopus	*R. stolonifer*	16.60

The Total viable count on the two different mediums is shown in Table 1 while Table 2 shows that most of the species found were from the genus *Aspergillus*; they made up 66.6 % of all the isolated species. As shown in Figure 1, storage moulds, most of them toxicogenic, were dominant in the samples. *Aspergillus* accounted for 97.8 % of the overall sage contamination myco-population. Figure 2. shows that *A. flavus was* predominant in all samples, especially in samples 2 (69.76%) and 3 (70%). The frequency of *A. rubrum* in sage's mycopopulations is shown in Figure 3. While Figure4 presents the frequency of *Aspergillus* spp. in sage mycopopulation, with the highest presence of *A .flavus*. AB1, OA and zearalenon found in all samples at a high concentration (Table3).

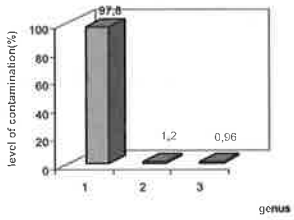

Figure 1: Frequency of genera in the sage myco-population *Aspergillus*, 2-*Fusarium* 3-*Rhizopus)*.

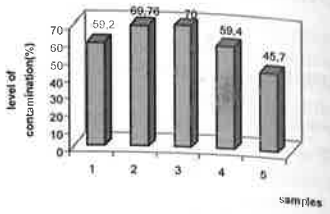

Figure 2: *Aspergillus flavus* frequency in tested (1. samples.

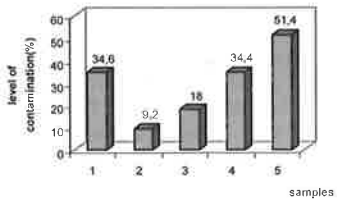

Figure 3: Frequency of *A. rubrum* in tested samples.

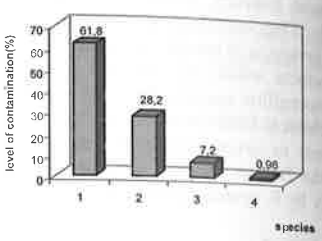

Figure 4: Frequency of *Aspergillus* species in sage (1-*A. flavus*, 2-*A. rubrum*, 3- *A.niger*, 4-*A. fumigatus*).

Table 3: Mycotoxins in five different samples ($\mu g \cdot kg^{-1}$).

sample	AB1	OA	ZEA
1	7,5	63	20,0
2	7,0	60	25,0
3	12,0	90	25,0
4	10,0	78	12,5
5	8,0	42	19,0

Conclusion

According to the FAO more than 25% of the world's agricultural production is contaminated with mycotoxins. Most countries have adopted regulations to limit exposure to mycotoxins, having strong impact on food and animal crop trade.The presence of mycotoxins is unavoidable and therefore testing of raw materials and products is required to keep our food and feed safe.

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