PhD Thesis Summary

Key words: mycotoxins, agro-food products, samples, immunoenzymatic tests, toxic effects, etc.

The doctoral thesis entitled ***Studies regarding the presence of mycotoxins in products of plant origin and the causes of their occurrence in the conditions of Iași county"*** is structured in two parts, being spread over 150 pages.

Part one of the work includes 6 chapters, being dedicated to the synthesis of the bibliographic study regarding the state of knowledge at the national and international level of the topic addressed. This includes information on research conducted on mycotoxins that influence the quality and safety of agri-food products.

Chapter 1 contains a series of general considerations regarding the main mycotoxins that frequently contaminate agro-food products, with reference to their general characteristics, to the mycotic species that generate them and to the categories of products that may present a risk of contamination.

Chapter 2 includes the description of the factors that influence the production of mycotoxins, with reference to environmental, chemical and biological factors. A brief description of the influence of each of these factors on the development of mycotoxin-producing fungi is given. The details of these aspects are highlighted in a figure and 3 tables.

Chapter 3 refers to the main mycotoxins with toxic potential that contaminate plant products and the legislative limits imposed on their presence in food products. The chapter includes 6 sub-chapters that include general information on food contamination with the following types of mycotoxins: aflatoxins, ochratoxins, zearalenone, fumonisins, trichothecenes (deoxynivalenol, T-2/HT-2 toxin) and patulin. The following main aspects are highlighted: the categories of food products at risk, ways to reduce the risk of contamination with mycotoxins, the conditions they can cause in humans and animals, as well as the maximum permissible limits imposed by the legislative norms of the European Community, for each type of mycotoxin. The details of these aspects are highlighted in 3 figures and 7 tables.

Chapter 4 includes 2 sub-chapters relating to the main and secondary sources of mycotoxin contamination. The main sources are represented by primary agricultural products (cereals, oilseeds, fresh fruits and vegetables, coffee and cocoa beans, etc.), and the secondary sources of infestation are constituted by processed agro-food products (oil, juices, fermented drinks, etc.) . For each separate category, both the levels of contamination and the sources of occurrence of mycotoxins that may have toxicogenic potential were analysed, each analysis being based on data related to the specialized literature, regarding the incidence of mycotoxins in plant substrates.

Chapter 5 refers to prevention and control methods in the case of mycotoxin contamination, being structured in 2 subchapters and 6 paragraphs, respectively, preventive methods and curative methods.

Prevention methods that can be applied to avoid mycotoxin contamination are easier from a technical point of view and are preferable to decontamination methods. These are based on the application of pre-harvest strategies for agricultural products, on ensuring proper harvest management and on the correct administration of post-harvest and storage strategies for agricultural products.

The curative methods are divided into 3 categories: physical, chemical and biological, of which only the physical methods have practical applicability, which have the advantage of not affecting the quality of the agro-food products or of the fodder subjected to the treatments.

Chapter 6 is structured in 6 sub-chapters related to the effects of consuming agri-food products contaminated with mycotoxins. Each category of mycotoxins is analysed in terms of the chronic or acute toxicity it can manifest in humans or animals. The toxic and carcinogenic effects associated with mycotoxins are highlighted in 7 figures and 2 tables, which are an integral part of the work. The chapter emphasizes the correlation between the different categories of plant products contaminated with mycotoxins and the carcinogenicity given by them, following human or animal consumption.

Part two of the paper includes the own research, being made up of 5 chapters in which the emphasis is placed on the identification and monitoring of mycotoxins, on the description of the materials and methods of their determination from plant products and respectively on the presentation of the results obtained.

Chapter 7 is dedicated to the motivation of the research theme, its purpose, objectives and specific research activities. There are mentions of the institutional and organizational framework where the research was carried out.

The motivation for choosing the studied topic was due to the following aspects:

- the precariousness of research on the prevalence and level of mycotoxins in agro-food products at the level of Iași county;
- the recommendations of the EFSA (European Food Safety Authority) to study the potential increase in mycotoxin contamination of agri-food products in the European Union, in order to apply appropriate measures;
- the need imposed by the high toxicity, to evaluate the degree of contamination of plant products, in order to protect the health of consumers.

The purpose of this study is to evaluate the presence and degree of mycotoxin contamination of various food products of vegetable origin, as well as to establish the causes and sources of their occurrence in the conditions of Iași county, in 2015-2020.

The objectives of the research were established in order to achieve the proposed goal, with the following aspects being targeted:

-identification of the main mycotoxins present in food products of vegetable origin, from Iasi county;
-the evaluation of the level of mycotoxin contamination of different categories of agro-food products, at the level of Iasi county;
-following the annual dynamics of the prevalence of mycotoxins in agro-food products;
-establishing and analysing the sources of contamination with mycotoxins for the food products of vegetable origin taken into study;
- performing the traceability of the food products of vegetable origin studied and analysing the causes of their mycotoxin contamination.

The specific activities carried out during the research consisted in: sampling of agri-food products and their preliminary preparation; performing laboratory analyses; interpretation of the results obtained; evaluation of the degree of mycotoxin contamination of the analysed products; assessment of main and secondary sources of contamination; establishing conclusions and recommendations.

The study material consisted of samples of agri-food products (cereals and derived products, bakery-pastry products, fresh fruits and vegetables, juices, wines, etc.), which were randomly sampled, following an objective sampling strategy, both from storage units, processing units as well as units for the sale of agri-food products, located within the radius of Iași county. The sampling was carried out based on a predetermined work procedure, in accordance with annex no. 1 of EC Regulation no. 401/2006

establishing the methods of sampling and methods of analysis for the official control of mycotoxin content in food.

The methods for determining the content of mycotoxins considered the performance of quantitative determinations using the ELISA and HPLC/LC determination methods, these being validated and accredited. The research was carried out during 6 years of study, in the period 2015-2020.

Chapter 8 includes the methodology for the identification and monitoring of mycotoxins, being structured in 4 sub-chapters that refer to: the method of preliminary preparation and sampling, the application of sampling methods, strategies and techniques, as well as the establishment of sample compliance. Details regarding these aspects are also highlighted in the 5 figures included in the chapter.

Chapter 9 refers to the effective determination methods of the main mycotoxins studied. This chapter contains one figure and is structured in 8 subchapters, related to each specified type of mycotoxin. Specific kits were used for the determination, the interpretation of the results being carried out by the ELISA and HPLC/LC methods. In the chapter, details are presented regarding the working methodology, the materials used and how to interpret the results obtained.

Chapter 10 includes the results and discussions regarding the mycotoxins identified in the research and is structured in 8 subchapters, specific to each mycotoxin studied.

During the study period, respectively, the years 2015-2020, at the level of Iași county, a total number of 698 samples of agri-food products of vegetable origin were taken and analysed, for the determination of the main mycotoxins. For each individual mycotoxin, a total number of samples were analysed as follows: 85 samples for aflatoxin B1, 90 samples for total aflatoxin, 133 samples for deoxynivalenol, 119 samples for zearalenone, 48 samples for fumonisins, 148 samples for ochratoxin A, 40 samples for Toxin T-2/HT-2 and 35 samples for patulin determination. The samples consisted of both primary agricultural products and processed agro-food products. In order to cover a wide area of analysis, these samples were taken from units with different specific activities, namely: grain warehouses, food product warehouses, retail units (supermarkets), processing units in the fields of baking, pastry, preserving vegetables and fruits, winemaking, obtaining beer, etc.

The chapter also includes 13 tables and 8 figures in which details are highlighted regarding: the total number and type of analysed samples, their area of origin, the values for positively detected samples, the legal limits allowed for each product category and the incidence of each mycotoxin reported to the analysed samples.

The general conclusion derived from the analysis of the percentage values of all mycotoxins with positive values in the studied samples is that the major incidence in agro-food products was recorded in the case of cereals and products derived from them, as well as in the case of bakery products, the analysis of mycotoxins revealing a higher level and dangerous deoxynivalenol (53.4%), zearalenone (20.17%) and fumonisins (18.8%). However, all the recorded values did not exceed the legal limits imposed.

The most alarming problem detected was the fact that mycotoxin contamination is present in bakery products in a percentage of 38.62% of the total samples analysed, presenting a high and worrying level of deoxynivalenol and zearalenone. Since bread and bakery products are basic foods in the nutritional regime of the majority of the population in our country, a permanent and rigorous monitoring of these categories of products is required regarding mycotoxin contamination.

Chapter 11 includes the general conclusions interpreted through the lens of the bibliography consulted, which sums up a total number of 181 reference sources. Details on the incidence of mycotoxins and the overall results of the research carried out are highlighted by a centralizing figure and table.