

UNIVERSITY OF PITEȘTI

FACULTY OF SCIENCES

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CONTROLLED CULTIVATION OF MUSHROOMS

FOR A HEALTHIER ENVIRONMENT

HABILITATION THESIS

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FORWARD

This habilitation thesis is a synthesis of the main scientific and academic results obtained by the author, Dr. Marian Petre, during the period from granting the Ph.D. in biological sciences, in 2001, till now, as a consequence of his research activities in the laboratories of the University of Pitesti, Ecological University and the National Institute of Research and Development for Biological Sciences Bucharest and the National Institute of Research and Development in Biotechnology for Horticulture Ștefănești-Arges.

Taking into consideration that these results were obtained by a continuous and sustained collaboration with valued researchers and distinguished academics, I would like to address all of them my deep gratitude for their great support and kind understanding they have given me throughout the activities carried out as a team. From all the outstanding professionals, to those personalities of exceptional human and professional values who ascended to Heaven, I will wear the holy eternal memory and I will be forever grateful.

Without any trace of resentment, even now, I thank those who, in different circumstances and for various reasons, did not give me any understanding or support they were able, in many difficult moments, because their harsh reactions hardened my spirit to overcome all obstacles and succeed on my own!

Last but not least, I want to thank my family who always supported me unconditionally without whose support, certainly, I would not have achieved the results that will be presented in this habilitation thesis.

RESUME

The Habilitation Thesis entitled „**Controlled Cultivation of Mushrooms for a Healthier Environment**” consists of three main sections. The first one refers to the scientific and academic professional achievements of its author being divided into seven chapters corresponding to the most important research and teaching results. The second section emphasizes the prospective development plans in scientific research as well as academic activities. In the last part of the thesis, the general conclusions are presented.

The main objectives of the studies and researches performed by the author of this habilitation thesis were focused on the following directions:

1 - the recovery and recycling of agricultural and forestry wastes through biological means to solve the environmental troubles raised by the accumulation of these organic wastes;

2 – the establishing of good practices which are needed to be applied in the ecological agro-food and forestry industries, by drawing up and applying on large scale the original biotechnological procedures of automatic controlled cultivating of edible and medical mushrooms on substrates made of agro-food and woody wastes, in order to valorize them as nutritive fungal biomass;

3 – the finding out of new methods of nutritive supplements producing through continuous and controlled submerged cultivation of edible and medicinal mushrooms

In the first subchapter of the Section 1 regarding the scientific achievements, there are presented the main results which were performed in the frame work of the research projects acquired by the author as project manager in the last ten years. The research in controlling the cellulose waste bioconversion into protein by using immobilized fungal cells on radiopolymerized hydrogels was an original scientific activity with significant results. The

interest about the further role of immobilized cells in mushroom cultivation, correlated with the current level of research, will lead to much more extensive commercial applications.

In the next subchapters, there are described the optimal procedures for fungal conversion of lignocellulose wastes from winery industry and viticulture. In this context, there were analyzed by comparison the solid state cultivation and the controlled submerged cultivation of mushrooms on winery waste substrates. The drawing up and application of biotechnological procedures for fungal fermentation of agro-food wastes could mean alternatives with double effect, both on the human nutrition and health as well as environment quality.

Among the original scientific achievements of the author, the conceptual model of controlled mushroom cultivation through the using of a modular robotic system can be considered as being one of the most innovative performances in the field. This functional model, which represents a new vision in mushroom cultivation technology, was patented in 2010 the authors of invention being rewarded in the international exhibitions of inventions.

The modular robotic system for edible mushroom cultivation provides the automatic sterilization of cultivation substrates, the automatic inoculation of substrates inside the aseptic room by a special device of controlled injection of liquid mycelia, the incubation and carpophores formation in special chambers under controlled atmosphere as well as the automatic picking-up of the carpophores (mushroom fruit bodies).

The recycling of forestry wastes through mushroom cultivation was another topic of the scientific activity achieved by the author as the main part of the working plan established to be carried out in the framework of a complex research project won in the national competitions. The cultivation experiments of edible and medicinal mushrooms on substrates made of different sorts of wood were achieved in order to establish the influence degree of chemical, physical and biological factors that could affect the mushroom fruit bodies productivity.

Another important part of the scientific research in the field of controlled cultivation of mushrooms was focused on the most performant procedures for bioconversion of fruit wastes into nutritive biomass. The main aim of this research was to establish the optimal technology for ecological recovery of fruit wastes to be valorized as natural-made fertilizers in organic horticulture because these wastes are improper to be used as organic substrates for mushroom cultivation, due to their natural contamination with pathogenic mycotoxins that could produce carcinogenic effects on animal and human bodies even after their biotechnological processing.

The last subchapter of the scientific achievements contains the most important scientific books edited by the author of this thesis and published by the international publishers as well as the registered patents on controlled cultivation of mushrooms, awarded with gold and silver medals at international exhibitions of inventions.

In the final part of this first section, there are depicted the main results of the teaching the courses of biotechnology for environmental protection, microbiology and ecological restoration for the students of degree level in ecology specialization as well as the courses of microbial biotechnology, bioremediation and microbial relationships with natural environment for the master students. Also, there are presented the activities of leading the students' graduation and dissertation papers as well as the assessment activities for the PhD. dissertation theses sustained by doctoral students in the universities of Bucharest, Bordeaux and Malaya. Last but not least, there are mentioned the results registered in the framework of the Teaching Mobility Programme – Erasmus. In the second section - Prospective development plans of scientific research and academic activity – both the strategy for the future scientific research plans based on the main objectives and the forthcoming novelties in academic development are presented.

The last section of this thesis contains the General Conclusions regarding the most important scientific and academic achievements of the author as well as his prospective plans in professional career